SIEMENS

TELEPERM M

AS 235, AS 235 H and AS 235 K Automation Systems

Catalog PLT 111 · 1999

This catalog is no longer available in printed form. However, it can still be used to obtain information and for ordering spare parts. Certain products from this catalog are no longer available. Your Siemens partner will offer appropriate substitutes wherever possible.

TELEPERM M
Introduction

Brief description

TELEPERM M process control system

The TELEPERM M process control system provides all functions required for process automation. It is highly suitable for the complete automation of continuous and discontinuous (batch) processes.

The TELEPERM M systems are divided into function units optimized for different tasks associated with process automation:

- AS automation systems
- OS operator systems
- CS and PROFIBUS bus systems

AS automation systems

The various TELEPERM M automation systems have different designs, ranges of functions and performances. The AS 235, AS 235 H and AS 235 K automation systems described in this catalog are proven and reliable. They can be configured within wide limits and coupled to a wide range of subordinate systems. The AS 235 H additionally has a redundant central unit and thus satisfies particularly high availability demands. The AS 235 systems can communicate with one another and with higher-level systems via the TELEPERM M CS 275 plant bus.

A wide range of TELEPERM M input/output modules is available for connection of the process peripherals (sensors and final control elements) to the AS 235, AS 235 H and AS 235 K automation systems. Some modules have their own processing features or can be configured application-specific.

The AS 388/TM and AS 488/TM automation systems (see Catalog PLT 112) use the SIMATIC M7-300 and M7-400 automation computers as the hardware platform and are compatible with the AS 235 system. They are appropriate for the extension of existing TELEPERM M systems or for the design of new systems.

The AS 388/TM and AS 488/TM systems can be operated on the PROFIBUS-TM plant bus. PROFIBUS-TM is based on the standardized PROFIBUS. The AS 488/TM system can additionally be operated on the CS 275 plant bus.

ET 200M distributed I/O systems with a comprehensive range of I/O modules can be connected to the AS 388/TM and AS 488/TM systems via one or two PROFIBUS-DP interfaces.

OS operator systems

The bus-compatible OS 525 (Catalog PLT 122) and WinCC/TM-OS (Catalog PLT 123) operator systems are used for process communication. They communicate with the subordinate TELEPERM M automation systems and with SIMATIC S5-155U via the CS 275 plant bus or PROFIBUS-TM.

The operator systems can have a configuration variable from a single-user system up to a multi-user system - where the OS basic unit communicates with several terminals via a terminal bus - and can thus cover the complete range from low-end to high-end applications.

The OS 525 *Local* system permits the design of a local AS operating console with the complete range of OS 525 functions.

Engineering

The PROGRAF AS+ configuring software is used for the AS 235, AS 235 H, AS 235 K, AS 388/TM and AS 488/TM automation systems and offers a wide range of support for documentation and configuring by means of a graphic functional diagram editor and an integrated database, amongst others.

Any single-user system WinCC/TM-OS-Single with RC license (Runtime+Configuration) is suitable as the configuring system for WinCC/TM-OS, and an OS 525 single-user system/terminal with OS 525-BIPRO configuring software for OS 525.

Plant bus

The plant bus is the central communication component of every distributed process control system. Two different bus systems are available for the TELEPERM M process control system, and can also be combined together within a system:

- CS 275
- PROFIBUS-TM

The CS 275 plant bus which has been proven in many automation plants is predestined for communication between the AS 235, AS 235 H, AS 235 K and AS 488/TM automation systems and the OS 525 and WinCC/TM-OS operator systems. The CS 275 plant bus functions according to the token passing principle and can also have a redundant configuration. Several buses can be combined together using bus couplers such that bus networks are produced corresponding to the plant structure. The bus system is provided with distributed control. The bus interface of each subsystem may take over the master function according to specific criteria.

The AS 388/TM and AS 488/TM automation systems and the OS 525 and WinCC/TM-OS operator systems can be connected to the PROFIBUS-TM plant bus. The PROFIBUS-TM is characterized in that it complies with the modern PROFIBUS communication standards to EN 50170 but also uses the TELEPERM M communication mechanisms of the CS 275 (AKS, BKS, MKS and PL/PS telegrams) at the user level (link between bus interface and application).

The PROFIBUS-TM plant bus also operates according to the token passing principle. It can be designed as an electrical or optical network. The two network instructions can also be mixed together. PROFIBUS-TM is preferably used for new systems or partial systems.

The CS 275 and PROFIBUS-TM buses can be connected together by a CS-L2 bridge, thus permitting linking of existing systems and new systems.

Note:
Information systems, computers from other manufacturers, personal computers and gateways can be connected to the CS 275 plant bus. Personal computers with the Win TM software package can also be connected to PROFIBUS-TM.
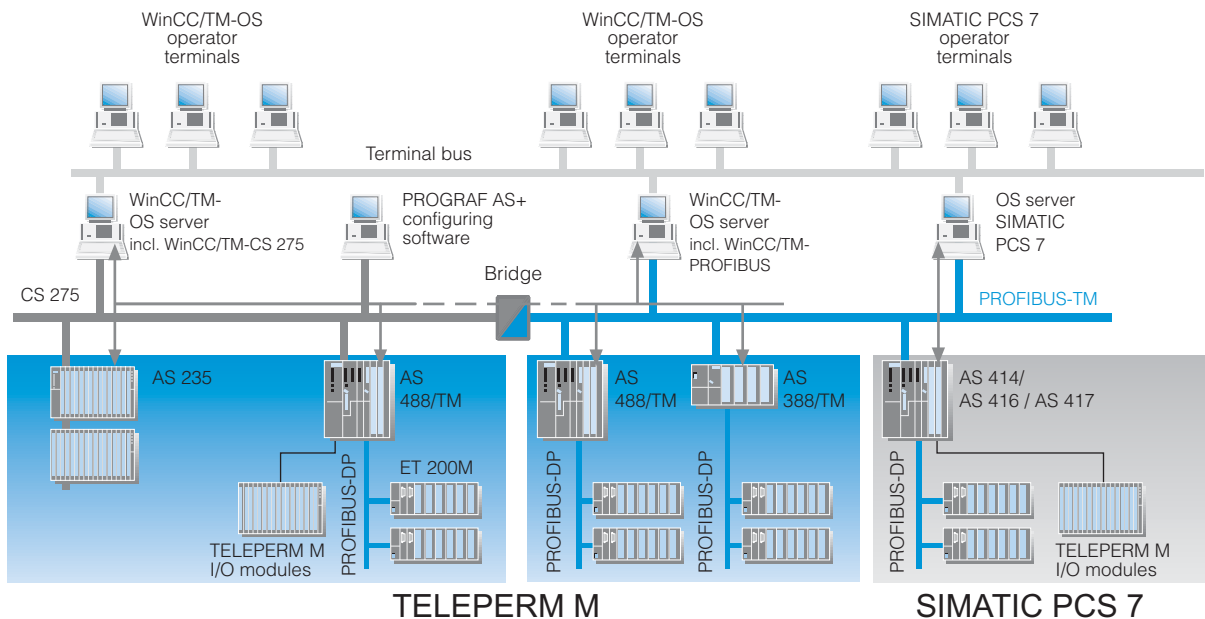
Brief description

Fig. 1/1   System configuration for the TELEPERM M process control system, with migration to the SIMATIC PCS 7 process control system

Functions of the AS 235 system

The AS 235, AS 235 H and AS 235 K automation systems provide all I & C functions such as measurement, supervision, calculation, closed-loop control and open-loop control, also particularly taking into account batch processes. The automation systems also handle the tasks for local operation and monitoring, e.g. display, signalling, alarm output, process operation and logging.

The AS 235 and AS 235 K only differ in their design. The AS 235 system is fitted in a cabinet, the AS 235 K system in a wall housing. The AS 235 H system with a redundant central unit is provided for applications with particularly high availability demands.

A large range of dedicated function blocks is available for solving I & C tasks in the AS 235, AS 235 H and AS 235 K automation systems. "Programming" of the automation systems is thus made extremely simple since the function blocks present in the system memory need only be activated by entering configuring instructions and parameters.

In addition, the AS 235, AS 235 H and AS 235 K permit the use of additional languages for special tasks - such as optimization, startup and shutdown of open-loop controls - which are difficult to solve using the existing function blocks or the batch functions. The TML process language (TELEPERM M Language) is available for analog and binary processing operations, as well as the STEP M control language already known from the SIMATIC industrial automation system. TML/STEP M can be used to define new function blocks optimally tailored to the respective task. Despite an extremely high degree of freedom, the clear and transparent "Block technology" is not relinquished. Frequently occurring block combinations can be combined into so-called Typicals and can then be used just like a single block.

A wide range of input and output modules is available for the AS 235, AS 235 H and AS 235 K systems as the interface to the process.

Intelligent I/O modules, e.g. modules which can carry out closed-loop control functions on their own, make it possible to configure a subordinate individual single-loop control level. This increases the availability of the automation system even further.

Further to this, the process interface is supplemented in particular for power applications or distributed small systems by system-compatible coupling of SIMATIC components.

The AS 235, AS 235 H and AS 235 K systems have either one or two autonomous operation channels for local operation and monitoring. This means that the process operation keyboard, process monitor and printer can be connected to each of the two operation channels and carry out operation and monitoring functions independent of one another.

In addition to the standardized displays which are achieved by addressing the automation function blocks without carrying out any further configuring, the user can also configure free displays. A standardized display is e.g. the loop display for operation of a control loop, a free display is the schematic representation of plant components (flowcharts) in their respective process status.

The local operation devices may be omitted when using central operation and monitoring in a network configuration.

Configuring

Configuring includes the incorporation of the automation structure into the automation system by using configuring instructions, by specifying parameters, by programming with TML and STEP M if applicable, and the feedback documentation.

This is possible either without an additional programming device/personal computer directly on the automation system (direct configuring, input/output using lists) or by using a PROGRAF AS+ engineering tool on a programming device/PC. Both configuring methods can be used

- locally for one automation system or
- centrally from one AS 235 system or one PC with PROGRAF AS+ for bus-coupled systems.

TELEPERM M
Introduction

System data

General system data [1]

Permissible ambient temperature

- Modules
  - Operation   0 to 70 °C
  - Δt/h   Max. 10 K
  - Δt/min   Max. 0,5 K
  - Transport and storage   -40 to +70 °C
- Cabinet (operation)
  Cabinet ambient temperature at
  1 m above cabinet base   0 to 40 °C

Reduction in specified temperature   10 K/1000 m
above 1000 m above sea level

Permissible humidity

	Operation	Storage
– Annual average	Max. 75 %	Max. 65 %
– On 30 days/year	Max. 95 %	–
– On 60 days/year	–	Max. 85 %

Condensation not permissible

Mechanical ambient conditions

Operation stress
(modules in subrack)
- 10 to 60 Hz   0.15 mm deflection
- 60 to 500 Hz   2 g acceleration

System cabinet
- 10 to 58 Hz   0.035 mm deflection
- 58 to 500 Hz   0.5 g acceleration

Transport stress
(modules in subrack)
- 5 to 8 Hz   7.5 mm deflection
- 8 to 500 Hz   2 g acceleration

Design, earthing conditions

Potential difference between all   Max. 7 V
ground star points of distributed
systems

Insulation   According to VDE 0160

Protection class   Class I

Insulation of modules, clearances and   According to VDE 0110
creepage distances from pin to pin or
from conductor to conductor

**Signal data
(interface to field level)**

- Binary signals

DC voltage   Referred to *M* potential

Signal definition   Inputs   Outputs
- L (low)   -30 to +4.5 V 0 to 2.5 V
- H (high)   +13 to +33 V   L+ to
                                                          (L+ - 2.5 V)

Input currents
- Electronic transmitters   0.5 mA   Typical values for
- Contacts   4 mA   configuring

Output currents with DC 24 V   8.5 mA/100 mA/120 mA

Power signals   Max. 400 mA

Binary signal outputs   Short-circuit-proof and
                               overload-proof

General system data

- Analog signals

DC voltage   Referred to *MZ*
- Rated range of use   -10 to +10 V
                                           -10 to 0 V
                                           0 to +10 V

- Overflow range   -10.5 to +10.5 V
- Input resistance   100 kΩ
- Output loading capacity   1 mA

Direct current   Referred to *M*
- Rated range of use   0 to 20 mA or 4 to 20 mA
- Overflow range   0 to 21 mA or 3.7 to 21 mA
- Input resistance   12.5, 50 or 350 Ω
- Rated output load   500 or 600 Ω

Analog signal outputs   Short-circuit-proof and over-
                                           load-proof

Overvoltage resistance of binary and   Class II
analog inputs and outputs according
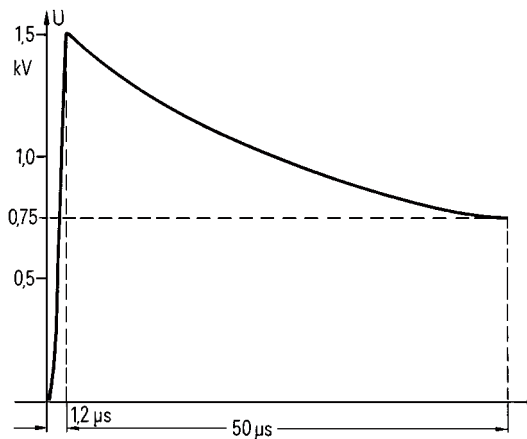to IEC information 255-4 (Fig. 1/2)

Fig. 1/2   Overvoltage resistance / dynamic destruction limit

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[1] Deviations possible in individual cases. Refer to technical data of individual components

TELEPERM M
Introduction

System data

▪ Technical data of automation systems

Central unit

Central processor	Microprogrammed
Arithmetic unit processing width	32 bit
Process execution levels	5
• Acyclic	2 (alarm and background levels)
• Cyclic	2 (125 ms, 1 s) and communication level

Memory (EDC)

	1-bit correction when reading
Interface to central processor	16 bit wide
Main memory (RAM)	4000 kbyte
Memory for system software (RAM)	1 Mbyte
Memory backup time (RAM) T_{min}	480 h

Input and output devices

Operation unit	1 process monitor 1 process operation keyboard
• Number of operation units which can be used simultaneously	2
Process monitor	
• Vertical frequency	50 Hz non-interlaced
• Horizontal frequency	15.625 kHz
• Video signals	RGB with SYNC in green channel
Graphic display	
• Semi-graphics	
• Format	32 lines with 64 characters each
• Colors	8
• Resolution	High-resolution
• Message line	1
• Working field	29 lines
• Input line	1, for configuring
Configuring unit	1 configuring keyboard, 1 mini floppy disk unit
Mini floppy disk unit	
• Diskette format	5.25 inch
• Max. storage volume per diskette	1 Mbyte
Logging printer/message printer	Needle and ink-jet printers
• Number of logging/message printers which can be operated simultaneously	2 / 2
• Format	DIN A4 (80 characters/line) or DIN A3 (136 characters/line)
• Printing speed with normal font	300 characters/s

▪ Technical data of automation systems (continued)

Power supply for AS

Supply voltage	DC 24 V (AS 235 K also AC 50/60 Hz, 230 V)
• Redundant supply	With AS 235 H and AS 235 K, DC 24 V; as option with AS 235
• Permissible range including ripple	DC 20.8 to 33 V (AS 235 and AS 235 K, DC 24 V) DC 21.6 to 31 V (AS 235 H)
Permissible ripple (DC 24 V systems)	15 % of mean DC value within the permissible range
Limiting range of use (DC 24 V systems)	35 V ≤ 500 ms 45 V ≤ 10 ms
Voltage dip with U_N=24 V (DC 24 V systems)	0 V ≤ 5 ms, recovery time 10 s
External fusing required	– Max. 80 A with I/O modules (AS 235 and AS 235 H) – 25 A (AS 235 K, DC 24 V) – 10 A (AS 235 K, AC 230 V)
Current consumption of basic unit/ basic system (typical value without I/O modules)	5.5 A (AS 235) 8.5 A (AS 235 H) 6.5 A (AS 235 K, DC 24 V) 1.0 A (AS 235 K, AC 230 V)
Power consumption (basic unit/system)	– Max. 160 W (AS 235, without I/O modules) – Max. 200 W (AS 235 H, without I/O modules) – Max. 220 W (AS 235 K, DC 24 V, with I/O modules) – Max. 330 VA (AS 235 K, AC 230 V, with I/O modules)
Permissible thermal load in cabinet (for AS 235 and AS 235 H)	
• Without heat exchanger [1] – Without fan subassembly – With fan subassemblies	Max. 350 W Max. 700 W
• With heat exchanger and fan subassemblies	Max. 1000 W
Heat to be dissipated from housing (only AS 235 K)	Max. 200 W

	AS 235/235 H	AS 235 K
Degree of protection EN 60 529		
• Standard cabinet without heat exchanger	IP 20	–
• Standard cabinet with heat exchanger	IP 54	–
• Sheet-steel housing	–	IP 21
• Subrack	IP 00	IP 00

Impairment of function by gases	Industrial atmospheres for occupied rooms are permissible

[1] With cabinet inlet temperature 40 °C

TELEPERM M
Introduction

System data

■ **Technical data of automation systems** (continued)

I/O modules	
Function modules/calculation modules	Autonomous closed-loop and individual control drive modules or user-configured with own microprocessor
Signal modules	Binary and analog
Counter modules	Metered pulse module, proportioning counter module
Coupling modules	For SIMATIC S5/S7 peripheral I/O modules and devices, and for subordinate devices and systems
Max. number of I/O modules	90 / 114[1] (AS 235) 91 / 103[1] (AS 235 H) 6 / 108[1] (AS 235 K)

Typical quantity breakdown	
Control loops	30 to 80
Additional analog-value monitoring	50 to 120
Sequential controls	5 to 15
Logic controls	100 to 250
Any number of flowcharts (up to 8 colors) and individually formatted logs	

Dimensions / weight	
Dimensions (*H x W x D*) in mm	
• Standard cabinets – With degree of protection IP 20 – With degree of protection IP 20 and IP 54	2200 x 900 x 400 2200 x 900 x 600
• Housing with degree of protection IP 21	820 x 600 x 360
Weight	
• AS 235 / AS 235 H	200 to 250 kg [2]
• AS 235 K (DC) AS 235 K (AC)	77 kg [3] 85 kg [3]

1) When used with ES 100 K extension system
2) Typical value, depends on configuration with I/O modules
3) Without I/O modules ■

System architecture

Configuring

System architecture

Performance characteristics

Performance characteristics

The AS 235, AS 235 H and AS 235 K systems are programmable automation systems of the TELEPERM M process control system based on function blocks. They have a different design and availability, but the same range of functions. The AS 235 K system is fitted in a wall housing, the AS 235 and AS 235 H systems are fitted in cabinets. The AS 235 H automation system has a redundant central unit to satisfy particularly high demands placed on the availability.

The systems can either be used on their own with local operation and monitoring, or coupled in system networks with central operation and monitoring.

System configuration

The automation systems consist of:

- A basic unit (AS 235, AS 235 H) or a basic system (AS 235 K)
- ES 100 K extension systems (wall housing) or extension units (for fitting in cabinets) as extension for configuring with input/output modules.

Standard input/output devices enable local communication with the automation system during the configuring and commissioning phases as well as during later operation. The following can be connected:

- 54-cm (21-inch) process monitors
- Process operation keyboard and configuring keyboard, max. 2 of each for 2 independent operating consoles
- Max. 4 logging printers
- 1 mini floppy disk unit for booting the system memory and for loading/saving the user memory.

Basic system/basic unit

The basic unit (AS 235, AS 235 H) or the basic system (AS 235 K) mainly contains

- the power supply modules,
- the central processor module,
- a memory module with user memory with 4,000 Kbyte capacity and battery backup and
- the interface modules for the input and output devices and the CS 275 bus system,

each of which is redundant in the AS 235 H system.

The central processor is microprogrammed and has a maximum processing width of 32 bits. Three basic cycles are present for processing (125 ms, 1 s and background level). An acyclic mode can also be defined.

The basic unit of the AS 235 and the basic system of the AS 235 K each has 6 slots for I/O modules. No I/O modules can be plugged into the basic unit of the AS 235 H systems.

The following can be fitted into the systems as standard:

- AS 235   Max. 90 I/O modules
            (basic unit + 6 extension units)
- AS 235 H Max. 91 I/O modules
            (7 extension units)
- AS 235 K Max. 108 I/O modules
            (basic system + eight ES 100 K extension systems)

The number of usable I/O slots with the AS 235 and AS 235 H can be increased by additional use of ES 100 K extension systems:

- AS 235   Max. 114 I/O modules
- AS 235 H Max. 103 I/O modules

I/O modules

There are the following groups of I/O modules:

- Signal modules
- Function modules
- Calculation modules
- Coupling modules.

Signal modules are required for input and output of the process signals, usually without further processing (exception: adaptation of characteristic with temperature measurements).

Function modules (closed-loop control modules) and calculation modules have additional performance features which are independent of the central unit of the automation system and which can be used to increase the total processing performance or the availability by transferring backup functions should the central unit of the automation system fail.

The calculation modules enable the configuring of individual user functions.

Coupling modules enable the connection of I/O modules over larger distances. They additionally enable use of non-intelligent I/O modules of the SIMATIC S5 programmable controllers, plus the ET 100U distributed I/Os for the automation systems.

Memory, configuring

The memory with battery backup of the automation systems is divided into:

- a system memory and
- a user memory.

The write-protected system memory contains the software which always belongs to the automation system, in the form of basic programs and function blocks. Far more than 100 standardized blocks are available for data acquisition, closed-loop control, open-loop control, calculation, supervision, logging, display and operation/monitoring.

Instead of programming the system with individual commands and carrying out the required program tests, it is only necessary in the TELEPERM M process control system to configure these complete function blocks in order to obtain a "user program". In the simplest case, configuring means calling the function blocks with the keyboard, several times if necessary, and then assigning the respective linking instructions and parameters. The resulting application-oriented configuring data are then stored in the user memory.

Configuring is possible before the automation system is started up as well as during operation. It is possible to temporarily switch partial functions of the user system out of operation for this purpose.

Convenient configuring using graphic inputs is possible using the PROGRAF AS+ engineering tool which can be executed in a personal computer connected locally to the AS 235/235 H/235 K automation system or centrally to the CS 275 bus system.

System architecture

STEP M

In addition to the function blocks for binary processing, the AS 235/235 H/235 K systems can use the STEP M control language, without leaving the block configuration, in order to formulate extensive and complex open-loop control tasks.

TML language

The TML process language can be used in addition to the firmware blocks for special tasks. It can be used to format special function blocks and to implement particularly complex functions, e.g. for the mixing of binary value arithmetic and measured value arithmetic.

Operation and monitoring

The AS 235, AS 235 H and AS 235 K systems have either one or two autonomous operation channels for local operation and monitoring. This means that process operation keyboards, printers and process monitors can be connected in duplicate and operated using operation/monitoring functions which are independent of one another. Some of the local operation devices can be omitted in the case of central operation and monitoring with a network configuration.

Scope of performance

The user RAM of the automation systems has a memory capacity of 4,000 Kbytes. This means that even one single system can already implement larger automation tasks. Even the data quantities encountered with extensive batch processes can be handled. If it is taken into account that various tasks occur mixed together, the performance is approximately as follows:

- 30 to 80 control loops
- 50 to 120 additional analog-value monitoring functions
- 5 to 15 sequential controls
- 100 to 250 logic controls
- Any number of flow charts (up to 8 colors) and individually designed logs.

Performance characteristics

Summary of system properties

- Automation system for autonomous operation with local communication or for network operation with central communication
- Fitted in wall housing or cabinet
- Configurable within wide limits (up to 114 I/O modules depending on system)
- User memory up to 4,000 Kbytes on one module
- 32-bit processing of analog values
- Optimized data transfer rate resulting from separate processing of analog and binary values
- Central unit redundant as option with synchronous processing of clocks (AS 235 H)
- Operation without fans possible
- Complete range of standard function blocks
- User function blocks with convenient TML programming language, also STEP M programming language for open-loop control tasks
- Configuring/programming either online without programmer (using lists) or with PC (using graphics)
- Local or central configuring (via bus)

System architecture
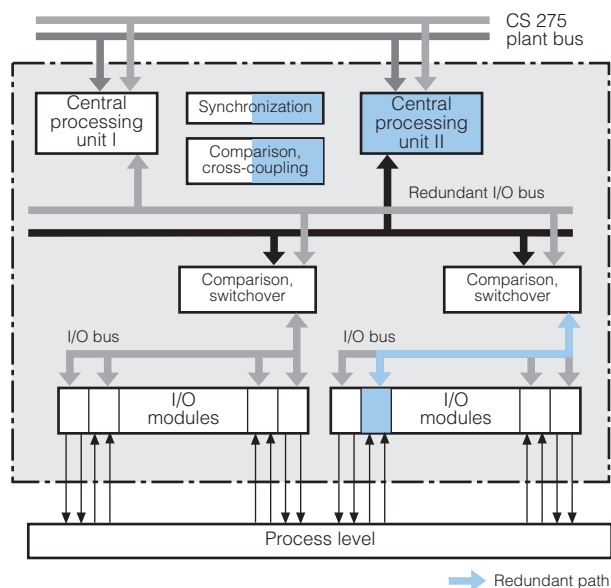
Redundancy with AS 235 H

Fig. 2/1   1-out-of-2 redundancy structure with AS 235 H

Redundancy with the AS 235 H automation system

Various system characteristics must be considered with regard to the reliability and availability of a system. The requirements for reliability are met by fault-tolerant (high-availability) systems while those for safety are met by fail-safe systems.

According to VDI/VDE 3542 the following applies:
A system is fault-tolerant if occurring faults have no effect on its function. Fail-safe is the ability of a technical system to remain in a safe mode or to switch immediately to another safe mode in the event of a fault.

The AS 235 H automation system is a high-availability system with redundant central units operating with system clocks where execution of the planned automation functions is not interrupted by system faults.

The system operates according to the fault-tolerant 1-out-of-2 principle. The AS 235 H system is equipped with 2 identical central processing units for this purpose, the master unit and the slave unit (Fig. 2/1). Each of the two CPUs contains a power supply module, central processor, memory module for system software and user program as well as 1 or 2 interface modules for the I/O bus depending on the number of I/O modules connected. The user programs stored in the 2 memory modules are identical.

Process signals are always applied to both CPUs. Only one of these, the master unit, can output commands to the process via the I/O modules. The other operates in hot standby mode and is always able to take over smooth control of the process should the master unit fail.

The fully-synchronous mode of operation of the two partial AS 235 H systems means that any assignment of the master is possible: master/slave or slave/master. Both partial systems are updated with the same information simultaneously because all input data are applied to both, meaning that online backup data transmission between the two partial systems is superfluous.

Central faults are detected very rapidly using a hardware comparator. This compares the redundant bus signals for each read or write operation of the central processors operating with synchronous clocks. Software test programs are started in the event of a fault in order to established its location.

The synchronous signals of the redundant I/O bus are checked for equality for selective areas of up to 13 I/O modules each and converted to the single-channel I/O bus of the standard I/O modules. Up to 3 selected I/O module areas can be supplied by the redundant I/O bus (A), a further 4 selected I/O module areas can be supplied by extending with a redundant I/O bus 2 (B). A strict division into fault limiting regions thus ensures that single faults can only have an effect within one selective I/O module area.

The AS 235 H system enables maintenance and repair without interfering with process operations. The corresponding partial system, irrespective of whether it is the master or slave, is removed from the synchronous operation. The partner system then retains the master status, or is assigned it automatically, and thus handles the active process operations. The disabled, passive partial system now operates completely independently, but without the I/O modules since these are required by the master.

This simplex operation with 2 independent systems enables new user programs to be configured, loaded or tested and to operate on the process either on a trial basis or permanently. This flexibility prevents undesirable down times in the process when changing the automation structure.

The backup of a passive partial system (transition from simplex to duplex operation with a slave system ready for operation) is initiated by the operator and is executed without influencing the online processing of the master system. It is terminated by automatic synchronization. The second partial system is then the slave and is ready to accept the master status at any time.

When connected to the CS 275 bus system, the redundant AS 235 H system responds like a single participant.

The user software of the AS 235 H automation system is compatible with that of the AS 235 and AS 235 K systems, i.e. user configurations which have been generated on these systems and which function directly can also be used in the AS 235 H system without limitations.

Important note:

The AS 235 automation system has been optimized for high reliability and availability by means of fault tolerance and a non-interacting design. However, it does not belong – just like any other single or redundant programmable system – to the class of special fail-safe systems approved by independent testing authorities (e.g. TÜV).

It is therefore important when automating processes or process sections relevant to safety to ensure that suitable subordinate interlocking circuits or protective systems are provided for these areas in the AS 235 H system as in the AS 235 / AS 235 K systems which make a dangerous operating state impossible should faults occur in the automation system.

System architecture
Configuring

Standard function blocks

Standard function blocks

Dedicated function blocks are present in the automation systems to solve the control tasks. These are the so-called standard function blocks. The AS 235, AS 235 H and AS 235 K systems have the same standard function blocks for data acquisition, closed-loop and open-loop control, calculation and monitoring.

The standard function blocks present in the system software are activated by engineering tools using configuring instructions. The blocks are combined into an automation structure which is processed cyclically, and sometimes acyclically, by the central processor of the automation system.

The configuration of the automation structure is usually generated graphically using the PROGRAF AS+ configuring tool (see also page 2/9).

The following tables list the standard function blocks divided according to their areas of application.

Blocks for analog and digital processing

Type	Designation	Function
SUM	Adder	$Y = X1 + X2 - X3 - X4$
MUL	Multiplier	$Y = X1 \cdot X2$
DIV	Divider	$Y = X1/X2$
RAD	Square-root extractor	$Y = \sqrt{X}$ or $Y = K\,\sqrt{X}$
LN	Logarithm extractor	$Y = KF \cdot \log_e |X|$
EXP	Exponential value	$Y = e^x$
ABS	Absolute value	$X = |X|$
INT	Integrator	$Y = K \cdot \int X\,dt,\ K = 1/T$
DIF	Differentiator	$Y(s)/X(s) = (T \cdot s)/(1 + (T \cdot s/v))$
PT	Delay	$Y(s)/X(s) = 1/(1 + T \cdot s)$
TOZ	Dead time	$Y(s)/X(s) = e^{-s \cdot T}$
MIN	Minimum-value selector	$Y = $ minimum of X1, X2, X3
MAX	Maximum-value selector	$Y = $ maximum of X1, X2, X3
TOB	Dead band	$Y = $ X-TOBU for X < TOBU 0 for TOBU ≤X ≤TOBO X-TOBO for X > TOBO
PLG	Function generator	Linear interpolation between 6 pairs of turning points
GW	Limit monitor	Limit check between two switching points
ASL	Analog-value switch	$Y = X1$ for S = "0" $Y = X2$ for S = "1"
SPEI	Analog-value memory	Storage of up to 256 analog values

Blocks for binary processing

Type	Designation	Function
VU	AND	$A = E1 \wedge E2 \wedge E3$
VO	OR	$A = E1 \vee E2 \vee E3$
VN	Negation	$A = \overline{E}$
VM	Flag	Flag of binary input signals (flip-flop)
VZ	Time delay	Switch-on and switch-off delays
VS + STEP	STEP M block	Freely programmable in STEP M
MPX	Multiplexer	To supply the STEP commands in the following VS/KS block
BW	Binary selection	Selection of status combination from up to 3 binary signals
INKU	Incremental converter	Converts analog value into an open or close pulse
BCE	BCD input	Conversion of a BCD signal into an analog value
BCA	BCD output	Conversion of an analog value into a BCD signal
KA	Sequence start	Marks the start of an ON/OFF branch of a subgroup control
KAK		As KA, but with additional functions
KB	Sequence	Conditions of a control step, for power plants
KBK		As KB, but with additional functions
KS	Sequence step	As KB, for process plants
KV	Sequence branch	Branch of a sequence into a maximum of 6 branches, with process plants
KE	Sequence end	Last block in a sequence
KEK		As KE, but with additional functions
HA	Auxiliary oil automatic unit	Controls electric auxiliary oil pumps for oil supply to generator sets
HUP	Horn block	Triggers signalling equipment (optical and audible)
EAR	Individual analog-value allocation	Allocates analog values from outputs in GA blocks
EBR	Single-bit allocation	Links individual binary outputs to GB/GM data blocks
UBR	Universal binary location	Links 16 binary outputs to GB/GM data blocks

System architecture
Configuring

Standard function blocks

Blocks for processing with standardized operation and monitoring

Type	Designation	Function
R	Closed-loop controller	PID control, e.g. for disturbance variable feedforward, tracking of setpoint and manipulated variable, limit formation
RN		As R, with additional functions
M	Measured-value monitoring	Monitors a measured value for 3 pairs of limits Extension of a closed-loop control block for limit monitoring Limitation of measured value at the error limits
V	Ratio	Generation of a ratio, e.g. with a ratio control Proportional adjuster, e.g. with synchronization control or to influence the command variable in a cascade
B	Operation block	Display of analog values (internal result of calculations, ...) Access to analog and binary values (input of constants, ...)
S	Control unit	Operation and monitoring of a sequence in process plants
G	Subgroup control	Operation and monitoring of sequences in power plants
GK	Group control	As G, with additional functions
A	Output for binary data	Display of and access to a binary value
F	Window block	Display of 5 measured values; each of the 5 values is monitored for a pair of limits
FN	Window block	Display and limit monitoring of 5 measured values; input of 5 pairs of limits each with hysteresis as well as 5 ranges for the measured value display
T	Trend [1]	Display of the trend of 2 measured values as a bargraph; time base between 1.625 s and 36 h
SR	Recorder [1]	Summary of up to 4 series of measurements, displayed on screen as dashed-line curves; 4 pairs of limits for monitoring the measured values
C	Selector	To switch over binary signals, e.g. manual/automatic mode
PKM	Alarm acquisition	Acquires planned alarms from binary input module/GB block
PKF	Alarm sequence display [1]	Output of PKM alarms; new alarms of PKM blocks, display of alarm history

1) Displays in PROGRAF AS+

Data blocks

Type	Designation	Function
GA	Data block for global analog values	Storage of 256 analog values with error 10^{-9}; storage of process image, historical values etc.
GB	Data block for global binary values	Storage and scanning of 256 binary values; especially for binary process inputs and outputs
GM	Data block for global flags	Storage and scanning of 256 internal binary statuses
GT	Data block for global times (timer)	Storage and generation of times/ timers for execution of time-dependent functions
FA	Data field block for analog values	Storage of internal/external analog values with error 10^{-9}; especially for internal results
FSA	Data field block for analog values	Storage of internal/external analog values with error 10^{-4}; especially for internal results
FB	Data field block for binary data	Storage of internal/external binary values; extension of GB/GM blocks
FC	Data field block for characters	Storage of characters (texts)

Blocks for signal exchange via CS 275

Type	Designation	Function
AKS	Analog coupling and transmitter block	Transmission of up to 28 analog values and abbreviated time (minutes and seconds) from an AS 235 system to a max. of 6 or 32 receivers (AKE blocks)
AKE	Analog coupling and receiver block	Reception of up to 28 analog values via the CS 275 from the data set of an MKS block of another bus participant
BKS	Binary coupling and transmitter block	Transmission of up to 128 binary signals and abbreviated time from an AS 235 to a max. of 6 or 32 receivers (BKE blocks)
BKE	Binary coupling and receiver block	Reception of up to 128 binary values via the CS 275 from the data set of a BKS block of another bus participant
ZKS	Character coupling and transmitter block	Transmission of up to four S16 strings from an AS 235 to up to 6 or 32 receivers (ZKE blocks)
ZKE	Character coupling and receiver block	Reception of up to four S16 strings from another AS system
MKS	Alarm coupling and transmitter block	Transition of 32 binary signals as alarms (with the time a signal changes from 0→1 or 1→0) to other bus participants
MKE	Alarm coupling and receiver block	Reception of 32 binary signals of an MKS block and the time of transmission sent by another bus participant via the CS 275
SKS	Status coupling and transmitter block	Transfer of status information to higher-level systems (operator system, computer)
PLPS	Reading and writing of parameters	Reading or writing of up to 20 parameters from a bus-coupled AS 235 system

Driver blocks for I/O modules

Type	Designation	Function	For modules with Order No.
AE	Analog input	Acquisition of an analog signal via an analog input module channel (0 to 20 mA, 4 to 20 mA, 0 to ± 10 V; Pt 100 resistance thermometer, thermocouples) or an analog input module of the SIMATIC S5 programmable controllers (instrument range U)	6DS1 701-8AA, -8AB 6DS1 730-8AA 6DS1 731-8AA/-8BA/ -8EA/-8FA/-8RR + 6DS1 703-8AB, -8RR
AR	Analog input allocation	Acquisition of 8 analog process variables, conversion into physical variables; storage in GA blocks or direct linking	6DS1 700-... 6DS1 321-8AA [1]
AA	Analog output	Output of an analog signal via a channel of an analog output module or an analog output module of the SIMATIC S5 programmable controllers (instrument range U)	6DS1 702-8AA, -8RR 6DS1 321-8AA [1]
BEI	Binary input	Acquisition of binary signals via a binary input module; storage of binary signals in GB block	6DS1 601-... 6DS1 602-...
BRA	Binary allocation	Acquisition of 8 binary signals via a binary input module; allocation of signals to specified linking addresses	6DS1 615-8AA
BAU	Binary output	Output of up to 32 binary signals to a binary output module	6DS1 603-... 6DS1 604-8AA 6DS1 605-8BA
RZ	Input block for two-channel controller	Acquisition of analog and binary signals from a channel of a two-channel controller module	6DS1 402-... 6DS1 403-...
RZA	Output block for two-channel controller	Transfer of the manipulated variable increment ΔY or setpoint increment ΔW from a closed-loop control block R or RN to a channel of a controller module	
BU8	Binary transmitter monitoring block	Acquisition and monitoring of 8 binary signals via a binary input module	6DS1 620-8AA 6DS1 621-8AA
BU16	Binary transmitter monitoring block	Acquisition and monitoring of 16 binary signals via a binary input module	6DS1 600-8AA
ZE	Metered pulse input	Acquisition of a channel of a metered pulse input module	6DS1 607-8AB
DR	Input/output for speed controllers	Acquisition of signals from the interface module, and transfer of signals to the interface module	6DS1 303-8AA [2]
E110	Binary input for SIMATIC S5 input modules	Reading in of 16 binary values from an interface module for input modules of the SIMATIC S5-110 programmable controllers or for input modules of the SIMATIC S5 programmable controllers (instrument range U) or for standard binary input modules	6DS1 310-8AA/8AB [1] 6DS1 321-8AA [1] 6DS1 600-8AA 6DS1 601-8BA 6DS1 602-8.. 6DS1 615-8AA
A110	Binary output for SIMATIC S5 output modules	Output of 16 binary values from an interface module for output modules of the SIMATIC S5-110 programmable controllers or for output modules of the SIMATIC S5 programmable controllers (instrument range U) or for standard binary output modules	6DS1 310-8AA/8AB [1] 6DS1 321-8AA [1] 6DS1 603-8.. 6DS1 604-8AA 6DS1 605-8BA
S5KE	Coupling to S5 - receive	Acquisition of signals from the interface module via telegrams with point-to-point coupling	6DS1 333-8AB [1]
S5KS	Coupling to S5 - transmit	Transfer of signals to the interface modules via telegrams with point-to-point coupling	6DS1 333-8AB [1]
AEF	Analog input (field multiplexer)	Driver for acquisition of analog signals via the field multiplexer analog input modules [2]	6DS1 706-8AA 6DS1 710-8AA
AAF	Analog output (field multiplexer)	Driver for acquisition of analog signals via the field multiplexer analog output modules [2]	6DS1 711-8AA 6DS1 406-8AA/407-8AA
BEF	Binary input (field multiplexer)	Driver for acquisition of binary signals via the binary signal input modules of the field multiplexer and for acquisition of fault signals from the binary I/O modules of the field multiplexer [2]	6DS1 610-8AA 6DS1 611-8AA
BAF	Binary output (field multiplexer)	Driver for output of binary signals via the binary signal output modules of the field multiplexer [2]	6DS1 612-8AA
PRA	Testable relay module	Driver for output of 16 binary signals to a testable relay output module	6DS1 606-8BA
PBE	Testable binary input	Acquisition of binary signals via a testable binary input module, and transfer of the binary signals to binary-value fields	6DS1 618-8CA

1) Coupling module
2) No longer available

System architecture

Configuring

Standard function blocks

Driver blocks for configurable TELEPERM ME I/O modules

Type	Designation	Function	For modules with Order No.
MSB	Motor/valve and actuator control	Acquisition and transfer of binary signals to the binary generation module	6DS1 717-8AA/-8RR + 6DS1 719-8AA/-8RR
TVB	Preselection and subloop control	Acquisition and transfer of binary signals to the binary calculation module for operation and monitoring of a preselection or subloop control	6DS1 717-8AA/-8RR
BRBK	Organization and binary input/output block	Acquisition of binary signals from the flag area of the binary calculation module, coordination together with ABR, MSB or TVB	6DS1 717-8AA/-8RR
ABR	Analog input and output	Acquisition and transfer of analog signals to the analog extension module via the binary calculation module	6DS1 717-8AA/-8RR + 6DS1 720-8AA
REN	Analog/binary inputs and output	Acquisition and transfer of analog and binary signals of the analog calculation module	6DS1 715-8BB
RSK	Closed-loop control module driver	Acquisition of signals from single-channel and two-channel configurable closed-loop control modules	6DS1 408-8BB 6DS1 410-8BB 6DS1 411-8AA/-8RR 6DS1 412-8AA/-8RR
RSKB	Operation block for RSK block	For operation and monitoring of configurable closed-loop control modules, together with RSK block	

Driver blocks for I/O modules with standardized display

Type	Designation	Function	For modules with Order No.
RE	Closed-loop controller, single-channel	Acquisition of signals from single-channel closed-loop control modules; transfer of commands and standardized increments to the closed-loop control modules	6DS1 400-8BA (S controller) 6DS1 401-8BA (K controller)
RK		As RE, with additional functions	
EM	Individual control drive, motor	Acquisition of signals from individual control drive modules and application of signals to the binary outputs, e.g. for a subgroup control; transfer of commands to the individual control drive modules	6DS1 500-8BA 6DS1 502-8BA
EU		As EM, with additional functions	
EV	Individual control drive, valve	As EM, for the corresponding modules	6DS1 501-8BA/-8BB 6DS1 503-8BA
EK		As EV, with additional functions	
DZ	Proportioning counter	Acquisition of signals from proportioning counter modules (2/4 channels); connection of these signals to the block outputs; transfer of commands and standardized analog values	6DS1 613-8BB
EG	Individual control drives (4 to 8 channels)	Acquisition of signals from modules; connection of these signals to the binary outputs; transfer of commands	6DS1 504-8AA 6DS1 505-8AA
FM	Field multiplexer	Acquisition of signals from a channel of the interface module for FM 100 field multiplexer [1]; transfer of signals to the module	6DS1 304-8AA 6DS1 304-8BB

1) No longer available

System architecture
Configuring

Standard function blocks

Output blocks for printer and process monitor

Type	Designation	Function
GP	Group display	Design of display hierarchy: area display and group display
MEL	Alarm output	Output of planned plain text alarms with time (resolution 1 s); also standard blocks, such as M, generate alarms
BILD +LAYO	Display output	Output of plant-specific displays
PROT +LAYO	Log output	Output of plant-specific logs on printers
PKF	Process coupling/ alarm sequence display	Output of PKM alarms

Organization blocks

Type	Designation	Function
XB	Processing, cyclic	To inhibit/release a group of function blocks and to release each n-th cycle
XA	Processing, acyclic	To inhibit/non-recurring release a sequence of function blocks. When installed in the alarm level (ZYK 1) as an ALARM block: 1 x execution of subsequent block sequence
XZ	Time start	For time-dependent switching-on/off of XB blocks
FUTA	Function keys	For switching-on/off of XA/XB blocks by operator input
RNAM	Rename	Modification of type name or block name
APRO+ PROB	TML connection (of PROBLEM blocks)	To insert a user-specific TML program into the execution list

Test blocks

Type	Designation	Function
TANZ	Test display	Monitoring of binary and analog variables; selective access to variables possible (max. 16 analog and 16 binary within a standard display)
TUEB	Test monitoring	For sequence monitoring of TML programs for: • Cyclic sequence monitoring • Non-recurring monitoring of a program run (up to 248 TML programs can be monitored)
SYST. WART	Test and maintenance	Menu-controlled calling of maintenance programs: • XB switchover • CS 275 coupling status • Activate error messages • TML • Reloading and selective archiving • System settings

System architecture

2

Configuring

System architecture

Performance characteristics

Performance characteristics

The AS 235, AS 235 H and AS 235 K systems are programmable automation systems of the TELEPERM M process control system based on function blocks. They have a different design and availability, but the same range of functions. The AS 235 K system is fitted in a wall housing, the AS 235 and AS 235 H systems are fitted in cabinets. The AS 235 H automation system has a redundant central unit to satisfy particularly high demands placed on the availability.

The systems can either be used on their own with local operation and monitoring, or coupled in system networks with central operation and monitoring.

System configuration

The automation systems consist of:

- A basic unit (AS 235, AS 235 H) or a basic system (AS 235 K)
- ES 100 K extension systems (wall housing) or extension units (for fitting in cabinets) as extension for configuring with input/output modules.

Standard input/output devices enable local communication with the automation system during the configuring and commissioning phases as well as during later operation. The following can be connected:

- 54-cm (21-inch) process monitors
- Process operation keyboard and configuring keyboard, max. 2 of each for 2 independent operating consoles
- Max. 4 logging printers
- 1 mini floppy disk unit for booting the system memory and for loading/saving the user memory.

Basic system/basic unit

The basic unit (AS 235, AS 235 H) or the basic system (AS 235 K) mainly contains

- the power supply modules,
- the central processor module,
- a memory module with user memory with 4,000 Kbyte capacity and battery backup and
- the interface modules for the input and output devices and the CS 275 bus system,

each of which is redundant in the AS 235 H system.

The central processor is microprogrammed and has a maximum processing width of 32 bits. Three basic cycles are present for processing (125 ms, 1 s and background level). An acyclic mode can also be defined.

The basic unit of the AS 235 and the basic system of the AS 235 K each has 6 slots for I/O modules. No I/O modules can be plugged into the basic unit of the AS 235 H systems.

The following can be fitted into the systems as standard:

- AS 235   Max. 90 I/O modules
  (basic unit + 6 extension units)
- AS 235 H Max. 91 I/O modules
  (7 extension units)
- AS 235 K Max. 108 I/O modules
  (basic system + eight ES 100 K extension systems)

The number of usable I/O slots with the AS 235 and AS 235 H can be increased by additional use of ES 100 K extension systems:

- AS 235   Max. 114 I/O modules
- AS 235 H Max. 103 I/O modules

I/O modules

There are the following groups of I/O modules:

- Signal modules
- Function modules
- Calculation modules
- Coupling modules.

Signal modules are required for input and output of the process signals, usually without further processing (exception: adaptation of characteristic with temperature measurements).

Function modules (closed-loop control modules) and calculation modules have additional performance features which are independent of the central unit of the automation system and which can be used to increase the total processing performance or the availability by transferring backup functions should the central unit of the automation system fail.

The calculation modules enable the configuring of individual user functions.

Coupling modules enable the connection of I/O modules over larger distances. They additionally enable use of non-intelligent I/O modules of the SIMATIC S5 programmable controllers, plus the ET 100U distributed I/Os for the automation systems.

Memory, configuring

The memory with battery backup of the automation systems is divided into:

- a system memory and
- a user memory.

The write-protected system memory contains the software which always belongs to the automation system, in the form of basic programs and function blocks. Far more than 100 standardized blocks are available for data acquisition, closed-loop control, open-loop control, calculation, supervision, logging, display and operation/monitoring.

Instead of programming the system with individual commands and carrying out the required program tests, it is only necessary in the TELEPERM M process control system to configure these complete function blocks in order to obtain a "user program". In the simplest case, configuring means calling the function blocks with the keyboard, several times if necessary, and then assigning the respective linking instructions and parameters. The resulting application-oriented configuring data are then stored in the user memory.

Configuring is possible before the automation system is started up as well as during operation. It is possible to temporarily switch partial functions of the user system out of operation for this purpose.

Convenient configuring using graphic inputs is possible using the PROGRAF AS+ engineering tool which can be executed in a personal computer connected locally to the AS 235/235 H/235 K automation system or centrally to the CS 275 bus system.

System architecture

STEP M

In addition to the function blocks for binary processing, the AS 235/235 H/235 K systems can use the STEP M control language, without leaving the block configuration, in order to formulate extensive and complex open-loop control tasks.

TML language

The TML process language can be used in addition to the firmware blocks for special tasks. It can be used to format special function blocks and to implement particularly complex functions, e.g. for the mixing of binary value arithmetic and measured value arithmetic.

Operation and monitoring

The AS 235, AS 235 H and AS 235 K systems have either one or two autonomous operation channels for local operation and monitoring. This means that process operation keyboards, printers and process monitors can be connected in duplicate and operated using operation/monitoring functions which are independent of one another. Some of the local operation devices can be omitted in the case of central operation and monitoring with a network configuration.

Scope of performance

The user RAM of the automation systems has a memory capacity of 4,000 Kbytes. This means that even one single system can already implement larger automation tasks. Even the data quantities encountered with extensive batch processes can be handled. If it is taken into account that various tasks occur mixed together, the performance is approximately as follows:

- 30 to 80 control loops
- 50 to 120 additional analog-value monitoring functions
- 5 to 15 sequential controls
- 100 to 250 logic controls
- Any number of flow charts (up to 8 colors) and individually designed logs.

Performance characteristics

Summary of system properties

- Automation system for autonomous operation with local communication or for network operation with central communication
- Fitted in wall housing or cabinet
- Configurable within wide limits (up to 114 I/O modules depending on system)
- User memory up to 4,000 Kbytes on one module
- 32-bit processing of analog values
- Optimized data transfer rate resulting from separate processing of analog and binary values
- Central unit redundant as option with synchronous processing of clocks (AS 235 H)
- Operation without fans possible
- Complete range of standard function blocks
- User function blocks with convenient TML programming language, also STEP M programming language for open-loop control tasks
- Configuring/programming either online without programmer (using lists) or with PC (using graphics)
- Local or central configuring (via bus)

System architecture
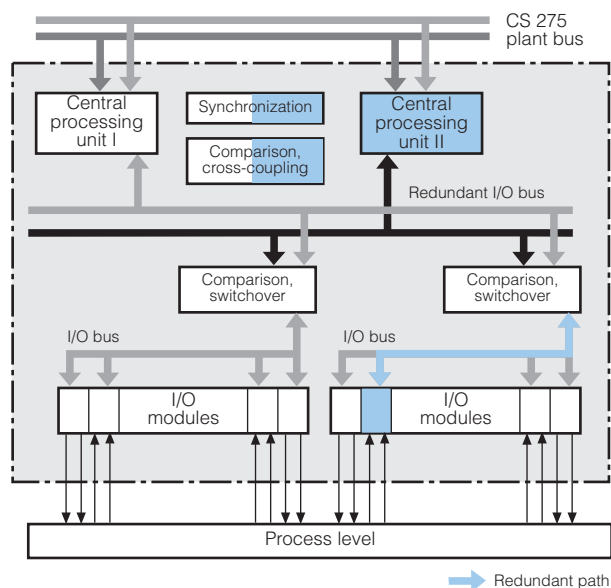
Redundancy with AS 235 H

Fig. 2/1   1-out-of-2 redundancy structure with AS 235 H

Redundancy with the AS 235 H automation system

Various system characteristics must be considered with regard to the reliability and availability of a system. The requirements for reliability are met by fault-tolerant (high-availability) systems while those for safety are met by fail-safe systems.

According to VDI/VDE 3542 the following applies:
A system is fault-tolerant if occurring faults have no effect on its function. Fail-safe is the ability of a technical system to remain in a safe mode or to switch immediately to another safe mode in the event of a fault.

The AS 235 H automation system is a high-availability system with redundant central units operating with system clocks where execution of the planned automation functions is not interrupted by system faults.

The system operates according to the fault-tolerant 1-out-of-2 principle. The AS 235 H system is equipped with 2 identical central processing units for this purpose, the master unit and the slave unit (Fig. 2/1). Each of the two CPUs contains a power supply module, central processor, memory module for system software and user program as well as 1 or 2 interface modules for the I/O bus depending on the number of I/O modules connected. The user programs stored in the 2 memory modules are identical.

Process signals are always applied to both CPUs. Only one of these, the master unit, can output commands to the process via the I/O modules. The other operates in hot standby mode and is always able to take over smooth control of the process should the master unit fail.

The fully-synchronous mode of operation of the two partial AS 235 H systems means that any assignment of the master is possible: master/slave or slave/master. Both partial systems are updated with the same information simultaneously because all input data are applied to both, meaning that online backup data transmission between the two partial systems is superfluous.

Central faults are detected very rapidly using a hardware comparator. This compares the redundant bus signals for each read or write operation of the central processors operating with synchronous clocks. Software test programs are started in the event of a fault in order to established its location.

The synchronous signals of the redundant I/O bus are checked for equality for selective areas of up to 13 I/O modules each and converted to the single-channel I/O bus of the standard I/O modules. Up to 3 selected I/O module areas can be supplied by the redundant I/O bus (A), a further 4 selected I/O module areas can be supplied by extending with a redundant I/O bus 2 (B). A strict division into fault limiting regions thus ensures that single faults can only have an effect within one selective I/O module area.

The AS 235 H system enables maintenance and repair without interfering with process operations. The corresponding partial system, irrespective of whether it is the master or slave, is removed from the synchronous operation. The partner system then retains the master status, or is assigned it automatically, and thus handles the active process operations. The disabled, passive partial system now operates completely independently, but without the I/O modules since these are required by the master.

This simplex operation with 2 independent systems enables new user programs to be configured, loaded or tested and to operate on the process either on a trial basis or permanently. This flexibility prevents undesirable down times in the process when changing the automation structure.

The backup of a passive partial system (transition from simplex to duplex operation with a slave system ready for operation) is initiated by the operator and is executed without influencing the online processing of the master system. It is terminated by automatic synchronization. The second partial system is then the slave and is ready to accept the master status at any time.

When connected to the CS 275 bus system, the redundant AS 235 H system responds like a single participant.

The user software of the AS 235 H automation system is compatible with that of the AS 235 and AS 235 K systems, i.e. user configurations which have been generated on these systems and which function directly can also be used in the AS 235 H system without limitations.

> **Important note:**
>
> The AS 235 automation system has been optimized for high reliability and availability by means of fault tolerance and a non-interacting design. However, it does not belong – just like any other single or redundant programmable system – to the class of special fail-safe systems approved by independent testing authorities (e.g. TÜV).
>
> It is therefore important when automating processes or process sections relevant to safety to ensure that suitable subordinate interlocking circuits or protective systems are provided for these areas in the AS 235 H system as in the AS 235 / AS 235 K systems which make a dangerous operating state impossible should faults occur in the automation system.

Standard function blocks

Dedicated function blocks are present in the automation systems to solve the control tasks. These are the so-called standard function blocks. The AS 235, AS 235 H and AS 235 K systems have the same standard function blocks for data acquisition, closed-loop and open-loop control, calculation and monitoring.

The standard function blocks present in the system software are activated by engineering tools using configuring instructions. The blocks are combined into an automation structure which is processed cyclically, and sometimes acyclically, by the central processor of the automation system.

The configuration of the automation structure is usually generated graphically using the PROGRAF AS+ configuring tool (see also page 2/9).

The following tables list the standard function blocks divided according to their areas of application.

Blocks for analog and digital processing

Type	Designation	Function
SUM	Adder	$Y = X1 + X2 - X3 - X4$
MUL	Multiplier	$Y = X1 \cdot X2$
DIV	Divider	$Y = X1/X2$
RAD	Square-root extractor	$Y = \sqrt{X}$ or $Y = K \sqrt{X}$
LN	Logarithm extractor	$Y = KF \cdot \log_e |X|$
EXP	Exponential value	$Y = e^x$
ABS	Absolute value	$X = |X|$
INT	Integrator	$Y = K \cdot \int X \, dt, K = 1/T$
DIF	Differentiator	$Y(s)/X(s) = (T \cdot s)/(1 + (T \cdot s/v))$
PT	Delay	$Y(s)/X(s) = 1/(1 + T \cdot s)$
TOZ	Dead time	$Y(s)/X(s) = e^{-s \cdot T}$
MIN	Minimum-value selector	Y = minimum of X1, X2, X3
MAX	Maximum-value selector	Y = maximum of X1, X2, X3
TOB	Dead band	$Y = $ X-**TOBU** for X < **TOBU** 0 for **TOBU** ≤X ≤**TOBO** X-**TOBO** for X > **TOBO**
PLG	Function generator	Linear interpolation between 6 pairs of turning points
GW	Limit monitor	Limit check between two switching points
ASL	Analog-value switch	$Y = X1$ for S = "0" $Y = X2$ for S = "1"
SPEI	Analog-value memory	Storage of up to 256 analog values

Blocks for binary processing

Type	Designation	Function
VU	AND	$A = E1 \wedge E2 \wedge E3$
VO	OR	$A = E1 \vee E2 \vee E3$
VN	Negation	$A = \bar{E}$
VM	Flag	Flag of binary input signals (flip-flop)
VZ	Time delay	Switch-on and switch-off delays
VS + STEP	STEP M block	Freely programmable in STEP M
MPX	Multiplexer	To supply the STEP commands in the following VS/KS block
BW	Binary selection	Selection of status combination from up to 3 binary signals
INKU	Incremental converter	Converts analog value into an open or close pulse
BCE	BCD input	Conversion of a BCD signal into an analog value
BCA	BCD output	Conversion of an analog value into a BCD signal
KA	Sequence start	Marks the start of an ON/OFF branch of a subgroup control
KAK		As KA, but with additional functions
KB	Sequence	Conditions of a control step, for power plants
KBK		As KB, but with additional functions
KS	Sequence step	As KB, for process plants
KV	Sequence branch	Branch of a sequence into a maximum of 6 branches, with process plants
KE	Sequence end	Last block in a sequence
KEK		As KE, but with additional functions
HA	Auxiliary oil automatic unit	Controls electric auxiliary oil pumps for oil supply to generator sets
HUP	Horn block	Triggers signalling equipment (optical and audible)
EAR	Individual analog-value allocation	Allocates analog values from outputs in GA blocks
EBR	Single-bit allocation	Links individual binary outputs to GB/GM data blocks
UBR	Universal binary location	Links 16 binary outputs to GB/GM data blocks

System architecture
Configuring

Standard function blocks

Blocks for processing with standardized operation and monitoring

Type	Designation	Function
R	Closed-loop controller	PID control, e.g. for disturbance variable feedforward, tracking of setpoint and manipulated variable, limit formation
RN		As R, with additional functions
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V	Ratio	Generation of a ratio, e.g. with a ratio control Proportional adjuster, e.g. with synchronization control or to influence the command variable in a cascade
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S	Control unit	Operation and monitoring of a sequence in process plants
G	Subgroup control	Operation and monitoring of sequences in power plants
GK	Group control	As G, with additional functions
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F	Window block	Display of 5 measured values; each of the 5 values is monitored for a pair of limits
FN	Window block	Display and limit monitoring of 5 measured values; input of 5 pairs of limits each with hysteresis as well as 5 ranges for the measured value display
T	Trend [1]	Display of the trend of 2 measured values as a bargraph; time base between 1.625 s and 36 h
SR	Recorder [1]	Summary of up to 4 series of measurements, displayed on screen as dashed-line curves; 4 pairs of limits for monitoring the measured values
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PKM	Alarm acquisition	Acquires planned alarms from binary input module/GB block
PKF	Alarm sequence display [1]	Output of PKM alarms; new alarms of PKM blocks, display of alarm history

1) Displays in PROGRAF AS+

Data blocks

Type	Designation	Function
GA	Data block for global analog values	Storage of 256 analog values with error 10^{-9}; storage of process image, historical values etc.
GB	Data block for global binary values	Storage and scanning of 256 binary values; especially for binary process inputs and outputs
GM	Data block for global flags	Storage and scanning of 256 internal binary statuses
GT	Data block for global times (timer)	Storage and generation of times/timers for execution of time-dependent functions
FA	Data field block for analog values	Storage of internal/external analog values with error 10^{-9}; especially for internal results
FSA	Data field block for analog values	Storage of internal/external analog values with error 10^{-4}; especially for internal results
FB	Data field block for binary data	Storage of internal/external binary values; extension of GB/GM blocks
FC	Data field block for characters	Storage of characters (texts)

Blocks for signal exchange via CS 275

Type	Designation	Function
AKS	Analog coupling and transmitter block	Transmission of up to 28 analog values and abbreviated time (minutes and seconds) from an AS 235 system to a max. of 6 or 32 receivers (AKE blocks)
AKE	Analog coupling and receiver block	Reception of up to 28 analog values via the CS 275 from the data set of an MKS block of another bus participant
BKS	Binary coupling and transmitter block	Transmission of up to 128 binary signals and abbreviated time from an AS 235 to a max. of 6 or 32 receivers (BKE blocks)
BKE	Binary coupling and receiver block	Reception of up to 128 binary values via the CS 275 from the data set of a BKS block of another bus participant
ZKS	Character coupling and transmitter block	Transmission of up to four S16 strings from an AS 235 to up to 6 or 32 receivers (ZKE blocks)
ZKE	Character coupling and receiver block	Reception of up to four S16 strings from another AS system
MKS	Alarm coupling and transmitter block	Transition of 32 binary signals as alarms (with the time a signal changes from $0\rightarrow1$ or $1\rightarrow0$) to other bus participants
MKE	Alarm coupling and receiver block	Reception of 32 binary signals of an MKS block and the time of transmission sent by another bus participant via the CS 275
SKS	Status coupling and transmitter block	Transfer of status information to higher-level systems (operator system, computer)
PLPS	Reading and writing of parameters	Reading or writing of up to 20 parameters from a bus-coupled AS 235 system

System architecture
Configuring

Standard function blocks

Driver blocks for I/O modules

Type	Designation	Function	For modules with Order No.
AE	Analog input	Acquisition of an analog signal via an analog input module channel (0 to 20 mA, 4 to 20 mA, 0 to ± 10 V; Pt 100 resistance thermometer, thermocouples) or an analog input module of the SIMATIC S5 programmable controllers (instrument range U)	6DS1 701-8AA, -8AB 6DS1 730-8AA 6DS1 731-8AA/-8BA/ -8EA/-8FA/-8RR + 6DS1 703-8AB, -8RR
AR	Analog input allocation	Acquisition of 8 analog process variables, conversion into physical variables; storage in GA blocks or direct linking	6DS1 700-... 6DS1 321-8AA [1]
AA	Analog output	Output of an analog signal via a channel of an analog output module or an analog output module of the SIMATIC S5 programmable controllers (instrument range U)	6DS1 702-8AA, -8RR 6DS1 321-8AA [1]
BEI	Binary input	Acquisition of binary signals via a binary input module; storage of binary signals in GB block	6DS1 601-... 6DS1 602-...
BRA	Binary allocation	Acquisition of 8 binary signals via a binary input module; allocation of signals to specified linking addresses	6DS1 615-8AA
BAU	Binary output	Output of up to 32 binary signals to a binary output module	6DS1 603-... 6DS1 604-8AA 6DS1 605-8BA
RZ	Input block for two-channel controller	Acquisition of analog and binary signals from a channel of a two-channel controller module	6DS1 402-... 6DS1 403-...
RZA	Output block for two-channel controller	Transfer of the manipulated variable increment ΔY or setpoint increment ΔW from a closed-loop control block R or RN to a channel of a controller module	
BU8	Binary transmitter monitoring block	Acquisition and monitoring of 8 binary signals via a binary input module	6DS1 620-8AA 6DS1 621-8AA
BU16	Binary transmitter monitoring block	Acquisition and monitoring of 16 binary signals via a binary input module	6DS1 600-8AA
ZE	Metered pulse input	Acquisition of a channel of a metered pulse input module	6DS1 607-8AB
DR	Input/output for speed controllers	Acquisition of signals from the interface module, and transfer of signals to the interface module	6DS1 303-8AA [2]
E110	Binary input for SIMATIC S5 input modules	Reading in of 16 binary values from an interface module for input modules of the SIMATIC S5-110 programmable controllers or for input modules of the SIMATIC S5 programmable controllers (instrument range U) or for standard binary input modules	6DS1 310-8AA/8AB [1] 6DS1 321-8AA [1] 6DS1 600-8AA 6DS1 601-8BA 6DS1 602-8.. 6DS1 615-8AA
A110	Binary output for SIMATIC S5 output modules	Output of 16 binary values from an interface module for output modules of the SIMATIC S5-110 programmable controllers or for output modules of the SIMATIC S5 programmable controllers (instrument range U) or for standard binary output modules	6DS1 310-8AA/8AB [1] 6DS1 321-8AA [1] 6DS1 603-8.. 6DS1 604-8AA 6DS1 605-8BA
S5KE	Coupling to S5 - receive	Acquisition of signals from the interface module via telegrams with point-to-point coupling	6DS1 333-8AB [1]
S5KS	Coupling to S5 - transmit	Transfer of signals to the interface modules via telegrams with point-to-point coupling	6DS1 333-8AB [1]
AEF	Analog input (field multiplexer)	Driver for acquisition of analog signals via the field multiplexer analog input modules [2]	6DS1 706-8AA 6DS1 710-8AA
AAF	Analog output (field multiplexer)	Driver for acquisition of analog signals via the field multiplexer analog output modules [2]	6DS1 711-8AA 6DS1 406-8AA/407-8AA
BEF	Binary input (field multiplexer)	Driver for acquisition of binary signals via the binary signal input modules of the field multiplexer and for acquisition of fault signals from the binary I/O modules of the field multiplexer [2]	6DS1 610-8AA 6DS1 611-8AA
BAF	Binary output (field multiplexer)	Driver for output of binary signals via the binary signal output modules of the field multiplexer [2]	6DS1 612-8AA
PRA	Testable relay module	Driver for output of 16 binary signals to a testable relay output module	6DS1 606-8BA
PBE	Testable binary input	Acquisition of binary signals via a testable binary input module, and transfer of the binary signals to binary-value fields	6DS1 618-8CA

1) Coupling module
2) No longer available

System architecture
Configuring

Standard function blocks

Driver blocks for configurable TELEPERM ME I/O modules

Type	Designation	Function	For modules with Order No.
MSB	Motor/valve and actuator control	Acquisition and transfer of binary signals to the binary generation module	6DS1 717-8AA/-8RR + 6DS1 719-8AA/-8RR
TVB	Preselection and subloop control	Acquisition and transfer of binary signals to the binary calculation module for operation and monitoring of a preselection or subloop control	6DS1 717-8AA/-8RR
BRBK	Organization and binary input/output block	Acquisition of binary signals from the flag area of the binary calculation module, coordination together with ABR, MSB or TVB	6DS1 717-8AA/-8RR
ABR	Analog input and output	Acquisition and transfer of analog signals to the analog extension module via the binary calculation module	6DS1 717-8AA/-8RR + 6DS1 720-8AA
REN	Analog/binary inputs and output	Acquisition and transfer of analog and binary signals of the analog calculation module	6DS1 715-8BB
RSK	Closed-loop control module driver	Acquisition of signals from single-channel and two-channel configurable closed-loop control modules	6DS1 408-8BB 6DS1 410-8BB 6DS1 411-8AA/-8RR 6DS1 412-8AA/-8RR
RSKB	Operation block for RSK block	For operation and monitoring of configurable closed-loop control modules, together with RSK block	

Driver blocks for I/O modules with standardized display

Type	Designation	Function	For modules with Order No.
RE	Closed-loop controller, single-channel	Acquisition of signals from single-channel closed-loop control modules; transfer of commands and standardized increments to the closed-loop control modules	6DS1 400-8BA (S controller) 6DS1 401-8BA (K controller)
RK		As RE, with additional functions	
EM	Individual control drive, motor	Acquisition of signals from individual control drive modules and application of signals to the binary outputs, e.g. for a subgroup control; transfer of commands to the individual control drive modules	6DS1 500-8BA 6DS1 502-8BA
EU		As EM, with additional functions	
EV	Individual control drive, valve	As EM, for the corresponding modules	6DS1 501-8BA/-8BB 6DS1 503-8BA
EK		As EV, with additional functions	
DZ	Proportioning counter	Acquisition of signals from proportioning counter modules (2/4 channels); connection of these signals to the block outputs; transfer of commands and standardized analog values	6DS1 613-8BB
EG	Individual control drives (4 to 8 channels)	Acquisition of signals from modules; connection of these signals to the binary outputs; transfer of commands	6DS1 504-8AA 6DS1 505-8AA
FM	Field multiplexer	Acquisition of signals from a channel of the interface module for FM 100 field multiplexer [1]; transfer of signals to the module	6DS1 304-8AA 6DS1 304-8BB

1) No longer available

System architecture
Configuring

Standard function blocks

Output blocks for printer and process monitor

Type	Designation	Function
GP	Group display	Design of display hierarchy: area display and group display
MEL	Alarm output	Output of planned plain text alarms with time (resolution 1 s); also standard blocks, such as M, generate alarms
BILD +LAYO	Display output	Output of plant-specific displays
PROT +LAYO	Log output	Output of plant-specific logs on printers
PKF	Process coupling/ alarm sequence display	Output of PKM alarms

Organization blocks

Type	Designation	Function
XB	Processing, cyclic	To inhibit/release a group of function blocks and to release each n-th cycle
XA	Processing, acyclic	To inhibit/non-recurring release a sequence of function blocks. When installed in the alarm level (ZYK 1) as an ALARM block: 1 x execution of subsequent block sequence
XZ	Time start	For time-dependent switching-on/off of XB blocks
FUTA	Function keys	For switching-on/off of XA/XB blocks by operator input
RNAM	Rename	Modification of type name or block name
APRO+ PROB	TML connection (of PROBLEM blocks)	To insert a user-specific TML program into the execution list

Test blocks

Type	Designation	Function
TANZ	Test display	Monitoring of binary and analog variables; selective access to variables possible (max. 16 analog and 16 binary within a standard display)
TUEB	Test monitoring	For sequence monitoring of TML programs for: • Cyclic sequence monitoring • Non-recurring monitoring of a program run (up to 248 TML programs can be monitored)
SYST. WART	Test and maintenance	Menu-controlled calling of maintenance programs: • XB switchover • CS 275 coupling status • Activate error messages • TML • Reloading and selective archiving • System settings

Automation systems

3

Automation systems

General

a Distributed configuration:
AS 235 K automation system,
can be extended by up to eight
ES 100 K extension systems

b Central configuration: AS 235 automation system with
basic and extension cabinets, max 6 extension units
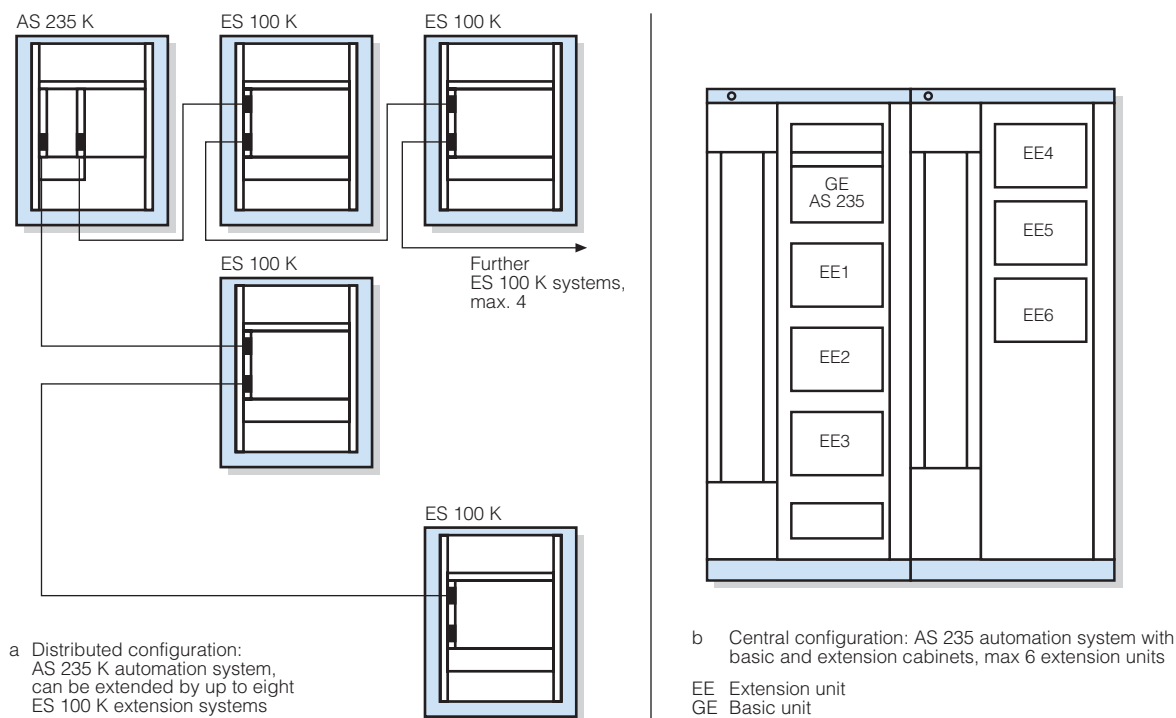
EE Extension unit
GE Basic unit

Fig. 3/1   Distributed and central configuration of AS 235 automation systems

General

The AS 235 automation system is available in three different versions:

• AS 235 cabinet version,

• AS 235 H high-availability cabinet version and

• AS 235 K compact version.

The I/O modules in the AS 235 and AS 235 H automation systems are in 6-U high subracks of the ES 902 packaging system, the extension units, which are only suitable for cabinet installation. A further 6 slots for I/O modules are available in the AS 235 basic unit.

The extension units are first installed in the basic cabinet of the AS 235/AS 235 H systems according to the numbers required for the respective automation task. If the basic cabinet is full, the remaining extension units are accommodated in the extension cabinet.

An AS 235 system can be fitted in this manner with up to 90 I/O modules, an AS 235 H system with up to 91 I/O modules. The number of available I/O slots can be increased to max. 114 (AS 235) or max. 103 (AS 235 H) by using additional ES 100 K extension systems.

In contrast to the AS 235 K automation system, the AS 235 and AS 235 H systems installed in cabinets are primarily designed for central configurations (Fig. 3/1b).

The main selection criterion for the AS 235 H system is its high availability.

The AS 235 K compact version is the smallest operable AS 235 automation system. It is fitted in a 15-U [1] high subrack of the ES 902 packaging system (DIN 41494) which in turn is installed in a sheet-steel housing with degree of protection IP 21. The housing is designed for wall mounting.

The basic system of the AS 235 K has 6 slots for I/O modules. Up to 8 independent ES 100 K extension systems can be connected, thus increasing the total number of I/O modules to 108.

The ES 100 K extension systems can be installed up to 500 m away from the AS 235 K automation system.

For these reasons, the AS 235 K system is primarily suitable for distributed configurations (Fig. 3/1a) in small and medium-size plants or as a stand-alone system.

[1] 1 U corresponds to 44.5 mm.

Automation systems
AS 235

AS 235 automation system

The AS 235 automation system is the cabinet version of the range. It can be ordered in the form of two ordering units: basic cabinet and extension cabinet:

The basic cabinet is the main component of the AS 235 automation system. It contains all components required for the AS 235 system to function. It can therefore also be used on its own, i.e. without an extension cabinet.

The extension cabinet increases the number of slots for I/O modules. It can only be operated in conjunction with the basic cabinet with up to 3 extension units. When using an extension cabinet it is possible to increase the number of slots for I/O modules in the basic cabinet (48) up to a maximum of 90.

Basic cabinet

The basic cabinet consists of the following main components:

Basic unit

The basic unit of the AS 235 automation system consists of:
- Subrack
  – For wire-wrap system   6DS9 026-8AB
  – For Maxi-Termi-Point system   6DS9 026-8AA
- Power supply subrack with
  – Slots for power supply and logic modules and
  – 6 slots for I/O modules
- Power supply module
  – DC 24 V / DC 24 V   C79451-A3260-A25
  – DC 24 V / DC 5 V   C79451-Z1359-U9
- Alarm logic module   6DS1 901-8BA
- Central processing unit with
  – Central processor module   6DS1 140-8AA
  – EDC memory module 4000 Kbyte   6DS1 844-8FA
  – Backup battery for memory module   W79084-U1001-B2
  – AS 235 system software, version G   6DS5 323-8AG
  – Interface module for I/O bus 1   6DS1 312-8BB
- Interface module for mini floppy disk unit   6DS1 326-8BB
- Interface module for operation channel 1   6DS1 330-8CA
- Bus terminator module   C79458-L445-B20
- Cable duct, 2 U high   6DS9 906-8AB
- Cover with wiring duct   6DS9 927-8AA
- Cable set for power supply and alarms   6DS9 908-8CA

The subrack for the basic unit of the AS 235 system corresponds to the ES 902 system and is 10 U high. It is the supporting system for the other components of the basic unit, the interface modules for the local bus, and the I/O modules. The process signal lines for the 6 I/O modules are connected to the rear, the plug connectors are equipped with wire-wrap or Multi-Termi-Point connections.

If the process signal cables leading to I/O slot 6 are to be connected in the cabinets also using the Maxi-Termi-Point system, conversion is necessary using SAE cabinet connection elements. These must be ordered separately.

The power supply module C79451-A3260-A25 is used to supply the basic unit with DC 24 V. The DC 24 V supply voltage is filtered and additionally fused on this module. Two process operation keyboards and a mini floppy disk unit can be powered with DC 24 V via 3 sockets on the front of the module.

The basic unit is equipped with 1 or 2 alarm logic modules depending on the configuration of the automation system. The alarm logic module ML1 is assigned to the basic cabinet. The alarm logic module ML2 is only required if the AS 235 system consists of a basic cabinet and an extension cabinet and has a basic unit with wire-wrap pins. In the case of the basic unit with Maxi-Termi-Point system, the tasks of the alarm logic module ML2 are handled by the interface module for I/O bus 2.
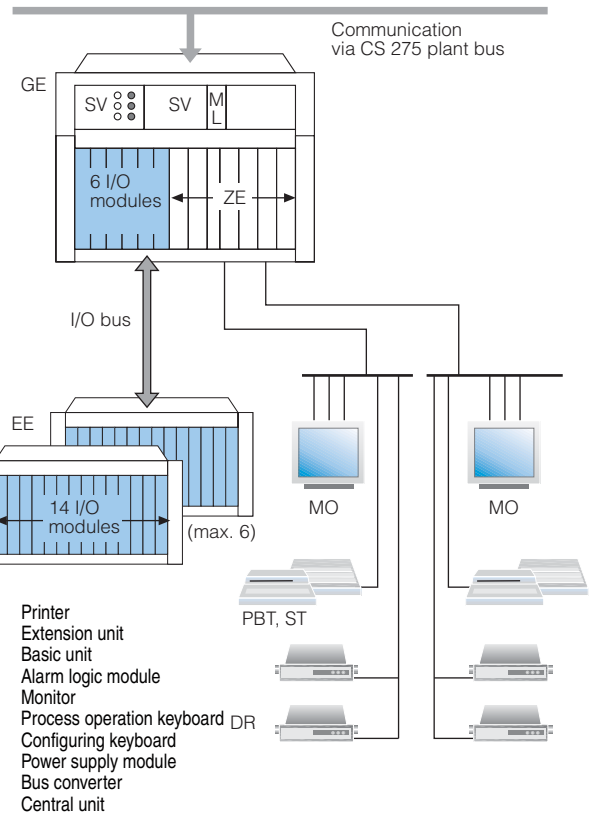

DR	Printer
EE	Extension unit
GE	Basic unit
ML	Alarm logic module
MO	Monitor
PBT	Process operation keyboard
ST	Configuring keyboard
SV	Power supply module
UI	Bus converter
ZE	Central unit

Fig. 3/2   AS 235 automation system, system configuration

The alarm logic modules monitor the voltages $L+$, PM (DC 24 V each) and $+5$ V as well as the I & C signals for overtemperature, door contacts, fan contacts and spare contacts, and trigger the current lamps.

The central processor is especially tailored to the processing of closed-loop and open-loop control tasks and to the TML programming language. It divides the RAM and differentiates access operations to
- the 1-Mbyte system RAM with battery backup for all fixed system data and programs,
- the 4000-Kbyte RAM with battery backup for all user programs and data and for variable system data, and
- the transfer memories of the interface modules for I/O bus, operation channel, mini floppy disk unit and local bus.

The memory module with *Error Detection and Correction* EDC can correct a 1-bit error when reading, and eliminate it in the memory cell together with the system software.

The interface module for I/O bus establishes the connection between the 8-bit central unit bus and the I/O bus. One or two of these modules can be plugged into the basic unit of the AS 235 system:
- The interface module for I/O bus 1 (A) supplies the I/O modules plugged into slots 1 to 5 of the basic unit and the 3 extension units of the basic cabinet. It is always required, and belongs to the standard delivery of the basic unit.
- The interface module for I/O bus 2 (B) must the ordered as an option. It connects slot 6 for I/O modules in the basic unit and the 3 extension units of the extension cabinet to the central processing unit via I/O bus 2 (B). It is therefore only required if slot 6 in the basic unit is to be used, or if an extension cabinet is used in addition to the basic cabinet.

Automation systems
AS 235

Basic cabinet

Fig. 3/3   AS 235 automation system, design
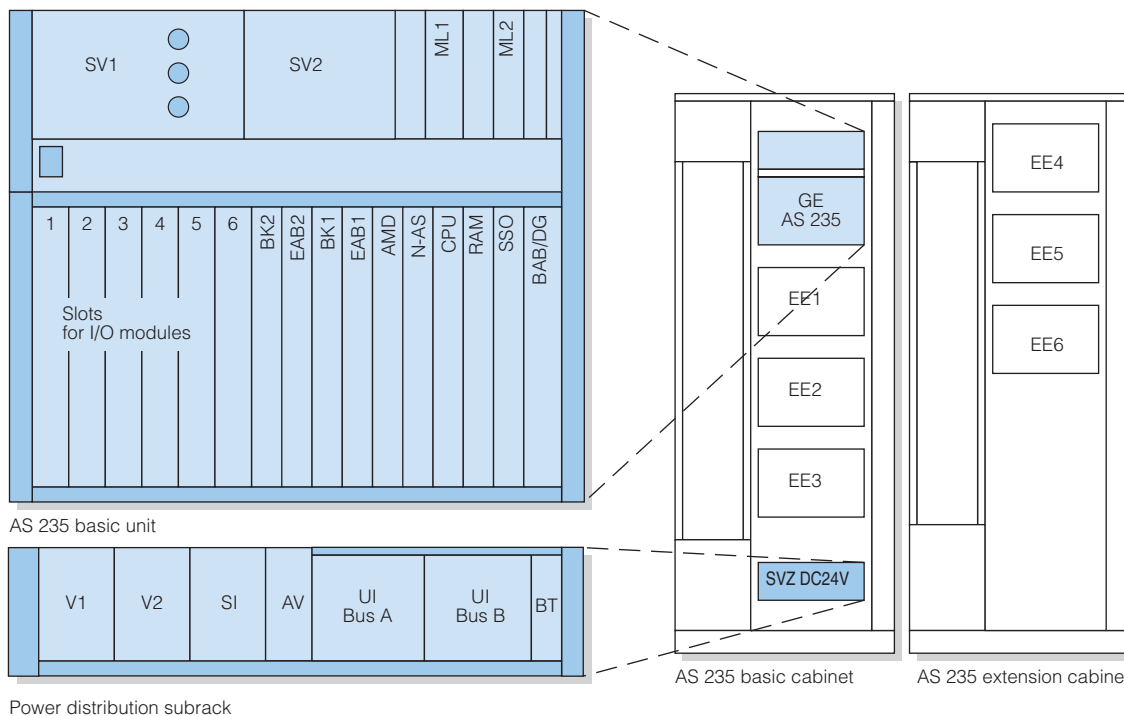
AMD   Interface module for mini floppy disk unit
AV   Connection distributor for 20-m local bus
BAB   Bus terminator module
BK   Interface module for operation channel
BT   Flashing pulse generator
CPU   Central processor module
DG   Diagnostics interface
EAB   Interface module for I/O bus
EE   Extension unit
GE   Basic unit

ML   Alarm logic module
N-AS Interface module for 20-m local bus
RAM   Memory module
SI   Automatic circuit-breaker
SSO   Special interface, not used
SV1   Power supply module DC 24 V / DC 24 V
SV2   Power supply module DC 24 V / DC 5 V
SVZ   Power distribution subrack DC 24 V
UI   Bus converter
V   Supply diode

Standard I/O devices

The standard I/O devices such as process monitor, process operation keyboard, configuring keyboard, mini floppy disk unit and logging/message printers are described in Section 5.

The interface modules for operation channel generate the RGB signals for the process monitors. They also have three 20-mA current loop interfaces to which the process operation keyboard or the configuring keyboard and 2 printers (logging and message printers) can be connected.

The interface module for operation channel 1 belongs to the scope of delivery of the basic unit and is always required. A second interface module is only required if 2 operating consoles are to be used via which operation and monitoring or configuring are to be carried out independently.

The combinations which can be ordered for the standard I/O devices comprise:
- PBT 65 process operation keyboard [1]   6DS3 305-8BA
- Configuring keyboard   6DS3 303-8AA
  with connecting cable, 1 m   6DS8 102-8AC
- Mini floppy disk unit with connecting cables for 6DS3 900-8AE
  signal transmission and power supply, 3 m each
- In addition for operation channel 2:
  – Interface module for operation channel 2   6DS1 330-8CA
  – 3 cable clamps   C79363-A3006-B10
  – Second PBT 65 process operation keyboard   6DS3 305-8BA
- One process monitor per operation channel
  as option:
  – Process monitor SCM 2140-I [2]   6GF6100-1BV

Extension units

Depending on the complexity of the automation function, the capacity of the basic unit for I/O modules can be increased up to max. 90 slots by the addition of up to 6 extension units.

Extension units EE1 to EE3 are connected to the central processing unit via I/O bus 1 (A) and the interface module for I/O bus 1 (A). These extension units are accommodated in the basic cabinet. Extension units EE4 to EE6 are components of the extension cabinet and thus connected to the central processing unit via I/O bus 2 (B) and the interface module for I/O bus 2 (B).

An extension unit of the AS 235 automation system consists of a 6-U high subrack with slots for 14 I/O modules (each 2 standard slots wide). 2 subracks with different process connections are available for
- Maxi-Termi-Point connections, pins 0.8 mm x 2.4 mm (recommended for direct connection of process cables) or
- wire-wrap connections, pins 1 mm x 1 mm (recommended for process cable connection via SAE cabinet connection elements).

1) Order connecting cables for signal transmission and power supply in addition, see page 5/5 (process operation keyboard)

2) Order connecting cables for signal transmission in addition, see page 5/4 (process monitor)

Basic cabinet

When ordering the extension units it is possible to select whether the extension unit EE1 is to be delivered on its own, together with EE2, or together with EE2 and EE3. The following components are supplied:

- 1, 2 or 3 subracks
  with slots for 14 I/O modules each
  – For wire-wrap system   6DS9 002-8BB
  – For Maxi-Termi-Point system   6DS9 002-8BA
- 1, 2 or 3 cable ducts, 2 *U* high   6DS9 906-8AB
- 1, 2 or 3 covers, 2 *U* high   6DS9 906-8BB
- Cable set for power supply
  – For EE1 on its own   6DS9 908-8CA
  – For EE1 (combined with further EE)   6DS9 908-8CB
  – For EE2   6DS9 908-8CC
  – For EE3   6DS9 908-8CD
- Cable set for I/O bus, + 5 V, 0 V
  – With EE1 on its own   6DS9 911-8FA
  – With EE1 and EE2   6DS9 911-8FB
  – With EE1, EE2 and EE3   6DS9 911-8FC

The extension units are supplied directly with DC 24 V from the power distribution subrack. Each extension unit is fused separately with 16 A on the power distribution subrack. The DC 5 V supply for the I/O bus is taken from the power supply module SV2 (C79451-Z1359-U9) in the basic unit and applied via the cable set 6DS9 911-8.. .

In addition to the I/O modules, max. 2 interface modules for 20-m local bus N-V.24 can be inserted into the I/O slots of the AS 235 system.

Accessories for the extension units: see Ordering data "Further options for AS 235 basic cabinet".

I/O modules

The I/O modules are the process interface of the AS 235 automation system. They comprise signal modules and function modules, including calculation modules. See Section 4 for the properties, functions and Ordering data of the I/O modules.

The basic unit of the AS 235 system has 6 slots for I/O modules. A further 42 I/O modules can be accommodated in the basic cabinet by inserting into 3 extension units with 14 slots each. A further 42 I/O modules can be inserted into an additional extension cabinet with up to 3 extension units, thus enabling a total of 90 I/O modules per AS 235 system.

One ES 100 K extension system can additionally be connected per I/O bus.

During planning it should be noted that the 16 A with which each extension unit is fused must not be exceeded.

The I/O modules can be supplied coded, inserted and with labelled slots. Arrangement, designation and connection diagrams (including address data) are required from the orderer.
- Coding, inserting and labelling   6DS5 705-8AA
  for 1 I/O module

Power supply components

The standard DC 24 V power supply unit of the AS 235 system comprises:
- Power distribution subrack for DC 24 V   6DS4 407-8CA
  with slots for 2 bus converters UI,
  8 automatic circuit-breakers,
  1 supply diode, terminal and alarm strip,
  overvoltage protection
- Connection distributor for 20-m local bus   6DS9 207-8AA
- Flashing pulse generator   6DS1 922-8AA
- 3 cabinet power supply terminals   C79165-A3012-D73

The power distribution subrack has separate automatic circuit-breakers for the basic unit and up to 6 extension units in the basic cabinet and the extension cabinets. The major functions of the power distribution subrack are:
- Supply of DC 24 V to a cabinet or a cabinet group
- Fusing of L+ and PM for the extension units and 24-V heat exchanger
- Separate supply of 2 bus converters with DC 24 V

- Combination of alarms as well as triggering of cabinet lamps and the cabinet row lamp (AS 235 H)
- Combination of cabinet lamps for the basic unit
- Generation of a flashing pulse for I/O modules of the TELEPERM ME process control system
- Supply of an external minutes pulse
- Connection distributor for 20-m local bus (e.g. for central configuring with PROGRAF AS+).

The DC 24 V supply is not redundant as standard. However, the power distribution subrack is prepared for a redundant supply of DC 24 V. A redundant supply of DC 24 V into the cabinet is also possible by installing a second supply diode and an extension set consisting of capacitor, a cable set and 2 cabinet supply terminals. These must be ordered separately.

The flashing pulse generator has 3 functions:
- Generation of a flashing signal which is required by the I/O modules of the TELEPERM ME process control system for alarm display (see Section 4 for modules)
- Signal lamp test using the LT key on the front panel (wiring optional)
- Electrical isolation of external time synchronization signals. The AS 235 can be synchronized using a minutes pulse.

Bus components

The TELEPERM M systems can communicate with one another via the CS 275 plant bus up to distances of 20 m (local bus) or 4 km (remote bus).

The local bus is redundant as standard. The remote bus can be redundant as an option.

Up to 9 participants can be interconnected as a local bus island via the 20-m local bus (each bus converter UI counts as 1 participant). The total length of the connecting cables must not exceed 20 m.

Interface modules for 20-m local bus (e.g. N-AS and N-V.24) of local bus participants can be connected together at the front using cables 6DS8 201-8.. . These cables are only provided with a plug at one end. They must be connected 1:1 at the free end to the plug of the adjacent local bus participant. If a cable is not yet connected there, a front plug 6DS9 200-8AA is required in addition. The cable 6DS8 205-8.. with 2 plugs can be used as an alternative to the combination of cable 6DS8 201-8.. and front plug.

It is possible to connect a personal computer via the connection distributor for 20-m local bus in the power distribution subrack. It must first be integrated into the local bus via a cable connector 6DS8 201-8.. or, in the case of a remote bus connection, via a cable 6DS8 204-8LC / 6DS9 201-8CA (see connection unit). Central configuring and feedback documentation of the AS 235 can be carried out in conjunction with the PROGRAF AS+ engineering tool (cf. Section 2).

The AS 235 is connected to a single remote bus via the interface connection unit.

The AS 235 can also be operated on a redundant remote bus. 2 bus converters UI and 2 remote bus connector boards AF are installed in this case. The interface connection unit for redundant remote bus is required for the connection to a redundant remote bus.

Automation systems
AS 235

With the standard ordering configuration, an additional connection unit for a single or redundant remote bus can be selected under "Power supply and bus components" in addition to the power supply unit. The connection unit comprises:

- Interface module for 20-m local bus N-AS — 6DS1 223-8AC
- Bus converter UI — 6DS4 400-8AB
  (2 x with redundant remote bus)
- Connector board AF "Remote bus" — 6DS9 203-8DA
  (2 x with redundant remote bus)
- For single remote bus:
  Connecting cable with 3 plugs for connection — 6DS8 204-8LC
  of N-AS to bus converter 1 and
  connection distributor for 20-m local bus
- For redundant remote bus:
  Connecting cable with 4 plugs for connection — 6DS9 201-8CA
  of N-AS to bus converters 1 and 2
  and connection distributor for 20-m local bus

The appropriate remote bus cable is required in addition to an interface connection unit for single or redundant remote bus. This cable is connected to the connector board AF and links the individual participants together at distances up to 4 km.

Ordering data for remote bus cable: see Section 6.

System cabinets

The system cabinets (see page 3/23 for further information) are supplied with 2 cabinet lamps and test pushbuttons and consist of the following components:

- Standard cabinet
  – IP 20, 2200 x 900 x 400 — 6DS9 300-8AA
  – IP 54, 2200 x 900 x 600 — 6DS9 310-8AB
  – IP 20, 2200 x 900 x 600 — 6DS9 302-8AA
- Transport lugs (4 off) — 6DS9 906-8CA
- Cable set for connection of cabinet lamp — 6DS9 912-8AA
- Door contact with mounting parts and — C79165-A3012-D83
  connection cables
- Cable duct, horizontal, for I/O bus — 6DS9 906-8PA
- Cable duct, vertical — C79165-A3012-D51
- Parts kit (screen board) — C79165-A3012-D41
- Thermostats, wired — C79165-A3012-D81
- Cable with mounting parts — C79165-A3012-D129
- Cable clamping rail — C79165-A3012-D128

The standard cabinet IP 54 with heat exchanger is supplied with the following additional components:

- Power distribution subrack AC 230 V — 6DS4 408-8AA
  with line filter
- Cable for monitoring the — C79195-A3828-H230
  heat exchanger
- Cable for connection of line filter — C79195-A3205-B93
  to motor supply terminals

Side panels or partitions for the standard cabinets: see cabinet accessories on page 3/23.

System documentation

German or English system documentation can be ordered with the AS 235 basic cabinet. The documentation comprises:

- Manuals
  – "AS 235 automation system" — C79000-G8000-C295
  – "Function modules", volumes 1 and 2 — C79000-G8000-C30
  – "Signal modules" — C79000-G8000-C31
  – "Coupling and calculation modules" — C79000-G8000-C32
  – "CS 275 bus system" — C79000-G8000-C6
- Description "AS 235, AS 235 H and AS 235 K — C79000-G8000-C416
  automation systems, version G",
  volumes 1 to 3
- Manual "Notes and guidelines for — C79000-G8000-C417
  planning, installation and operation"

In the English system documentation, the center block of the individual Order Nos. is replaced by ".....-G8076-...".

- AS 235 / AS 235 H / AS 235 K table pamphlet, — C79000-N8000-C1
  German, order separately if required.

Also refer to the ordering instructions in the appendix (page 8/2) with information on ordering complete systems and options.

Ordering data	Order No.
AS 235 automation system, basic cabinet	6DS2 124-■■■■-■■
Basic unit	
• Without basic unit	0
• Basic unit 4 Mbyte, wire-wrap system	7
• Basic unit 4 Mbyte, Maxi-Termi-Point system	8
Standard I/O devices	
• Without standard I/O devices	X
• For operation channel 1: process operation/configuring keyboards, mini floppy disk unit	
– Without process monitor	A
– With process monitor	M
• Operation channel 2: 2 process oper. keyboards, config. keyboard and mini floppy disk unit	
– Without process monitor	C
– With 2 process monitors for operation channels 1 and 2	N
Option: extension units	
• Without extension unit	X
• Extension unit EE1, wire-wrap system	A
• Extension unit EE1, Maxi-Termi-Point system	B
• Extension units EE1 and EE2, wire-wrap system	C
• Extension units EE1 and EE2, Maxi-Termi-Point system	D
• Extension units EE1, EE2 and EE3, wire-wrap system	E
• Extension units EE1, EE2 and EE3, Maxi-Termi-Point system	F
Option: power supply and bus components	
• Without components	0
• Power supply unit DC 24 V for single supply	1
• Power supply unit DC 24 V for single supply and connection unit for remote bus	2
• Power supply unit DC 24 V for single supply and connection unit for redundant remote bus	3
Option: system cabinets	
• Without cabinet	0
• Standard cabinet, 400 mm deep, degree of protection IP 20, without heat exchanger	1
• Standard cabinet, 600 mm deep, degree of protection IP 54, with heat exchanger	2
• Standard cabinet, 600 mm deep, degree of protection IP 20, without heat exchanger	3
Option: System documentation	
• Without system documentation	0 X
• German documentation	0 D
• English documentation	0 E

Automation systems
AS 235

Ordering data	Order No.
Options for AS 235 basic cabinet	
Basic unit	
Backup battery for memory module	W79084-U1001-B2
Interface module for I/O bus 2	6DS1 312-8BB
Extension units	
For retrofitting of extension units EE2 and EE3:	
Subrack for extension unit with mounting parts and slots for 14 I/O modules	
• Wire-wrap system	6DS9 002-8BB
• Maxi-Termi-Point system	6DS9 002-8BA
Accessories for EE2:	
Cable set for power supply of EE2	6DS9 908-8CC
Cable set for I/O bus	6DS9 911-8FB
Cable duct	6DS9 906-8AB
Cover	6DS9 906-8BB
Accessories for EE3:	
Cable set for power supply of EE3	6DS9 908-8CD
Cable set for I/O bus	6DS9 911-8FC
Cable duct	6DS9 906-8AB
Cover	6DS9 906-8BB
Bus connection of further participants via 20-m local bus	
Interface module for 20-m local bus N-V.24 [1]	6DS1 202-8AB
With standard configuration without remote bus connection:	
Interface module for 20-m local bus N-AS	6DS1 223-8AC
Connecting cable for local bus with 1 plug 0.3 m	6DS8 201-8MB
0.5 m	6DS8 201-8SB
1.5 m	6DS8 201-8EC
5.0 m	6DS8 201-8SC
Front plug [2]	6DS9 200-8AA
With standard configuration with remote bus connection:	
Connecting cable for local bus with 1 plug	6DS8 201-8.. (see above)
Connection to single remote bus	
Bus converter UI	6DS4 400-8AB
Connector board AF "Remote bus"	6DS9 203-8DA
Interface module for 20-m local bus N-AS	6DS1 223-8AC
Connecting cable with 3 plugs [3] to connect N-AS to bus converter 1	6DS8 204-8LC

Ordering data	Order No.
Connection to redundant remote bus	
With standard configurations 6DS2 124-...2.	
Bus converter UI	6DS4 400-8AB
Connector board AF "Remote bus"	6DS9 203-8DA
With standard configurations 6DS2 124-...1.	
2 bus converters UI	6DS4 400-8AB
2 connector boards AF "Remote bus"	6DS9 203-8DA
Interface module for 20-m local bus N-AS	6DS1 223-8AC
Connecting cable with 4 plugs to connect N-AS to bus converters 1 and 2 and the connection distributor for 20-m local bus	6DS9 201-8CA
Remote bus cable	
See page 6/6	
Redundant supply of *L+* **and** *M*	
Supply diode 80 A	C74103-A1900-A351
Parts set for redundant power supply with 2 cabinet power supply terminals, capacitor and cable set	C79165-A3012-D74
Option: system cabinets	
Fan subassembly DC 24 V (complete) Installation kit/retrofitting kit for AS 235 basic cabinet	
• For installation below the basic unit (initial use)	C79165-A3012-D201
• For installation below the basic unit (retrofitting) with power distribution subrack 6DS4 407-8CA with	
– Version 1	C79165-A3012-D220
– Version 2	C79165-A3012-D221
• For installation below the extension unit	C79165-A3012-D206
Further cabinet accessories	See page 3/23
Parts kit for upgrading the degree of protection of a 400-mm deep standard cabinet from IP 10 to IP 20 (for former cabinets)	C79165-A3012-D90

[1] Max. 2 within an AS 235 consisting of basic and extension cabinets; cannot be used in ES 100 K.
[2] The cable connector 6DS8 205-8.. with 2 plugs can be used as an alternative to the combination of connecting cable and front plug
[3] 3rd plug not used, or on connection distributor

Automation systems
AS 235

Extension cabinet

Extension cabinet

Depending on the complexity of the automation task, the capacity of the basic unit can be increased to a maximum of 90 slots for I/O modules by using up to 6 extension units.

The extension units EE4 to EE6 are fitted in the extension cabinet and thus connected to the central processing unit via I/O bus 2 (B) and the interface module for I/O bus 2 (B).

When ordering the extension cabinet it is possible to select whether the extension unit EE4 is to be delivered on its own, together with EE5, or together with EE5 and EE6. The following components are supplied:

- 1, 2 or 3 subracks
  with slots for 14 I/O modules each
  – For wire-wrap system   6DS9 002-8BB
  – For Maxi-Termi-Point system   6DS9 002-8BA
- 1, 2 or 3 cable ducts, 2 *U* high   6DS9 906-8AB
- 1, 2 or 3 covers, 2 *U* high   6DS9 906-8BB
- Cable set for power supply
  – For EE4   6DS9 908-8CE
  – For EE5   6DS9 908-8CF
  – For EE3   6DS9 908-8CG
- Cable set for I/O bus 2
  – With EE4 on its own   6DS9 911-8FD
  – With EE4 and EE5   6DS9 911-8FE
  – With EE4, EE5 and EE6   6DS9 911-8FF
- Interface module for I/O bus 2   6DS1 312-8BB
  (slot in the basic unit)
- Only for cabinets with wire-wrap system:
  Alarm logic module 2   6DS1 901-8BA
  (slot in the basic unit)

The system cabinets (see page 3/23 for further information) are supplied with 2 cabinet lamps and test pushbuttons and consist of the following components:

- Standard cabinet
  – IP 20, 2200 x 900 x 400   6DS9 300-8AA
  – IP 54, 2200 x 900 x 600   6DS9 310-8AB
  – IP 20, 2200 x 900 x 600   6DS9 302-8AA
- Transport lugs (4 off)   6DS9 906-8CA
- Cable set for connection of cabinet lamp   6DS9 912-8AB
- Door contact with mounting parts and   C79165-A3012-D84
  connection cables
- Cable duct, horizontal for I/O bus   6DS9 906-8PA
- Cable duct, vertical   C79165-A3012-D50
- Thermostats, wired   C79165-A3012-D82
- Cable with mounting parts   C79165-A3012-D129
- Cable   M75412-B5152-E150
- Cable clamping rail   C79165-A3012-D128
- Partition with cut-outs and mounting parts,
  – For standard cabinet IP 20, 400 mm deep   6DS9 906-8JB
  – For standard cabinets IP 54 and IP 20,   6DS9 906-8MA
    600 mm deep

The standard cabinet IP 54 with heat exchanger is additionally supplied with further components:

- Cable set for heat exchanger   C79165-A3012-D19
- Cable for monitoring of heat exchanger   C79195-A3828-H390
- Cable for connection of line filter to   C79195-A3205-B94
  motor supply terminals

Side panel or 2nd partition for the standard cabinets: see cabinet accessories on page 3/23.

Also refer to the ordering instructions in the appendix (page 8/2) with information on ordering complete systems and options.
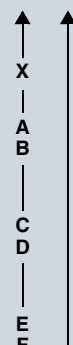
Ordering data
Order No.

AS 235 automation system, extension cabinet	**6DS2 127- 0 X ■ 0 ■**
Extension units	
• Without extension units	X
• Extension unit EE4	
– Wire-wrap system	A
– Maxi-Termi-Point system	B
• Extension units EE4 and EE5	
– Wire-wrap system	C
– Maxi-Termi-Point system	D
• Extension units EE4, EE5 and EE6	
– Wire-wrap system	E
– Maxi-Termi-Point system	F
System cabinets	
• Without cabinet	0
• Standard cabinet in degree of protection IP 20, without heat exchanger	1
• Standard cabinet in degree of protection IP 54, with heat exchanger	2
• Standard cabinet in degree of protection IP 20, without heat exchanger	3

Ordering data
Order No.

Options for AS 235 extension cabinet	
Extension units	
For retrofitting of extension units EE5 and EE6:	
Subrack for extension unit With mounting parts and slots for 14 I/O modules	
• Wire-wrap system	**6DS9 002-8BB**
• Maxi-Termi-Point system	**6DS9 002-8BA**
Accessories for EE5:	
Cable set for power supply of EE5	**6DS9 908-8CF**
Cable set for I/O bus	**6DS9 911-8FE**
Cable duct	**6DS9 906-8AB**
Cover	**6DS9 906-8BB**
Accessories for EE6:	
Cable set for power supply of EE6	**6DS9 908-8CG**
Cable set for I/O bus	**6DS9 911-8FF**
Cable duct	**6DS9 906-8AB**
Cover	**6DS9 906-8BB**
Standard cabinets	
Parts kit for upgrading the degree of protection of a 400-mm deep standard cabinet from IP 10 to IP 20 (for former cabinets)	**C79165-A3012-D90**
Fan subassembly DC 24 V (complete)	
• Installation kit/retrofitting kit for AS 235 extension cabinet with degree of protection IP 10 or IP 20, for installation below the extension unit EE4 and/or EE5	**C79165-A3012-D202**
• Retrofitting kit for AS 235 extension cabinet with degree of protection IP 54, for installation below the extension unit EE5	**C79165-A3012-D222**

Automation systems
AS 235 H

■ AS 235 H automation system

The AS 235 H automation system is the high-availability cabinet version of the AS 235 range. In contrast to the simple cabinet version, the AS 235 H is of redundant design and operates according to the 1-out-of-2 principle.

> More information on the topic of redundancy can also be found in Section 2, page 2/3 "Redundancy with AS 235 H"

It is possible to implement interruption-free operation with a fully-redundant basic unit, the I/O bus (redundant as standard), the I/O bus comparator and switchover modules, and redundant I/O modules.

The AS 235 H must be ordered in the form of 2 separate ordering units: the basic cabinet and the extension cabinet:

The basic cabinet is the main component of the AS 235 H automation system. It contains all components required for the AS 235 H system to function and is fitted with up to 3 extension units. It can therefore also be used on its own without an extension cabinet.

The extension cabinet is used to increase the number of slots available for I/O modules. It can only be operated in conjunction with the basic cabinet and can be equipped with up to 4 extension units. Together with the extension cabinet it is possible to increase the number of slots for I/O modules in the basic cabinet (39) to a total of 91.

■ Basic cabinet

The basic cabinet consists of the following main components:

Basic unit

The basic unit of the AS 235 H automation system consists of 2 identical partial systems which are designed symmetrically and which operate in synchronism and redundant to one another. A non-redundant basic unit can also be ordered.

The redundant basic unit comprises:
• Subrack	6DS9 027-8AB
• Power supply subrack DC 24 V / DC 5 V	6DS4 432-8AA
• 2 power supply modules DC 24 V / DC 5 V	C79451-Z1359-U9
• Backup module DC 24 V	C79451-A3125-B227
• Central processing units ZE I and ZE II with	
– 2 central processor modules	6DS1 141-8AA
– 2 EDC memory modules 4000 Kbyte	6DS1 844-8FA
– 2 backup batteries for memory module	W79084-U1001-B2
– AS 235 system software, version G	6DS5 323-8AG
– 2 interface modules for I/O bus 1	6DS1 312-8BB
– 2 synchronization modules	6DS1 143-8AA
– Comparator/coupling module	6DS1 142-8AA
• 2 interface modules for mini floppy disk unit	6DS1 326-8BB
• 2 alarm logic modules [1]	6DS1 901-8AA
• 2 bus terminator modules	C79458-L445-B20
• Cable set	6DS9 908-8GA
• Cable duct, rear	6DS9 906-8AA
• Cable duct, horizontal (rear)	6DS9 906-8AB
• Cable duct, horizontal (front)	6DS9 906-8TA
• Cover with wiring duct	6DS9 927-8AA

The non-redundant basic unit comprises:
• Subrack	6DS9 027-8AB
• Power supply subrack DC 24 V / DC 5 V	6DS4 432-8AA
• Power supply module DC 24 V / DC 5 V	C79451-Z1359-U9
• Backup module DC 24 V	C79451-A3125-B227

DR	Printer
EE	Extension unit
GE	Basic unit
MO	Monitor
PBT	Process operation keyboard
ST	Configuring keyboard
SV	Power supply module
ZE	Central unit

Fig. 3/4   AS 235 H automation system, system configuration

• Central processing units ZE I with	
– 1 central processor module	6DS1 141-8AA
– 1 EDC memory module 4000 Kbyte	6DS1 844-8FA
– 1 backup battery for memory module	W79084-U1001-B2
– AS 235 system software, version G	6DS5 323-8AG
– 1 interface module for I/O bus 1	6DS1 312-8BB
– 1 synchronization modules	6DS1 143-8AA
• 1 interface module for mini floppy disk unit	6DS1 326-8BB
• 1 alarm logic module [1]	6DS1 901-8AA
• 1 bus terminator module	C79458-L445-B20
• Cable set	6DS9 908-8GA
• Cable duct, rear	6DS9 906-8AA
• Cable duct, horizontal (rear)	6DS9 906-8AB
• Cable duct, horizontal (front)	6DS9 906-8TA
• Cover with wiring duct	6DS9 927-8AA

The subrack for the central modules of the AS 235 H corresponds to the ES 902 packaging system and is 10 *U* high. It is the supporting system for the two central processing units, the comparator/coupling module and the interface modules for mini floppy disk unit, operation channel and 20-m local bus. The 3-*U* high power supply subrack 6DS4 432-8AA accommodates the power supply modules required for the basic unit as well as the backup module.
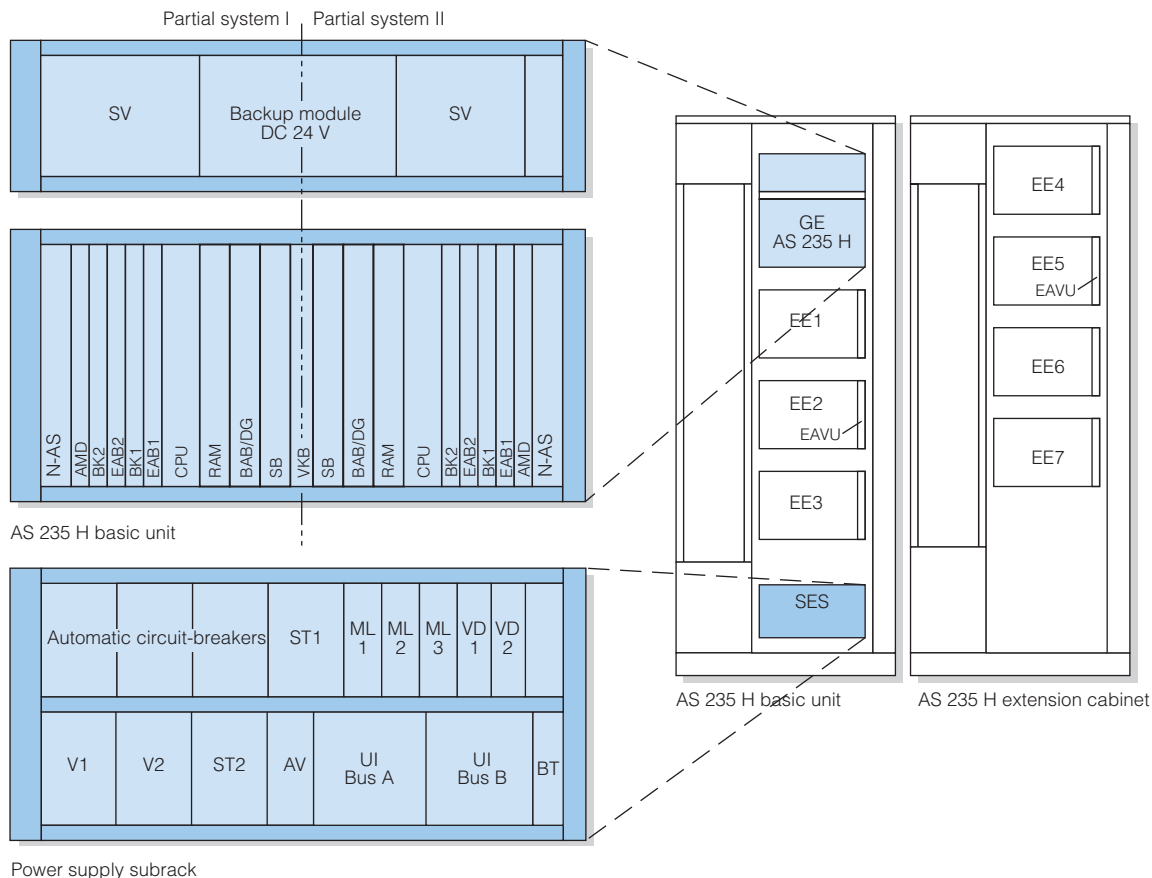
The power supply module C79451-Z1359-U9 is used to supply the basic unit with DC 5 V. Each AS 235 H partial system is supplied from its own power supply module. The backup module compensates brief voltage dips in the DC 24 V supply.

The central processor modules of the AS 235 H basically correspond to those of the AS 235 system. The required clocks are no longer generated on the module itself but are supplied by the synchronization module.

[1] Can be inserted into power supply subrack

Automation systems
AS 235 H

Basic cabinet

Partial system I | Partial system II

SV | Backup module DC 24 V | SV

N-AS | AMD | BK2 | EAB2 | BK1 | EAB1 | CPU | RAM | BAB/DG | SB | VKB | SB | BAB/DG | RAM | CPU | BK2 | EAB2 | BK1 | EAB1 | AMD | N-AS

AS 235 H basic unit

Automatic circuit-breakers | ST1 | ML1 | ML2 | ML3 | VD1 | VD2

V1 | V2 | ST2 | AV | UI Bus A | UI Bus B | BT

Power supply subrack

GE AS 235 H

EE1

EE2 EAVU

EE3

SES

AS 235 H basic unit

EE4

EE5 EAVU

EE6

EE7

AS 235 H extension cabinet

AMD	Interface module for mini floppy disk unit	ML	Alarm logic module
AV	Connection distributor for 20-m local bus	N-AS	Interface module for 20-m local bus
BAB	Bus terminator module	RAM	Memory module
BK	Interface module for operation channel	SB	Synchronization module
BT	Flashing pulse generator	SES	Power supply subrack
CPU	Central processor module	ST	24 V sockets for connection of keyboards
DG	Diagnostics interface	SV	Power supply module DC 24 V / DC 5 V
EAB	Interface module for I/O bus	UI	Bus converter
EAVU	I/O bus comparator and switchover module	V	Supply diode
EE	Extension unit	VD	Diode module for linking signals
GE	Basic unit	VKB	Comparator/coupling module

Fig. 3/5   AS 235 H automation system, design

The memory module with *Error Detection and Correction* EDC can correct a 1-bit error when reading, and eliminate it in the memory cell together with the system software.

The interface module for I/O bus establishes the connection between the 8-bit central bus and the I/O bus. One or two of these modules can be plugged into the basic unit of each partial system of the AS 235 H system:

- The interface module for I/O bus 1 (A) is essential for partial systems I and II and is included in the delivery of the basic unit. Each of the two CPUs operating with synchronous clocks is connected to the I/O bus comparator and switchover modules (EAVU) of the basic cabinet via its own interface module and own I/O bus 1 (A). Both the two interface modules and the two I/O buses 1 (A) are redundant to one another. This enables two-channel, clock-synchronous triggering of the EAVU modules.
- The interface modules for I/O bus 2 (B) must be ordered additionally (one module for each partial system). The interface modules are only required if an extension cabinet is used in addition to the basic cabinet.

Each of the two partial systems has a synchronization module. The two modules are redundant to one another and linked together without feedback. Together with the comparator/coupling module they constitute the central components of the AS 235 H system responsible for the control, coordination and monitoring of the two partial systems. The synchronization module is also required for operation of a non-redundant basic unit.

Depending on the configuration of the automation system, the power supply subrack is equipped with one or more alarm logic modules:

- Alarm logic module ML1 (basic cabinet with 1 partial system)
- Alarm logic modules ML1 and ML2 (basic cabinet with 2 redundant partial systems)
- Alarm logic modules ML1, ML2 and ML3 (basic cabinet with 2 redundant partial systems and extension cabinet).

The alarm logic models monitor the central processing units and the optionally used signal inputs for temperature monitoring, door contact, fan contact and spare contact. In the event of a fault, the cabinet lamps on the basic and extension cabinets are triggered via these contacts.

Standard I/O devices

The standard I/O devices such as process monitor, process operation keyboard, configuring keyboard, mini floppy disk unit, logging printer and message printer are described in Section 5.

The interface modules for operation channel generate the RGB signals for the process monitors. They also have three 20-mA current loop interfaces to which the process operation keyboard or the configuring keyboard and 2 printers (logging printer and message printer) are connected.

No operation channel interface modules are essential if the AS 235 H is always operated and configured centrally. However, the use of an interface module is recommended for diagnostics. The operation channel interface modules must be ordered together with the standard devices.

In contrast to the AS 235 system, the process monitors, keyboards and printers in the AS 235 H are not directly connected to the operation channel interface module. The process motors are connected to the operation channel interface modules of the two partial systems via video relays. A video relay is assigned to each operation channel. The video relays ensure that the connected process monitors always display the same screen contents. The process monitors are connected to the active partial system when transferring to asynchronous operation. The video relays are also connected to the synchronization modules for this purpose.

The signal cables of the keyboards and printers are connected to the operation channel interface modules of the two partial systems via distribution cables.

The keyboard and printer distributors as well as the video relays are components of the parts set for operation channel switchover which belongs to the delivery of an operation channel. An additional printer distributor is required if a second printer is to be connected to an operation channel, and must be ordered separately (option).

Possible connections and a summary of connecting cables: see page 3/29 ff.

The combinations which can be ordered for the standard I/O devices comprise:

- Interface module for operation channel 1   6DS1 330-8CA
  (with redundant basic unit: 2 off)
- PBT 65 process operation keyboard [1]   6DS3 305-8BA
- Configuring keyboard   6DS3 303-8AA
  with connecting cable, 1 m   6DS8 102-8AC
- Mini floppy disk unit with connecting cables for 6DS3 900-8AE
  signal transmission and power supply, 3 m each
- Parts set for operation channel switchover   C79165-A3012-D70

- In addition for operation channel 2:
  – Interface module for operation channel 2   6DS1 330-8CA
    (with redundant basic unit: 2 off)
  – Second PBT 65 process operation keyboard 6DS3 305-8BA
  – Parts set for operation channel switchover C79165-A3012-D70
- One process monitor per operation channel as option:
  – Process monitor SCM 2140-I [2]   6GF6100-1BV

Extension units

Depending on the complexity of the automation function, the capacity of the AS 235 H can be increased up to max. 91 slots for I/O modules by the addition of up to 7 extension units.

The extension units EE1 to EE3 are connected to the basic unit via 2 separate, redundant I/O buses 1 (A). Each of these buses is connected to the CPU of an AS 235 H partial system via a separate interface module for I/O bus 1 (A). These extension units are fitted in the basic cabinet.

[1] Order connecting cables for signal transmission and power supply in addition, see page 5/5 (process operation keyboard)
[2] Order connecting cables for signal transmission in addition, see page 5/4 (process monitor)

Extension units EE4 to EE7 are fitted in the extension cabinet. These are also connected to the CPU of an AS 235 H partial system via 2 separate I/O buses 2 (B) which are redundant to one another, each of which has its own interface module for I/O bus 2 (B).

An extension unit of the AS 235 H automation system consists of a subrack with slots for 13 I/O modules, I/O bus comparator and switchover module, and a DC 5 V power supply module.

When ordering the extension units it is possible to select whether the extension unit EE1 is to be delivered on its own, together with EE2, or together with EE2 and EE3.

The following components are supplied:
- 1, 2 or 3 subracks
  with slots for 13 I/O modules
  – For wire-wrap system   6DS9 002-8BB
  – For Maxi-Termi-Point system   6DS9 002-8BA
- 1, 2 or 3 cable ducts, 2 *U* high   6DS9 906-8AB
- 1, 2 or 3 covers, 2 *U* high   6DS9 906-8BB
- Cable set for power supply
  – For EE1   6DS9 908-8GB
  – For EE2   6DS9 908-8GC
  – For EE3   6DS9 908-8GD
- Cable set for I/O bus, + 5 V, 0 V
  – With EE1 on its own   6DS9 911-8GA
  – With EE1 and EE2   6DS9 911-8GB
  – With EE1, EE2 and EE3   6DS9 911-8GC
- 1, 2 or 3 I/O bus comparator and   6DS1 144-8AA
  switchover modules
- 1, 2 or 3 upgrading sets with   C79451-A3117-D29
  switched-mode regulator DC 5 V (6DS1 006-8AA)

The extension units are supplied directly with DC 24 V from the power supply subrack. Each extension unit is fused separately with 16 A on the power supply subrack. The DC 5 V supply is taken from the power supply module DC 5 V.

In addition to the I/O modules, the interface module for 20-mA local bus N-V.24 can be inserted into the I/O slots of the AS 235 H system. One interface module N-V.24 can be inserted per interface module.

Accessories for the extension units: see Ordering data "Further options for AS 235 H basic cabinet".

I/O modules

The I/O modules are the process interface of the AS 235 H automation system. They comprise signal modules and function modules, including calculation modules. See Section 4 for the properties, functions and Ordering data of the I/O modules.

Up to 13 I/O modules can be inserted into each of the extension units (max. 3) of the basic unit. Please observe the max. thermal loading (see standard cabinets and accessories, page 3/23). A further 52 I/O modules can be inserted into an additional extension cabinet with up to 4 extension units, thus enabling a total of 91 I/O modules per AS 235 H system.

One ES 100 K extension system can additionally be connected per I/O bus 1.

During planning it should be noted that the 16 A with which each extension unit is fused must not be exceeded.

The I/O modules can be supplied coded, inserted and with labelled slots. Arrangement, designation and connection diagrams (including address data) are required from the orderer.
- Coding, inserting and labelling   6DS5 705-8AA
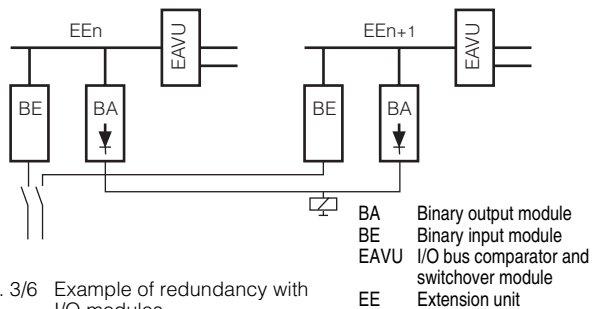 for 1 I/O module

Automation systems
AS 235 H

Fig. 3/6 Example of redundancy with
I/O modules
(1-out-of-2 structure)

BA	Binary output module
BE	Binary input module
EAVU	I/O bus comparator and switchover module
EE	Extension unit

Redundant process I/Os

Some of the I/O modules are suitable for producing a redundant process I/O area and for thus implementing an interruption-free automation system.

When using corresponding software structures generated by the user, it is possible to detect and signal the failure of an I/O module, to disable the faulty module for system interventions, and to continue data transfer via the redundant I/O module. Thus faulty modules can be replaced without operation of the individual loop.

Since the system redundancy ends at the I/O bus comparator and switchover module (EAVU), the I/O modules which are redundant to one another must be arranged in different extension units.

Power supply components

The DC 24 V power supply unit of the AS 235 H system comprises:

- Power supply subrack DC 24 V   6DS4 428-8AA
  with slots for 2 bus converters UI,
  24 automatic circuit-breakers,
  2 supply diodes, 6 sockets for DC 24 V,
  terminal and alarm strip,
  overvoltage protection
- Connection distributor for 20-m local bus   6DS9 207-8AA
- Flashing pulse generator   6DS1 922-8AA
- Cabinet power supply terminals   C79165-A3012-D73
  for single supply
- Cabinet power supply terminals, extension set C79165-A3012-D74
  for redundant power supply

The power supply subrack has separate fuses for the two partial subsystems of the AS 235 H. The major functions of the power supply subrack are:

- Redundant supply of DC 24 V in the basic cabinet or in the basic and extension cabinets
- Fusing of DC 24 V for keyboards, mini floppy disk unit and heat exchanger
- Separate supply of 2 bus converters with DC 24 V
- Combination of cabinet alarms for the basic unit
- Supply of an external minutes pulse
- Connection distributor for 20-m local bus (e.g. for central configuring with PROGRAF AS+)
- Monitoring of central processing units and signal inputs of basic and extension cabinets by the alarm logic modules
- Generation of a flashing pulse for I/O modules of the TELEPERM ME process control system and the EAVU modules

The flashing pulse generator has the following functions:

- Generation of a flashing signal which is required by the I/O modules of the TELEPERM ME process control system for alarm display (see Section 4 for modules).
  The flashing pulse generator has two channels. The flashing pulses of the two channels can be synchronized.
  It provides a lamp test for the fault display of those I/O modules which are supplied with the flashing signal (optional wiring).
- Electrical isolation of external time synchronization signals. The AS 235 H can be synchronized using a minutes pulse.

Bus components

The TELEPERM M systems can communicate with one another via the CS 275 plant bus up to distances of 20 m (local bus) or 4 km (remote bus). The local bus is redundant as standard. The remote bus can be redundant as an option.

The central processing units of the two partial systems of the AS 235 H are each connected to the CS 275 bus system via an interface module N-AS. The interface modules handle all duties connected with transmission, including occasional control of data transfer. Only the interface module of the partial system with the master function is active. Thus the AS 235 H system acts on the bus as an individual participant despite the 2 connections for modules N-AS on the bus.

Up to 9 participants can be interconnected as a local bus island via the 20-m local bus (each bus converter UI counts as 1 participant). The total length of the connecting cables must not exceed 20 m.

Interface modules for 20-m local bus of local bus participants can be connected together at the front using cables 6DS8 201-8.. . These cables are only provided with a plug at one end. They must be connected 1:1 at the free end to the plug of the adjacent local bus participant. If a cable is not yet connected there, a front plug 6DS9 200-8AA is required in addition. The cable 6DS8 205-8.. with 2 plugs can be used as an alternative to the combination of cable 6DS8 201-8.. and front plug.

It is possible to connect a personal computer via the connection distributor for 20-m local bus in the power distribution subrack. If the connection distributor is not integrated into the local bus via a connecting cable 6DS9 201-8FC, it must first be connected to the interface module N-AS via a connecting cable 6DS9 201-8LC. Central configuring and feedback documentation of the AS 235 H can be carried out in conjunction with the PROGRAF AS+ engineering tool (cf. Section 2).

The AS 235 H is connected to a single remote bus via the interface connection unit. The AS 235 H can also be operated on a redundant remote bus. 2 bus converters UI and 2 remote bus connector boards AF are installed in this case. The interface connection unit for redundant remote bus is required for the connection to a redundant remote bus.

With the standard ordering configuration, an additional connection unit for a single or redundant remote bus can be selected under "Power supply and bus components" in addition to the power supply unit.

The connection unit for a redundant AS 235 H basic unit comprises:

- 2 interface modules for 20-m local bus N-AS   6DS1 223-8AA
- Bus converter UI   6DS4 400-8AB
  (2 x with redundant remote bus)
- Connector board AF "Remote bus"   6DS9 203-8DA
  (2 x with redundant remote bus)
- For redundant remote bus:
  connecting cable with 5 plugs for connection   6DS9 201-8FC
  of N-AS to bus converters 1 and 2
  and connection distributor for 20-m local bus

The connection unit for a non-redundant AS 235 H basic unit is delivered with 1 interface module N-AS.

The appropriate remote bus cable is required in addition to an interface connection unit for single or redundant remote bus. This cable is connected to the connector board AF and links the individual participants together at distances up to 4 km.

Ordering data for remote bus cable: see Section 6.

System cabinets

The system cabinets (see page 3/23 for further information) are supplied with 2 cabinet lamps and test pushbuttons and consists of the following components:

- Standard cabinet
  – IP 20, 2200 x 900 x 400   6DS9 300-8AA
  – IP 54, 2200 x 900 x 600   6DS9 310-8AB
  – IP 20, 2200 x 900 x 600   6DS9 302-8AA
- Transport lugs (4 off)   6DS9 906-8CA
- Cable set for connection of cabinet lamp   6DS9 912-8AC
- Door contact with mounting parts and   6DS9 905-8CA
  connection cables
- Cable duct, vertical, with parts set   C79165-A3012-D71
- Thermostats, wired   C79165-A3012-D85
- Cable with mounting parts   C79165-A3012-D129
- Cable clamping rail   C79165-A3012-D128

The standard cabinet IP 54 with heat exchanger is supplied with the following additional components:

- Power distribution subrack AC 230 V   6DS4 408-8AA
  with line filter
- Cable for monitoring the   C79195-A3828-H230
  heat exchanger
- Cable for connection of line filter   C79195-A3205-B93
  to motor supply terminals

Side panels or partitions for the standard cabinets: see cabinet accessories on page 3/23.

System documentation

German or English system documentation can be ordered with the AS 235 H basic cabinet. The documentation comprises:

- Manuals
  – "AS 235 H automation system"   C79000-G8000-C293
  – "Function modules", volumes 1 and 2   C79000-G8000-C30
  – "Signal modules"   C79000-G8000-C31
  – "Coupling and calculation modules"   C79000-G8000-C32
  – "CS 275 bus system"   C79000-G8000-C6
- Description "AS 235, AS 235 H and AS 235 K   C79000-G8000-C416
  automation systems, version G",
  volumes 1 to 3
- Manual "Notes and guidelines for   C79000-G8000-C417
  planning, installation and operation"

In the English system documentation, the center block of the individual Order Nos. is replaced by ".....-G8076-...".

- AS 235 / AS 235 H / AS 235 K table pamphlet,   C79000-N8000-C1
  German, order separately if required

Automation systems
AS 235 H

Ordering data for basic cabinet

Ordering data	Order No.
AS 235 automation system, basic cabinet	**6DS2 131-** ■ ■ ■ ■ - ■ ■

Basic unit

• Without basic unit	0
• Basic unit 4 Mbyte, with I/O bus 1, redundant design	7
• Basic unit 4 Mbyte, with I/O bus 1, non-redundant design	8

Standard I/O devices

• Without standard I/O devices	X
• Operation channel 1 with process operation and configuring keyboards, for redundant basic unit	
– Without process monitor	A
– With process monitor	M
• Operation channels 1 and 2: 2 process operation keyboards and configuring keyboard, for redundant basic unit	
– Without process monitors	C
– With 2 process monitors	N
• Operation channel 1 with process operation and configuring keyboards, for non-redundant basic unit	
– Without process monitor	E
– With process monitor	P
• Operation channels 1 and 2, 2 process operation keyboards and configuring keyboard, for non-redundant basic unit	
– Without process monitors	G
– With 2 process monitors	Q

Option: extension units

• Without extension unit	X
• Extension unit EE1, wire-wrap system	A
• Extension unit EE1, Maxi-Termi-Point system	B
• Extension units EE1 and EE2, wire-wrap system	C
• Extension units EE1 and EE2, Maxi-Termi-Point system	D
• Extension units EE1, EE2 and EE3, wire-wrap system	E
• Extension units EE1, EE2 and EE3, Maxi-Termi-Point system	F

Ordering data	Order No.
AS 235 H automation system, basic cabinet	**6DS2 131-** ■ ■ ■ ■ - ■ ■

Option: power supply and bus components

• Without components	0
• Power supply unit DC 24 V, for redundant or non-redundant basic unit	1
• Power supply unit DC 24 V and connection unit for remote bus, for redundant basic unit	2
• Power supply unit DC 24 V and connection unit for redundant remote bus, for redundant basic unit	3
• Power supply unit DC 24 V and connection unit for remote bus, for non-redundant basic unit	4
• Power supply unit DC 24 V and connection unit for redundant remote bus, for non-redundant basic unit	5

Option: system cabinets

• Standard cabinet, degree of protection IP 20, 400 mm deep, without heat exchanger	1
• Standard cabinet, degree of protection IP 54, 600 mm deep, with heat exchanger	2
• Standard cabinet, degree of protection IP 20, 600 mm deep, without heat exchanger	3

Option: system documentation

• Without system documentation	0 X
• German documentation	0 D
• English documentation	0 E

Also refer to the ordering instructions in the appendix (page 8/2) with information on ordering complete systems and options.

Options for basic cabinet

Ordering data	Order No.
Options for AS 235 H basic cabinet	
Basic unit	
Retrofitting of basic unit to redundant design:	
Central processor module	6DS1 141-8AA
EDC memory module with 4000 Kbyte user RAM	6DS1 844-8FA
Backup battery for memory module	W79084-U1001-B2
Interface module for I/O bus 1	6DS1 312-8BB
Synchronization module	6DS1 143-8AA
Comparator/coupler module	6DS1 142-8AA
Interface module for mini floppy disk unit	6DS1 326-8BB
Alarm logic module	6DS1 901-8AA
Additionally required for the 4th to 7th extension unit:	
With redundant design: **2 interface modules for I/O bus 2**	6DS1 312-8BB
With non-redundant design: **1 interface module for I/O bus 2**	6DS1 312-8BB
Retrofitting of operation channels	
Retrofitting to redundant operation channel 1 or 2:	
Interface module for operation channel	6DS1 330-8CA
Retrofitting of operation channel 2, non-redundant:	
Interface module for operation channel	6DS1 330-8CA
Parts set for operation channel switchover	C79165-A3012-D70
– 1 video relay, complete,	
– 1 connecting cable,	
– 1 keyboard distributor,	
– 1 printer distributor	
Retrofitting of operation channel 2, redundant:	
2 interface modules for operation channel	6DS1 330-8CA
Parts set for operation channel switchover	C79165-A3012-D70
Extension units	
For retrofitting of extension units EE2 and EE3:	
Subrack for extension unit With mounting parts and slots for 13 I/O modules	
• Wire-wrap system	6DS9 002-8BB
• Maxi-Termi-Point system	6DS9 002-8BA
Accessories for EE2 and EE3:	
Cable set for power supply	
– For extension unit EE2	6DS9 908-8GC
– For extension unit EE3	6DS9 908-8GD
Cable set for I/O bus	
– For extension unit EE2	6DS9 911-8GB
– For extension unit EE3	6DS9 911-8GC
Cable duct	6DS9 906-8AB
Cover	6DS9 906-8BB
I/O bus comparator and switchover module	6DS1 144-8AA
Upgrading set with switched-mode regulator DC 5 V (6DS1 006-8AA)	C79451-A3117-D29

Ordering data	Order No.
Bus connection of further participant via 20-m local bus	
Interface module for 20-m local bus N-V.24 [1]	6DS1 202-8AB
• Starting from standard configuration 6DS2 131-...1.	
Connecting cable for local bus with 1 plug 0.3 m	6DS8 201-8MB
0.5 m	6DS8 201-8SB
1.5 m	6DS8 201-8EC
5.0 m	6DS8 201-8SC
• and with non-redundant basic unit:	
Front plug [2]	6DS9 200-8AA
Interface module for 20-m local bus N-AS	6DS1 223-8AA
• and with redundant basic unit:	
2 interface modules for 20-m local bus N-AS	6DS1 223-8AA
Connecting cable for local bus with 2 plugs, 0.5 m	6DS8 205-8SB
Connection to single remote bus	
Starting from standard configuration 6DS2 131-...1.	
With non-redundant basic unit:	
Interface module for 20-m local bus N-AS	6DS1 223-8AA
Bus converter UI	6DS4 400-8AB
Connector board AF "Remote bus"	6DS9 203-8DA
Connecting cable with 5 plugs [3] to connect N-AS to bus converter 1 an connection distributor for 20-m local bus	6DS8 201-8FC
With redundant basic unit: as above, plus:	
2 interface modules for 20-m local bus N-AS	6DS1 223-8AA
Connection to redundant remote bus	
• With standard configurations 6DS2 131-...2. or -...4.	
Bus converter UI	6DS4 400-8AB
Connector board AF "Remote bus"	6DS9 203-8DA
• With standard configurations 6DS2 131-...1.	
With non-redundant basic unit:	
Interface module for 20-m local bus N-AS	6DS1 223-8AA
2 bus converters UI	6DS4 400-8AB
2 connector boards AF "Remote bus"	6DS9 203-8DA
Connecting cable with 5 plugs to connect N-AS to bus converters 1 and 2 and the connection distributor for 20-m local bus	6DS8 201-8FC
With redundant basic unit: as above, plus:	
2 interface modules N-AS	6DS1 223-8AA

1) Max. 2 within an AS 235 consisting of basic and extension cabinets; cannot be used in ES 100 K.
2) The cable connector 6DS8 205-8.. with 2 plugs can be used as an alternative for the combination between connecting cable and front plug
3) 2 plugs not used.

Automation systems
AS 235 H

Extension cabinet

Ordering data	Order No.
Options for AS 235 H basic cabinet (continued)	
Remote bus cable	
See page 6/6	
Option: system cabinets	
Parts kit for upgrading the degree of protection of a 400-mm deep standard cabinet from IP 10 to IP 20 (for former cabinets)	C79165-A3012-D90
Fan subassembly DC 24 V (complete) [1]	
Insulation kit/retrofitting kit for AS 235 H basic cabinet with degree of protection IP 10 or IP 20	
• For installation below the basic unit (initial use)	C79165-A3012-D204
• For installation below the basic unit (retrofitting)	C79165-A3012-D225
• For installation below extension unit EE2	C79165-A3012-D207
Insulation kit/retrofitting kit for AS 235 H basic cabinet with degree of protection IP 54	
• For installation below the basic unit (initial use)	C79165-A3012-D204
• For installation below the basic unit (retrofitting)	C79165-A3012-D226
• For installation below extension unit EE2	C79165-A3012-D207

1) Required with a cabinet power loss > 350 W and a power loss > 150 W for an extension unit

AS 235 H extension cabinet

Depending on the complexity of the automation function, the AS 235 H can be increased up to max. 91 slots for I/O modules by using up to 7 extension units.

The extension units EE4 to EE7 are part of the extension cabinet. They are connected to the central processing unit of an AS 235 H system via 2 separate, redundant I/O buses 2 (B), each with its own interface module for I/O bus (B).

An extension unit of the AS 235 H automation system consists of a subrack with slots for 13 I/O modules, I/O bus comparator and switchover module, and a DC 5 V power supply module.

When ordering the extension units it is possible to select whether the extension unit EE4 is to be delivered on its own, together with EE5, together with EE5, or together with EE6:

The following components are supplied:
- 1, 2, 3 or 4 subracks with slots for 13 I/O modules each
  - For wire-wrap system   6DS9 002-8BB
  - For Maxi-Termi-Point system   6DS9 002-8BA
- 1, 2, 3 or 4 cable ducts, 2 U high   6DS9 906-8AB
- 1, 2, 3 or 4 covers, 2 U high   6DS9 906-8BB
- Cable set for power supply
  - For EE4   6DS9 908-8GE
  - For EE5   6DS9 908-8GF
  - For EE6   6DS9 908-8GG
  - For EE7   6DS9 908-8GH
- Cable set for I/O bus 2
  - With EE4 on its own   6DS9 911-8GD
  - With EE4 and EE5   6DS9 911-8GE
  - With EE4, EE5 and EE6   6DS9 911-8GF
  - With EE4, EE5, EE6 and EE7   6DS9 911-8GG
- Alarm logic module 3   6DS1 901-8AA
- 1 or 2 interface modules for I/O bus 2 (slot: basic unit)   6DS1 312-8BB
- 1, 2, 3 or 4 I/O bus comparators and switchover modules   6DS1 144-8AA
- 1, 2, 3 or 4 upgrading sets with switched-mode regulator DC 5 V (6DS1 006-8AA)   C79451-A3117-D29

The system cabinets (see page 3/23 for further information) are supplied with 2 cabinet lamps and test pushbuttons and consist of the following components:
- Standard cabinet
  - IP 20, 2200 x 900 x 400   6DS9 300-8AA
  - IP 54, 2200 x 900 x 600   6DS9 310-8AB
  - IP 20, 2200 x 900 x 600   6DS9 302-8AA
- Transport lugs (4 off)   6DS9 906-8CA
- Cable set for connection of cabinet lamp   6DS9 912-8AC
- Door contact with mounting parts and connection cables   6DS9 905-8CA
- Cable duct, horizontal for I/O bus   6DS9 906-8PA
- Cable duct, vertical   C79165-A3012-D72
- Thermostats, wired   C79165-A3012-D86
- Cable with mounting parts   C79165-A3012-D129
- Cable clamping rail   C79165-A3012-D128
- Partition with cut-outs and mounting parts
  - For standard cabinet IP 20, 400 mm deep   6DS9 906-8JB
  - For standard cabinet IP 54 and IP 20, 600 mm deep   6DS9 906-8MA

The standard cabinet IP 54 with heat exchanger is additionally supplied with further components:
- Cable set for heat exchanger   C79165-A3012-D19
- Cable for monitoring of heat exchanger   C79195-A3828-H390
- Cable for connection of line filter to motor supply terminals   C79195-A3205-B94

Side panel or 2nd partition for the standard cabinets: see cabinet accessories on page 3/23.

Automation systems
AS 235 H

Ordering data for extension cabinet

Ordering data	Order No.
AS 235 H automation system, extension cabinet	**6DS2 132- 0 X ■ 0 ■**

Extension units

• Without extension units	X

For redundant basic units, each with alarm logic module 3 and 2 interface modules for I/O bus 2

• Extension unit EE4	
– Wire-wrap system	A
– Maxi-Termi-Point system	B
• EE4 and EE5	
– Wire-wrap system	C
– Maxi-Termi-Point system	D
• EE4, EE5 and EE6	
– Wire-wrap system	E
– Maxi-Termi-Point system	F
• EE4, EE5, EE6 and EE7	
– Wire-wrap system	G
– Maxi-Termi-Point system	H

For non-redundant basic units, each with alarm logic module 3 and 2 interface modules for I/O bus 2

• Extension unit EE4	
– Wire-wrap system	J
– Maxi-Termi-Point system	K
• EE4 and EE5	
– Wire-wrap system	L
– Maxi-Termi-Point system	M
• EE4, EE5 and EE6	
– Wire-wrap system	N
– Maxi-Termi-Point system	P
• EE4, EE5, EE6 and EE7	
– Wire-wrap system	Q
– Maxi-Termi-Point system	R

System cabinets

• Standard cabinet, degree of protection IP 20, 400 mm deep, without heat exchanger	1
• Standard cabinet, degree of protection IP 54, 600 mm deep, with heat exchanger	2
• Standard cabinet, degree of protection IP 20, 600 mm deep, without heat exchanger	3

Ordering data	Order No.
Options for AS 235 H extension cabinet	

Extension units

For retrofitting of extension units EE5, EE6 or EE7:

Subrack for extension unit
With mounting parts and slots for 13 I/O modules

• Wire-wrap system	6DS9 002-8BB
• Maxi-Termi-Point system	6DS9 002-8BA

Accessories for EE5:

Cable set for power supply of EE5	6DS9 908-8GF
Cable set for I/O bus	6DS9 911-8GE
Cable duct	6DS9 906-8AB
Cover	6DS9 906-8BB
I/O bus comparator and switchover module	6DS1 144-8AA
Upgrading set with switched-mode regulator DC 5 V (6DS1 006-8AA)	C79451-A3117-D29

Accessories for EE6:

Cable set for power supply of EE6	6DS9 908-8GG
Cable set for I/O bus	6DS9 911-8GF
Cable duct	6DS9 906-8AB
Cover	6DS9 906-8BB
I/O bus comparator and switchover module	6DS1 144-8AA
Upgrading set with switched-mode regulator DC 5 V (6DS1 006-8AA)	C79451-A3117-D29

Accessories for EE7:

Cable set for power supply of EE7	6DS9 908-8GH
Cable set for I/O bus	6DS9 911-8GG
Cable duct	6DS9 906-8AB
Cover	6DS9 906-8BB
I/O bus comparator and switchover module	6DS1 144-8AA
Upgrading set with switched-mode regulator DC 5 V (6DS1 006-8AA)	C79451-A3117-D29

Redundant design of I/O bus 2

Interface module for I/O bus 2 (slot: basic unit)	6DS1 312-8BB

Standard cabinets

Fan subassembly DC 24 V (complete)

• Installation kit/retrofitting kit for AS 235 H extension cabinet with degree of protection IP 10, IP 20 or IP 54, for installation below the extension unit EE4 and/or EE6	C79165-A3012-D205
• Retrofitting it for AS 235 H with degree of protection IP 54, for installation below the extension unit EE4	C79165-A3012-D227

Automation systems
AS 235 K

Basic system

AS 235 K automation system

The AS 235 K automation system is the compact version of the AS 235 system. Both systems use the same central unit modules, interface modules and I/O modules. They also have the same range of functions.

The AS 235 K system is fully operable on its own without any extensions. Since the number of I/O modules which can be plugged into the AS 235 K system is limited to 6, however, the AS 235 K is usually used together with ES 100 K extension systems (see page 3/21).

Basic system

The AS 235 K automation system is available for AC 230 V and DC 24 V supply voltages. The basic system of the AS 235 K automation system comprises:

- ES 902 subrack
  – For AC 230 V   C79451-A3260-A16
  – For DC 24 V   C79451-A3260-A17
  each with
  power supply subrack with slots for power supply and alarm logic modules, 6 slots for I/O modules [1], process connection panel for I/O modules 1 to 6, mounting plate with slots for 2 connector boards AF "Remote bus" and slots for 2 bus converters UI, power supply unit, cable clamping rail with 10 clamps
- Power supply module SV1
  For AS 235 K with AC 230 V:
  – AC 230 V / DC 24 V   C79451-A3260-A20
  For AS 235 K with DC 24 V:
  – DC 24 V / DC 24 V   C79451-A3260-A25
- Power supply module SV2,
  DC 24 V / DC 5 V   C79451-Z1359-U9
- Alarm logic module   6DS1 901-8BA
- Bus terminator module   C79458-L445-B20
- Flashing pulse generator   6DS1 922-8AA
- Central processing unit with
  – Central processor module   6DS1 140-8AA
  – EDC memory module 4000 Kbyte   6DS1 844-8FA
  – Backup battery for memory module   W79084-U1001-B2
  – AS 235 system software, version G   6DS5 323-8AG
  – Interface module for I/O bus 1   6DS1 312-8BB[1]
- Interface module for mini floppy disk unit   6DS1 326-8BB
- Interface module for operation channel 1   6DS1 330-8CA

The subrack of the AS 235 K system corresponds to the ES 902 system and is 15 U high. It is the supporting system for the other components of the basic system, the bus components, and the I/O modules.

The front of the subrack contains a process connection panel for the process signal cables with Maxi-Termi-Point connections (pins 2.4 mm x 0.8 mm). The rear of the process connection panel is wired to the base plugs X2, i.e. the process interfaces of the 6 I/O modules in the basic system.

Two power supply modules are used for the basic system:

- Power supply module SV1
  One of the following modules is used depending on the selected supply voltage for the AS 235 K:
  – C79451-A3260-A20 (AC 230 V / DC 24 V) or
  – C79451-A3260-A25 (DC 24 V / DC 24 V).
  Both designs are equipped with 3 sockets via which 2 process operation keyboards and a mini floppy disk unit can be powered with DC 24 V.

- Power supply module SV2
  The power supply module SV2 (C79451-Z1359-U9) converts DC 24 V into DC 5 V for the central processing unit and the I/O bus interface modules.
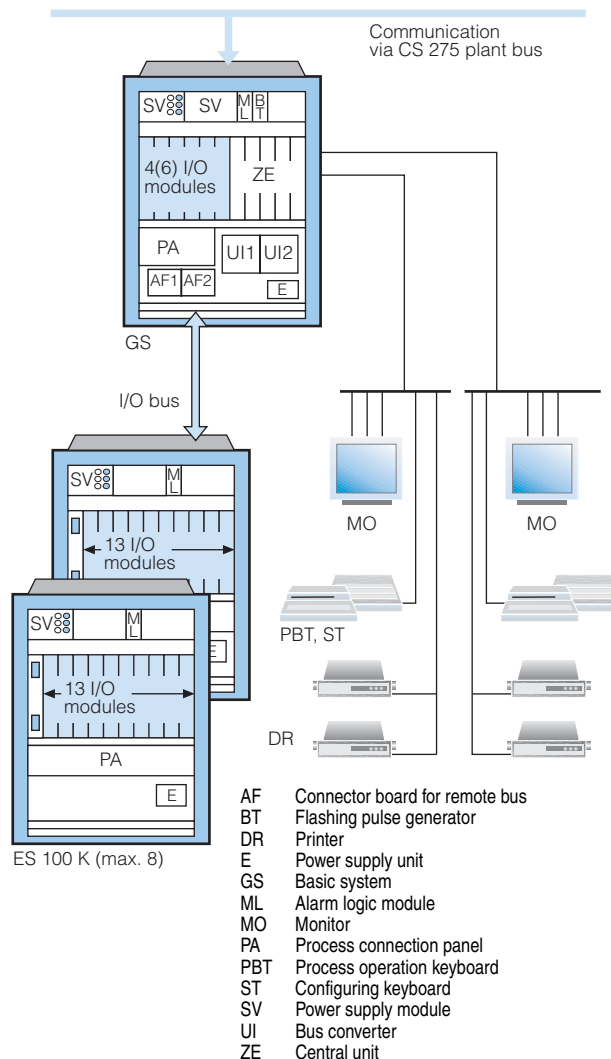
[1] If I/O slot 6 is used, the interface module for I/O bus 2 (B) is required in addition. See AS 235 K functions for Ordering data.

Fig. 3/7   AS 235 K automation system, system configuration

AF	Connector board for remote bus
BT	Flashing pulse generator
DR	Printer
E	Power supply unit
GS	Basic system
ML	Alarm logic module
MO	Monitor
PA	Process connection panel
PBT	Process operation keyboard
ST	Configuring keyboard
SV	Power supply module
UI	Bus converter
ZE	Central unit

The alarm logic module monitors the 24-V voltages L+ and PM, the +5-V voltage and the optionally used signal inputs for temperature monitoring, door contact and spare contact. Error messages via these signal inputs as well as further system messages trigger a flashing LED and a relay of the module at the same time. This common alarm can be switched via this relay to an external signalling lamp for another signalling device.

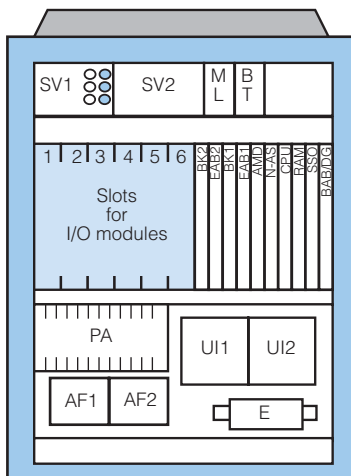The flashing pulse generator has the following functions:

- Generation of a flashing signal which is required by the I/O modules of the TELEPERM ME process control system for alarm display. The flashing signal is fused in the flashing pulse generator

- Lamp test for the fault display of the I/O modules which are supplied with the flashing signal

- Electrical isolation of external time synchronization signals. The AS 235 K can be synchronized using a minutes pulse.

Automation systems
AS 235 K

AMD	Interface module for mini floppy disk unit	ML	Alarm logic module
AF	Connector board "Remote bus"	N-AS	Interface module for 20-m local bus
BAB	Bus terminator module	PA	Process connection panel
BK	Interface module for operation channel	RAM	Memory module
		SSO	Special interface, not used
BT	Flashing pulse generator	SV1	Power supply module AC 230 V / DC 24 V or power supply module DC 24 V / DC 24 V
CPU	Central processor module		
DG	Diagnostics interface		
E	Power supply unit for AC 230 V or 2 x DC 24 V	SV2	Power supply module DC 24 V / DC 5 V
EAB	Interface module for I/O bus	UI	Bus converter

Fig. 3/8   AS 235 K automation system, design

The central processor divides the RAM and differentiates access operations to

- the 1-Mbyte system RAM with battery backup for all fixed system data and programs,
- the 4000-Kbyte RAM with battery backup for all user programs and data and for variable system data, and
- the transfer memories of the interface modules for I/O bus, operation channel, mini floppy disk unit and local bus.

The memory module with *Error Detection and Correction* EDC can correct a 1-bit error when reading, and eliminate it in the memory cell together with the system software.

The interface module for I/O bus establishes the connection between the 8-bit central unit bus and the I/O bus. One or two of these modules can be plugged into the basic system of the AS 235 K:

- The interface module for I/O bus 1 (A) supplies the I/O modules plugged into slots 1 to 5 of the basic system and/or the interface modules for the ES 100 K extension system. It is always required.
- The interface module for I/O bus 2 (B) is only required if slot 6 in the basic system is to be used. It must be ordered as an option.

Standard I/O devices

The standard I/O devices such as process monitor, process operation keyboard, configuring keyboard, mini floppy disk unit and logging/message printers are described in Section 5.

The interface module for operation channel generates the RGB signals for the process monitors, including the CVS signal. It also has three 20-mA current loop interfaces to which the process operation keyboard PBT or the configuring keyboard and 2 printers (logging and message printers) can be directly connected.

See page 3/29 for possible connections of standard I/O devices and a summary of connecting cables.

The interface module for operation channel 1 belongs to the scope of delivery of the basic system and is always required. A second interface module is only required if 2 operating con-

soles are to be used via which operation and monitoring or configuring are to be carried out independently.

The combinations which can be ordered for the standard I/O devices comprise:

- Configuring unit, comprising:
  - Configuring keyboard — 6DS3 303-8AA
  - Connecting cable for configuring keyboard, 1 m [1] — 6DS8 102-8AC
  - Mini floppy disk unit with cables for signal transmission and power supply, 3 m each — 6DS3 900-8AE
- Operation unit, comprising:
  - PBT 65 process operation keyboard with cable for signal transmission, 5 m — 6XV2 167-8CH50
    with cable for power supply, 5 m — 6DS8 103-8SC
  - SCM 2140-I process monitor — 6GF6100-1BV
    with 3 video cables, 5 m — 6DS8 116-8SC
- In addition for operation channel 2:
  - Interface module for operation channel 2 [2] — 6DS1 330-8CA

I/O modules

The I/O modules are the process interface of the AS 235 K. They comprise signal modules and function modules, including calculation modules. See Section 4 for the properties, functions and Ordering data of the I/O modules.

The AS 235 K has slots for 6 I/O modules. Slots 1 to 5 are connected to the central processing unit via I/O bus 1 (A). Slot 6 is connected to I/O bus 2 (B). As a result, the interface module for I/O bus 2 must be inserted if slot 6 is to be used.

The number of slots for I/O modules can be increased up to a maximum of 108 by connecting up to eight ES 100 K extension systems.

The I/O modules can be supplied coded, inserted and with labelled slots. Arrangement, designation and connection diagrams (including address data) are required from the orderer.

- Coding, inserting and labelling for 1 I/O module — 6DS5 705-8AA

Interface module for ES 100 K

The interface module for the ES 100 K links the I/O bus of the AS 235 K basic system to the I/O bus of the ES 100 K via a cable. Interface modules are required in both the AS 235 K basic system and the ES 100 K extension system.

The interface module for the ES 100 K can be inserted into any slot for I/O modules in both the AS 235 K and the ES 100 K. A maximum of four interface modules for a total of four ES 100 K extension systems can be plugged into slots 1 to 5 in the AS 235 K.

The I/O bus 2 (B) only supplies slot 6. Therefore a further four ES 100 K extension systems can be connected serially to the interface module inserted there. The use of slot 6 requires that the interface module for I/O bus 2 (optional accessory) is inserted.

Bus components

The TELEPERM M systems can communicate with one another via the CS 275 plant bus up to distances of 20 m (local bus) or 4 km (remote bus). The local bus is redundant as standard. The remote bus can be redundant as an option.

Up to 9 participants can be interconnected as a local bus island via the 20-m local bus (each bus converter UI counts as 1 participant). The total length of the connecting cables must not exceed 20 m.

---

1)   This cable is only suitable for connection to the process operation keyboard or the signal distribution unit. A cable 6XV2 167-8B.. (order separately) is required for the direct connection to the basic unit of the AS 235 K system (operation channel).

2)   Interface module for operation channel 1 is included in the basic system.

Automation systems
AS 235 K

Ordering data for AS 235 K

Max. 2 interface modules N-V.24 inserted in one of the I/O slots in the AS 235 K basic system can be integrated via a front connection to the interface module N-AS of the system by means of cable 6DS8 201-8.. . Please contact Siemens in the case of other participants and additions.

The cable 6DS8 201-8.. is only provided with a plug at one end. It is connected 1:1 at the free end to the plug of the N-AS. If a cable is not yet connected there, a front plug 6DS9 200-8AA is required in addition. The cable 6DS8 205-8.. with 2 plugs can be used as an alternative to the combination of cable 6DS8 201-8.. and front plug.

The AS 235 K is connected to a single, non-redundant remote bus via the interface connection unit. The AS 235 K can also be operated on a redundant remote bus. In this case, a connection unit for redundant remote bus with 2 bus converters UI and 2 remote bus connector boards AF "Remote bus" is required.

The connection unit for single for redundant remote bus can be selected in the standard ordering configuration under "Bus components". The connection unit comprises:

- Interface module for 20-m local bus N-AS   6DS1 223-8AC
- Bus converter UI   6DS4 400-8AB
  (2 x with redundant remote bus)
- Connector board AF "Remote bus"   6DS9 203-8DA
  (2 x with redundant remote bus)
- For single remote bus:
  Connecting cable with 2 plugs for connection   6DS8 205-8MB
  of N-AS to bus converter UI
- For redundant remote bus:
  Connecting cable with 3 plugs for connection   6DS8 204-8MB
  of N-AS to bus converters UI1 and UI2

In order to implement a remote bus, the appropriate remote bus cable is required in addition to a connection unit for single or redundant remote bus. This cable is connected to the connector board AF "Remote bus" and links the individual bus participants together at distances up to 4 km (see also Section 6).

Housing

The AS 235 K is installed as standard in a sheet-steel housing with degree of protection IP 21:

- Sheet-steel housing, degree of
  protection IP 21   C79451-A3260-A50
  Dimensions (HxWxD)
  820 mm x 600 mm x 360 mm,
  without heat exchanger, with
  – separate ventilation roof,
  – top panel with ventilation slits,
  – front door, 600 mm wide, with lock,
  – base with screwed-in cable panel,
    175 mm deep, front half with ventilation slits

A diagram of the housing with dimensions can be found on page 3/22, Fig. 3/10. When using the supplied parts set for wall mounting, the dimensions are increased as shown in this Fig.

System documentation

German or English system documentation can be ordered with the AS 235 K basic system. The documentation comprises:

- Manuals
  – "AS 235 K automation system"   C79000-G8000-C305
  – "Function modules", volumes 1 and 2   C79000-G8000-C30
  – "Signal modules"   C79000-G8000-C31
  – "Coupling and calculation modules"   C79000-G8000-C32
  – "CS 275 bus system"   C79000-G8000-C6
- Description "AS 235, AS 235 H and AS 235 K   C79000-G8000-C416
  automation systems, version G",
  volumes 1 to 3
- Manual "Notes and guidelines for   C79000-G8000-C417
  planning, installation and operation"

In the English system documentation, the center block of the individual Order Nos. is replaced by ".....-G8076-...".

- AS 235 / AS 235 H / AS 235 K table pamphlet,   C79000-N8000-C1
  German, order separately if required

Ordering data	Order No.
AS 235 K automation system	**6DS2 117-** ■ ■ ■ ■ ■ **-** ■ ■
Basic system	
• Without basic system	0
• Basic system AC 230 V, with operation channel 1 and I/O bus 1	7
• Basic system DC 24 V, with operation channel 1 and I/O bus 1	8
Standard I/O devices	
• Without standard I/O devices	X
• Configuring unit with configuring keyboard and mini floppy disk unit	E
• Operation unit 1 for operation channel 1 with process monitor and process operation keyboard	
– Without configuring unit	M
– With configuring unit	P
• Operation channel 2 and operation unit 2 with interface module for operation channel 2, process monitor and process operation keyboard	N
• Operation channel 2 and operation units 1 and 2 with interface module for operation channel 2, 2 process monitors and 2 process operation keyboards	
– Without configuring unit	Q
– With configuring unit	R
Bus components	
• Without bus components	X 0
• Connection unit	
– For non-redundant remote bus	X 1
– For redundant remote bus	X 2
Housing	
• Without housing	0
• Sheet-steel housing, degree of prot. IP 21, without heat exchanger	1
Option: system documentation	
• Without system documentation	0 X
• German documentation	0 D
• English documentation	0 E

AS 235 K options	Order No.
Basic system	
Backup battery for memory module	W79084-U1001-B2
Interface module for I/O bus 2 [1]	6DS1 312-8BB
Bus connection of further participants via 20-m local bus	
Interface module for 20-m local bus N-V.24	6DS1 202-8AB
Connecting cable for local bus, 0.3 m	6DS8 201-8MB
Remote bus cable	
See page 6/6	

[1] Additionally required if I/O slot 6 is used.

Also refer to the ordering instructions in the appendix (page 8/2) with information on ordering complete systems and options.

Automation systems
ES 100 K

ES 100 K extension system

Up to eight ES 100 K extension systems can be connected in order to supplement the 6 I/O module slots in the AS 235 K system (max. 4 systems per I/O bus). Extension of the AS 235 system by the ES 100 K extension system is also possible.

Each ES 100 K system has space for 13 I/O modules. The number of I/O modules per AS 235 K automation system can therefore be extended to 108 (104 slots in the ES 100 K + 4 slots in the AS 235 K).

The extension systems can be connected with a cascade or radial configuration. The total cable length must not exceed 500 m.

An interface module 6DS1322-8AA is required for the coupling in both the basic system and the extension system. The interface module can be inserted into any slot for I/O modules in the AS 235 K and ES 100 K systems. Slot 1 should be preferably used, however.

The ES 100 K extension system is available for AC 230 V and DC 24 V. It consists of:

- ES 902 subrack, 15 *U* high
  – For AC 230 V   C79451-A3260-A3
  – For DC 24 V   C79451-A3260-A4
  each with
  power supply subrack,
  13 slots for I/O modules,
  process connection panel for I/O modules,
  power supply system,
  cable clamping rail with 10 clamps
- Power supply module SV1
  For ES 100 K with AC 230 V
  – AC 230 V / DC 24 V   C79451-A3260-A20
  For ES 100 K with DC 24 V
  – DC 24 V   C79451-A3260-A25
- Interface module for ES 100 K   6DS1 322-8AA

The subrack corresponds to the ES 902 packaging system and is 15 *U* high. It contains slots for the power supply module, an alarm logic module, and the interface module for ES 100 K and 13 I/O modules.

The subrack also contains a process connection panel with 576 pins 2.4 mm x 0.8 mm in the Maxi-Termi-Point system.

A power supply module is required for the extension system depending on the selected supply voltage of the ES 100 K:

- C79451-A3260-A20 (AC 230 V) or
- C79451-A3260-A25 (DC 24 V).

The same power supply modules are also used in the AS 235 K system.

The alarm logic module 6DS1 901-8AA can the ordered as an optional accessory. It monitors the 24-V voltages L+ and PM, the optionally used signal inputs for temperature monitoring, door contact, fan contact and spare contact, e.g. if the ES 100 K extension system is installed in a TELEPERM M standard cabinet and if cabinet messages are to be detected or cabinet alarm lamps are to be triggered.

An alarm detected in the ES 100 K system is not transmitted to the central processing unit of an AS 235 K automation system, however. Therefore it does not lead to the output of an alarm text on the process monitor.
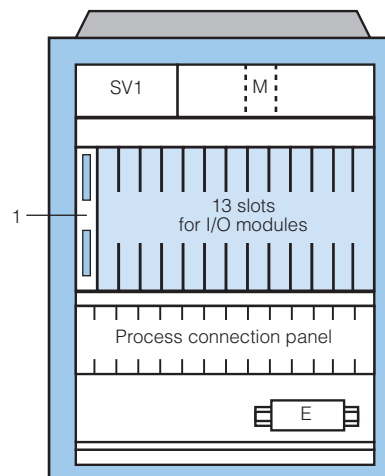
1	Interface module for ES 100 K
E	Power supply unit for AC 230 V or 2 x DC 24 V
M	Alarm logic module

Fig. 3/9   ES 100 K extension system, design

Interface module for ES 100 K

The interface module for ES 100 K links the I/O bus of the AS 235 K basic system to the I/O bus of the ES 100 K extension system via a cable.

Interface modules for ES 100 K are required in the AS 235 K basic system and in the ES 100 K extension system.

The interface module inserted in the ES 100 K provides the DC 5 V supply required for the I/O bus.

I/O modules

Slots for up to 13 I/O modules are present in the ES 100 K extension system. In addition to the I/O modules of the TELEPERM M process control system, certain I/O modules of the TELEPERM ME process control system can also be used in the ES 100 K system.

Depending on the addressing volume of the I/O bus, up to eight ES 100 K extension systems with a total of 104 I/O modules can be operated with one AS 235 K system.

See Section 4 for the properties, functions and Ordering data of the I/O modules.

Automation systems
ES 100 K

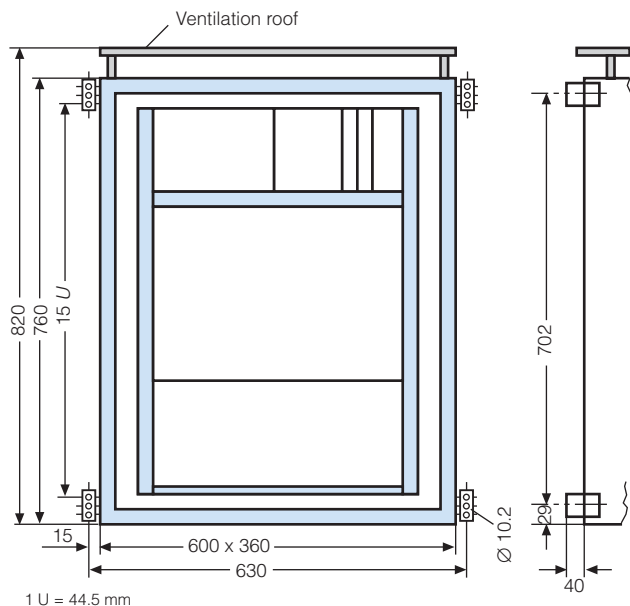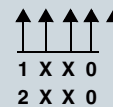**Ordering data for ES 100 K**

Fig. 3/10 ES 100 K extension system, design

Housing

The ES 100 K extension system is installed in a sheet-steel housing with degree of protection IP 21. This corresponds to a standard ordering configuration:

- Sheet-steel housing, degree of
  protection IP 21   C79451-A3260-A50
  Dimensions (HxWxD)
  820 mm x 600 mm x 360 mm,
  without heat exchanger, with
  – separate ventilation roof,
  – top panel with ventilation slits,
  – front door, 600 mm wide, with lock,
  – base with screwed-in cable panel,
    175 mm deep, front half with ventilation slits

When using the supplied parts set for wall mounting, the dimensions are increased as shown in Fig. 3/10.

Also refer to the ordering instructions in the appendix (page 8/2) with information on ordering complete systems and options.

Ordering data	Order No.
ES 100 K extension system	**6DS2 103 -** ■ ■ ■ ■ ■
Basic system	
• Extension system AC 230 V	1 X X 0
• Extension system DC 24 V	2 X X 0
Housing	
• Without housing	0
• Sheet-steel housing, degree of protection IP 21, without heat exchanger	1

ES 100 K options	Order No.
Connection of the 1st of max. four ES 100 K systems of a link to - I/O bus 1(A), address range 0 to 60, or - I/O bus 2(B), address range 100 to 160	
2 interface modules for ES 100 K extension system Can be inserted in slot for I/O modules in the AS 235 and ES 100 K	**6DS1 322-8AA**
Cable for signal transmission (max. length Length 25 m of a link: 5 m 500 m) 50 m 100 m 500 m Intermediate lengths	**6ES5 721-0BC50** **6ES5 721-0BF00** **6ES5 721-0CF00** **6ES5 721-0DB00** **6ES5 721-0DF00** See Catalog ST 50
Cable terminating plug Can be inserted in interface module for ES 100 K, required with last extension system of a link	**6ES5 760-1AA11**
In addition when using the address range 100 to 160:	
Interface module for I/O bus 2	**6DS1 312-8BB**
Connection of 2nd to 4th ES 100 K system of a link	
Required per ES 100 K system: **Interface module for ES 100 K extension system** Can be plugged in slot for I/O modules of ES 100 K	**6DS1 322-8AA**
Cable for signal transmission	See above
Installation of ES 100 K in standard cabinet if cabinet messages are to be detected	
Alarm logic module	**6DS1 901-8AA**
System documentation	
Instruction Manual "ES 100 K extension system" [1] – German – English	**C79000-B8000-C124** **C79000-B8076-C124**

1) Only order separately if the ES 100 K system is not ordered together with an AS 235 K system.

Standard cabinets and accessories

The AS 235 and AS 235 H automation systems can be delivered in 400 mm or 600 deep standard cabinets with or without a heat exchanger. The following standard ordering configurations are available:

- Standard cabinet without heat exchanger, degree of protection IP 20, cabinet depth 400 mm
- Standard cabinet without heat exchanger, degree of protection IP 20, cabinet depth 600 mm [1]
- Standard cabinet with heat exchanger, degree of protection IP 54, cabinet depth 600 mm

Options, to be ordered in addition:

- Upgrading set for standard cabinets, degree of protection IP 10 to degree of protection IP 20 [2]
- Fan subassembly

In the cabinets with degree of protection IP 20, heat dissipation is by means of through-ventilation. The outside air circulates through the cabinet and dissipates the produced heat. The disadvantage of this type of heat dissipation is that dirt may be deposited if dust is present in the ambient air. This disadvantage does not occur in cabinets with heat exchangers. The max. permissible thermal load is 700 W at an ambient temperature of 40 °C.

In the cabinets with heat exchanger (degree of protection IP 54), the air within the cabinet and outside remain separated. These cabinets must be used if the ambient conditions deviate from the permissible values as a result of rough operating conditions. Examples include the chemical industry, iron and steel industry, mining, and plants exposed to salty atmospheres. The max. thermal load is 1000 W at an ambient temperature of 40 °C.

The standard cabinet can be used either without forced ventilation or provided with one or two fan subassemblies depending on the permissible thermal load of the cabinet, the desired design and, especially, the I/O modules used.

The fan subassembly 6DS9 943-8AA is used for forced ventilation. This subassembly contains three fans whose speeds are monitored, as well as an electronic fuse.

In cabinets with heat exchangers, the fan monitoring functions of the fan subassemblies and of the heat exchanger are connected in series. The failure signal LK is connected to the basic unit.

Each standard cabinet has 2 thermostats to measure overtemperatures. See the following pages for configuring guidelines concerning the permissible thermal load.

The basic cabinets are always delivered without side panels and partitions since they can be installed individually, as double cabinets, or in a cabinet row depending on the location and the size of the system. Extension cabinets are supplied with one partition. The side panels and partitions must be additionally ordered as required.

Basic and extension cabinets can also be supplied as a double cabinet screwed together with a low-impedance connection.

A cabinet row lamp can be fitted into the top bezel panel of the first cabinet when installing cabinets in rows.

The rooms in which the cabinets are installed should be sufficiently large (ceiling height approx. 3 m). They should also be dry and dust-free. Air-conditioning must be provided if necessary.

[1] Recommended if cabinets without heat exchangers are to be installed combined with cabinets with heat exchangers.
[2] For former cabinets with degree of protection IP 10.

Ordering data	Order No.
System cabinet accessories	
Side panels and partitions / mounting of double cabinets	
Side panel for standard cabinets, with mounting parts, assembled	
– 400 mm wide	**6DS9 906-8FA**
– 600 mm wide	**6DS9 906-8KA**
Partition with mounting parts and set of fittings for joining cabinets	
• For 400-mm deep cabinets	
– Without cut-outs	**6DS9 906-8GA**
– With fire bulkhead	**6DS9 906-8HA**
– With cut-outs	**6DS9 906-8JB**
• For 400-mm deep cabinets	
– Without cut-outs	**6DS9 906-8LA**
– With cut-outs	**6DS9 906-8MA**
Set of fittings for joining cabinets without partition	**6DS9 906-8EA**
Conversion of a basic cabinet and an extension cabinet to a double cabinet (delivered as double cabinet)	**6DS5 707-8AA**
Cabinet accessories	
Cabinet row lamp with mounting parts and connection cables, installed	**6DS9 905-8DA**
Cabinet connection elements (SAE)	
Cabinet connection element with mounting screws and nuts, assembled (max. 90 off/cabinet)	
• **SAE 32/3** Process side: Maxi-Termi-Point 2.4 mm x 0.8 mm Internal: wire-wrap 1 mm x 1 mm	**6DS9 907-8BA**
• **SAE 32/1** Process side and internal: Maxi-Termi-Point 2.4 mm x 0.8 mm	**6DS9 907-8AA**
Labelling material in addition:	
For connection of cables color-coded in groups of 8 (TELEPERM M):	
Labelling cards A-H/H-A for 4 cabinet connection elements, 1 pair	**6DS9 906-8DA**
Labelling strips for cards A-H/ H-A for 1 cabinet, 1 sheet (2 sheets required per cabinet)	**C79165-A3012-C99**
For numbered designation:	
Labelling card 1-32 for 4 cabinet connection elements SAE 32	**6XP1 846**
Labelling cards 32-1 for 4 cabinet connection elements SAE 32	**6XP1 847**
Labelling strips for cards 1-32/32-1 for one cabinet, 1 sheet	**6XP1 856**
Cabinet connection element SAE 32/3 with screw attachment SAE 32 S (max. 40 off/ cabinet) Process side: screw attachment: SAE 32 S Internal: wire-wrap 1 mm x 1 mm	
Order:	
Cabinet connection element SAE 32/3 with mounting screws and nuts, assembled	**6DS9 907-8BA**
Screw attachment SAE 32 S	**6XP1 828**

Automation systems
Standard cabinets

Ordering data for system cabinet accessories

Ordering data	Order No.
System cabinet accessories (continued)	
Cabinet connection element SAE 32/1 with screw attachment SAE 32 S (max. 40 off/cabinet) Process side: screw attachment SAE 32 S Internal: Maxi-Termi-Point 2.4 x 0.8 *Order:*	
Cabinet connection element SAE 32/1 with mounting screws and nuts, assembled	**6DS9 907-8AA**
Screw attachment SAE 32 S	**6XP1 828**
Labelling material:	
Labelling card 32-1 for 4 cabinet connection elements SAE 32	**6XP1 847**
Labelling strips for screw attachment SAE 32 S for one cabinet, 1 sheet	**6XP1 858**
Cabinet connection element SAE 32/3 with connecting cable Process side: cable plug SAE 32 ST of connecting cable Internal: wire-wrap 1 mm x 1 mm *Order:*	
Cabinet connection element SAE 32/3 with mounting screws and nuts, assembled	**6DS9 907-8BA**
Connecting cable, unscreened L-YY 16 x 2 x 0.22 mm², with – 2 cable plugs SAE 32 ST – 1 cable plug SAE 32 ST	**6XP1 831-8■ ■** **6XP1 832-8■ ■**
Connecting cable, screened L-YCY 16 x 2 x 0.22 mm², with – 2 cable plugs SAE 32 ST – 1 cable plug SAE 32 ST	**6XP1 833-8■ ■** **6XP1 834-8■ ■**

4 m **AA**   15 m **AE**   30 m **AH**
6 m **AB**   20 m **AF**   35 m **AJ**
9 m **AC**   25 m **AG**   40 m **AK**
12 m **AD**

Ordering data	Order No.
Cabinet connection element SAE 32/1 with connecting cable Process side: cable plug SAE 32 ST of cable Internal: Maxi-Termi-Point 2.4 x 0.8 *Order:*	
Cabinet connection element SAE 32/1 With mounting screws and nuts, assembled	**6DS9 907-8AA**
Connecting cable	See above
Labelling material:	
Labelling foil for connecting cable 1 sheet with 10 foils	**6XP1 868**
Labelling cards 32-1 for 4 cabinet connection elements SAE 32	**6XP1 847**
Labelling strips for cards 1-32/32-1 for one cabinet, 1 sheet	**6XP1 856**

Ordering data	Order No.
System cabinet accessories (continued)	
For potential and signal distribution:	
Cabinet connection element SAE 32/3, with jumper SL on the process side – 1-16 and 17-32 jumpered separately	**6XP1 821**
Cabinet connection element SAE 32/1, with jumper SL on the process side – 1-16 and 17-32 jumpered separately – 1-16 jumpered – 17-32 jumpered	**6XP1 812** **6XP1 810** **6XP1 811**

SAE installation

SAE installation	
• For 6DS9 907-8AA, -8BA	Included in delivery
• For 6XP1 810, 6XP1 811, 6XP1 812, 6XP1 819, 6XP1 820, 6XP1 821	Dependent on expense

SAE wiring

SAE wiring Maxi-Termi-Point	
• Direct from circuit diagram, per line	**6DS5 706-8AA**
• Malta, per line	**6DS5 706-8AC**
• From data transfer diskette, per line	**6DS5 706-8AF**
• Running-out lists, per line	**6DS5 706-8AE**
SAE wiring wire-wrap	
• Direct from circuit diagram, per line	**6DS5 706-8BA**
• Malta, per line	**6DS5 706-8BC**
• From data transfer diskette, per line	**6DS5 706-8BF**
• Running-out lists, per line	**6DS5 706-8BE**

Automation systems
Standard cabinets

Permissible thermal loading

■ Permissible thermal loading, configuring guidelines

Standard cabinets without forced ventilation

Basic and extension units fitted in standard cabinets can be operated without fans if

- the cabinet thermal load $P_{s\ max}$ permissible depending on the cabinet unit temperature is not exceeded and
- a heat loss greater than 150 W does not occur in any extension system.

If many I/O modules are used with a high heat loss, these should not all be fitted next to one another but distributed amongst the various subracks in order to prevent heat accumulation. $P_{s\ max}$ is usually not achieved in the extension cabinet even with the full configuration of 42 I/O modules. An exact determination of the total heat loss is only required with a non-typical module configuration (many I/O modules of the same type, modules with more than 8 W heat loss).

Standard cabinets with degree of protection IP 20, with forced ventilation

Extension unit with > 150 W/subrack

Basic and extension cabinets whose thermal load (without fan subassembly) is not exceeded must be provided with forced ventilation if an extension unit is configured with I/O modules such that the heat loss of this subrack exceeds 150 W. At least one fan subassembly must then be provided between the basic unit GE and the 1st extension unit EE1 (in the basic cabinet) or between the 4th and 5th extension units (in the extension cabinet).

Cabinet thermal load > 350 to 450 W, < 700 W

If the thermal load is between 350/450 W (depending on cabinet ambient temperature) and 700 W, and if 150 W is not exceeded in any extension unit of the cabinet, at least one fan subassembly must be provided between the basic unit GE and the 1st extension unit EE1 (in the basic cabinet) or between the 4th and 5th extension units (in the extension cabinet).

A 2nd fan subassembly must be provided if an extension unit is additionally configured with I/O modules such that its heat loss exceeds 150 W. The 2nd fan subassembly must be fitted above the 3rd extension unit EE3 (in the basic cabinet) or above the 6th extension unit EE6 (AS 235, extension cabinet) or above the 7th extension unit EE7 (AS 235 H, extension cabinet).

Standard cabinet with heat exchanger

The standard cabinet with heat exchanger can be operated without an additional fan subassembly if the total thermal load of 350/450 W (depending on cabinet ambient temperature) is not exceeded in the cabinet and if 150 W is not exceeded in any extension unit.

The standard cabinet with heat exchanger is operated with a fan subassembly if the total thermal load is < 700 W and if 150 W is not exceeded in any extension unit. The fan subassembly must be fitted between the basic unit and the 1st extension unit EE1 (in the basic cabinet) or between the 4th and 5th extension units EE4 and EE5 (in the extension cabinet).

If the thermal load in one of the three extension units exceeds 150 W or if the total thermal load exceeds 700 W, a 2nd fan subassembly must be fitted between the 2nd and 3rd extension units EE2 and EE3 (in the basic cabinet) or between the 5th and 6th extension units EE5 and EE6 (AS 235, extension cabinet) or between the 6th and 7th extension units (AS 235, extension cabinet). A maximum thermal load of 1000 W is then permissible.

■ Configuring values for thermal load

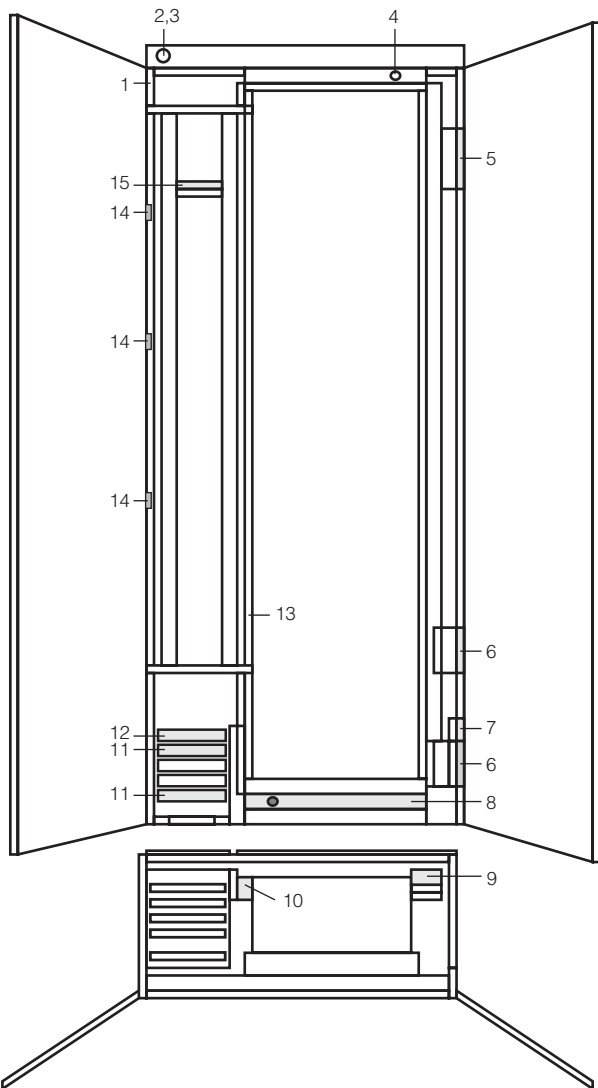| **AS 235**	
Basic cabinet without I/O modules, redundant bus connection	≤ 150 W
Bus connection, single	- 10 W
Connected extension cabinet	+ 16 W
AS 235 extension cabinet without I/O modules	0 W
AS 235 H	
Basic cabinet without I/O modules, redundant bus connection	≤ 200 W
Bus connection, single	- 10 W
Connected extension cabinet	+ 8 W
AS 235 H extension cabinet without I/O modules	30 W

Automation systems
Standard cabinets

The cable bars are included in the standard delivery of the cabinet. The locations for installation of the video relays and the connector boards for remote bus are identified accordingly.

The standard cabinets with degree of protection IP 20 are equipped with:

- Main frame with conductive, corrosion-proof surface; fitted off-set to one side and electrically connected to the cabinet frame. Side members of the main frame with fixing holes for mounting the subracks
- Three-part metal cable duct with cover plate on the right-hand side member on the cable connection side for the ribbon cables of the I/O bus, for power supply cables, internal bus connections and cables to the operation devices
- Cable duct 80 mm x 75 mm on the left-hand side member for internal wiring of process signals
- Cabinet connection element support for up to 90 32-way cabinet connection elements (SAE)
- Screen bars for connection of process cable screens
- Cable clamping rails for the process cables
- Screen board on the right-hand side of the cabinet for external operation and monitoring devices
- Screen board on the right-hand side of the cabinet for remote bus cables
- Socket for connection of a telephone to the internal telephone network. The socket is not wired-up and is accessible from the front of the cabinet. It consists of a two-pin plug connector 4/13 DIN 47 284 with insulated sleeve and cover
- 4 door contacts with associated cable set
- Bar for 24-V terminals
- 2 thermostats for overtemperature detection.

1   Cabinet housing
2   Cabinet alarm lamp
3   Lamp test pushbutton
4   Socket for telephone connection
5   Slots for video relay (AS 235 H basic cabinet only)
6   Slots for connector boards AF "Remote bus" (basic cabinet only)
7   Screen bar for connecting bus cable screens
8   Screen board
9   Three-part cable duct
10 Cable duct
11 Screen bar for connecting process cable screens
12 Bar for 24 V terminals
13 Main frame
14 Bar for fixing the cables
15 Cabinet connection element support

Fig. 3/11 Standard cabinet without heat exchanger

Standard cabinet with degree of protection IP 20, without heat exchanger

Design

Cabinet with two-leaf doors at front and rear; lift-off doors. Each door with 3 rows of ventilation slots.

Front and rear of cabinet each with a top bezel panel with cabinet alarm lamp and lamp test pushbutton.

The cables are connected to cable bars in the rows of holes in the cabinet frame using commercially available parts.

Technical data

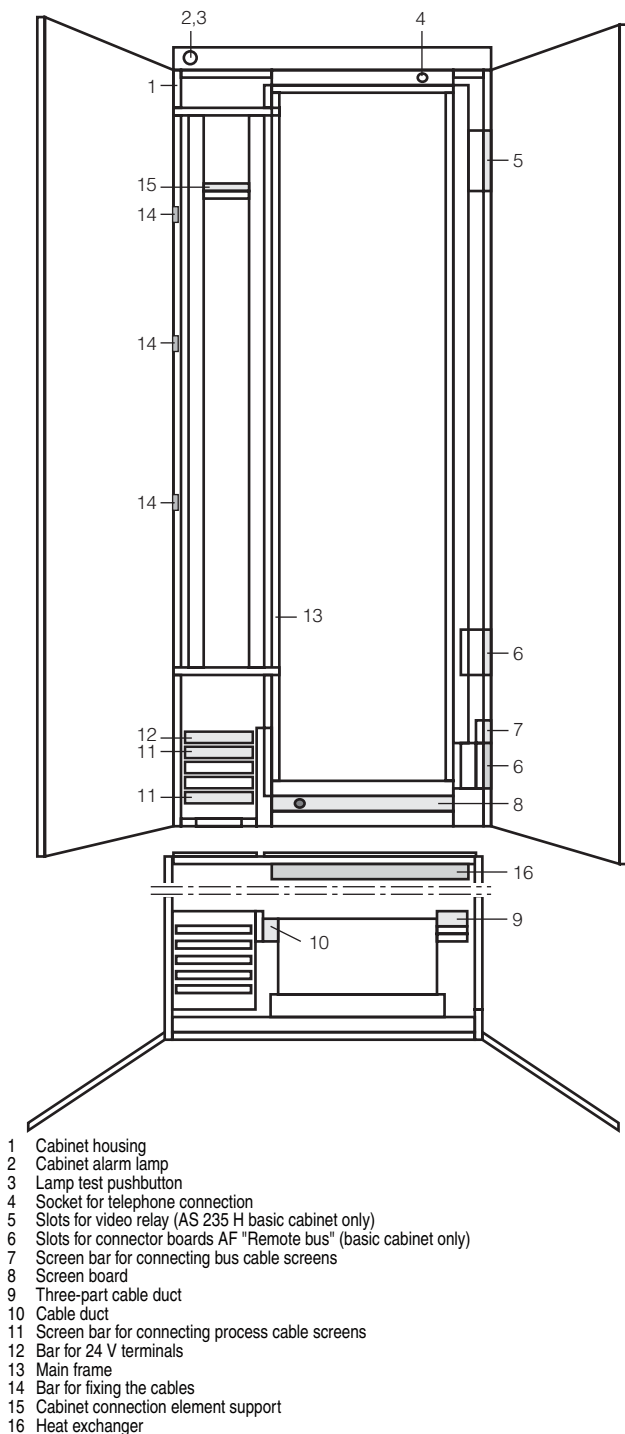| Door width	450 mm each			
Angle of opening of doors – Separate cabinet – Cabinet row	180° 135°			
Degree of protection to DIN 40050 – Cabinet 6DS9 300-8AA (400 mm) – Cabinet 6DS9 302-8AA (600 mm)	IP 20 IP 20			
Permissible cabinet inlet temperature	25 °C	30°C	35°C	40°C
Permissible thermal load $P_{s\,max}$ – with fan subassembly	450 W ≤ 700 W	420 W	380 W	350 W
Permis. humidity (no condensation) – Operation – Transport and storage	$\leq 65\%$ $\leq 75\%$			
Cabinet colors – Cladding – Cabinet frame – Labelling strips	Acrylic resin fine-texture single-coat lacquer Light beige (Siemens color 103) Gray-brown (Siemens color 105) Ochre (Siemens color 100)			
Required floor loading capacity including weight of cables and traffic	1000 kg/m^2			
Dimensions (H x W x D) in mm – Cabinet 6DS9 300-8AA – Cabinet 6DS9 302-8AA	2200 x 900 x 400 2200 x 900 x 600			
Weight of empty cabinet	Approx. 130 kg			
Option				
Fan subassembly – Supply voltage – Power consumption	DC 24 V Approx. 36 W			

Automation systems
Standard cabinets

Standard cabinets IP 54 with heat exchanger

The cable bars are included in the standard delivery of the cabinet. The locations for installation of the video relays and the connector boards for remote bus are identified accordingly.

The standard cabinet with degree of protection IP 54 is equipped with:

- Main frame with conductive, corrosion-proof surface; fitted off-set to one side and electrically connected to the cabinet frame. Side members of the main frame with fixing holes for mounting the subracks
- Three-part metal cable duct with cover plate on the right-hand side member on the cable connection side for the ribbon cables of the I/O bus, for power supply cables, internal bus connections and cables to the operation devices
- Cable duct 80 mm x 75 mm on the left-hand side member for internal wiring of process signals
- Cabinet connection element support for up to 90 32-way cabinet connection elements (SAE)
- Screen bars for connection of process cable screens
- Cable clamping rails for the process cables
- Screen board on the right-hand side of the cabinet for external operation and monitoring devices
- Screen board on the right-hand side of the cabinet for remote bus cables
- Socket for connection of a telephone to the internal telephone network. The socket is not wired-up and is accessible from the front of the cabinet. It consists of a two-pin plug connector 4/13 DIN 47 284 with insulated sleeve and cover
- 4 door contacts with associated cable set
- Bar for 24-V terminals
- 2 thermostats for overtemperature detection.
- Heat exchanger with forced ventilation (AC 50 Hz 230 V) installed in the rear door

1 Cabinet housing
2 Cabinet alarm lamp
3 Lamp test pushbutton
4 Socket for telephone connection
5 Slots for video relay (AS 235 H basic cabinet only)
6 Slots for connector boards AF "Remote bus" (basic cabinet only)
7 Screen bar for connecting bus cable screens
8 Screen board
9 Three-part cable duct
10 Cable duct
11 Screen bar for connecting process cable screens
12 Bar for 24 V terminals
13 Main frame
14 Bar for fixing the cables
15 Cabinet connection element support
16 Heat exchanger

Fig. 3/12 Standard cabinet with heat exchanger

Standard cabinets with degree of protection IP 54, with heat exchanger

Design

Cabinet with two 450-mm wide doors at the front and one 300-mm wide door at the rear. The heat exchanger is fitted on the 600-mm wide door. Front and rear of cabinet each with a top bezel panel with cabinet alarm lamp and lamp test pushbutton.

The cables are connected to cable bars in the rows of holes in the cabinet frame using commercially available parts.

Technical data

Door width				
– Front door	450 mm each			
– Rear door	1 x 300 mm, 1 x 600 mm			
Angle of opening of doors				
– Separate cabinet	180°			
– Cabinet row	135°			
Degree of protection to DIN 40050	IP 54			
Permissible cabinet inlet temperature	25 °C	30°C	35°C	40°C
Permissible thermal loading $P_{s\,max}$	450 W	420 W	380 W	350 W
– With 1 fan subassembly				700 W
– With 2 fan subassemblies				1000 W
Permis. humidity (no condensation)				
– Operation	≤ 65%			
– Transport and storage	≤ 75%			
Heat exchanger				
– Fans, rated voltage U_n Power consumption per fan	AC 50 Hz 230 V Approx. 85 W			
– Dimensions (H x W x D) in mm	1820 x 460 x 111			
Cabinet colors	Acrylic resin fine-texture single-coat lacquer			
– Cladding	Light beige (Siemens color 103)			
– Cabinet frame	Gray-brown (Siemens color 105)			
– Labelling strips	Ochre (Siemens color 100)			
Required floor loading capacity including weight of cables and traffic	1000 kg/m²			
Dimensions (H x W x D) in mm	2200 x 900 x 600			
Weight of empty cabinet	Approx. 180 kg			
Option				
Fan subassembly				
– Supply voltage	DC 24 V			
– Power consumption	Approx. 36 W			

Automation systems
Process connection systems

Process connection systems

■ **Process connection systems**

Process signal cables, information on cable routing

The process signal cables should be screened installation cables for industrial electronics with color-coded conductors twisted in pairs and combined into bundles.

Highly suitable are SIMATIC cables with a conductor cross-section of 0,5 mm² (conductor diameter 0.8 mm). In these cables, 8 pairs of twisted conductors, each identified by different colors, are combined into a bundle. The conductors of each bundle have a special ring identification in order to differentiate the bundles.

Process cables (< 60 V) must always be routed separately from power cables and high-voltage cables (> 60 V) (minimum spacing 20 cm). Depending on the plant it may be necessary to use a spacing of 1 m where large sources of interference are present.

If this spacing is not possible, the cables must be routed in metal protective tubes or in closed metal ducts with a continuous electrical connection. These must be earthed every 20 m.

Suitable overvoltage arresters for lightning protection must be provided when the cables enter and leave buildings.

Analog and binary signals must be routed in separate cables.

Signal distribution cabinets and marshalling racks must be fitted between the process I/O peripherals and the TELEPERM M standard cabinet in the case of larger plants. These are suitable for cross-connecting analog and binary signals and to enable grouped connections with appropriate colors in the TELEPERM M standard cabinet as a result of corresponding marshalling connections.

Connections for process signal cables

The process signal cables must be inserted into the cabinet (AS 235 and AS 235 H) or housing (AS 235 K) of the automation system from below. Their screens must be connected to the cable clamping rails.

The process signal cables can be connected either directly, i.e. to the base plugs X2 of the extension units (AS 235 or AS 235 H) or to the process connection panel (AS 235 K), or also via cable connection elements SAE (only AS 235 and AS 235 H).

Direct connection of process cables

In the case of a direct connection, the process signal cables are directly connected to the base plugs X2 of the I/O slots (AS 235 or AS 235 H) or to the process connection panel (AS 235 K) using the Maxi-Termi-Point system.

Base plugs X2 with wire-wrap connections are not suitable for direct connection of process signal cables.

The slots 1 to 5 for I/O modules of the AS 235 basic unit can be wired using the wire-wrap system or the Maxi-Termi-Point system. Slot 6 can only be wired using the wire-wrap system. The process signal cables leading to these slots must therefore not be wired directly. They must be converted via cabinet connection elements SAE (Maxi-Termi-Point/wire-wrap).

Connection of process signal cables via cabinet connection elements SAE

Using cabinet connection elements (SAE) it is possible

- to marshall within the standard cabinet between the cabinet connection elements and the subracks,
- to convert the standard connection system (Maxi-Termi-Point or wire-wrap) into a different system or
- to connect process signal cables to the front.

If requested by the customer, the internal system wiring between the cabinet connection elements and the base plugs X2 of the subracks can already be carried out in the factory. If this is required, an SAE locating and labelling diagram as well as an SAE wiring list must be enclosed with the order.

2 basic elements are available:

- Cabinet connection element SAE 32/3 (6DS9 907-8BA)
  Process side: Maxi-Termi-Point pins
  2.4 mm x 0.8 mm
  Internal: Wire-wrap pins 1 mm x 1 mm.
- Cabinet connection element SAE 32/1 (6DS9 907-8AA)
  Process side: Maxi-Termi-Point pins
  2.4 mm x 0.8 mm
  Internal: Maxi-Termi-Point pins
  2.4 mm x 0.8 mm

The cabinet connection elements are mounted by latching into the SAE bars on the left side of the cabinet.

Any length of cabinet connection element blocks can be produced. The bottom basic element in each case is secured using 2 Fillister head screws.

A pair of labelling cards is required for each group of 4 basic elements to label the front and rear pins. 2 types of labelling are possible:

- For numbering of the 32 pins of a basic element from 1 to 32 or 32 to 1
  (labelling cards 6XP1 846 and 6XP1 847)
- For identifying groups of 8 pins of a basic element by A to H, e.g. for cables with color codes for 8 conductors
  (labelling cards 6DS9 906-8DA).

The basic elements are numbered with the corresponding labelling strips according to the selected labelling cards:

- For labelling cards 1-32/32-1 for continuous or block-by-block numbering of the basic elements
  (labelling strips 6XP1 856)
- For labelling cards A-H/H-A for continuous or block-by-block numbering of the groups of 8
  (labelling strips C79165-A3012-C99)

Additional elements are available for the two basic SAE elements and enable either screw terminal connections or plug connections at the process end. The additional elements are plugged onto the basic elements.

Automation systems
Connection diagrams

Standard I/O devices to AS 235 / AS 235 K

Connection diagrams for standard I/O devices to AS 235 / AS 235 K
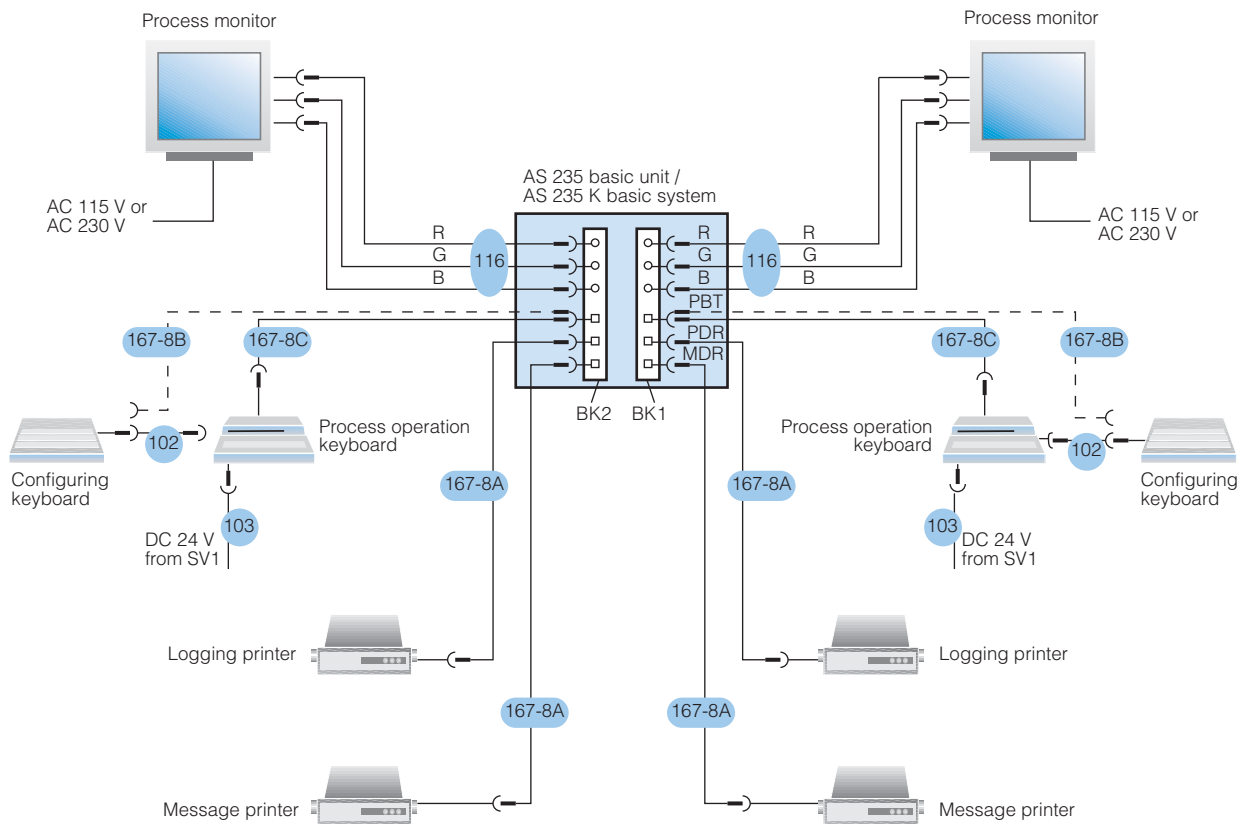

Fig. 3/13 Connection of standard I/O devices to an AS 235 basic unit or an AS 235 K basic system with distances **up to 10 m**

The connecting cables marked blue in the following connection diagrams can be found in the summary of cables on page 3/34.

Automation systems
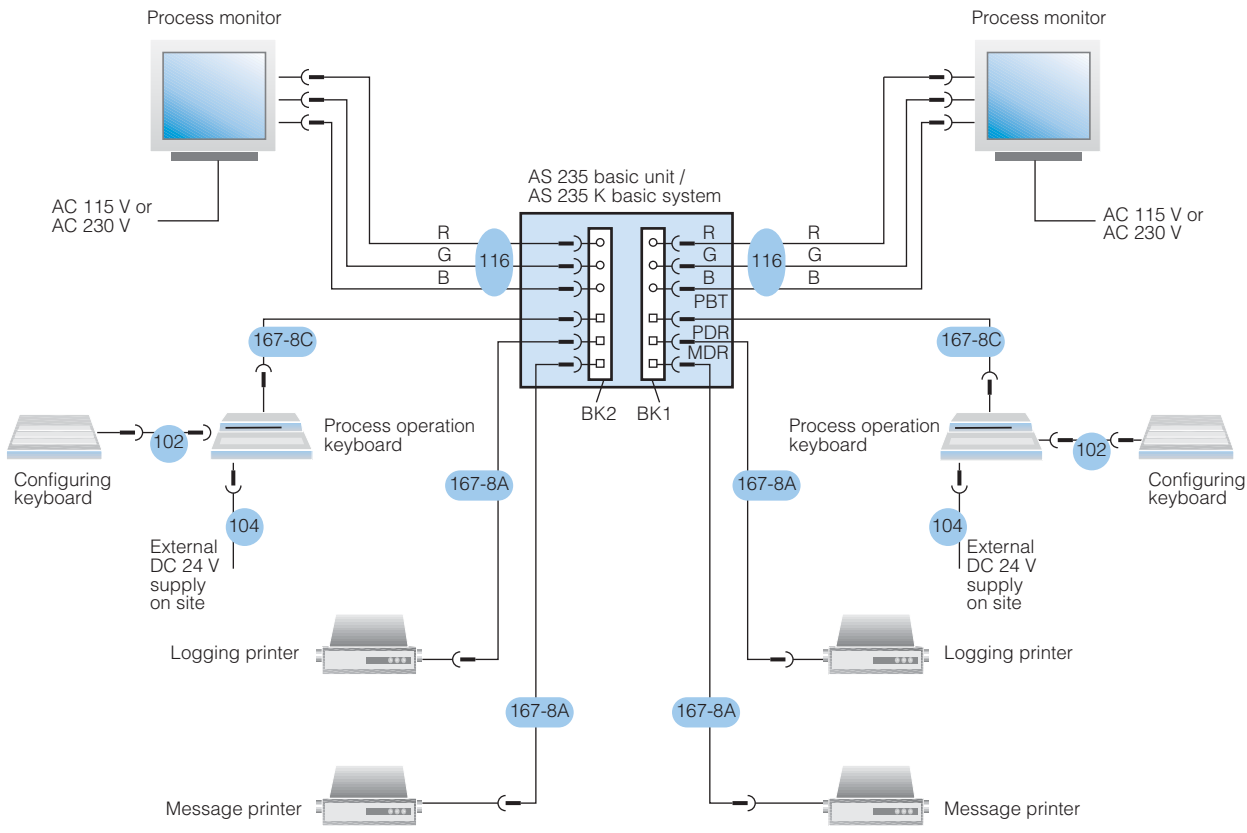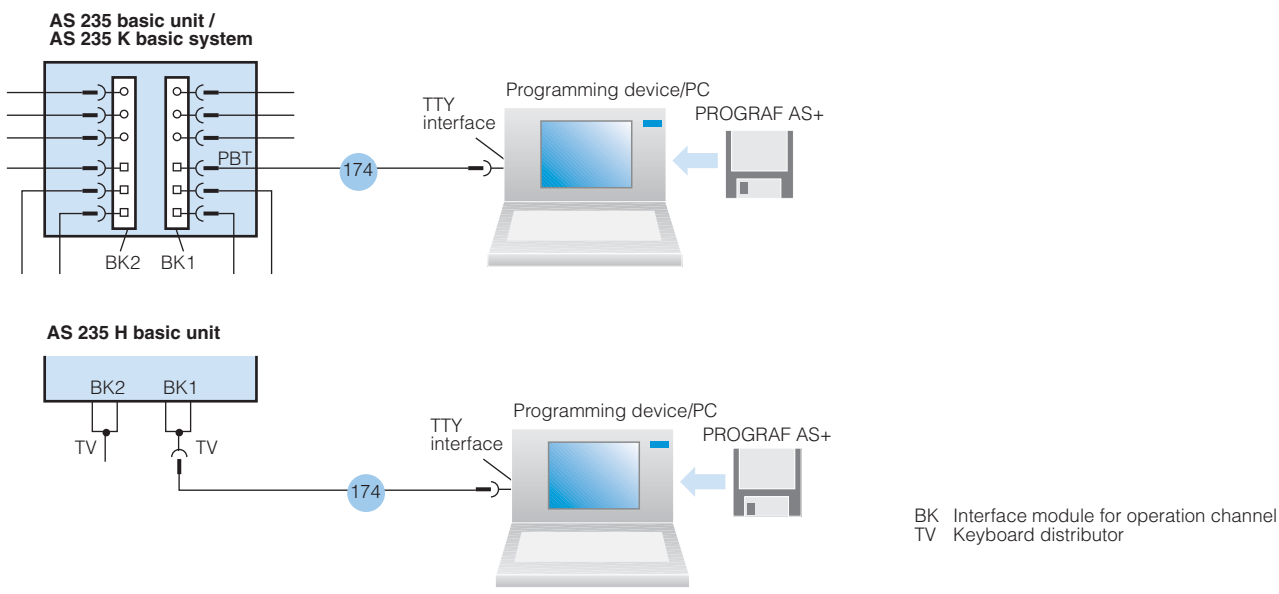## Connection diagrams

Connection of personal computer

Fig. 3/14 Connection of standard I/O devices to an AS 235 basic unit or an AS 235 K basic system with distances **above 10 m**

Connection of personal computer

BK Interface module for operation channel
TV Keyboard distributor

Fig. 3/15 Connection of a programming device or personal computer to an AS 235 basic unit or AS 235 K basic system (top) or to an
AS 235 H basic unit (bottom)

Automation systems
Connection diagrams

Connection of process monitors and parallel monitors

In the case of process monitors connected in parallel, the total of all looped cable lengths (a + b + c + ...) is decisive for the max. distance.

Example: a = 40 m, b = 30 m, c= 10 m

*) If the RGB video signal is looped via several monitors, only the same picture can be displayed on all monitors.
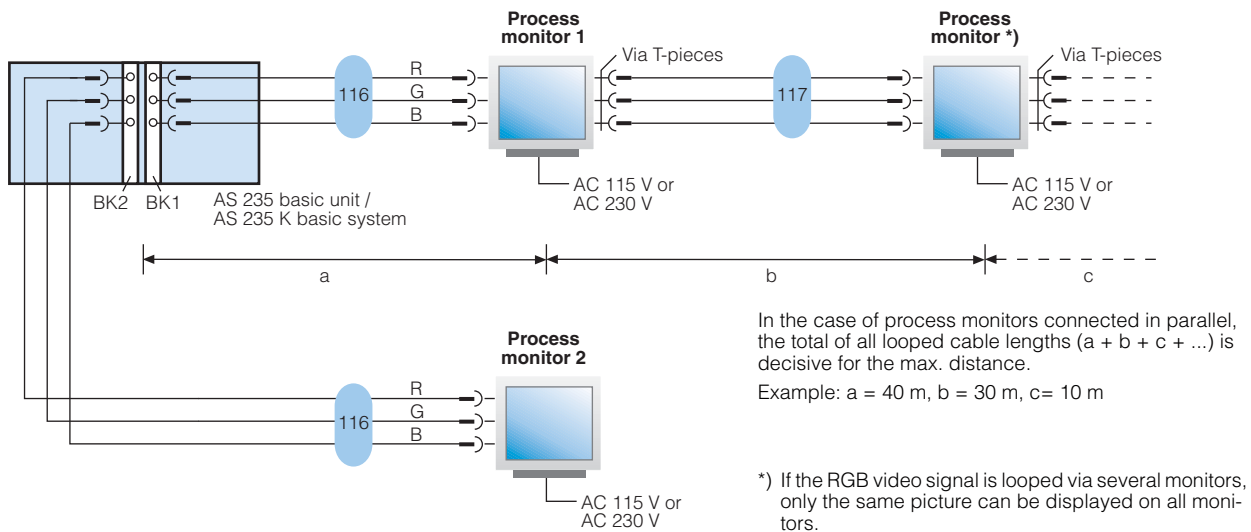
Fig. 3/16 Connection of process monitors and parallel monitors to an AS 235 basic unit or an AS 235 K basic system, with distances **up to 80 m**

Note:

- It must be possible to separate the video ground from the protective earth on the monitors (this is already the case with the SCM 2140-I monitor).
- The 75-Ω terminators are only inserted for the last monitor in the sequence.
- To prevent impairment of the picture quality, a maximum of 3 monitors should be used.
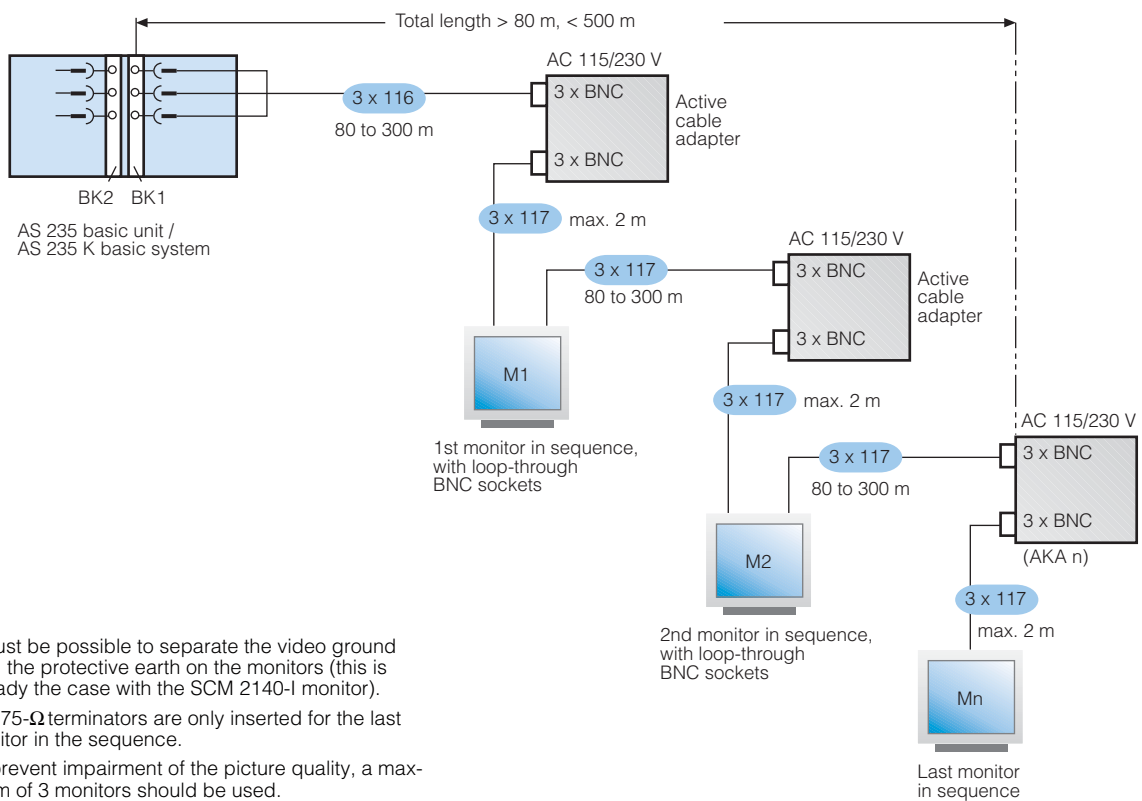
Fig. 3/17 Connection of process monitors and parallel monitors to an AS 235 basic unit or an AS 235 K basic system, with distances from **80 up to 500 m**

Automation systems
Connection diagrams

Standard I/O devices to AS 235 H

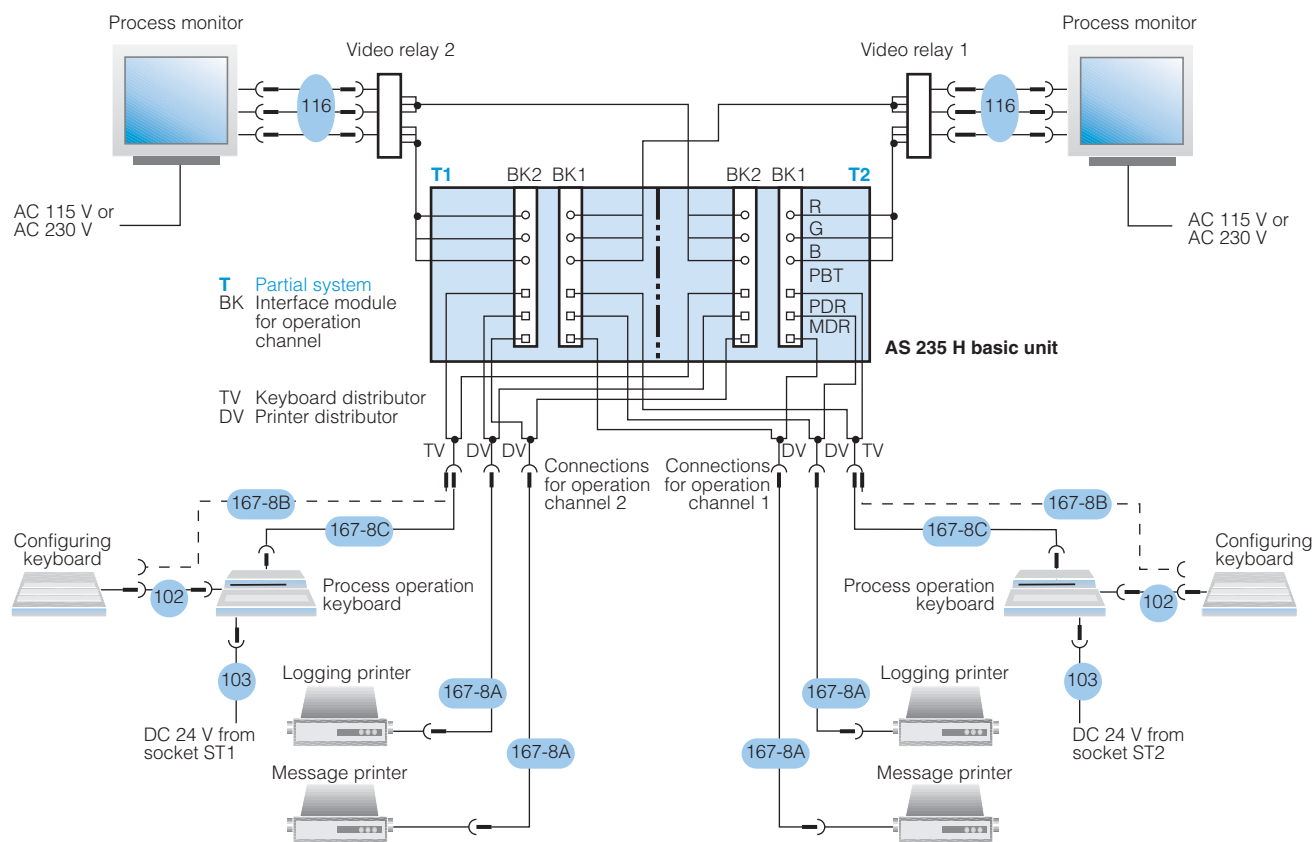#### Connection diagrams for standard I/O devices to AS 235 H

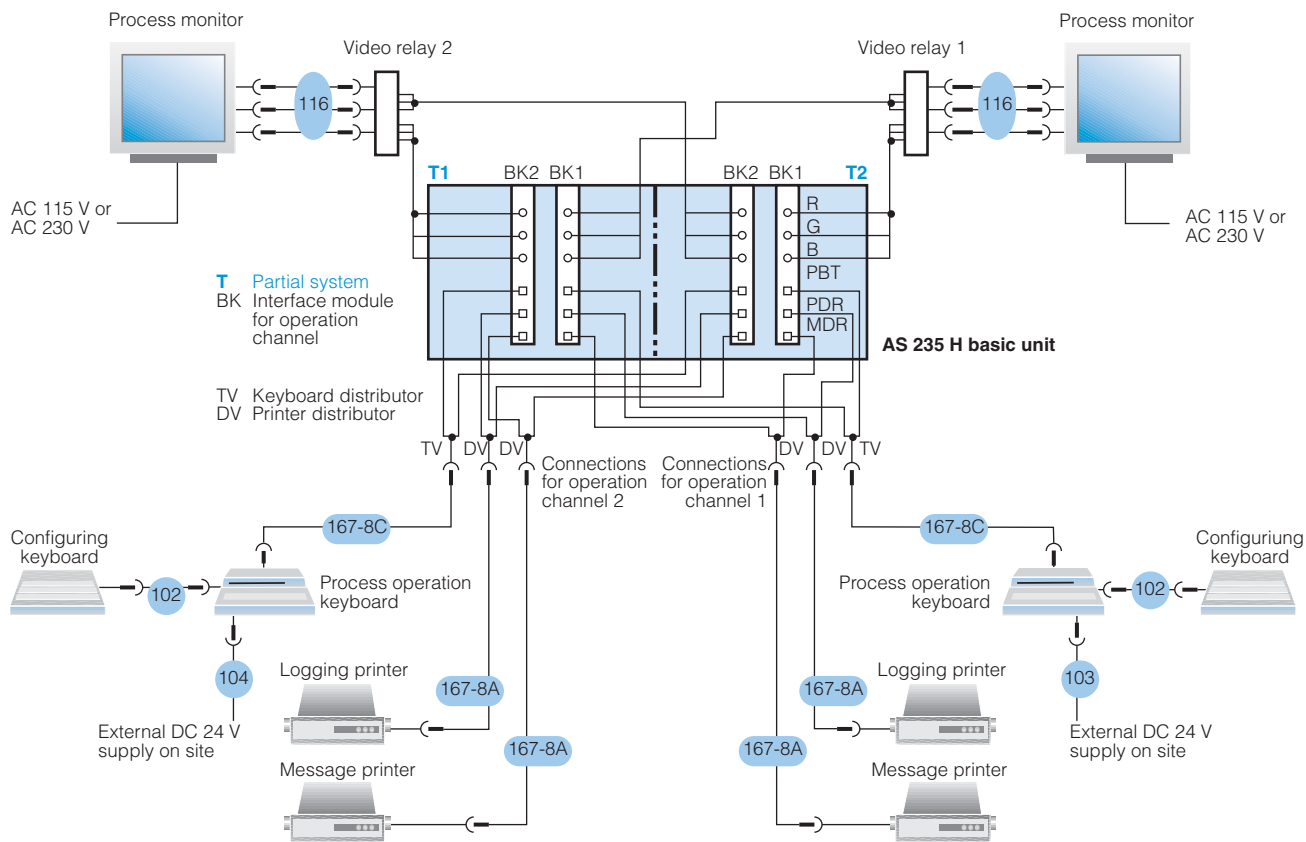Fig. 3/18 Connection of standard I/O devices to an AS 235 H basic unit, with distances **up to 10 m**

Fig. 3/19 Connection of standard I/O devices to an AS 235 H basic unit with distances **above 10 m**

Automation systems
Connection diagrams

Item	Connecting cable From	To	Plug 1	Plug 2	Cable	Max. cable length	Order No.	Page
102	Configuring keyboard	Signal distribution unit 6DS9 913-8DA [1] or process operation keyboard	15-contact (Cannon, sockets)	15-contact (Cannon, pins)	L-YCY 12 x 2 x 0.22	10 m [2]	6DS8 102-8..	5/8
103	Process operation keyboard	Power supply module SV 1 or power supply subrack	9-contact (Cannon, sockets)	S400-A002-E (Fischer, WW)	H03YY-F30 0.75 gr	10 m	6DS8 103-8..	5/5
104	Process operation keyboard	External power supply DC 24 V	9-contact (Cannon, sockets)	Without plug	H03YY-F30 0.75 gr	10 m	6DS8 104-8..	5/5
116	Process monitor	Interface module for operation channel 6DS1 330-8CA or video relay (AS 235 H)	Coaxial plug	BNC plug	2YCYCY 1 x 0.6/3.7-75	80 m	6DS8 116-8..	5/4
117	Process monitor	Process monitor	BNC plug	BNC plug	2YCYCY 1 x 0.6/3.7-75	300 m [3]	6DS8 117-8..	5/4
167-8A	Printer	Interface module for operation channel 6DS1 330-8CA (AS 235/AS 235 K) or printer distributor for operation channel 1 or 2 (AS 235 H)	25-contact (Cannon, pins)	9-contact (Cannon, pins)	LiYCY 2 x 2 x 0.5	100 m	6XV2 167-8A.	5/7
167-8B	Configuring keyboard	Interface module for operation channel 6DS1 330-8CA (AS 235/AS 235 K) or keyboard distributor for operation channel 1 or 2 (AS 235 H)	15-contact (Cannon, sockets)	15-contact (Cannon, pins)	LiYCY 8 x 0.25	10 m	6XV2 167-8B.	5/8
167-8C	Process operation keyboard or signal distribution unit 6DS9 913-8DA [1]	Interface module for operation channel 6DS1 330-8CA (AS 235/AS 235 K) or keyboard distributor for operation channel 1 or 2 (AS 235 H)	15-contact (Cannon, sockets)	15-contact (Cannon, pins)	LiYCY 2 x 2 x 0.5	150 m [2]	6XV2 167-8C.	5/5
174	Interface module for operation channel or signal distribution unit 6DS9 913-8DA [1]	Programming device or personal computer	15-contact (Cannon, pins)	25-contact (Cannon, pins)	LiYCY 5 x 0.14 gr	10 m	6DS8 174-8AD	2/10
201	Interface module for 20-m local bus, n-th participant	Interface module for 20-m local bus, (n-1)th participant (n ≤9)	ES 902 plug	End of cable prepared for plug connection	LiYCY 12 x 2 x 0.22 VZNSi	0.3 to 15 m (over n participants ≤20 m)	6DS8 201-8..	6/6
204	Interface module for 20-m local bus	Bus converters UI1 and UI2	ES 902 plug	ES 902 plug (also 3rd plug)	LiYCY 12 x 2 x 0.22 VZNSi	0.3 m (UI1-UI2) 0.3 to 5 m (UI interface module)	6DS8 204-8..	6/6
205	Interface module for 20-m local bus	Bus converter UI	ES 902 plug	ES 902 plug	LiYCY 12 x 2 x 0.22 VZNSi	0.3 to 5 m	6DS8 205-8..	6/6

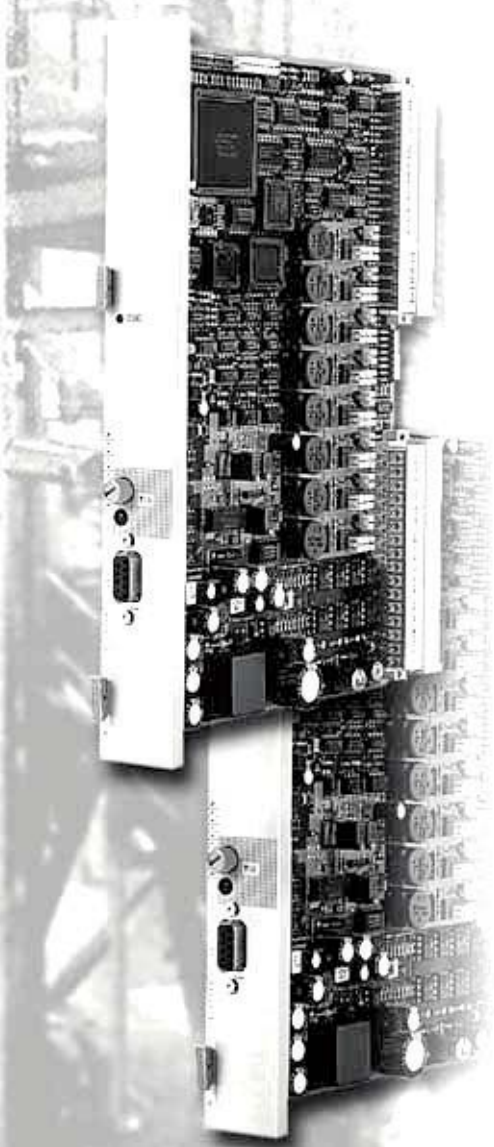1) The signal distribution unit is no longer available.
2) Always applicable: length of connecting cables 167-8C + 102 max. 150 m
3) In the case of parallel monitors, max. total cable length from the RGB signal source (interface module for operation channel) up to last process monitor ∎

I/O modules

4

I/O modules

Summary

This section lists the available input and output modules of the TELEPERM M range. A detailed description of all modules (including those which are no longer available) with photos, functional diagrams and complete technical data can be found in Internet at:

http://www.ad.siemens.de/teleperm

in the section "Process I/Os - TELEPERM M".

Summary

The I/O modules constitute the interface of the automation system to the process. I/O modules of the TELEPERM M process control system are available for all common process signals, transmitters, final control elements and automation tasks associated with process engineering.

The I/O modules are divided into:
- function modules with autonomous functions independent of the central unit,
- signal modules (input/output modules without central-unit-independent interventions in the process) and
- counter modules.

Design

The I/O modules are designed as double-height plug-in modules with a front panel width of 30.48 mm. The front panel contains the module fuse, LEDs for diagnosis and error messages and – depending on the type of module – controls, test sockets or a plug for connection of a configuring device (configurable modules).

The I/O modules have 2 base plugs, the I/O bus interface and the process interface.

The modules are divided into 4 areas which are separated from one another by constructive measures and circuit features. Area 1 contains the hardware for non-reactive interfacing to the I/O bus of the automation system. This part is supplied via the I/O bus (= 5 V bus). Area 2 contains the interference suppression and protective circuits for the process signals. These prevent interfering signals from being transferred to the automation system via the process cables as well as the destruction of modules by overvoltages. Area 3 contains the power supply circuit of the module, area 4 the function-dependent processing circuit.

In the AS 235 system, a specific slot address is unequivocally assigned to each I/O slot. There are two types of I/O modules as far as addressing is concerned:
- I/O modules with jumper/slot addressing
- I/O modules only with jumper addressing

I/O modules with jumper/slot addressing should preferably be operated with slot addressing. The I/O module is then automatically assigned the slot address when inserting.

The slot address should be set on the I/O modules only with jumper addressing using the corresponding jumpers prior to inserting the module.

Measures to prevent interference, short-circuit and overload

Great attention has been paid to an interference-proof and overvoltage-resistant design of the process interface.

The socket boards are divided into screening areas which are separated from each other by grounded surfaces. These screening areas attenuate and decouple the noise signals from the process such that the processing circuits of the I/O modules and the central unit are not influenced. All process inputs/outputs are provided with overvoltage protection circuits. Their overvoltage resistance of 1.5 kV at 1.2 μs / 50 μs satisfies the requirements of the IEC standard 255-4, Class II and they function correctly up to a noise voltage of 1 kV and 1 MHz.

The CE certifications apply if the TELEPERM M installation guidelines are observed.

All analog and binary outputs are short-circuit-proof and overload-proof.

Power supply

The I/O modules only require DC 24 V as the supply voltage. All auxiliary voltages required by the module are generated by its own switched-mode power supply unit. Thus each I/O module can function on its own as long as the redundant DC 24 V system voltage is present.

As a result of the stand-alone supply and fusing of each I/O module, the modules are largely non-reactive with respect to the power supply. All internally generated voltages are monitored. Voltage failures lead to an alarm in the system. Failure of the module fuse is signalled by the separate alarm voltage *PM* on the supply bus.

Module response upon failure of the automation system

Failure of the automation system (hardware fault, user configuration in stop status, central processing unit in stop status) is detected by the I/O modules.

The function modules have backup modes which enable operation independent of the central unit. The output modules (signal modules) react to a reset either by retaining the last output value or by switching to the safety setting. The desired reaction is configured on the module.

Monitoring, alarms

The functions of the modules connected to the I/O bus of the automation system as well as their interaction with the automation system are monitored by several mechanisms. Each I/O module monitors its own internal functions and signals e.g. power failure, blown fuse, hardware fault in module electronics to the automation system via the associated driver block.

The module for the I/O bus interface of the automation system detects missing or incorrectly addressed I/O modules as well as multiple addressing on the I/O bus. Faults in the firmware of the module are also detected and signalled by special acknowledgment procedures between the function modules and their drivers. The maintenance staff are specifically guided towards the location of a fault by means of alarms on the monitor and printer, lighting-up of cabinet lamps and LEDs on the front panels of the modules.

I/O modules

I/O modules
Summary of properties

- High-availability, autonomous power supply for each I/O module; integrated power supply for transmitters

- Modules can be replaced during operation

- Comprehensive self-test routines on the modules

- Mutual test in dialog with the associated driver

- Fault diagnosis using I & C alarms, channel-specific up to the transmitter or final control element

- Tailored driver block for each type of module

- High electromagnetic compatibility; field inputs and outputs destruction-proof to IEC 255-4, Class II

- Selectable backup response of modules

- Configurable modules for processing independent of central unit

Configurable I/O modules

Function modules generally have a configuration which is defined by their firmware and which can be modified to a certain extent by plug-in jumpers (e.g. inversion of manipulated variable, internal/external definition of setpoint etc.).

The standard system software of the AS 235 automation system also contains driver blocks for configurable function modules from the device spectrum of the TELEPERM ME process control system for power plants. In this case, the firmware of these modules contains an interpreter which processes a user configuration generated using defined blocks. This user configuration is produced on a personal computer in the STEP M (BG) language, loaded into the module via a serial interface, and stored in an EEPROM.

This principle enables the implementation of highly flexible, individual concepts on the modules for process-oriented preprocessing with direct intervention into the process whilst bypassing the automation system. Likely applications are e.g. balanced backup structures or particularly time-critical process operations.

An example of a configurable signal module is the analog input module 6DS1 731-8RR for temperature signals. The required data on the type of transmitter, measuring range, cold junction etc. must be defined by configuring for the input channels (max. 32, basic module and 2 extension modules). The configuring data for this module are stored in a flash-PROM. The STRUK-AS 220 EA program is required for loading/configuring (see page 4/6).

Summary

General technical data

Power supply $L+$

Rated voltage	DC 24 V
Permissible range	20 to 33 V including superimposed ripple
Permissible superimposed ripple U_{pp}	15 % of mean value of DC voltage
Limiting range of use	35 V, max. 500 ms 45 V, max. 10 ms
Voltage dip	0 V, max. 5 ms; recovery time min. 10 s

Process interface

- Binary signals

DC voltage		Referred to potential M
Signal definitions		
– Inputs	L (low) H (high)	-33 to +4.5 V +13 to +33 V
– Outputs	L (low) H (high)	0 to 3 V $L+$ to ($L+$ - 2.5 V)
Input currents		0.5 mA
Process signals		4 mA
Output currents with DC 24 V		Max. 8.5 mA
Power signals	Type 1 Type 2 Type 3	Max. 100 mA Max. 400 mA Max. 800 mA

Binary output signals are short-circuit-proof and overload-proof and can be connected in parallel.

- Analog signals

DC voltage	Referred to MZ
Rated range of use	-10 to +10 V -10 to 0 V 0 to +10 V
– Overflow range	-10,5 to +10,5 V
– Input impedance	100 kΩ $\leq R_i \leq$ 1MΩ
– Output loading capacity	3 mA
Direct current	Referred to M
– Rated range of use	0 to 20 mA or 4 to 20 mA
– Rated input impedance	50 Ω
– Rated output load	600 Ω

All analog output signals are short-circuit-proof and overload-proof

I/O modules

Summary

I/O modules from other systems

I/O modules from other systems can be operated on the I/O bus of an AS 235 automation system via existing parallel and serial links (see Section 7).

The following modules can be connected:
- SIMATIC S5-115U digital and analog input/output modules, fitted in ER 701-1 and ER 701-2 expansion racks
- SIMATIC S5-135U/155U digital and analog input/output modules, fitted in EU 183U, EU 184U and EU 187U expansion units
- Digital and analog input/output modules of the ET 100U electronic terminator

The respective interface module for the coupling occupies one I/O slot.

These modules are addressed via the driver blocks for analog and binary input/output which are present as standard in the AS 235 automation system. The analog drivers are equipped with special, parameterizable operating modes for SIMATIC S5 modules. Limit monitoring functions in the driver software are used for measured-value monitoring functions which are missing on the SIMATIC S5 modules or which operate with limits other than those common in the TELEPERM M system.

Communication between TELEPERM M and SIMATIC S5/S7 automation systems is possible using the coupling module 6DS1 333-8AB (page 7/8) and the 3964 R/RK 512 procedure.

Selection criteria for I/O modules

There are various criteria for selecting the most suitable I/O modules for a particular application; these criteria must be evaluated depending on the respective application. The selection of either TELEPERM M or SIMATIC S5 modules is made easier for the planning engineer by the following decision criteria:
- Preprocessing on the module
  Only signal modules from the SIMATIC S5 range without preprocessing (non-intelligent) can be used.
- 230 V peripherals
  In contrast to TELEPERM M, the range of SIMATIC S5 modules also contains input/output modules for signals up to 230 V.
- Backup response
  In the event of a fault in the automation system, a fault in the coupling, or faults in the expansion unit, SIMATIC modules always enter the safety status (0 V, 0 mA), whereas the planning engineer can select for the TELEPERM M output modules whether the last value is to be retained or whether the safety value is to be output.
- Transmitter and measuring range monitoring
  The monitoring functions for measuring range limits which are not present in the SIMATIC S5 modules to the same extent as in the TELEPERM M modules are implemented in the special operating modes of the driver blocks in the automation system so that they are also available when using SIMATIC S5 modules.

Power supply, earthing

The different earthing concepts of the two systems must be observed when using TELEPERM M automation systems and SIMATIC S5 expansion units together. An automation system is always part of a so-called "0-V island" which is earthed via a single connection to the central earthing point (with the central 24-V supply). In the SIMATIC S5 expansion unit, the *M* potential of each module is directly connected to the frame and via this to the local earth.

In the case of coupling between TELEPERM M automation systems and SIMATIC S5 expansion units, it must be ensured that the screen of the connection cable does not destroy the earthing concept of TELEPERM M. Isolating power supply units must be used in the expansion unit, or DC 24 V/DC 24 V converters with electrical isolation must be provided if necessary.

Lightning protection with distributed configuration

The use of SIMATIC S5 modules in distributed, serially-coupled EU expansion units makes it possible to protect the transmission lines using appropriate overvoltage arresters.

I/O modules
Function modules

Closed-loop control modules

Function modules

Function modules have their own functions which are independent of the central unit. They possess backup modes which permit operation independent of the central unit.

Some of the function modules are configurable. The firmware of these configurable modules contains an interpreter which processes a user configuration made up of defined blocks. This user configuration is generated on a personal computer using the STEP M (BG) programming language, loaded into the module via a serial TTY interface, and stored in an EEPROM. The STRUK-AS 220 EA program is used as the configuring aid for this purpose (see page 4/9). [1]

Closed-loop control modules

Three different S and K closed-loop control modules are available:

- **S closed-loop control module, with 2 PI controllers S, 6DS1 402-8BA**
  Two-channel, autonomous PI closed-loop controller. Can be used as a fixed setpoint controller in SPC, DDC and backup modes. In backup mode, the controller can be operated using controls on the front panel.
  The module detects 3 analog signals and a position feedback per channel.

- **S closed-loop control module, two-channel, configurable, 6DS1 411-8RR**
  Two-channel, autonomous controller which acts directly on the process via power control units. The manipulated variable signal is a stepped output.
  The module can be used to implement 2 independent controls (individual controls) or 2 associated controls (master controls) by appropriate configuring.
  The closed-loop control module must be configured. The PC is connected via the front plug of the module. [1]

- **K closed-loop control module, with 2 PI controllers K, 6DS1 403-8CB**
  Two-channel, autonomous PI closed-loop controller. Can be used as a fixed setpoint controller in SPC, DDC and backup modes. In backup mode, the controller can be operated using controls on the front panel.
  The module detects 3 analog signals and a position feedback per channel. The input signals can be monitored in live-zero mode according to the NAMUR NE 43 recommendation.

- **K closed-loop control module, two-channel, configurable, 6DS1 412-8RR**
  Two-channel, autonomous controller which acts directly on the process via power control units. The manipulated variable signal is a continuous output.
  The module can be used to implement 2 independent controls (individual controls) or 2 associated controls (master controls) by appropriate configuring.
  The closed-loop control module must be configured. The PC is connected via the front plug of the module. [1]

Ordering data

	Order No.
Closed-loop control modules	
S closed-loop control module, with 2 PI controllers S	
– Module	**6DS1 402-8BA**
– German Instruction Manual	**C79000-B8000-C17**
– English Instruction Manual	**C79000-B8076-C17**
S closed-loop control module, two-channel, configurable	
– Module	**6DS1 411-8RR**
– German Instruction Manual	**C79000-B8000-C258**
– English Instruction Manual	**C79000-B8076-C258**
K closed-loop control module, with 2 PI controllers K	
– Module	**6DS1 403-8CB**
– German Instruction Manual	**C79000-B8000-C298**
– English Instruction Manual	**C79000-B8076-C298**
K closed-loop control module, two-channel, configurable	
– Module	**6DS1 412-8RR**
– German Instruction Manual	**C79000-B8000-C257**
– English Instruction Manual	**C79000-B8076-C257**

Calculation modules

- **Binary calculation module, configurable, 6DS1 717-8RR, and binary extension module, 6DS1 719-8RR**
  Autonomous module for binary logic operations. Application examples:
  – Individual control drive (max. 5 channels)
  – 2-out-of-3 selection with switching off of faulty channel
  – Limit formation
  – Protective and release interlocks
  – Unit switchover.
  The calculation module must be configured. The PC is connected via the front plug of the module. [1]
  The binary extension module 6DS1 719-8RR can be connected in order to increase the number of binary signal inputs and outputs.

Ordering data

	Order No.
Calculation modules	
Binary calculation module, configurable	
– Module	**6DS1 717-8RR**
– German Instruction Manual	**C79000-B8000-C129**
– English Instruction Manual	**C79000-B8076-C129**
Cable, for connection of	
– 1 extension module	**6DS9 925-8AA**
– 2 extension modules	**6DS9 925-8AB**
– 3 extension modules	**6DS9 925-8AC**
– 4 extension modules	**6DS9 925-8AD**
Binary extension module, for binary calculation module	**6DS1 719-8RR** **(additional order code: G1A)**
Instruction Manual Binary extension module	
– German	**C79000-B8000-C130**
– English	**C79000-B8076-C130**

[1] With AS 235 systems, STRUK-AS 220 EA (page 4/9) can also be used for operations via the CS 275 plant bus (software release G and later)

I/O modules
Signal modules

Analog input and output modules

Signal modules

Analog input/output modules and binary input/output modules are available as signal modules.

Analog input and output modules

The following modules are available:

- **Analog input module with 8 channels and power supply for transmitters, floating, 6DS1 701-8AB**

  For input of 8 analog, floating process signals (transmitter signals) for further processing in the central unit of the automation system. The module powers 8 transmitters in a two-wire or four-wire system.

  HART-compatible transmitters can be connected to the module without influencing the measured signal. External analog distribution is possible in the case of current measurements. The max. value for the load is 150 Ω.

- **Analog input module with 8 channels and power supply for transmitters, non-floating, 6DS1 730-8AA**

  For non-floating input of 8 analog process signals (transmitter signals) to the central unit of an automation system. The module powers 8 transmitters with a two-wire or four-wire system. The input signal can be divided in the case of a current circuit via two Z diodes per channel.

  The input signals can be measured at test sockets on the front panel.

- **Basic module with 4 channels for thermocouples, resistance thermometers and process signals, floating, 6DS1 731-8RR, and**

  measurement-point extension module with 14 channels, 6DS1 703-8RR

  For direct acquisition of 4 temperatures (floating) with thermocouples or Pt 100 resistance thermometers. Process signals of 0 to 20 mA or 4 to 20 mA can also be connected to all 4 channels, 0 to 10 V can also be connected to channel 1.

  The analog input module can be extended by 2 x 14 inputs using measurement-point extension modules.

  Linearization of the input signals and compensation of the cold junction temperature are carried out on the module. The characteristics for standard thermocouples and Pt 100 resistance thermometers are stored in the module. Adaptation to special thermocouples is possible by means of corresponding configuring.

  The module has 4 free analog outputs for voltage and another 4 for current.

  The analog module must be configured. The PC is connected via the front plug of the module. [1]

- **Analog output module with 4 channels, floating, 6DS1 702-8RR**

  To output 4 analog signals of 0 to 20 mA or 4 to 20 mA. These are available at the process interface for further processing by analog instruments or systems.

  The output signals can also be output as voltages of 0 to 10 V or 2 to 10 V for loads with a very high internal impedance (Ri > 500 kΩ).

Ordering data Order No.

Analog input module	
• With 8 channels and power supply for transmitters, floating – Module [1]	**6DS1 701-8AB**
• With 8 channels and power supply for transmitters, non-floating – Module [1]	**6DS1 730-8AA**
• Basic module with 4 channels for thermocouples, resistance thermometers and process signals, floating, configurable – Module – German Instruction Manual – English Instruction Manual	**6DS1 731-8RR** **C79000-B8000-C427** **C79000-B8076-C427**
• Measurement-point extension module with 14 channels – Module – Instruction Manual	**6DS1 703-8RR** Included in Instruction Manual of basic module
Cable to connect the analog input module (basic module) – 1 extension module 6DS1 703-8RR – 2 extension modules 6DS1 703-8RR	**C79458-L442-B21** **C79548-L442-B22**
Analog output module with 4 channels, floating – Module [1]	**6DS1 702-8RR**

1) Instruction Manual not available separately but as part of the manual "Signal modules" C79000-G8000-C31 (German) or C79000-G8076-C31 (English).

1) With AS 235 systems, STRUK-AS 220 EA (page 4/9) can also be used for operations via the CS 275 plant bus (software release G and later)

Binary input and output modules

The following modules are available:

- **Binary input module with 48 inputs, non-floating, with interrupt control, 6DS1 601-8BA**
  To input 48 binary signals DC 24 V (non-floating) to the central unit of an automation system, optionally with interrupt control. With binary inputs with interrupt on AS 235 systems, the module can be used as a common alarm module for subordinate binary input modules 6DS1 601-8BA or 6DS1 602-8BA. The common alarm module can be used with 1-out-of-2 or 1-out-of-3 redundancy in the AS 235 H system.

- **Binary input module with 32 inputs, floating, with interrupt control, 6DS1 602-8BA**
  To input 32 binary signals DC 24 V (floating) with an external reference potential or highly affected by interference to the central unit of an automation system, optionally with interrupt control. Interrupt acquisition is carried out as a slave module with common alarm.

- **Binary input module, testable, 6DS1 618-8CA**
  To input 48 binary signals DC 24 V (floating) to the central unit of an AS 235 or AS 235 H automation system, optionally with common alarm. The driver PBE can carry out a function test.

- **Binary output module with 32 outputs, 100 mA each, non-floating, 6DS1 603-8RR**
  To output 32 binary signals (non-floating) via output drivers with a loading capacity of 100 mA or 400 mA.

- **Binary output module with 16 relays, 6DS1 605-8BA**
  To switch high-power loads up to 60 VA and to transfer signals to other systems via floating contacts. One changeover contact is available at each of the 16 relay outputs (common point, NC contact and NO contact). Each of the lines to the common points is fused (on the front panel).

- **Relay output module, testable 6DS1 606-8BA**
  To output 16 fused binary signals via floating, monitored contacts up to DC 60 W. One changeover contact is available at each of the 16 relay outputs. The driver PBA carries out comprehensive monitoring functions in the AS 235 and AS 235 H systems.

Ordering data	Order No.
Binary input module	
• With 48 inputs, non-floating, with interrupt control [1]	
– Module [2]	**6DS1 601-8BA**
• With 48 inputs, floating, with interrupt control	
– Module [2]	**6DS1 602-8BA**
• With 48 inputs, non-floating, with common alarm, testable	
– Module	**6DS1 618-8CA**
– German Instruction Manual	**C79000-B8000-C131**
– English Instruction Manual	**C79000-B8076-C131**
Binary output module	
• With 32 outputs, 100 mA each, non-floating	
– Module [2]	**6DS1 603-8RR**
• With 16 relays	
– Module [2]	**6DS1 605-8BA**
• Relay output module, with 16 outputs, testable	
– Module	**6DS1 606-8BA**
– German Instruction Manual	**C79000-B8000-C160**
– English Instruction Manual	**C79000-B8076-C160**

1) If this module is used as a common interrupt module, only 1 x per AS 235 system (insert in I/O slot 61), max. 3 x per AS 235 H in slots 12, 28 and 44.

2) Instruction Manual not available separately but as part of the manual "Signal modules" C79000-G8000-C31 (German) or C79000-G8076-C31 (English).

I/O modules
Proportioning and counter modules

**Proportioning counter module,
metering pulse input module**

Counter modules

Two counter modules are available:
- **Proportioning counter module with 2 or 4 channels, 6DS1 613-8BB**
  For counting and largely autonomous processing of metering pulses, independent of the superimposed automation system. The module can be used for
  – proportioning,
  – measuring rotational speed and velocity,
  – measuring lengths and
  – counting pulses.
- **Metering pulse input module with 8 channels, 6DS1 607-8AB**
  Input and addition of 8 metering pulses from contacts or BERO proximity switches with transmitter supply from the module (non-floating).

Configuring

STRUK-AS 220 EA configuring program

STRUK-AS 220 EA can be used to configure the configurable I/O modules on a programming device/PC (with MS-DOS operating system). The programming device/PC must be connected
- via a built-in TTY interface and the cable 6DS8 170-8AD to the TTY interface of the I/O module (direct coupling) or alternatively
- integrated via a local bus interface module N-AT and a cable for 20-m local bus into the CS 275 plant bus (central coupling).

Special requirements for module configuring via the CS 275 plant bus:
- AS 235 system software version G.1 or later
- Vacant user memory (RAM) at least 300 byte (memory is made available again following configuring).

The complete configuration including all application parameters can be stored on diskette and thus loaded into a replacement module if necessary. New settings, and the associated possibility of making mistakes, are therefore unnecessary. The replacement module is immediately ready for use.

Ordering data

Proportioning counter module with 2 or 4 channels	
– Module	**6DS1 613-8BB**
– German Instruction Manual	**C79000-B8000-C46**
– English Instruction Manual	**C79000-B8076-C46**
Metering pulse input module, with 8 channels	
– Module	**6DS1 607-8AB**
– German Instruction Manual	**C79000-B8000-C45**
– English Instruction Manual	**C79000-B8076-C45**

Ordering data

	Order No.
STRUK-AS 220 EA program German/English	**6DS5 221-8AX**
STRUK-AS 220 EA User's Guide	
– German	**C79000-G8000-C310**
– English	**C79000-G8076-C310**
Direct coupling	
Cable to connect a configurable I/O module to a personal computer, 10 m long	**6DS8 170-8AD**
Central coupling	
Hardware coupling package to couple a PC to CS 275, comprising interface module N-AT, cable for 20-m local bus and Instruction Manual in	
– German	**6DS1 222-1BA10**
– English	**6DS1 222-1BA20**

Coding, inserting and labelling

The I/O modules can be supplied coded, inserted and with labelled slots. Arrangement, designation and connection diagrams (including address data) are required from the orderer.

Ordering data

	Order No.
Coding, inserting and labelling for 1 I/O module	**6DS5 705-8AA**

Modules which can be used on the I/O bus

The following table does not refer to the availability of modules but to their approval for use in AS 235 systems.

Designation	Order No. of module	Release	Re-marks
Closed-loop control modules			
Closed-loop control module PI controller S	**6DS1 400-8AA**	≥ 16	1) 14)
	6DS1 400-8BA	≥ 1	14)
Closed-loop control module Controller K	**6DS1 401-8AA**	≥ 11	1)
	6DS1 401-8BA	≥ 1	14)
Closed-loop control module 2 PI controllers	**6DS1 402-8AA**	≥ 15	1) 14)
	6DS1 402-8BA	≥ 1	14)
Closed-loop control module	**6DS1 403-8AA**	≥ 21	1) 14)
	6DS1 403-8BA	≥ 1	14)
	6DS1 403-8CA	≥ 1	14)
Closed-loop control module with NAMUR limits	**6DS1 403-8CB**	≥ 1	14)
Closed-loop control module S, configurable	**6DS1 408-8BB**	≥ 2 SW:B03	14)
Closed-loop control module K, configurable	**6DS1 410-8BB**	≥ 2 SW:B03	14)
Closed-loop control module S, configurable, 2 channels	**6DS1 411-8AA**	≥ 1 SW:B01	14)
	6DS1 411-8RR	≥ 1 SW: > 2	14)
Closed-loop control module K, configurable, 2 channels	**6DS1 412-8AA**	≥ 1 SW:B01	14)
	6DS1 412-8RR	≥ 2 SW:> 2	14)
Individual control drive modules			
Control module for motor	**6DS1 500-8BA**	≥ 1	
Individual control drive module	**6DS1 501-8BA**	≥ 1	
	6DS1 501-8BB	≥ 1	
Control module	**6DS1 502-8BA**	≥ 1	
Control module	**6DS1 503-8BA**	≥ 1	
Individual control drive module for valves, 4 channels	**6DS1 504-8AA**	≥ 3	
Individual control drive module for valves, 8 channels	**6DS1 505-8AA**	≥ 2	
Binary output modules BA			
BA	**6DS1 603-8AB**	≥ 1	
BA	**6DS1 603-8BA**	≥ 1	13)
BA	**6DS1 603-8RR**	≥ 1	
BA (16 x 400 mA)	**6DS1 604-8AA**	≥ 1	8)
BA	**6DS1 605-8AA**	≥ 1	
BA 16, relays	**6DS1 605-8BA**	≥ 1	
PRA 16, relays, testable	**6DS1 606-8BA**	≥ 5	1)

See overleaf for explanations on the table.

Designation	Order No. of module	Release	Re-marks
Binary input modules BE			
BE, 16 contacts	**6DS1 600-8AA**	≥ 5	1)
BE with 48 inputs	**6DS1 601-8AA**	≥ 3	1) 6)
BE with 48 inputs with INT + process alarm	**6DS1 601-8AC**	≥ 2	1) 7)
BE with 48 inputs with INT as common alarm module	**6DS1 601-8BA**	≥ 2	7)
BE input	**6DS1 602-8AA**	≥ 1	
BE 32 channels, floating	**6DS1 602-8BA**	1; 2; ≥ 4	5) 6) 11)
BE, interrupt, 48 inputs as common alarm module	**6DS1 615-8AA**	≥ 4	7)
BE, changeover contacts	**6DS1 620-8AA**	≥ 5	
BE, BERO	**6DS1 621-8AA**	≥ 5	
PBE, testable	**6DS1 618-8CA**	≥ 4	
Metering pulse input module			
Metering pulse input module, 8 channels	**6DS1 607-8AB**	≥ 1	5)
Proportioning counter module			
Proportioning counter	**6DS1 613-8AB**	≥ 7	1)
	6DS1 613-8BB	≥ 7	1)
Analog output modules			
Analog output, 4 outputs	**6DS1 702-8AA**	≥ 5	1)
	6DS1 702-8RR	≥ 1	
Analog input modules			
Analog input (8 channels)	**6DS1 700-8AA**	≥ 10	1) 14)
Analog input (8 channels)	**6DS1 700-8AB**	≥ 16 SW:1	14)
Analog input (8 channels)	**6DS1 700-8BA**	≥ 1	14)
Analog input (8 channels)	**6DS1 700-8BB**	≥ 1 SW:1	14)
Analog input (8 channels)	**6DS1 701-8AA**	≥ 1 SW:1	14)
Analog input (8 channels), NAMUR limits	**6DS1 701-8AB**	≥ 2 SW:1	14)
Measurement-point extension	**6DS1 703-8AB**	= 1	14) 17)
	6DS1 703-8RR	= 1	14) 17)
	6DS1 713-8AB	≥ 1	14)
Analog input	**6DS1 730-8AA**	≥ 1	5) 9) 14)
Analog input modules for thermocouples and Pt100	**6DS1 731-8AA**	≥ 1	5) 9) 14)
	6DS1 731-8BA	≥ 1 SW:4	5) 9) 14)
	6DS1 731-8EA	≥ 1	5) 9) 14)
	6DS1 731-8FA	≥ 1	5) 9) 14)
	6DS1 731-8RR	≥ 4 SW:3	5) 9) 14)

I/O modules
Configuring

Modules which can be used on the I/O bus

Designation	Order No. of module	Release	Re-marks
Analog calculation modules			
Analog calculation module	**6DS1 715-8BB**	≥ 2 SW:03	
Binary calculation modules			
Binary calculation module	**6DS1 717-8AA**	≥ 8 SW:08	16)
Binary/analog calculation module (max. 31 channels)	**6DS1 717-8RR**	≥ 1 SW:3	
Binary extension	**6DS1 719-8AA**	≥ 2	15)
Analog extension	**6DS1 720-8AA**	= 1	15)
Binary extension (for 6DS1717-8RR)	**6DS1 719-8RR**	≥ 1	
Coupling modules			
Speed controller	**6DS1 303-8AA**	≥ 9	
Field multiplexer FM	**6DS1 304-8AA**	≥ 6 SW: 2	1)
	6DS1 304-8BB	≥ 1 SW: 2	1)
S5-110 coupling	**6DS1 310-8AA**	≥ 8	
	6DS1 310-8AB	≥ 8	
S5 coupling, serial	**6DS1 318-8AB**	≥ 3 SW: 1	1)
S5 coupling, expansion unit	**6DS1 321-8AA**	≥ 4	
S5 coupling, serial	**6DS1 333-8AB**	≥ 1 SW=1	
S7 coupling, serial	**6DS1 333-8AB**	≥ 1 SW=1	22)
MODBUS coupling (on request)	**6DS1 333-8AB** with M1328-V5	≥ 1 SW=5	3)
I/O bus remote coupling AS - I/O bus - ES 100 K	**6DS1 322-8AA**	≥ 5	1) 12)
Coupling of SIPART DR20, TELEPERM D compact controller	**6DS1 325-8AA**	≥ 2	2) 3)
S5 coupling, serial, ET100, EU / I/Os, coupling module TM-S5	**6DS1 327-8AA**	≥ 4	
Serial coupling, 4 channels, hardware without firmware	**6DS1 328-8AA**	≥ 2	18)
TM/EA coupling, I/O bus	**6DS1 312-8BB**	≥ 2	10)
Coupling of external computer CS 275 / N-V.24	**6DS1 202-8AB**	≥ 5	19) 20)
CP 581 TM interface modules			
CP 581 TM communications module	**6DS1 337-1AD** with S5KE, S5KS	≥ 1 SW: ...	19) 20) 2) 21)
CP 581 TM-L2 (DP/FDL)	**6DS1 341-1AD** with DP drivers	≥ 1 SW: ...	19) 20) 2) 21)
CP 581 TM-L2 (FMS)	**6DS1 341-1BD** with S5KE, S5KS	≥ 1 SW: ...	19) 20) 2) 21)
CP 581 TM FUZZY	**6DS1 342-1BD** with S5KE, S5KS	≥ 1 SW: ...	19) 20) 2) 21)

Explanations for the column "Remarks"

1) Earlier release versions not permissible!
2) Special product
3) Not a standard product, no system test carried out
4) Cannot be operated in AS 235 systems with auxiliary driver
5) Application only without interrupt!
6) No application as common alarm module (SF 61)
7) Approved for common alarm modules, the latest product release is required.
8) Note current balance of subrack: max. 4 A per module, max. 16 A per subrack
9) Combination modules for use in TELEPERM M standard systems and in TELEPERM ME systems. Application in AS 235 extension units only as TELEPERM ME module with slot addressing.
10) AS 235: with release ≥ 2, AS 235 H and AS 235 K: with release ≥ 1.
11) With AS 235 H: > 5.
12) Observe cycle time for processing with ES 100 K! (delay resulting from cable lengths)
13) Application in ES 100 K not allowed (timing)
14) Connection of transmitters with two-wire system not permissible with AS 235 K and ES 100 K in AC 230 V! The ripple of the power supply in the AS is too high for these transmitters and the connection system.
15) Module only functions together with 6DS1 717-8AA
16) Only alarm function
17) Module only functions together with 6DS1 713 or 6DS1 731.
18) Only a hardware module; no function in delivered state. For use with standard drivers, the module firmware is usually adapted to existing drivers.
19) A maximum of two modules of type N-V.24 or CP 581 TM are permissible in a system (in basic cabinet and extension cabinet)
20) Application in ES 100 K not allowed (5 V power)
21) Hardware/software releases on request: Siemens Karlsruhe, Dept. ATD TD 4, D-76181 Karlsruhe
22) S7 coupling with 3964 R / RK 512 procedure, SEND/RECEIVE, no FETCH, SIMATIC S5 analog value format

Explanations for the column "Release"

≥ 5 Tested with AS 235 system technology, no imperative release version. No negative information with earlier releases.
1; 2; Permissible releases
=5 Valid release of a module
≥ 6 ≥ and remark 1) mean an imperative minimum release (6 in this case), i.e. upgrading is essential at least up to release 6.

Observe the respective indexed remarks for the individual modules. ∎

Input and output devices
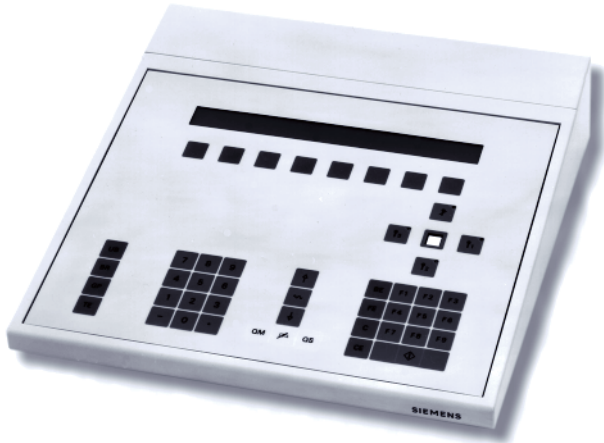## Operation unit

PBT 65 process operation keyboard

The 4 authorization stages have the following meaning:
- Stage 1: keyboard "OFF", no operation possible
- Stage 2: process operation keyboard "ON"
- Stage 3: configuring keyboard "ON"
- Stage 4: configuring keyboard and process operation keyboard "ON".

A 4-digit password which can be individually modified is assigned to each authorization key. The last authorization stage selected is automatically present when the PBT 65 process operation keyboard is switched on. Transfer to a different authorization stage is only possible if the appropriate password is known. The authorization stage set is indicated by a yellow LED integrated in the corresponding key.

Test mode

The PBT 65 process operation keyboard has an integrated test mode. The test functions include initialization and deletion of the LCD, EPROM, LED, LCD, RAM, interfaces, testing of the authorization memory, and resetting of passwords.

A special test cable which must be ordered separately is required for this PBT test.

Technical data

Automation system	20-mA current loop interface, floating, active, 1200 bits/s
Configuring keyboard	20-mA current loop interface, floating, passive, 1200 bits/s
Power supply	DC 24 V (18 to 33 V), 200 mA
Permissible ambient temperature – Operation – Transport and storage Permissible relative humidity	 0 to +40 °C -40 to +70 °C Max. 95 % at 25 °C
Dimensions (H x W x D) in mm – Without IP 65 kit – With IP 65 kit	 84 x 370 x 305 95 x 370 x 373
Weight	Approx. 3.6 kg

Ordering data

	Order No.
PBT 65 process operation keyboard	**6DS3 305-8BA**
IP 65 kit	**C79372-A3018-D1**
Test cable	**C79372-A3018-D2**
Instruction Manual – German – English	 **C79000-B8000-C410** **C79000-B8076-C410**
Connecting cable for power supply to process operation keyboard, – With 2 plugs – With 1 plug	 **6DS8 103-8 ■ ■** **6DS8 104-8 ■ ■**

3 m **MC**   5 m **SC**   10 m **AD**

Connecting cable for connection of PBT 65 to an automation system	**6XV2 167-8C ■ ■ ■**

3 m **H30**	25 m **N25**	100 m **T10**
5 m **H50**	40 m **N40**	120 m **T12**
10 m **N10**	50 m **N50**	150 m **T15**
16 m **N16**	80 m **N80**	

Fig. 5/3   PBT 65 process operation keyboard

PBT 65 process operation keyboard

The PBT 65 process operation keyboard is used:
- To enter operating data
- For process operations (modification of operating modes, values and statuses)
- To select area, group and loop displays
- To acknowledge messages and horn alarms.

It is possible to connect an additional configuring keyboard.

Design

The PBT 65 process operation keyboard consists of a desktop housing with
- dust-proof and slash-proof touch pad keyboard,
- LCD unit and
- keyboard electronics.

At the rear there are connections for the configuring keyboard, the automation system and the DC 24 V power supply.

In order to achieve the degree of protection IP 65, it is necessary to protect the rear connections against dust, splashing and gases. A keyboard attachment is available for this purpose as an IP 65 kit. Without this kit, the process operation keyboard corresponds to the degree of protection IP 20.

The two-row LCD unit of the process operation keyboard can display 40 characters in each line. The top line is used for messages, the bottom line for the variable inscription of the 8 keys located below it. The background can be illuminated if necessary. The background illumination is automatically switched off if no operations are made for a longer period of time.

Mode of operation

The functions of the process operation keyboard are enabled in 4 authorization stages and selected using authorization keys identified by key switch symbols and a password.

Input and output devices
Configuring unit

Configuring keyboard

Fig. 5/5   Configuring keyboard

■ Technical data

Interface	20-mA current loop interface, floating (active)
Transmission rate	1200 bits/s
Parity and stop bits	Active 1200 bits/s, even parity, 2 stop bits
Power supply	DC 24 V (20 to 33 V); 0.2 A
Permissible ambient temperature – Operation – Storage	+5 to +40 °C -40 to +70 °C
Permissible relative humidity	Max. 95 %, no condensation
Degree of protection to EN 60 529	IP 20
Dimensions (H x W x D) in mm	57 x 370 x 280
Weight	Approx. 2.6 kg

■ Configuring keyboard

The configuring keyboard is used to enter configuring instructions, i.e. for linking and parameterizing function blocks.

The cable 6DS8 102-8.. is used for indirect connection of the configuring keyboard to an AS 235 automation system via a PBT 65 process operation keyboard.

The cable 6XV2 167-8B... is required for direct connection of the configuring keyboard to an AS 235.

Connection diagrams: see page 3/29 ff.
Summary of connecting cables with description: see page 3/34.

■ Ordering data   Order No.

Configuring keyboard	**6DS3 303-8AA**
Connecting cable for indirect connection of a configuring keyboard to an automation system	**6DS8 102-8 ■ ■**

1 m **AC**   5 m **SC**   10 m **AD**
3 m **MC**

Connecting cable for direct connection of a configuring keyboard to an automation system	**6XV2 167-8B ■ ■ ■**

1 m **H10**   5 m **H50**   10 m **N10**
3 m **H30**

Input and output devices
Configuring unit

Mini floppy disk unit

Technical data

Data medium	Floppy disk; 5,25 inch
Data capacity	1.2 Mbytes
Data transfer rate	300 kbits/s
Power supply	DC 24 V (20 to 33 V); approx. 0.52 A; approx. 0,74 A during motor startup for 400 ms
Permissible ambient temperature – Operation – Storage	+10 to +40 °C -20 to +65 °C
Permissible relative humidity	20 to 80 %, no condensation
Vibration resistance – Operation	< 55 Hz, < 0.5 g 55 to 500 Hz, < 0.25 g
– Transport and storage	< 100 Hz, < 2 g
Dimensions (H x W x D) in mm	120 x 180 x 320
Weight	Approx. 3 kg

Fig. 5/6   Mini floppy disk unit

Mini floppy disk unit

The mini floppy disk unit is required for booting, loading and archiving the RAM contents of an AS 235 using floppy disks.

The mini floppy disk unit is a desktop unit with 3-m long connection cables for data transmission and power supply.

The data media are 5.25" floppy disks, double sided, high density (DS-HD).

Mode of operation

The drive interface of the mini floppy disk unit is matched to the central processing unit by the interface module. The data are exchanged sector by sector by direct memory access (DMA). This ensures rapid data access and little loading on the central processor.

Since the drive of the mini floppy disk unit is not equipped with a head load function, the read/write head always rests on the floppy disk when the drive is locked using the lever. To prevent high wear and possible damage to the read/write head or the floppy disk during permanent operation, the lever should either be opened immediately following an archiving or loading procedure, or the floppy disk should be removed.

Ordering data	Order No.
Mini floppy disk unit with connection cables for data transmission and power supply, 3 m each	**6DS3 900-8AE**
Floppy disks for archiving user data	5.25" floppy disk, DS-HD, IBM-compatible, unformatted
Obtainable from computer suppliers e.g. MAXELL disk, order no. 555081	obtainable from MAXELL Europe GmbH D-40670 Meerbusch

Bus communication

Bus communication

AS 235, AS 235 H and AS 235 K can only be operated on the CS 275 plant bus, but can also communicate with automation systems and operator systems on the PROFIBUS-TM plant bus via a CS-L2 bridge.

This section only describes bus communication with the CS 275 plant bus. A description of bus communication via the PROFIBUS-TM plant bus can be found in Catalog PLT 112.

When planning TELEPERM M systems with the CS 275 plant bus, please observe the TELEPERM M design guidelines in the manual "Information and guidelines for planning, installation and operation", C79000-G8000-C417 (German) or C79000-G8076-C417 (English).

Application

The AS 235, AS 235 H and AS 235 K automation systems are connected together and to other automation systems and operator systems of the TELEPERM M process control system via the CS 275 bus in medium-sized and large plants.

Central process control is carried out using the OS 525 and WinCC/TM-OS operator systems. SIMATIC PC or other AT-compatible personal computers, PG programming devices and computers from other manufacturers can be connected to the bus system for higher-level tasks.

Sequential transfer of data between the individual participants is in time-division multiplex mode. Participants within a local area or a cabinet group are connected over distances of up to 20 m by a local bus. A remote bus connects distributed systems over distances of up to 4 km.

A redundant design of the bus line increases of the availability of the CS 275 plant bus. The remote bus network can be extended to a maximum length of 3 x 4 km using bus couplers.

Design

The CS 275 bus system consists of
• a local bus which is always redundant and
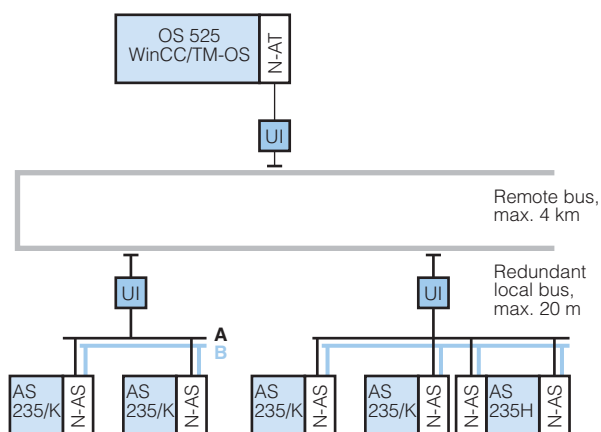• a remote bus which can be either of single or redundant design.

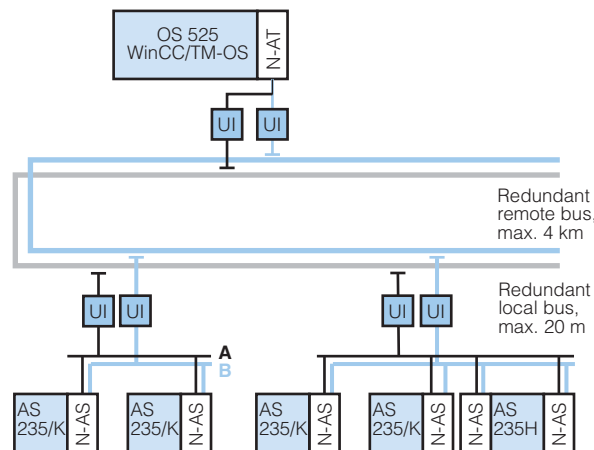Fig. 6/1   CS 275 bus system; example of connection of local bus and remote bus, single remote bus

Fig. 6/2   CS 275 plant bus; example of connection of local bus and remote bus, redundant remote bus

Local range

4 line signals are used in the local range. The data are transmitted sequentially on one data line. A second line transmits the clock, the third is used for synchronization. The fourth line is required to switch over data transmission to channel A or B of the redundant local bus. The wired-OR technique is used with the local bus for coupling.

The interface modules for the local bus have a redundant local bus interface. They are connected together with one cable in which the local bus is redundant.

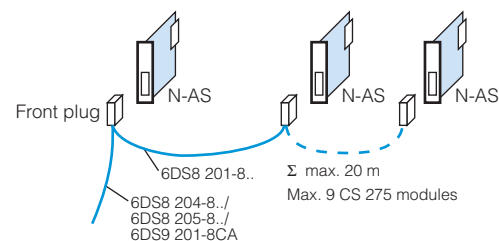The max. length of the local bus cable is 20 m.

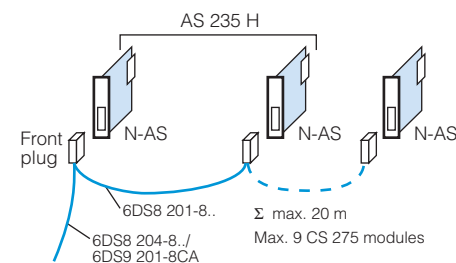Fig. 6/3   Local bus coupling between AS 235 and AS 235 K

Fig. 6/4   Local bus coupling with AS 235 H

Bus communication

If e.g. automation systems are to be connected together via a local bus, the following are required for *n* participants:

- *n* interface modules for 20-m local bus
  (cf. table on page 6/5)
- *n*-1 cables 6DS8 201-8..
- 1 front plug 6DS9 200-8AA.

2 interface modules N-AS are required for the AS 235 H system. These are handled as one participant, i.e. the same bus address is set on both interface modules.

Up to nine CS 275 modules can be coupled together as a local bus island via the 20-m local bus. If this local bus island is connected to the remote bus, each of the bus converters UI (max. 2) is also counted as a participant (cf. Figs. 6/3 and 6/4).

The cable connectors are provided at one end with a front plug for connection to the interface module for 20-m local bus, the other end of the cable is prepared for the connection and is soldered to the front plug of the next interface module. Only one front plug is required for the n-th local bus participant. This is soldered to the free end of the cable. The single front plug is not required with an additional remote bus coupling. It is replaced in this case by the front plug of the cable 6DS8 204-8.., 6DS8 205-8.., 6DS9 201-8CA or -8FC.

With a remote bus connection, the AS 235 H is always delivered with a cable 6DS9 201-8FC with 5 plugs instead of a combination of two connecting cables (6DS8 204-8../6DS9 201-8CA + 6DS8 201-8..).

The cable 6DS8 205-8.. with two plugs can be used for the point-to-point connection of two local bus participants as an alternative to the combination of cable 6DS8 201-8.. and front plug.

Local bus cables which have to be routed more than 2.5 m out of cabinets must be laid in a separate, screened/earthed cable duct.

The various interface modules for 20-m local bus are listed in the following table. Catalog PLT 130 contains a detailed description of the individual modules.

Remote range

Transmission takes place via a coaxial cable at distances up to 4 km. The coupling to the remote bus is non-reactive.

Remote and local buses can be connected by bus converters. In this way, individual AS or OS systems or groups located in one area and connected by a local bus can exchange information with more distant individual systems or groups. The complete plant bus carries the same information.

Two autonomous plant buses are connected together via a bus coupler so that only the information intended for the other bus is transferred.
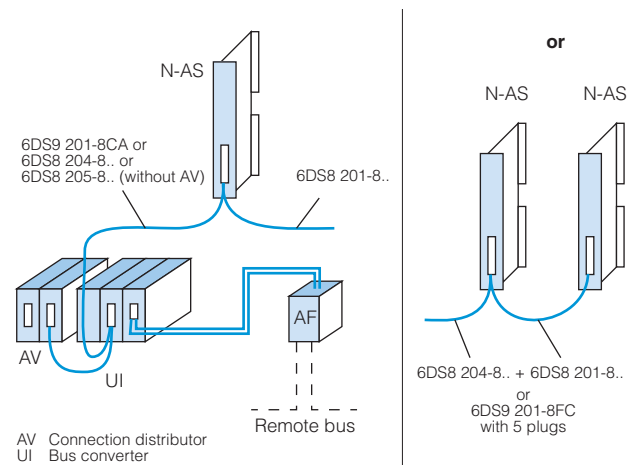

Fig. 6/5   Connection of a single remote bus
(AS 235 / AS 235 K/ AS 235 H)

Single remote bus

An AS 235 or AS 235 K system is connected to a single non-redundant remote bus via the interface module for 20-m local bus N-AS and a bus conductor UI. Two coupled interface modules N-AS are used in the AS 235 H system.

A cable 6DS8 205-8MB is required in this case with the AS 235 K system. This is provided with 2 front plugs for connection to the interface module N-AS and the bus converter UI. The connection distributor AV is omitted in the AS 235 K.

The cable 6DS8 204-8.. with 3 plugs is used for the single remote bus with the AS 235, and connects the N-AS to the bus converter UI and the connection distributor AV. An alternative is the cable 6DS9 201-8CA with 4 plugs which is provided for the redundant remote bus. One plug remains unused in this case until a redundant design is made if required.

The AS 235 H is also provided with the cable 6DS9 201-8FC with 5 plugs for a single remote bus connection. This connects both N-AS modules to the bus converter UI and the connection distributor AV. One plug remains initially unused. An alternative is a combination of cables 6DS8 204-8.. and 6DS8 201-8.. .

A connector board AF "Remote bus" is required to connect the remote bus cable. The coaxial cable connection to the connector board AF has a fixed connection to the bus converter.
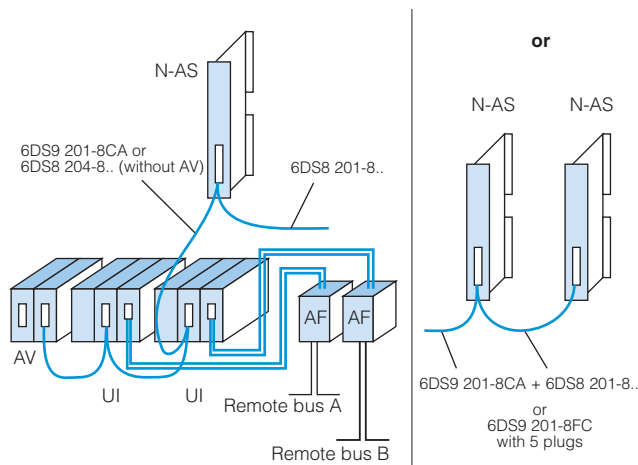
Bus communication

Design

Fig. 6/6   Connection of a redundant remote bus
(AS 235 / AS 235 K/ AS 235 H)

Redundant remote bus

2 bus converters UI are required to connect an automation system to a redundant remote bus. The bus converters are connected

- in the AS 235 system via a cable 6DS9 201-8CA to the N-AS and the connection distributor AV,
- in the AS 235 H system via a cable 6DS9 201-8FC to both N-AS and the connection distributor AV, and
- in the AS 235 K system via a cable 6DS8 204-8MB to the N-AS.

When converting/retrofitting, cable combinations together with the cable 6DS8 201-8.. are possible instead of the above cables (cf. Fig. 6/6).

Local bus interface modules

Interface module for 20-m local bus Type	For connection of the following systems and devices to the CS 275 plant bus
N-AS 6DS1 223-8AC	AS 235 and AS 235 K automation systems
N-AS 6DS1 223-8AA	AS 235 H automation system
N-BK 6DS1 223-8AB	Bus coupler
N-AT 6DS1 222-1AB10/20	OS 525 / WinCC/TM-OS operator systems, AT-compatible personal computers, SIMATIC PC and PG programming devices
N-V.24 6DS1 202-1AB	Computers from other manufacturers via V.24 or 20-mA current loop interface
N-S5 [1] 6DS1 206-8AA	SIMATIC S5-155U programmable controllers

1) Discontinued product

Further information on the various interface modules can be found in Catalog PLT 130 and the following manuals:

- CS 275 bus system   C79000-G8076-C6
- N-V.24 coupling of computers from
  other manufacturers   C79000-G8076-C87
- KSN-S55 / S5-155U programmable controller C79000-G8076-C319

Connection distributor AV

The connection distributor AV (Order No. 6DS9 207-8AA) has a vacant plug connection to the redundant 20-m local bus for the connection of configuring aids (e.g. personal computer with the PROGRAF AS+ engineering tool). It must be connected to the local bus via a cable for this purpose.

Bus converter UI

A bus converter is required to connect individual participants or a local bus with several participants to a remote bus. It performs continuous signal conversion between the local bus and the remote bus or vice versa without intermediate storage. The coupling is inductive and non-reactive.

Possible locations:

- AS 235 and AS 235 H basic cabinet
- AS 235 K basic system
- Remote bus connection unit
- Bus coupler
- Remote bus connection subrack.

See Catalog PLT 130 for detailed information on the bus converter.

Connector board AF "Remote bus"

The remote bus cable is connected to the bus converter via the connector board AF "Remote bus". The board is provided with a terminating resistor which can be activated using a jumper. The resistor is activated in the first and last bus participants.
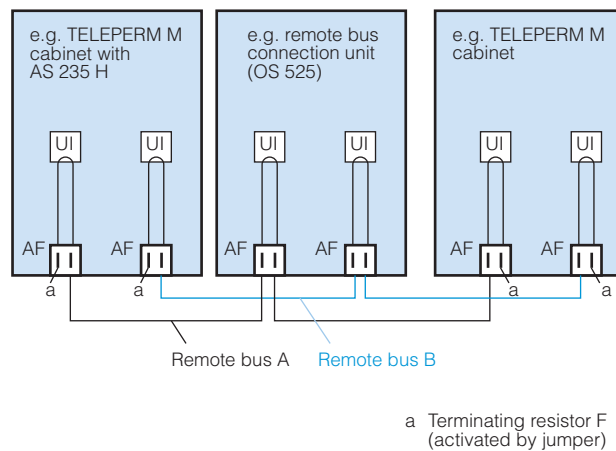

a Terminating resistor F
(activated by jumper)

Fig. 6/7   Redundant remote bus with terminating resistors

Overvoltage protection
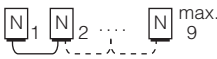
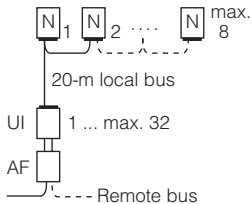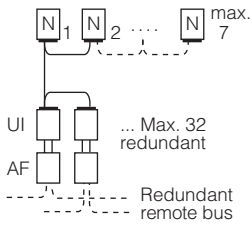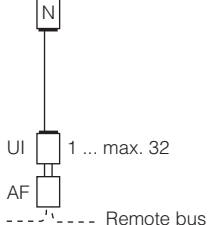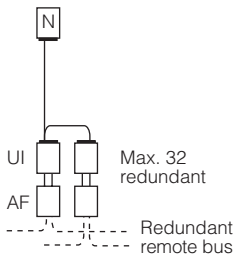The participants connected to the remote bus can be extensively protected against destruction by overvoltages by means of the coarse and fine overvoltage protection units.

The coarse protection limits high-voltage signals of high power to the arc voltage. The coarse protection is able to handle brief peaks in the kA range. It is installed where the remote bus enters the building. The fine protection reduces the residual voltage which passes the coarse protection down to a value between the internal conductor and the screen of the remote bus cable which is harmless for the amplifier of the inductive coupler in the bus converter. The fine protection is fitted on the connector AF.

Bus communication

Bus configurations, examples

	Application	Other conditions	Connecting cables
20-m local bus N 1, N 2 …. N max. 9	Small plants Max. 9 participants possible Max. 20 m bus cable Standard design redundant	Can only be used in instrumentation rooms. The guidelines for earthing and screening must be observed for the participants on the local bus. Ensure in particular that the participants have the same ground potential (equipotential bonding, 0-V island).[1]	N1 to N2, N2 to N3 etc.: 6DS8 201-8.. Front plug on N1: 6DS9 200-8AA

20-m local bus / 4-km remote bus
 	
 N 1, N 2 …. N max. 8
 20-m local bus
 UI 1 ... max. 32
 AF — Remote bus
	Large plants
	
	 Max. 100 participants possible
	 Max. 4 km remote bus cable
		Max. 32 bus converters UI can be used, power distribution subrack can be used for 2 bus converters UI. The guidelines for earthing and screening must be observed for the participants on the local bus.
		
		 Ensure in particular that the participants have the same ground potential (equipotential bonding, 0-V island).[1]
			N1 to UI: 6DS8 205-8..
			             6DS8 204-8.. [2]
			             6DS9 201-8FC [3]
			
			 N1 to N2,
			 N2 to N3 etc.:
			 6DS8 201-8..

20-m local bus / 4-km remote bus, redundant N 1, N 2 …. N max. 7 UI ... Max. 32 redundant AF — Redundant remote bus	Large plants Max. 100 participants possible Max. 4 km remote bus cable	Max. 32 bus converters UI can be used, power distribution subrack can be used for 2 bus converters UI. The guidelines for earthing and screening must be observed for the participants on the local bus. Ensure in particular that the participants have the same ground potential (equipotential bonding, 0-V island).[1]	N1 to UI1 and UI2: 6DS8 204-8.. 6DS9 201-8CA [2] 6DS9 201-8FC [3] N1 to N2 or N2 to N3 etc.: 6DS8 201-8..

Individual participants on 4-km remote bus
 	
 N
 UI 1 ... max. 32
 AF — Remote bus
	Medium-sized plants
	
	 Individual participants on remote bus (large distances between individual participants)
	
	 Maximum peripheral configuration of connected automation systems
	
	 Max. 32 participants possible
	 Max. 4 km remote bus cable
		Interface module(s) for 20-m local bus and bus converter in the same cabinet or subrack.
		
		 Power distribution subrack can be used for 2 bus converters UI per cabinet.
			N to UI: 6DS8 205-8..
			           6DS8 204-8.. [2]
			           6DS9 201-8FC [3]

Individual participants on 4-km remote bus, redundant N UI Max. 32 redundant AF — Redundant remote bus	Medium-sized plants Individual participants on remote bus (large distances between individual participants) Maximum peripheral configuration of connected automation systems Max. 32 participants possible Max. 4 km remote bus cable	Interface module(s) for 20-m local bus and bus converter in the same cabinet or subrack. Power distribution subrack can be used for 2 bus converters UI per cabinet.	N to UI1 and UI2: 6DS8 204-8.. 6DS9 201-8CA [2] 6DS9 201-8FC [3]

1) Exceptions apply to the floating local bus interface modules N-AS and N-AT
2) Alternative with AS 235 as N/N1 and incorporation of connection distributor AV
3) Alternative with AS 235 H as N/N1 and incorporation of connection distributor AV

Bus communication

Connecting cables

Connecting cables for 20-m local bus

To connect the interface modules for 20-m local bus to one another and to the bus converter UI. A front plug is required for the last participant on the local bus when using the cable 6DS8 201-8.. .

Ordering data	Order No.
Connecting cable for 20-m local bus between two interface modules for 20-m local bus, **1 plug**	**6DS8 201-8 ■ ■**
0.3 m **MB** 1.5 m **EC** 10 m **AD** 0.5 m **SB** 5.0 m **SC** 15 m **ED** 0.63 m **UB**	
Front plug	**6DS9 200-8AA**
Connecting cable for 20-m local bus between two interface modules for 20-m local bus and bus converter UI, **2 plugs**	**6DS8 205-8 ■ ■**
0.3 m **MB** 1.5 m **EC** 5 m **SC** 0.5 m **SB**	
Connecting cable for 20-m local bus between interface modules for 20-m local bus and bus converters UI1 and UI2, **3 plugs**	**6DS8 204-8 ■ ■**
0.3 m **MB** 2.0 m **HC** 2.7 m **LC** 1.2 m **CC** 2.2 m **JC** 5.0 m **SC** 1.5 m **EC** 2.5 m **KC**	
Connecting cable for 20-m local bus between interface modules for 20-m local bus N-AS and bus converters UI1 and UI2 as well as connection distributor for 20-m local bus, **4 plugs**	**6DS9 201-8CA**
Connecting cable for 20-m local bus between interface module for 20-m local bus N-AS and bus converters UI1 and UI2 as well as connection distributor for 20-m local bus, **5 plugs**	**6DS9 201-8FC**

Summary of connecting cables with description: see page 3/34.

Connecting cables for remote bus

The following two remote bus cables are recommended:

Ordering data	Order No.
Remote bus cable	
Standard remote bus cable Specify length in plain text (max. 4 km)	**V45466-D21-B35** [1] Length ..... m
Inhouse remote bus cable Specify length in plain text (max. 2 km) [2]	**V45466-D17-B135** [1] Length ..... m

1) Order from
   ICP CC VCE
   Kistlerhofstr. 170
   D-81379 Munich
   Tel.+49 (89) 722-22150
   Fax +49 (89) 722-41032

2) When mixed with the standard remote bus cable, the total length of the two cables must not exceed 4 km.

Coupling with other systems

Coupling with other systems

Summary

Interface modules for coupling with other systems, summary

Interface module	Type of coupling	Interface	Procedure	Electrical isolation	Coupling partner
6DS1 321-8AA	Parallel, bus connection	RS 422	I/O bus interface	No	SIMATIC S5 expansion units
6DS1 327-8AA	Serial, bus connection	RS 485	(ET 100)	Yes	SIMATIC S5 expansion units, ET 100U
6DS1 333-8AB	Serial, point-to-point connection	TTY	3964 R / RK 512	Yes, at receiver	SIMATIC S5 programmable controllers with CP 524 and CP 544 communications processors SIMATIC S7-400 automation systems with CP 441-2 communications processor SIMATIC S7-300 automation systems with CP 341 communications processor

Summary

A differentiation is made for AS 235 couplings between

- coupling via the CS 275 bus and
- direct coupling via special interface modules.

This section only deals with direct coupling.

The summary table lists all available interface modules for coupling with other systems, together with the most important features of the modules.

All interface modules are operated in a slot for I/O modules.

An important feature for differentiation is the type of coupling (parallel/serial):

- With a parallel coupling, the interface module 6DS1 321-8AA transfers all bus signals between the automation system and the coupling partner – with the exception of the level conversion signals TTL-RS 422-TTL – in real-time mode. The driver blocks directly access the I/O modules in the connected expansion unit with a parallel coupling.
- With a serial coupling, the interface modules themselves handle the data transfer with the coupling partner. Data transfer is via the transfer RAM of the interface module with a serial coupling.

When selecting the interface module suitable for the respective application, the following factors may be important in addition to the type of coupling partner:

- The distance to the coupling partner
- The topology of the system
- The earthing concept
- Measures which may be needed for lightning protection.

Since the parallel coupling is not electrically isolated and the RS 422 system used permits a maximum difference of 7 V between the earth potentials of the coupling partners, it is recommendable to use a serial coupling for longer distances within buildings and for links between different buildings. As a result of the lower number of conductors in the cable and the electrical isolation, this facilitates any protection measures for static and dynamic differences in potential (earthing, lightning protection).

The transmission rate and thus the cycle time can be varied with a serial coupling. However, the selected data transfer rate has an influence on the maximum distance which can been covered.

The driver blocks required for the various links are contained in the standard software of the automation system.

Coupling of other systems

The interface module 6DS1 333-8AB can be used to couple other systems (e.g. scales, data acquisition units, process chromatographs) if the system has an appropriate interface, i.e. 20-mA current loop interface (TTY) and 3964 R / RK 512 procedure. Other procedures and protocols require especially produced firmware. However, detailed knowledge of the module hardware, the interface to the automation system, and the driver blocks is required in this case.

We would be pleased to recommend software companies with appropriate know-how for the generation of this firmware.

Coupling with other systems
SIMATIC S5 expansion units
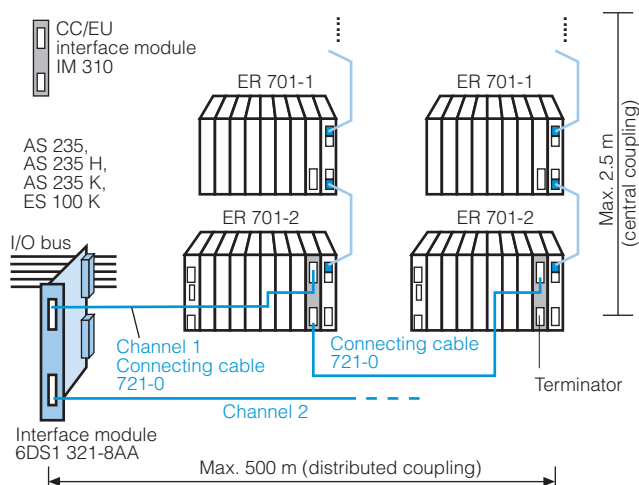
Parallel coupling with S5-115U I/O modules

Up to 6 interface modules 6DS1321-8AA with a total of 12 usable channels can be operated per AS 235 automation system.

The interface module can be inserted into any slot for I/O modules of an AS 235 automation system or ES 100 K extension system. The module has two bit-parallel RS 422 interfaces via which direct access (without intermediate storage) is possible to the SIMATIC S5 I/O modules. The CC/EU interface module IM 310 is used for the coupling at the SIMATIC end. This is inserted into slot 7 of the ER 701-2 subrack for extension units.

The maximum distance between the interface module 6DS1 321-8AA and the last expansion unit is 500 m with a distributed coupling.

Data transfer between the central processing unit of an AS 235 automation system and the SIMATIC S5-115U I/O models is handled by the driver blocks AA and AE for analog values and the drivers A110 and E 110 for binary values.

The maximum permissible difference in the M potential between the AS 235 automation system and the expansion unit is 7 V.

See page 7/7 for interface module 6DS1 321-8AA.

Fig. 7/1   Coupling of automation systems with SIMATIC S5-115U I/O modules, fitted in ER 701 subrack for expansion units

Parallel coupling with SIMATIC S5-115U I/O modules

The SIMATIC S5-115U I/O modules provide the user of the TELEPERM M process control system with a further comprehensive range of I/O modules for optimizing the field connections.

Of major advantage is that signal voltages up to 250 V can be used with these I/O modules, and that the coupling level otherwise required with TELEPERM M can be omitted. However, intelligent SIMATIC S5 I/O modules are not suitable for operation on AS 235 automation systems.

The following are required to couple the AS 235 automation systems to SIMATIC S5-115U I/O modules in the ER 701 subrack for extension units:

- Interface module for
  SIMATIC S5 expansion units   6DS1 321-8AA
- Connecting cable 721   6ES5 721-0..
- CC/EU interface module IM 310   6ES5 310-3AB11
  with adapter casing   6ES5 491-0LB11
- Terminator   6ES5 760-0AA11

An ER 701 subrack can be directly connected via each of the two channels of interface module 6DS1 321-8AA. Further central or distributed expansion units can be connected to this (see Catalog ST 50). The number of SIMATIC S5 I/O modules which can be coupled to an interface module is limited, however, by the maximum addressing volume of 2 x 256 bytes (256 bytes per channel).

Notes:

- An ER 701-3 subrack *cannot* be used instead of the ER 701-2.
- The first half of the address area of each channel of the interface module (128 bytes) is reserved for digital inputs and outputs and must not be used for analog inputs and outputs.

Coupling with other systems
SIMATIC S5 expansion units

Parallel coupling with S5-115U I/O modules

SIMATIC S5-115U I/O modules appropriate for coupling

Module	Electrical isolation	Number of inputs/outputs		Order No.
Digital input modules			**Input voltage**	
Digital input 420-7	No	32 inputs	DC 24 V	6ES5 420-7LA11
Digital input 430-7	Yes	32 inputs	DC 24 V	6ES5 430-7LA12
Digital input 431-7	Yes	16 inputs	AC/DC 24 V, AC/DC 48 V	6ES5 431-7LA11
Digital input 432-7	Yes	16 inputs	AC/DC 48 V, AC/DC 60 V	6ES5 432-7LA11
Digital input 434-4	Yes	32 inputs	DC 5 V, DC 15 V	6ES5 434-4UA12
Digital input 434-7	Yes	8 inputs	DC 24 V	6ES5 434-7LA12
Digital input 435-7	Yes	16 inputs	AC/DC 115 V	6ES5 435-7LA11/-7LB11
Digital input 435-7	Yes	8 inputs	AC/DC 115 V	6ES5 435-7LC11
Digital input 436-7	Yes	16 inputs	AC/DC 230 V	6ES5 436-7LA11/-7LB11
Digital input 436-7	Yes	8 inputs	AC/DC 230 V	6ES5 436-7LC11
Digital output modules			**Power supply, output current/continuous current**	
Digital output 441-7	No	32 outputs	DC 24 V, 0.5 A	6ES5 441-7LA12
Digital output 451-7	Yes	32 outputs	DC 24 V, 0.5 A	6ES5 451-7LA12/-7LA21
Digital output 453-7	Yes	16 outputs	DC 24 V/48 V/60 V, 0.5 A	6ES5 453-7LA11
Digital output 454-7LA	Yes	16 outputs	DC 24 V, 2 A	6ES5 454-7LA11
Digital output 454-7LB	Yes	8 outputs	DC 24 V, 2 A	6ES5 454-7LB11
Digital output 455-7	Yes	16 outputs	AC 48 V/115 V, 2 A/group	6ES5 455-7LA11
Digital output 456-7LA	Yes	16 outputs	AC115 V/230 V, 1 A	6ES5 456-7LA11
Digital output 456-7LB	Yes	8 outputs	AC115 V/230 V, 2 A	6ES5 456-7LB11
Digital output 457-7	Yes	32 outputs (mechanical switch)	DC 5 V/12 V/24 V, 0.1 A	6ES5 457-7LA11
Digital output 458-7LA	Yes	16 relay contact outputs	AC/DC 30 V, 0.5 A	6ES5 458-7LA11
Digital output 458-7LB	Yes	8 relay contact outputs	AC 250 V, max. 5 A / DC 30 V, max. 2.5 A	6ES5 458-7LB11
Digital output 458-7LC	Yes	16 relay contact outputs	AC 250 V, max. 5 A / DC 30 V, max. 5 A	6ES5 458-7LC11
Digital input/output modules			**Power supply, output current**	
Digital input/output 482-7	Yes	16 inputs 16 outputs	DC 24 V DC 24 V, 0.5 A	6ES5 482-7LA11
Digital input/output 482-7	Yes	8 inputs 8 outputs	DC 24 V DC 24 V, 2.5 A	6ES5 482-7LF31
Analog input modules			**Input ranges**	
Analog input 460-7	Yes	8 inputs	Signal range corresponding to measuring range module	6ES5 460-7LA13
Analog input 465-7	No	16 inputs (8 with Pt 100)	Signal range corresponding to measuring range module	6ES5 465-7LA13
Analog input 463-4	Yes	4 inputs	0 to 1 V, 0 to 10 V, 0 to 20 mA, 4 to 20 mA	6ES5 463-4UA12/-4UB12
Analog input 466-3	Yes	16 single/ 8 differential inputs	3 current ranges up to ± 20 mA 9 voltage ranges up to ±10 V	6ES5 466-3LA11
Analog output modules			**Output ranges**	
Analog output 470-7LA	Yes	8 outputs	± 10 V, 0 to 20 mA	6ES5 470-7LA13
Analog output 470-7LB	Yes	8 outputs	± 10 V	6ES5 470-7LB13
Analog output 470-7LC	Yes	8 outputs	4 to 20 mA, +1 to +5 V	6ES5 470-7LC13

Details on these I/O modules can be found in Catalog ST 50.

Coupling with other systems
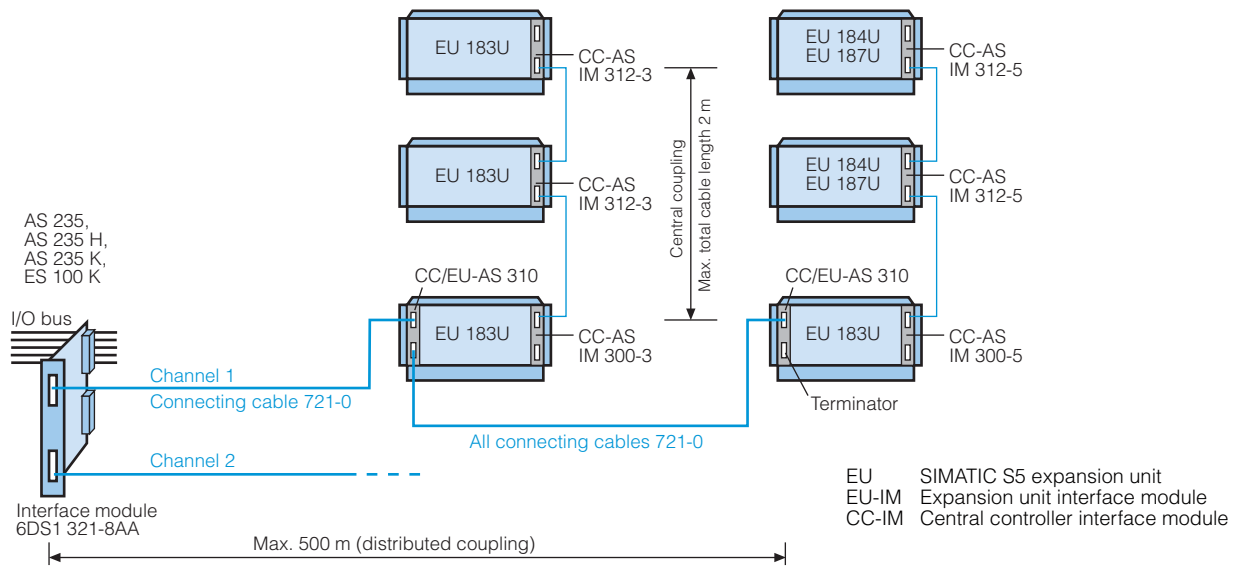## SIMATIC S5 expansion units

Fig. 7/2   Coupling of automation systems with SIMATIC S5-135U/155U
I/O modules, fitted in SIMATIC S5 expansion units

Parallel coupling with
SIMATIC S5-135U/155U I/O modules

The SIMATIC S5-135U/155U I/O modules provide the user of the TELEPERM M process control system with a further comprehensive range of I/O modules for optimizing the field connections.

Of major advantage is that signal voltages up to 250 V can be used with these I/O modules, and that the coupling level otherwise required with TELEPERM M can be omitted. However, intelligent SIMATIC S5 I/O modules are not suitable for coupling with TELEPERM M.

The following are required to couple the AS 235 automation systems to SIMATIC S5 I/O modules of compact design in EU 183U expansion units:

- Interface module for
  SIMATIC S5 expansion units   6DS1321-8AA
- Connecting cable 721   6ES5 721-0..
- CC/EU interface module IM 310   6ES5 310-3AB11
- Terminator   6ES5 760-0AA11

An EU 183U expansion unit can be directly connected via each of the two channels of interface module 6DS1 321-8AA. Further EU 183U expansion units can be connected to this either centrally or distributed. EU 184U and EU 187U expansion units can only be connected centralized (see Catalog ST 50). The number of SIMATIC S5 I/O modules which can be coupled to an interface module is limited, however, by the maximum addressing volume of 2 x 256 bytes (256 bytes per channel).

Note:
An EU 185U or EU 186U expansion unit cannot be used instead of the EU 183U. The EU 185U / EU 186U are only partially suitable for coupling. They can only be used if they are directly operated as the only unit without central expansion.

Up to 6 interface modules 6DS1321-8AA with a total of 12 usable channels can be operated per AS 235 automation system.

The interface module can be inserted into any slot for I/O modules of an AS 235 automation system or ES 100 K extension system.

The module has two bit-parallel RS 422 interfaces via which direct access (without intermediate storage) is possible to the SIMATIC S5-135U/155U I/O modules. The CC/EU interface module IM 310 is used for the coupling at the SIMATIC end. This is inserted into slot 3 of the EU 183U expansion unit.

The maximum distance between the interface module 6DS1 321-8AA and the last expansion unit is 500 m with a distributed coupling.

Data transfer between the central processing unit of an AS 235 automation system and the SIMATIC S5-135U/155U I/O modules is handled by the driver blocks AA and AE for analog values and the drivers A110 and E 110 for binary values.

The maximum permissible difference in the *M* potential between the AS 235 automation system and the expansion unit is 7 V.

See page 7/7 for interface module 6DS1 321-8AA.

Coupling with other systems
SIMATIC S5 expansion units

**Parallel coupling with
S5-135U/155U I/O modules**

SIMATIC S5-135U/155U I/O modules appropriate for coupling

Module	Electrical isolation	Number of inputs/outputs		Order No.
Digital input modules			**Input voltage**	
Digital input 420-4	No	32 inputs	DC 24 V	6ES5 420-4UA14
Digital input 430-4	Yes	32 inputs	DC 24 V	6ES5 430-4UA14
Digital input 431-4	Yes	16 inputs	DC 24 V/48 V/60 V	6ES5 431-4UA12
Digital input 432-4	Yes	32 inputs	DC 24 V	6ES5 432-4UA12
Digital input 434-4	Yes	32 inputs	DC 5 V/15 V	6ES5 434-4UA12
Digital input 435-4	Yes	16 inputs	AC 24 V/48 V/60 V	6ES5 435-4UA12
Digital input 436-4UA	Yes	16 inputs	AC 115 V/230 V	6ES5 436-4UA12
Digital input 436-4UB	Yes	8 inputs	AC 115 V/230 V	6ES5 436-4UB12
Digital output modules			**Power supply, output current/continuous current**	
Digital output 441-4	No	32 outputs	DC 24 V, 0.5 A	6ES5 441-4UA14
Digital output 451-4	Yes	32 outputs	DC 24 V, 0.5 A	6ES5 451-4UA14
Digital output 453-4	Yes	16 outputs	DC 24 V, 2 A	6ES5 453-4UA12
Digital output 454-4	Yes	16 outputs	DC 24 V, 2 A	6ES5 454-4UA14
Digital output 455-4	Yes	16 outputs	AC 24 V/48 V/60 V, 2 A	6ES5 455-4UA12
Digital output 456-4UA	Yes	16 outputs	AC 115 V/230 V, 2 A	6ES5 456-4UA12
Digital output 456-4UB	Yes	8 outputs	AC 115 V/230 V, 2 A	6ES5 456-4UB12
Digital output 457-4	Yes	16 outputs	DC 24 V/48 V, 60 V, 0.5 A	6ES5 457-4UA12
Digital output 458-4UA	Yes	16 relay outputs	DC 60 V / AC 48 V, 0.5 A	6ES5 458-4UA12
Digital output 458-4UC	Yes	16 relay outputs	DC 30 V, max. 5 A / AC 250 V, max. 5 A	6ES5 458-4UC11
Analog input modules			**Input ranges**	
Analog input 460-4	Yes	8 inputs	Signal range corresponding to measuring range module	6ES5 460-4UA13
Analog input 465-4	No	16 inputs (8 for Pt 100 resistance thermometers)	Signal range corresponding to measuring range module	6ES5 465-4UA13
Analog input 463-4	Yes	4 inputs	0 to 1 V, 0 to 10 V, 0 to 20 mA, 4 to 20 mA	6ES5 463-4UA12 6ES5 463-4UB12
Analog input 466-3	Yes	8 differential inputs or 16 individual inputs	3 current and 9 voltage ranges	6ES5 466-3LA11
Analog output modules			**Output ranges**	
Analog output 470-4UA	Yes	8 outputs	± 10 V, 0 to 20 mA	6ES5 470-4UA13
Analog output 470-4UB	Yes	8 outputs	±10 V	6ES5 470-4UB13
Analog output 470-4UC	Yes	8 outputs	4 to 20 mA, +1 to +5 V	6ES5 470-4UC13

Details on these I/O modules can be found in Catalog ST 50.

Coupling with other systems
SIMATIC S5 expansion units

Interface module for SIMATIC S5 expansion units

Interface module for SIMATIC S5 expansion units

The interface module 6DS1 321-8AA is a compact subassembly, double height (2 standard slots). The module has:

- 2 base plugs for
  - I/O bus interface, 48-contact male connector
  - Power supply, 64-contact male connector
- 2 parallel interfaces for connection of expansion units of the S5-115U, S5-135U and S5-155U programmable controllers to SIMATIC S5 I/O modules, 50-contact front plugs in each case

Mode of operation

The interface module 6DS1 321-8AA enables direct, parallel read/write operations on the I/O modules of the S5-115U, S5-135U and S5-155U programmable controllers without inter-mediate storage. It matches the I/O bus of the TELEPERM M process control system to that of SIMATIC S5.

The TTL levels of the TELEPERM M I/O bus are converted into symmetrical levels of the RS 422 interface.

The addressing volume of 2 x 256 bytes for I/O modules of the S5-115U, S5-135U and S5-155U programmable controllers is mapped in the I/O addressing volume of 4 Kbyte of the AS 235/AS 235 K/AS 235 H automation systems. This means that a TELEPERM M address is assigned to each SIMATIC S5 address.

Technical data

Power supply	L+	DC 24 V, 450 mA
	PM	DC 24 V, 35 mA
Number of channels/interfaces		2
Interface to		
• S5-115U, S5-135U, S5-155U expansion units		RS 422, symmetrical
• TELEPERM M process control system		I/O bus (TTL)
Max. addressing volume		2 x 256 byte
Permissible ambient temperature		
– Operation		0 to +55 °C
– Transport and storage		-40 to +70 °C
Weight		Approx. 0.5 kg

Ordering data

	Order No.
Interface module for SIMATIC S5 expansion units	**6DS1 321-8AA**
CC/EU interface module IM 310	**6ES5 310-3AB11**
Cable terminator for plugging onto plug 2 of the CC/EU interface module IM 310, on the last expansion unit	**6ES5 760-0AA11**
Adapter casing for SIMATIC S5-115U I/O modules	**6ES5 491-0LB11**
Connecting cable for ES 100 K and SIMATIC S5 expansion unit [1]	
2.5 m	**6ES5 721-0BC50**
5 m	**6ES5 721-0BF00**
50 m	**6ES5 721-0CF00**
100 m	**6ES5 721-0DB00**
500 m	**6ES5 721-0DF00**
SIMATIC S5 subrack, I/O modules [2], power supply module	See Catalog ST 50
Instruction Manual [3] Interface module for SIMATIC S5 expansion units	
– German	**C79000-B8000-C169**
– English	**C79000-B8076-C169**

1) Max. permissible total length 500 m
2) Only non-intelligent I/O modules are permissible.
3) Part of manual "Coupling and calculation modules", Order No. C79000-G80..-C32.

Coupling with other systems
SIMATIC S5/S7 central controllers

**Serial coupling
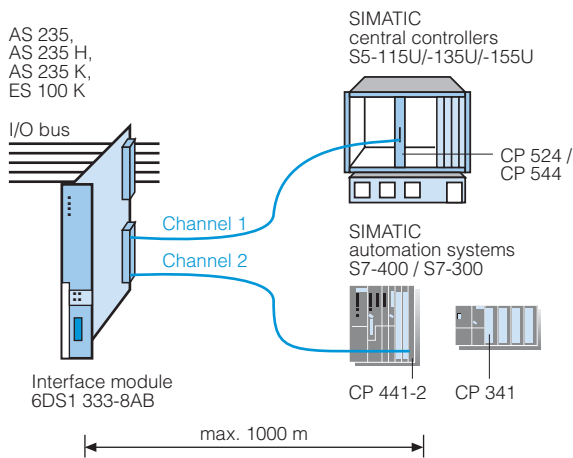with SIMATIC S5/S7 central controllers**

Fig. 7/3 Coupling of automation systems with SIMATIC S5/S7 central controllers

Serial coupling with SIMATIC S5/S7 central controllers

In certain cases it may be advantageous to assign autonomous parts of an automation program to a subordinate automation level. There is less loading on the automation system, and valuable calculation time can be saved. This is especially important in the case of automation tasks with short cycle times which may place a heavy loading on the calculation capacity of a processor. Subordinate programs can also be developed and tested independently of other program sections.

The following are required to couple the AS 235, AS 235 H and AS 235 K automation systems to SIMATIC S5-115U, S5-135U and S5-155U central controllers and SIMATIC S7-300 and S7-400 automation systems:

- interface module for
  SIMATIC S5/S7 central controllers   6DS1 333-8AB
- Connecting cable   6DS8 137-8..
- For SIMATIC S5:
  CP 524 communications processor [1] 6ES5 524-3UA15
  CP 544 communications processor [1] 6ES5 544-3UA11
- For SIMATIC S7-300:
  CP 341 communications processor [2] 6ES7 341-1BH00-0AE0
  with 20-mA (TTY) interface
- For SIMATIC S7-400:
  CP 441-2 communications
  processor [2]   6ES7 441-2AA02-0AE0

The interface module 6DS1 333-8AB can be inserted into any slots for I/O modules of an AS 235 automation system or an ES 100 K extension system. A SIMATIC S5/S7 central controller can be connected to each of its 2 channels.

A screened, four-conductor cable twisted in pairs is used for data transmission. The maximum distance between the interface module and the central controller is 1000 m. Data transfer is sequential via a coupling link with 20-mA current loop. The channel-specific transmission rate can be adjusted in steps:

Transmission rate	Max. coupling line length
300, 600, 1200, 2400 bits/s	1000 m
4800 bits/s	500 m
9600 bits/s	300 m

Data transfer between the AS 235 central processing unit and the interface module 6DS1 333-8AB is handled via the S5KS and S5KE driver blocks in the automation system. The 3964 or 3964 R transmission procedure (selectable) is used for data transmission between the interface module and the SIMATIC S5/S7 central controller.

RK 512 is used as the protocol. The SIMATIC S5 sends or fetches the data by means of messages. The TELEPERM M interface module is the passive participant in the communication. S7 central controllers operate with SEND/RECEIVE and S5 analog-value format.

Further information
- Catalog ST 50
  for SIMATIC S5 central controllers and
  CP 524/544 communications processors
- Catalog ST 70
  for SIMATIC S7 central controllers and
  CP 341/441-2 communications processors

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1) See Catalog ST 50 for interface modules, parameterization tools and accessories
2) See Catalog ST 70 for interface modules, parameterization tools and accessories

Coupling with other systems
SIMATIC S5/S7 central controllers

**Interface module for
SIMATIC S5/S7 central controllers**

Interface module for SIMATIC S5/S7 central controllers

The interface module for SIMATIC S5/S7 central controllers, 6DS1 333-8AB, is a double-height compact subassembly. The front panel width is 30.48 mm (2 standard slots). The module has 2 base plugs for the I/O bus interface and two serial interfaces for connection of a SIMATIC-S5/S7 central controller.

Mode of operation

The data arriving in parallel via the I/O bus of the automation system are stored cyclically in the transfer memory (RAM) of the interface module for SIMATIC S5/S7 central controllers. The SIMATIC S5 central controllers can read the transfer memory using fetch messages. The transmitter section of the interface module reads the data from the transfer memory, supplements them into a complete message, and outputs this via the serial interface to the SIMATIC S5/S7 central controller.

Messages transmitted by the SIMATIC S5/S7 central controller are tested for reliability in the receiver section of the interface module, and the data contained in them are stored in the transfer memory. The automation system cyclically reads these data from the transfer memory.

Technical data

Power supply	$L+$	DC 24 V, 260 mA
	PM	DC 24 V, 40 mA
Number of channels/interfaces		2
Interface to SIMATIC S5 central controller		20-mA current loop, transmitter and receiver either active, non-floating or passive, floating
Max. message length		128 byte net data + 10 byte header
Permissible ambient temperature – Operation – Transport and storage		0 to +55 °C -40 to +70 °C
Weight		Approx. 0.5 kg

Ordering data

Interface module for SIMATIC S5/S7 central controllers	**6DS1 333-8AB**
SIMATIC S5 coupling	
CP 524 communications processor [1]	**6ES5 524-3UA15**
CP 544 communications processor [1]	**6ES5 544-3UA11**
SIMATIC S7-300 coupling	
CP 341 communications processor incl. 20-mA (TTY) interface [2]	**6ES7 341-1BH00-0AE0**
SIMATIC S7-400 coupling	
CP 441-2 communications processor [2]	**6ES7 441-2AA02-0AE0**
Connecting cable To connect a CP to the interface module for SIMATIC S5/S7 central controllers 10 m	**6DS8 137-8AD**
50 m	**6DS8 137-8SD**
100 m	**6DS8 137-8AE**
300 m	**6DS8 137-8ME**
500 m	**6DS8 137-8SE**
1,000 m	**6DS8 137-8AF**
SIMATIC S5-115U, S5-135U, S5-155U programmable controllers	See Catalog ST 50
SIMATIC S7-300 and S7-400 programmable controllers	See Catalog ST 70
Instruction Manual Interface module for SIMATIC S5/S7 central controllers – German – English	**C79000-B8000-C297** **C79000-B8076-C297**

1) See Catalog ST 50 for interface modules, parameterization tools and accessories
2) See Catalog ST 70 for interface modules, parameterization tools and accessories

Coupling with other systems
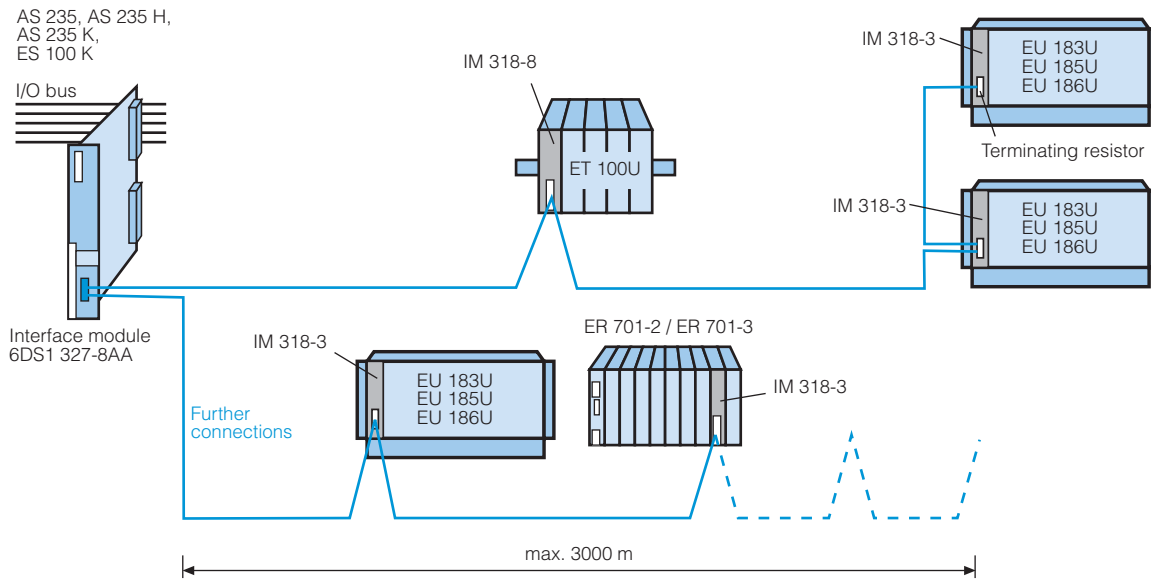## SIMATIC S5 I/Os / ET 100U

Fig. 7/4   Coupling of automation systems with ET 100U electronic terminator and SIMATIC S5 I/O modules

Serial coupling with SIMATIC S5 I/O modules and peripheral devices (up to 3000 m)

The SIMATIC S5 I/O modules and the ET 100U electronic terminator provide the user of the TELEPERM M process control system with two further comprehensive ranges of I/O modules for optimizing the field connections.

Binary and analog input/output modules can be connected:
• I/O modules of the SIMATIC S5-115U programmable controller

I/O modules which can be connected in the ER 701-2 or ER 701-3 expansion racks (cf. page 7/4):
• I/O modules of the SIMATIC S5-135U and S5-155U programmable controllers

I/O modules which can be connected in the EU 183U, EU 185U or EU 186U expansion units (cf. page 7/6):
• ET 100U electronic terminator

The ET 100U electronic terminator (see Catalog ST 50) enables direct connection of transmitters, final control elements, valves and lamps in the immediate vicinity of the process. Cabling and assembly costs can be greatly reduced by the omission of junction boxes and as a result of the serial two-wire connection to the programmable controller.

Digital and analog I/O modules with intrinsically-safe inputs and outputs are available for the connection of devices in potentially explosive atmospheres.

The following are required to connect these SIMATIC peripheral devices:
• The interface module 6DS1 327-8AA in the AS 235 automation system
• The IM 318-8 interface module (6ES5 318-8MA12) in the ET 100U electronic terminator
• The IM 318-3 interface module (6ES5 318-3UA11) in the expansion units; the adapter casing 6ES5 491-0LB11 in addition with the 701-2 expansion subrack.

The interface module 6DS1 327-8AA has 2 connections with 1 plug for 2 lines. Up to 32 devices can be connected in any sequence to each connection. Up to 3 interface modules 6DS1 327-8AA are permissible per AS 235 automation system.

A line may be up to 3000 m long up to the last device. However, the distances which can be covered depend on the type of cable used and the selected transmission rate.

Coupling with other systems
SIMATIC S5 I/Os / ET 100U

Serial coupling with SIMATIC S5 I/Os

ET 100U I/O modules appropriate for coupling

Module	Electrical isolation	Number of inputs/outputs		Order No.
Digital input modules			Input voltage	
Digital input 420-8	No	4 inputs	DC 24 V	6ES5 420-8MA11
Digital input 421-8	No	8 inputs	DC 24 V	6ES5 421-8MA12
Digital input 422-8	No	16 inputs	DC 24 V	6ES5 422-8MA11
Digital input 430-8	Yes	4 inputs	DC 24 V/60 V	6ES5 430-8MB11
Digital input 430-8	Yes	4 inputs	AC/DC 115 V, 47 to 63 Hz	6ES5 430-8MC11
Digital input 430-8	Yes	4 inputs	AC/DC 230 V, 47 to 63 Hz	6ES5 430-8MD11
Digital input 431-8	Yes	8 inputs	DC 24 V	6ES5 431-8MA11
Digital input 431-8	Yes	8 inputs	AC/DC 115 V, 47 to 63 Hz	6ES5 431-8MC11
Digital input 431-8	Yes	8 inputs	AC/DC 230 V, 47 to 63 Hz	6ES5 431-8MD11
Digital input 433-8	Yes	8 inputs	DC 5 to 24 V	6ES5 433-8MA11
Digital output modules			Power supply, output current/continuous current	
Digital output 440-8	No	4 outputs	DC 24 V, 0.5 A	6ES5 440-8MA12
Digital output 440-8	No	4 outputs	DC 24 V, 2 A	6ES5 440-8MA22
Digital output 441-8	No	8 outputs	DC 24 V, 0.5 A	6ES5 441-8MA11
Digital output 450-8	Yes	4 outputs	DC 24 V/60 V; 0.5 A	6ES5 450-8MB11
Digital output 450-8	Yes	4 outputs	AC115 V/230 V;1 A	6ES5 450-8MD11
Digital output 451-8	Yes	8 outputs	AC115 V/230 V;0.5 A	6ES5 451-8MD11
Digital output 451-8	Yes	8 outputs	DC 24 V, 1 A	6ES5 451-8MA11
Digital output 451-8	Yes	8 relay outputs	Max. 3 A with AC 250 V, Max. 1.5 A with DC 30 V	6ES5 451-8MR12
Digital output 452-8	Yes	8 relay outputs	Max. 5 A with AC 250 V, Max. 2.5 A with DC 30 V	6ES5 452-8MR11
Digital output 453-8	Yes	8 outputs	DC 5 to 24 V; 0.1 A	6ES5 453-8MA11
Ex(i) modules			Input voltage	
Digital input 437-8E	Yes	4 inputs	DC 8.2 V [1]	6ES5 437-8EA12
Digital output 457-8E	Yes	4 outputs	DC 7 V, 2 mA [1]	6ES5 457-8EA12
Analog input 467-8E	Yes	1 or 2 inputs, switchable, for 4 to 20 mA		6ES5 467-8EE11
Analog input 467-8E	Yes	4 inputs for thermocouples		6ES5 467-8EA11
Analog input 467-8E	Yes	2 inputs for Pt 100 resistance thermometers		6ES5 467-8EF11
Analog output 477-8E	Yes	2 outputs for 4 to 20 mA		6ES5 477-8EC11
Analog input modules				
Analog input 464-8	Yes	4 inputs for ± 50 mV		6ES5464-8MA11
	Yes	4 inputs for thermocouples (± 50 mV), with linearization		6ES5 464-8MA21
	Yes	4 inputs for ± 1 V		6ES5 464-8MB11
	Yes	4 inputs for ± 10 V		6ES5 464-8MC11
	Yes	4 inputs for ± 20 mA		6ES5 464-8MD11
	Yes	4 inputs for 4 to 20 mA		6ES5 464-8ME11
	Yes	2 inputs for ± 500 mV or Pt 100		6ES5 464-8MF11
	Yes	2 inputs for ± 500 mV or Pt 100, with linearization		6ES5 464-8MF21
Analog input 466-8	No	4 inputs 0 to 10 V		6ES5 466-8MC11
Analog output modules				
Analog output 470-8	Yes	2 outputs for ±10 V		6ES5 470-8MA12
	Yes	2 outputs for ± 20 mA		6ES5 470-8MB12
	Yes	2 outputs for 4 to 20 mA		6ES5 470-8MC12
	Yes	2 outputs for 1 to 5 V		6ES5 470-8MD12

1) From internal power supply

Details on these I/O modules can be found in Catalog ST 50.

Coupling with other systems
SIMATIC S5 I/Os / ET 100U

Interface module for ET 100U

Interface module for ET 100U

The interface module for ET 100U, 6DS1 327-8AA, is a double-height compact subassembly. The front panel width is 30.48 mm (2 standard slots).

The module has 2 base plugs for the I/O bus interface and the power supply, as well as a front plug (4-contact male connector) with screw terminals for lines 1 and 2.

ET 100U electronic terminators, ER 701-2 and ER 701-3 expansion racks and EU 183U, EU 185U and EU 186U expansion units can be connected to each line in any order. The total cable length up to the last device must not exceed 3000 m.

The front panel of the interface module has a slot for inserting a configuration EPROM submodule. This is required when connecting ET 100U electronic terminators.

Mode of operation

Up to 3 interface modules 6DS1 327-8AA can be inserted into any I/O bus slots in an AS 235 automation system. Each module occupies several module numbers.

The interface modules adapt the I/O bus interface to the serial SIMATIC S5 interface. In this manner, analog and digital input/output modules of the ET 100U electronic terminator or the S5-115U, S5-135U and S5-155U programmable controllers can be connected to an AS 235 automation system.

If SIMATIC analog input modules are used, linearization of the characteristic and compensation of the cold junction temperature must be carried out by the user for non-linear transmitters and thermocouples.

Following application of the supply voltage after briefly switching off the mode switch on the module and following elimination of an interruption in the transmission cable on one of the two lines, the interface module carries out a configuration operation in which it stores an image of the connected SIMATIC S5 peripheral devices and used I/O modules in its main memory.

The configuration data for the connected SIMATIC S5 expansion units are determined by reading the configuration lists in the expansion units, and for the ET 100U electronic terminator by scanning the configuration EPROM submodule generated by the user. The configuration data are the reference data for the interface module.

The AS 235 automation system communicates with the SIMATIC S5 peripheral devices via an intermediate memory on the interface module. Both the automation system and the processor of the interface module store transfer data in this memory.

The processor of the interface module cyclically processes the connected SIMATIC S5 I/O modules, transfers the output data entered by the automation system to the SIMATIC S5 output modules and updates the input area in the intermediate memory by scanning the SIMATIC S5 input modules.

Data transfer between the interface module and the SIMATIC S5 peripheral devices is carried out in half-duplex operation. The initiative always originates in the interface module.

The data are protected by 1 or 2 test bytes depending on the set transmission rate (cyclic BGH code).

If a plug on any SIMATIC S5 device is disconnected, the transmission line to the other devices is not interrupted (party line).

Technical data

Power supply	L+	DC 24 V, 500 mA
	PM	DC 24 V, 35 mA
Number of channels/interfaces		2, operated in parallel
Interface to		
– ET 100U, ER 701-2, EU 183U, EU 185U and EU 186U		Asynchronous, half-duplex, similar to RS 485 I/O standard
– TELEPERM M		I/O bus (TTL)
Connectable devices per interface line (channel)		Max. 32 SIMATIC S5 devices, can be mixed as required; 2 x number of ET 100U + number of expansion units ≤32
Configuration per AS 235 automation system		Max. 3 interface modules
Transmission rate		375 / 187.5 / 62.5 / 31.25 kbits/s, adjustable
Max. line length		
– With 375 kbits/s		0.5 km
– With 187.5 kbits/s		1 km
– With 62.5 kbits/s		1 km
– With 31.25 kbits/s		3 km
Transmission cable		Screened, twisted in pairs, 0.5 to 1.5 mm², flexible
Permissible ambient temperature		
– Operation		0 to +55 °C
– Transport and storage		-40 to +70 °C
Weight		Approx. 0.5 kg

Ordering data

Interface module for ET 100U	**6DS1 327-8AA**
IM 318-3 interface module for EU 183U, EU 185U, EU 186U expansion units and ER 701-2 or ER 701-3 subracks	**6ES5 318-3UA11**
Adapter casing for ER 701 subrack	**6ES5 491-0LB11**
IM 318-8 interface module for ET 100M electronic terminator	**6ES5 318-8MA12**
EPROM memory submodule 376 for generation of configuration EPROM for ET 100U connection	**6ES5 376-1AA11**
COM ET 100U parameterization software	
– On 3.5" diskette	**6ES5 835-3SC12**
– On 5.25" diskette	**6ES5 895-3SC12**
SIMATIC S5 I/O modules, ET 100U electronic terminator	See Catalog ST 50
Instruction Manual for interface module 6DS1 327-8AA	
– German	**C79000-B8000-C231**
– English	**C79000-B8076-C231**

Appendix

Ordering information

Ordering information

Individual components/options and complete systems

When ordering, a differentiation must be made between individual components/options (e.g. I/O modules, printers) and complete systems (AS 235 standard configurations defined by ordering units).

All individual components/options are subject to individual testing. With complete systems, the interactions of the individual components in the system network is proven in a system test.

Ordering of complete systems (AS 235 standard configuration)

Complete systems can be configured from a selection of defined, functionally divided ordering units, and ordered using an Order No. (e.g. 6DS2 124-7CC31-0D). The scope of delivery of such AS 235 standard configurations coded in the second and third blocks of the Order No. is reproduced exactly in the component lists. The modification of this scope of delivery by additions of type "But without ..." is therefore impossible.

The complete systems defined by an Order No. can be supplemented or modified by additional options. Operation of the options into the system test of the complete system must be agreed upon separately.

Ordering of options

When ordering options, a differentiation must be made between "Options with assembly" and "Options without assembly".

The options with Order No. and quantity must be listed in the order. Please enclose additional information required for order processing in the form of arrangement, designation and connection diagrams.

- Options with assembly

  "Options with assembly" comprise mechanical components, connection elements, modules or devices which can be fitted in the cabinet and wired and labelled if necessary, including side panels and partitions.

  The customer-specific designation and wiring of cabinet connection elements SAE 32, the coding and insertion of I/O modules, and the inscription of subracks necessitate additional data when ordering (arrangement, designation and connection diagrams). If, for example, appropriate data for the I/O modules is missing, these are delivered as "Options without assembly".

- Options without assembly

  "Options without assembly" are loosely supplied mechanical components, connection elements, modules or devices, e.g. input/output devices, connecting cables or also side panels and partitions if these are to be assembled on site.

  When ordering input and output devices and their connecting cables, we recommend that you enclose an arrangement diagram.