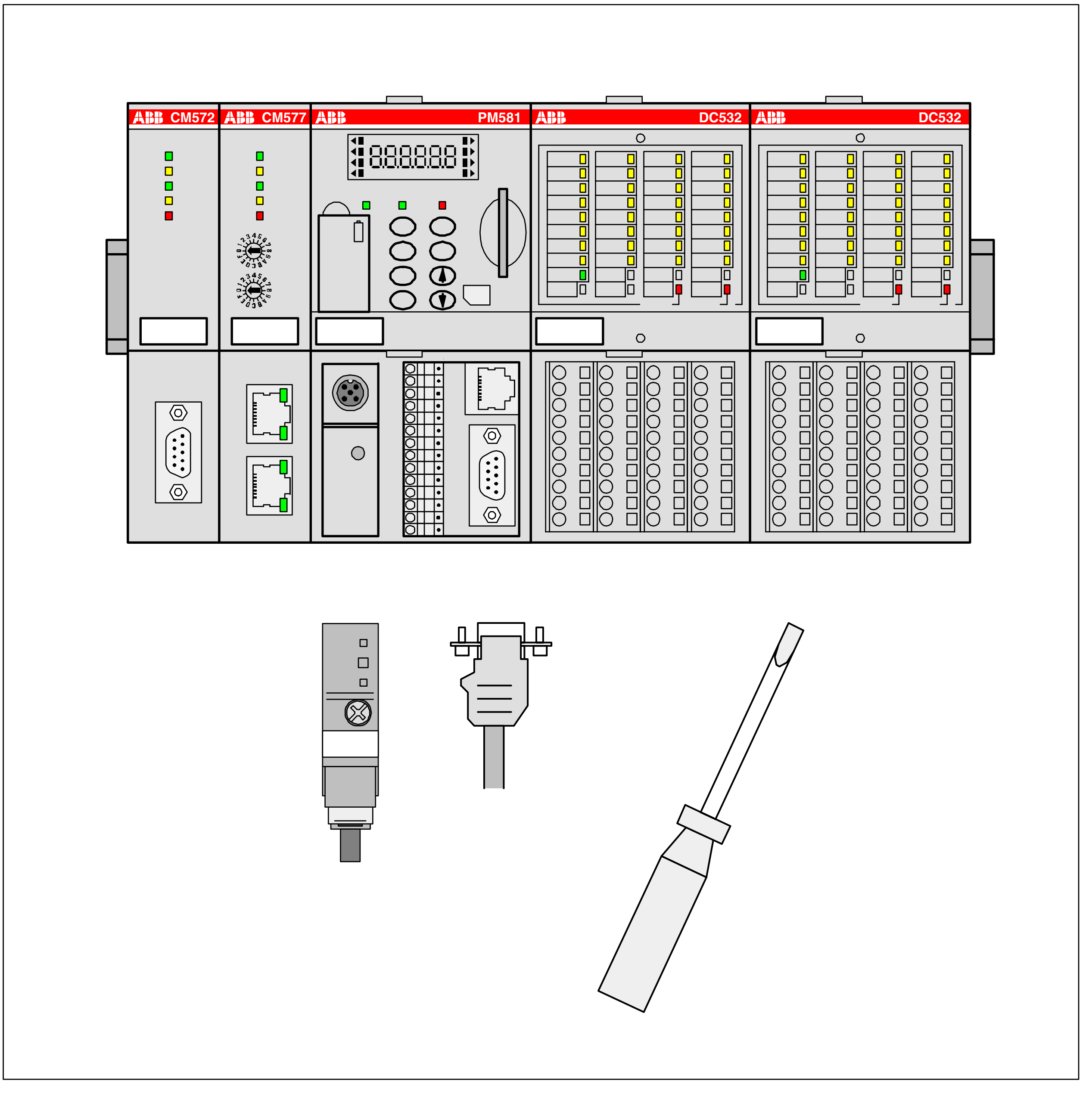
System Description

AC500

Scalable PLC
for Individual Automation

Hardware



Contents Hardware AC500

Analog input/output modules

Contents

AC500 System data and system construction

The product family Advant Controller 500 control system is designed according to EN 61131-2 IEC 61131-2 standards. Data, different from IEC 61131, are caused by the higher requirements of Maritime Services.

System data

Operating and ambient conditions

Voltages, according to EN 61131-2		
24 V DC	process and supply voltage	24 V DC (-15 %, +20 % without ripple)
	absolute limits	19.2 V...30 V inclusive ripple (see remarks above)
	ripple	< 5 %
	protection against reverse polarity	10 s
120 V AC	line voltage	120 V AC (-15 %, +10 %)
	frequency	47 Hz..62.4 Hz / 50...60 Hz (-6 %, +4 %)
230 V AC	line voltage	230 V AC (-15 %, +10 %)
	frequency	47 Hz..62.4 Hz / 50...60 Hz (-6 %, +4 %)
120-240 V AC	wide-range supply	
	line voltage	102 V...264 V / 120 V...240 V (-15 %, +10 %)
	frequency	47 Hz..62.4 Hz / 50...60 Hz (-6 %, +4 %)
Allowed interruptions of power supply, according to EN 61131-2		
	DC supply	interruption < 10 ms, time between 2 interruptions > 1 s, PS2
	AC supply	Interruption < 0.5 periods, time between 2 interruptions > 1 s

⚠ **Important:** Exceeding the maximum power supply voltage (>30 V DC) for process or supply voltages could lead to unrecoverable damage of the system. The system could be destroyed.

Temperature		
	operating	0 °C...+60 °C (horizontal mounting of modules) 0 °C...+40 °C (vertical mounting of modules and output load reduced to 50 % per group)
	storage	-25 °C...+75 °C
	transport	-25 °C...+75 °C
Temperature of the Lithium battery		
	operating	0 °C...+60 °C
	storage	-20 °C...+60 °C
	transport	-20 °C...+60 °C
Humidity		max. 95 %, without condensation
Air pressure		
	operating	> 800 hPa / < 2000 m
	storage	> 660 hPa / < 3500 m

Creepage distances and clearances

The creepage distances and clearances meet the overvoltage category II, pollution degree 2.

Insulation test voltages, routine test, according to EN 61131-2

230 V circuits against other circuitry	2500 V	surge 1.2/50 µs
120 V circuits against other circuitry	1500 V	surge 1.2/50 µs
120 V to 240 V circuits against other circuitry	2500 V	surge 1.2/50 µs
24 V circuits (supply, 24 V inputs/outputs), if they are electrically isolated against other circuitry	500 V	surge 1.2/50 µs
COM interfaces, electrically isolated	500 V	surge 1.2/50 µs
FBP interface	500 V	surge 1.2/50 µs
Ethernet	500 V	surge 1.2/50 µs
ARCNET	500 V	surge 1.2/50 µs
230 V circuits against other circuitry	1350 V	AC 2 s
120 V circuits against other circuitry	820 V	AC 2 s
120 V to 240 V circuits against other circuitry	1350 V	AC 2 s
24 V circuits (supply, 24 V inputs/outputs), if they are electrically isolated against other circuitry	350 V	AC 2 s
COM interfaces, electrically isolated	350 V	AC 2 s
FBP interface	350 V	AC 2 s
Ethernet	350 V	AC 2 s
ARCNET	350 V	AC 2 s

Power supply units

For the supply of the modules, power supply units according to PELV specifications must be used.

Electromagnetic compatibility

Immunity	
against electrostatic discharge (ESD)	according to EN 61000-4-2, zone B, criterion B
- electrostatic voltage in case of air discharge	8 kV
- electrostatic voltage in case of contact discharge	4 kV, in a closed switch-gear cabinet 6 kV [1])
ESD with communication connectors	In order to prevent operating malfunctions, it is recommended, that the operating personnel discharge themselves prior to touching communication connectors or perform other suitable measures to reduce effects of electrostatic discharges.
ESD with connectors of Terminal Bases	The connectors between the Terminal Bases and CPUs or couplers must not be touched during operation. The same is valid for the I/O-Bus with all modules involved.
Immunity	
against the influence of radiated (CW radiated)	according to EN 61000-4-3, zone B, criterion A
- test field strength	10 V/m
Immunity	
against transient interference voltages (burst)	according to EN 61000-4-4, zone B, criterion B
- supply voltage units (AC, DC)	2 kV
- digital inputs/outputs (24 V DC)	1 kV
- digital inputs/outputs (120/230 V AC)	2 kV
- analog inputs/outputs	1 kV
- CS31 system bus	2 kV
- serial RS-485 interfaces (COM)	2 kV
- serial RS-232 interfaces (COM)	1 kV
- ARCNET	1 kV
- FBP	1 kV
- Ethernet	1 kV
- I/O supply, DC-out	1 kV
Immunity	
against the influence of line-conducted interferences (CW conducted)	according to EN 61000-4-6, zone B, criterion A
- test voltage	3V zone B, 10 V is also met.
High energy surges	according to EN 61000-4-5, zone B, criterion B
- power supply AC	2 kV CM* / 1 kV DM*
- power supply DC	1 kV CM* / 0.5 kV DM*
- AC I/O supply, add. AC-supply-out	2 kV CM* / 1 kV DM*
- DC I/O supply, add. DC-supply-out	0.5 kV CM* / 0.5 kV DM*
- Buses, shielded	1 kV CM*
- AC-I/O unshielded	2 kV CM* / 1 kV DM*
- I/O analog, I/O DC unshielded	1 kV CM* / 0.5 kV DM*
	* CM = Common Mode, * DM = Differential Mode
Radiation (radio disturbance)	according to EN 55011, group 1, class A

[1]) High requirement for shipping classes are achieved with additional specific measures (see specific documentation).

Mechanical data

Wiring method / terminals	
Mounting	horizontal
Degree of protection	IP 20
Housing	according to UL 94
Vibration resistance acc. to EN 61131-2	all three axes 2 Hz...15 Hz, continuous 3.5 mm 15 Hz...150 Hz, continuous 1 g (4 g in preparation)
Vibration resistance with SD Memory Card inserted	15 Hz...150 Hz, continuous 1 g
Shock test	all three axes 15 g, 11 ms, half-sinusoidal
Shipping specific requirements	
Mounting of the modules	
- DIN rail according to DIN EN 50022	35 mm, depth 7.5 mm or 15 mm
- mounting with screws	screws with a diameter of 4 mm
fastening torque	1.2 Nm

Mounting and disassembling the Terminal Bases, the CPUs and the couplers

Assembly on DIN rail

Step 1: Mount DIN rail 7.5 mm or 15 mm

Step 2: Mount Terminal Base (TB521, TB521, TB541)

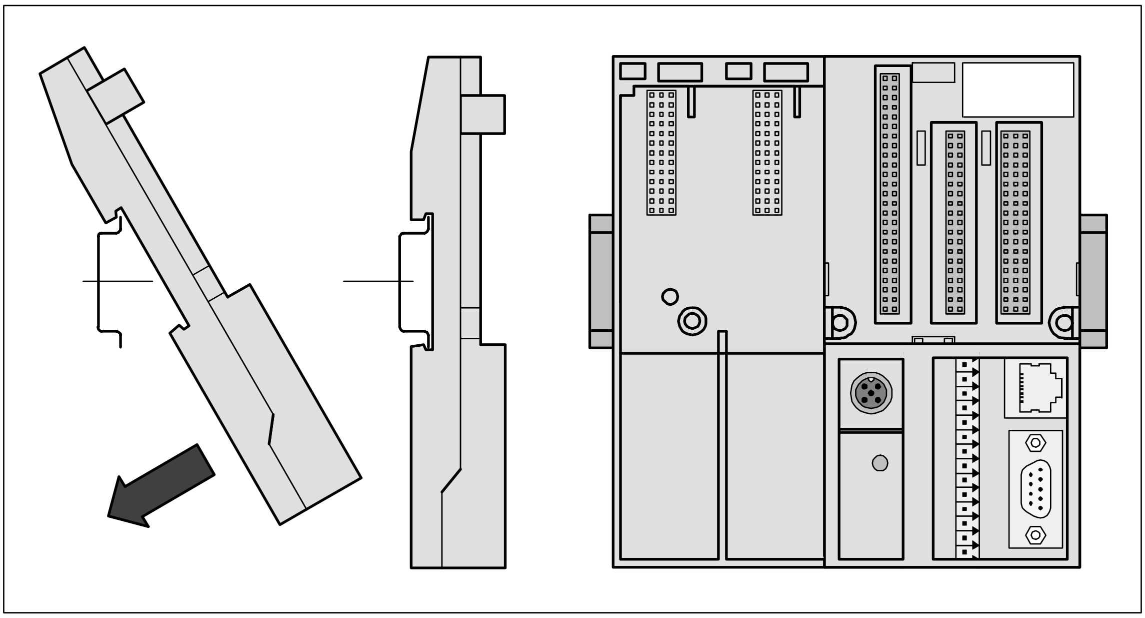


Figure: **Assembly** of the Terminal Base (TB511, TB521 or TB541)

The Terminal Base is put on the DIN rail above and then snapped-in below. The disassembly is carried out in a reversed order.

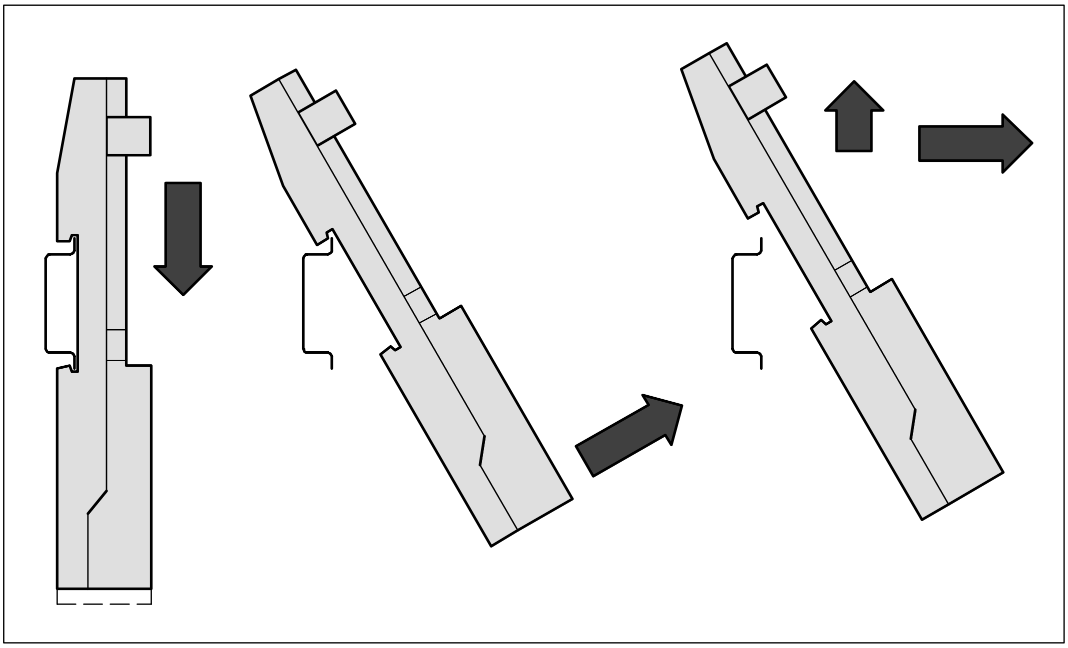


Figure: **Disassembly** of the Terminal Base (TB511, TB521 or TB541)

Step 3: Mount I/O Terminal Unit (TU515, TU516, TU531 or TU532)

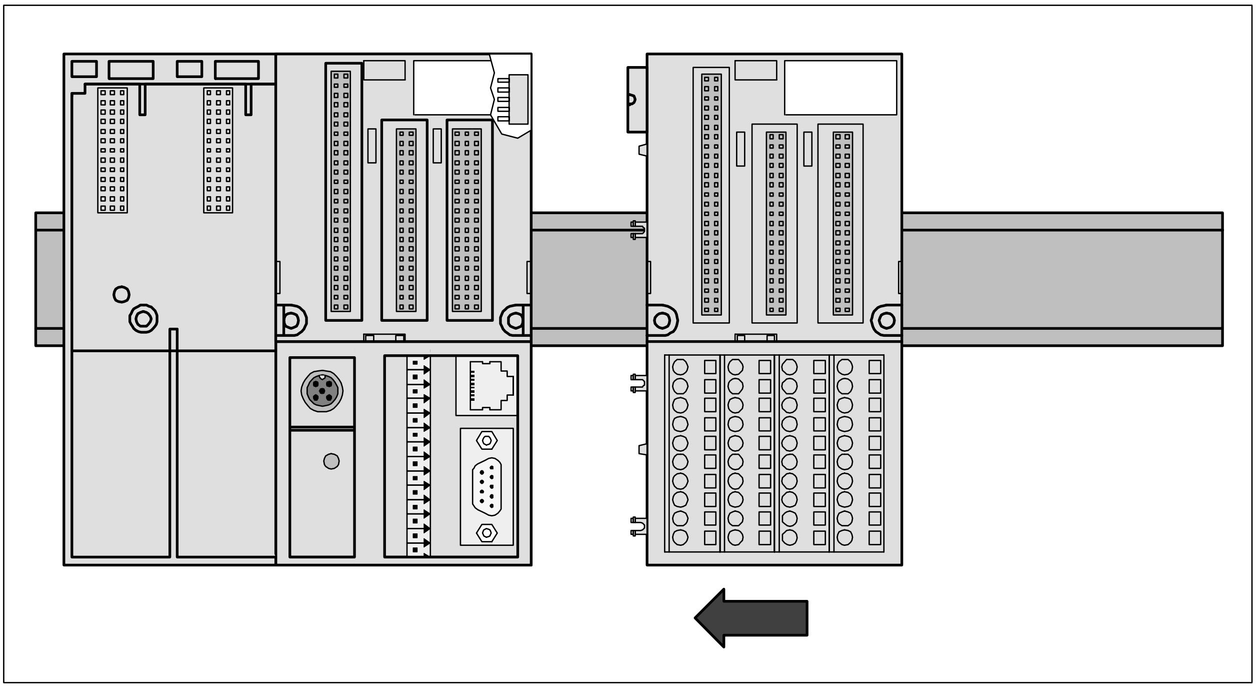


Figure: **Assembly** of the I/O Terminal Unit (TU515, TU516, TU531 or TU532)

The I/O Terminal Unit is snapped into the DIN rail in the same way as the Terminal Base. Once secured to the DIN rail, slide the I/O unit to the left until it fully locks into place creating a solid mechanical and electrical connection.

Altogether 7 I/O Terminal Units can be combined with the Terminal Base.

If both of the following conditions are fulfilled, max. 10 I/O Terminal Units can be combined with the Terminal Base:
- PS501 as of version V1.2
- CPUs as of firmware V1.2.0

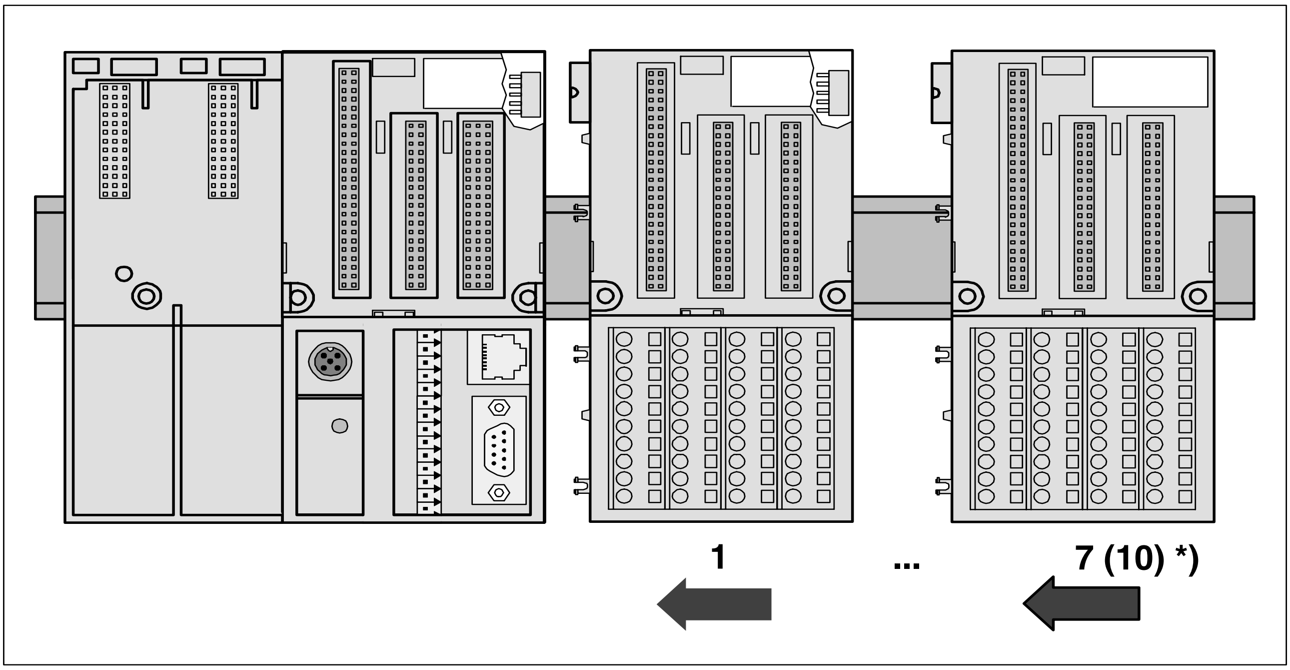


Figure: Maximum configuration (1 Terminal Base plus 7 I/O Terminal Units)

***)** If both of the following conditions are fulfilled, max. 10 I/O Terminal Units can be combined with the Terminal Base:

- PS501 as of version V1.2
- CPUs as of firmware V1.2.0

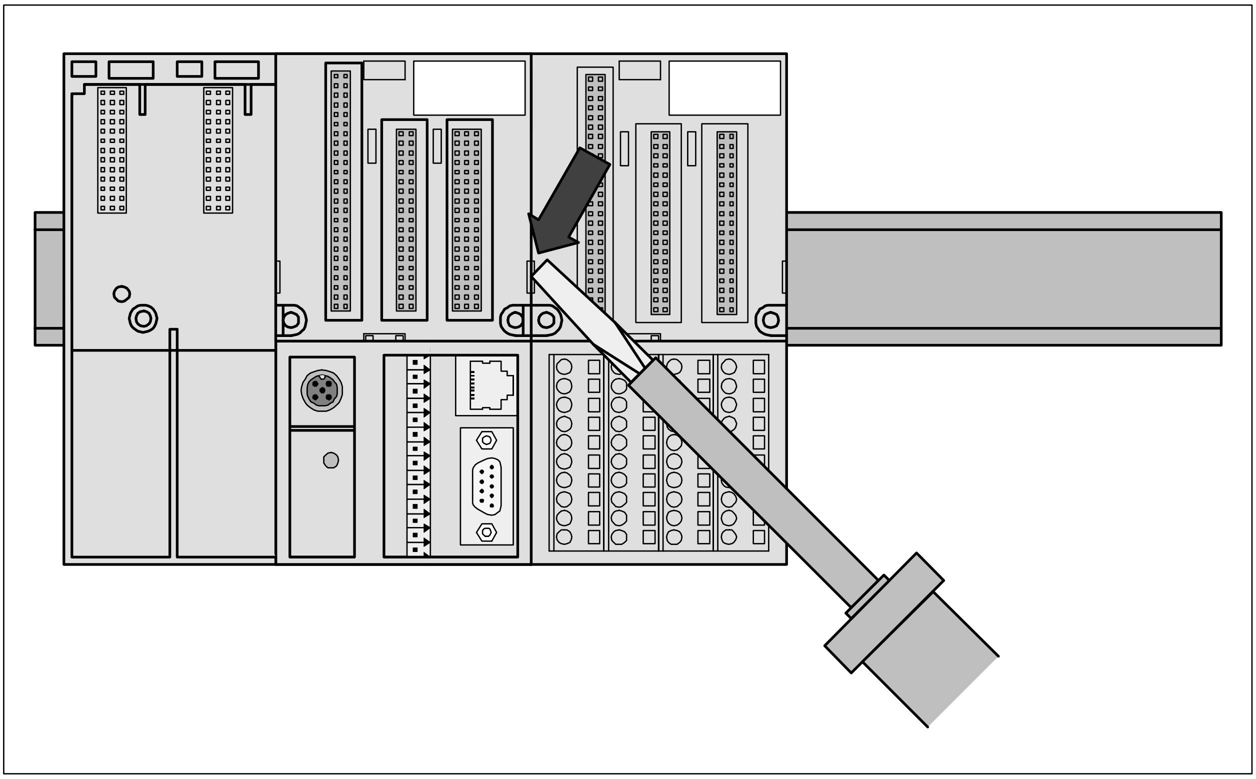


Figure: **Disassembly** of the I/O Terminal Unit (TU515, TU516, TU531 or TU532)

A screwdriver is inserted in the indicated place to separate the Terminal Units.

Step 4: Mount the CPU

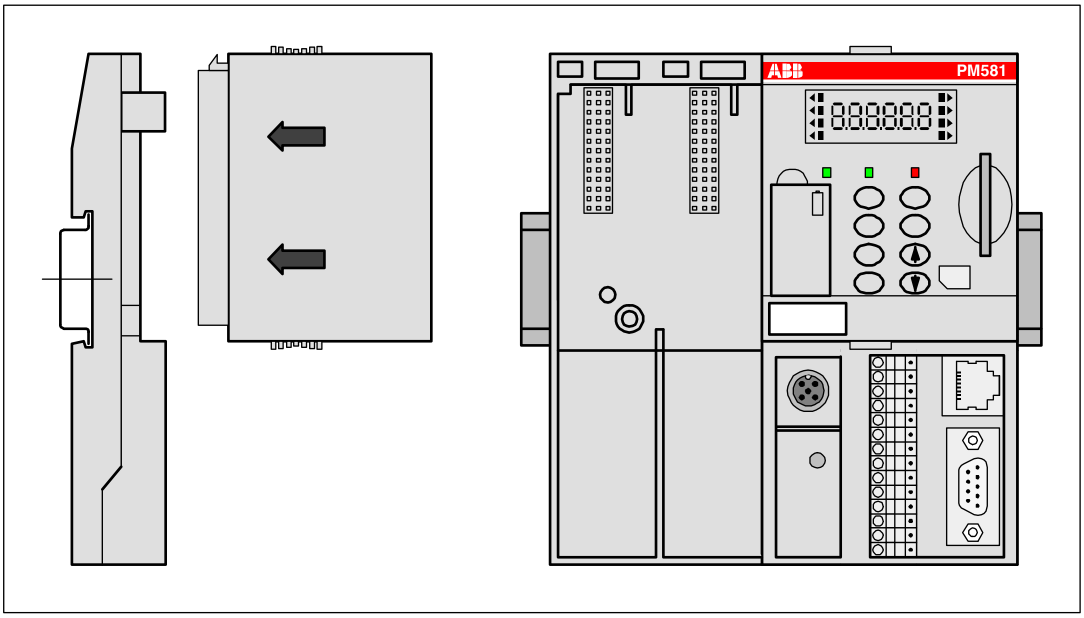


Figure: **Assembly** of the CPU

Press the CPU into the Terminal Base until it locks in place.

The disassembly is carried out in a reversed order.

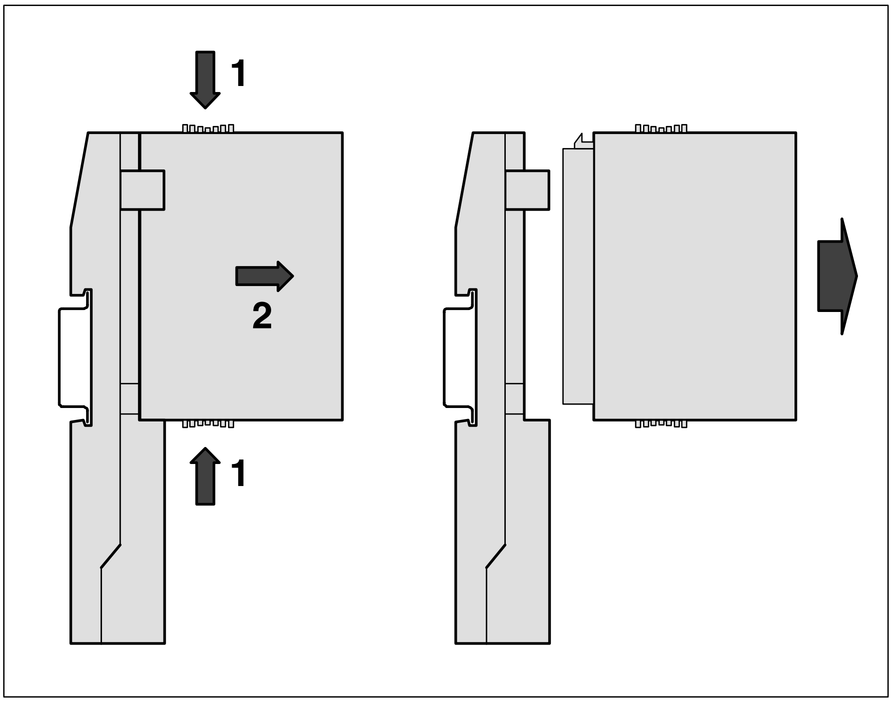


Figure: **Disassembly** of the CPU

Disassembly: Press above and below, then remove the CPU.

Step 5: Mount the coupler (communication module)

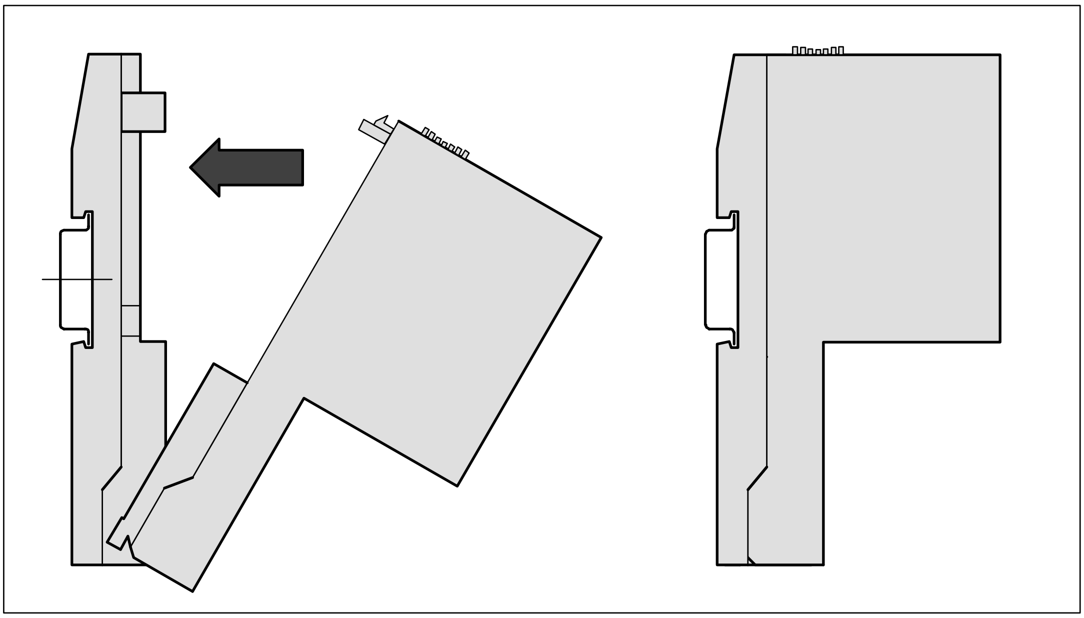


Figure: **Assembly** of a coupler

The coupler is first inserted below, then clicked-in above.

The disassembly is carried out in a reversed order.

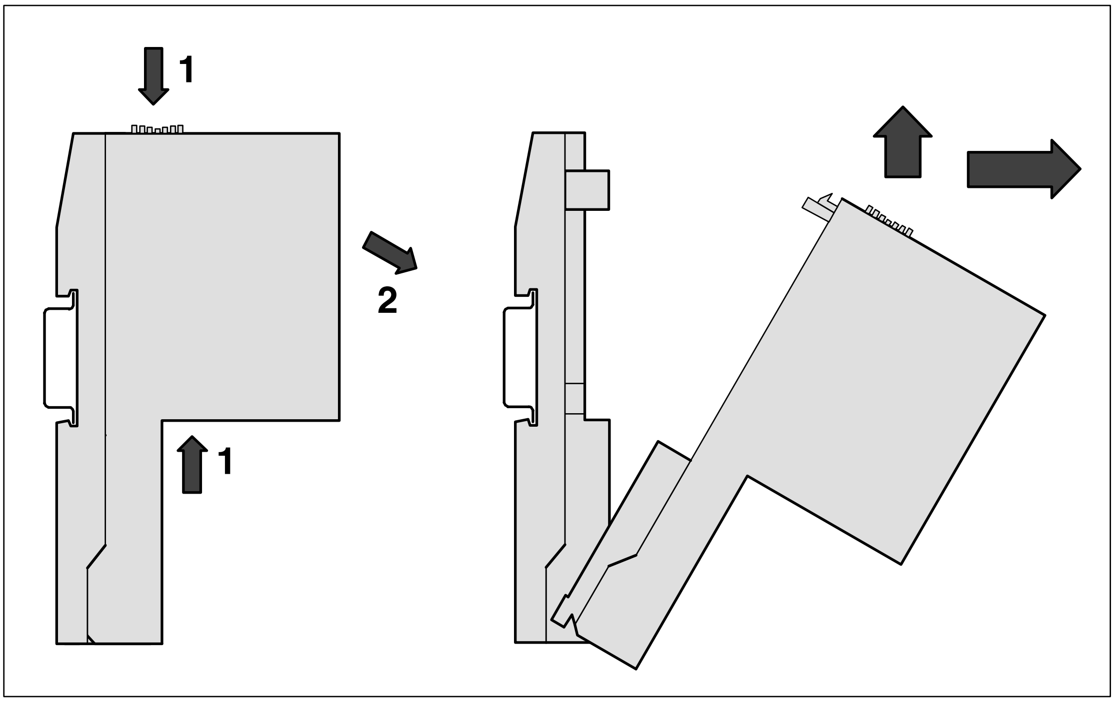
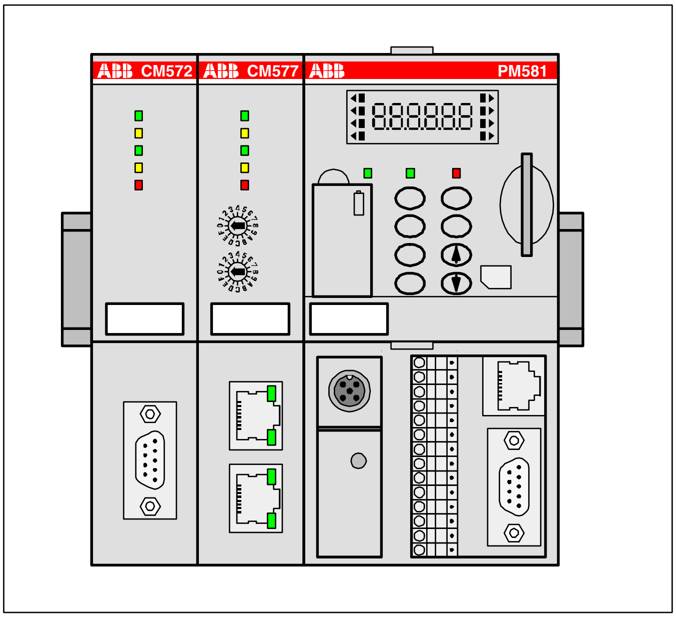


Figure: **Disassembly** of a coupler

Disassembly: Press above (and below), then swing out the coupler and remove it.

The following figure shows a Terminal Base with a CPU and two couplers inserted.



Assembly with screws

If the Terminal Base should be mounted with screws, Wall Mounting Accessories TA526 must be inserted at the rear side first. These plastic parts prevent bending of the Terminal Base while screwing on. TB511 needs one TA526, TB521 and TB541 need two TA526.

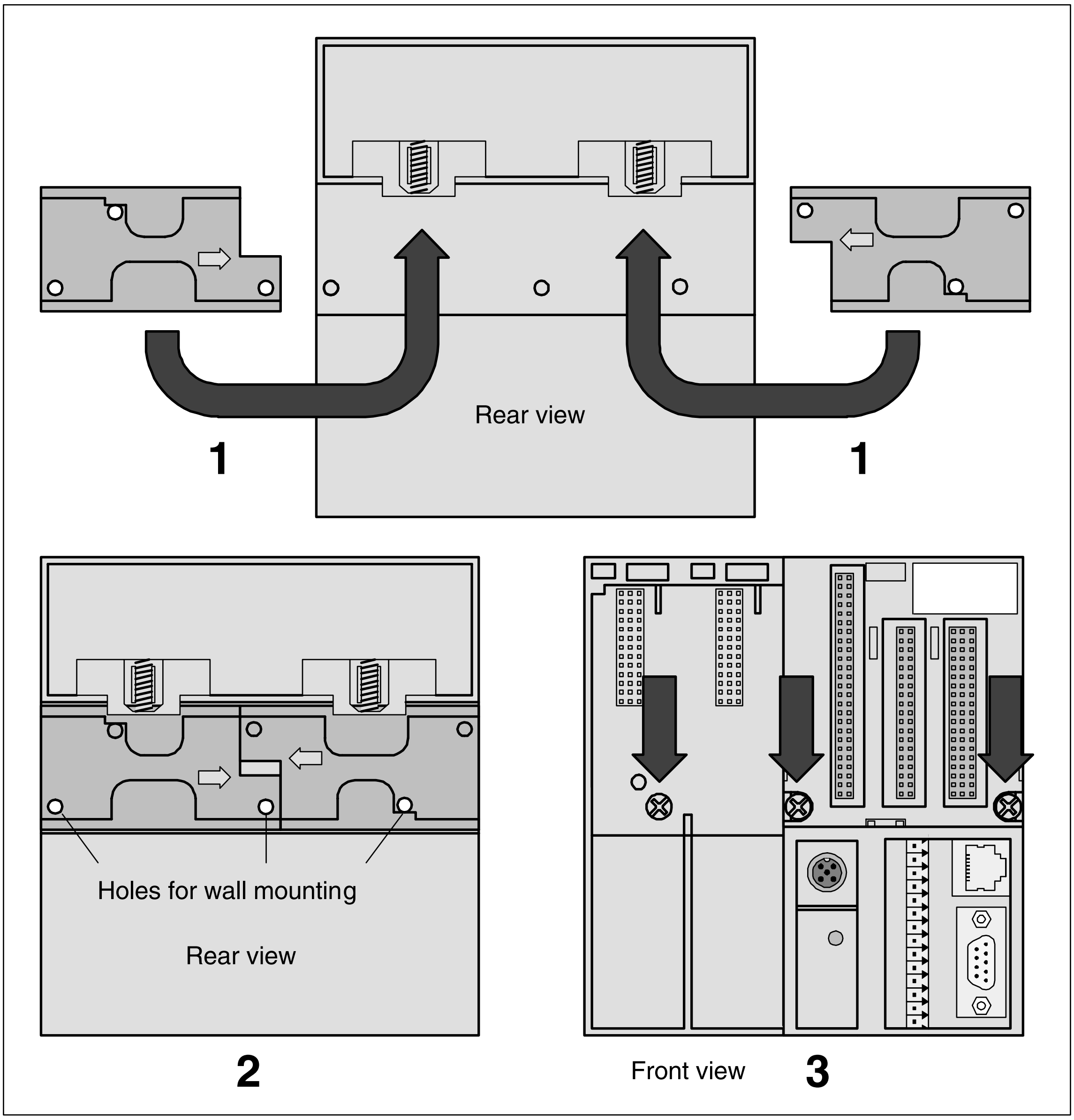


Figure: Fastening with screws of the Terminal Base TB521-ETH (as an example)

1 The two Wall Mounting Accessories TA526 are snapped on the rear side of the Terminal Unit like DIN rails. The arrows point to the middle of the Terminal Base. One TA526 is turned by 180°.

2 Two accessories for wall mounting inserted

3 Terminal Base, fastened with screws

By wall mounting, the Terminal Base is earthed through the screws. It is necessary that

- the screws have a conductive surface (e.g. steel zinc-plated or brass nickel-plated)
- the **mounting plate is earthed**
- the screws have a good electrical contact to the mounting plate

Mounting and disassembling the Terminal Units and the I/O modules

Assembly on DIN rail

Step 1: Mount DIN rail 7.5 mm or 15 mm

Step 2: Mount FBP Terminal Unit (TU505 or TU506)

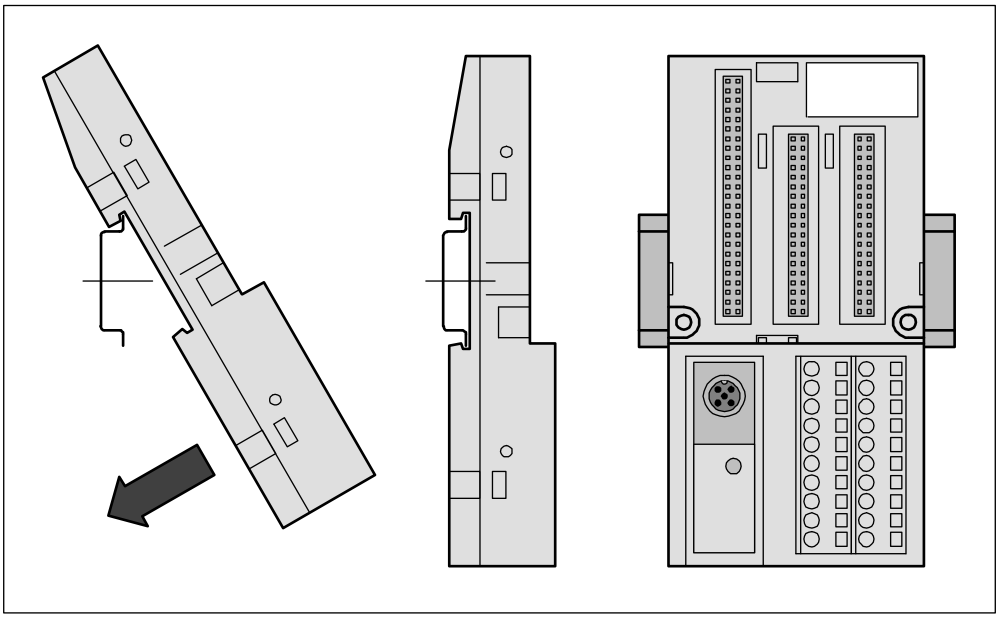


Figure: **Assembly** of the FBP Terminal Unit (TU505 or TU506)

The FBP Terminal Unit is put on the DIN rail above and then snapped-in below. The disassembly is carried out in a reversed order.

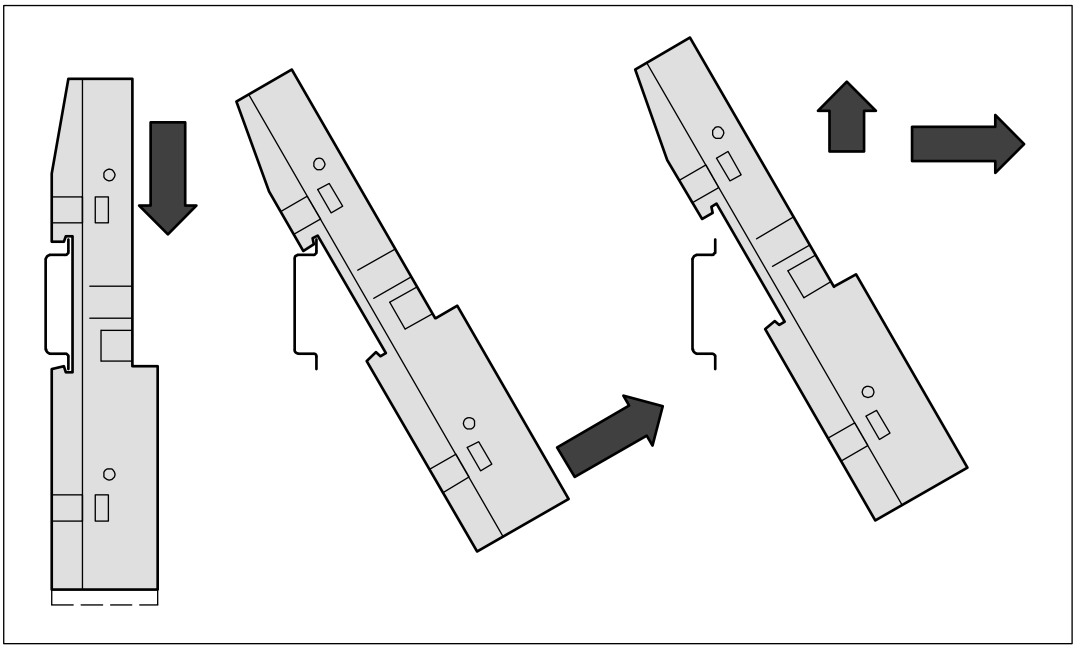


Figure: **Disassembly** of the FBP Terminal Unit (TU505 or TU506)

Step 3: Mount I/O Terminal Unit (TU515, TU516, TU531 or TU532)

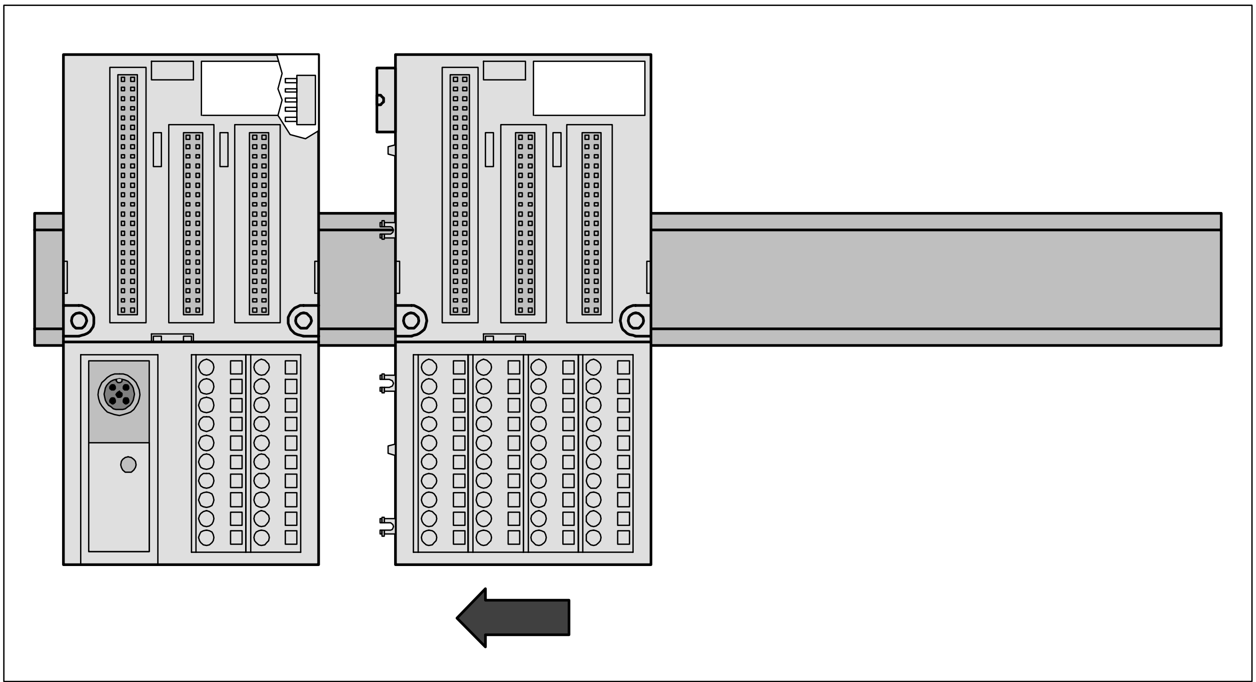


Figure: **Assembly** of the I/O Terminal Unit (TU515, TU516, TU531 or TU532)

The I/O Terminal Unit is installed on the DIN rail in the same way as the FBP Terminal Unit. Once secured on the DIN rail, slide the I/O unit to the left until it fully locks into place creating a solid mechanical and electrical connection.

Altogether 7 I/O Terminal Units can be combined with the FBP Terminal Unit.

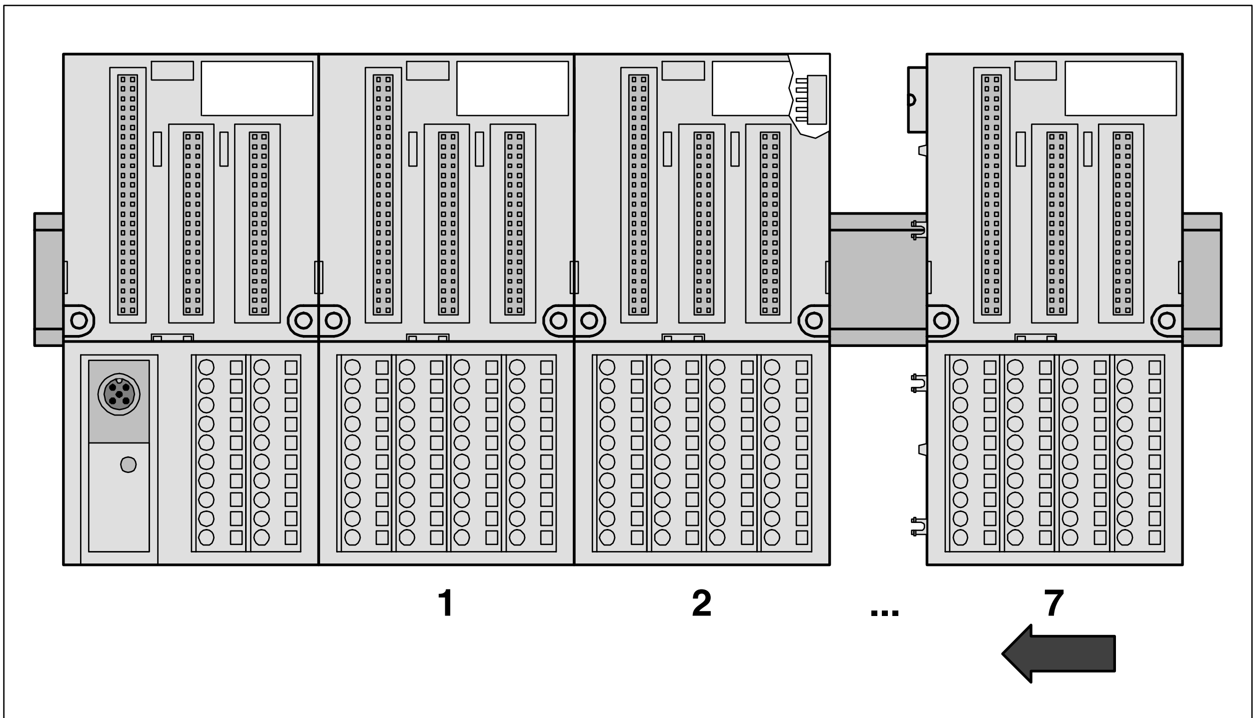


Figure: Maximum configuration (1 FBP Terminal Unit plus 7 I/O Terminal Units)

Important: Up to 7 I/O modules can be used, of which up to **4 analog I/O modules** are possible.

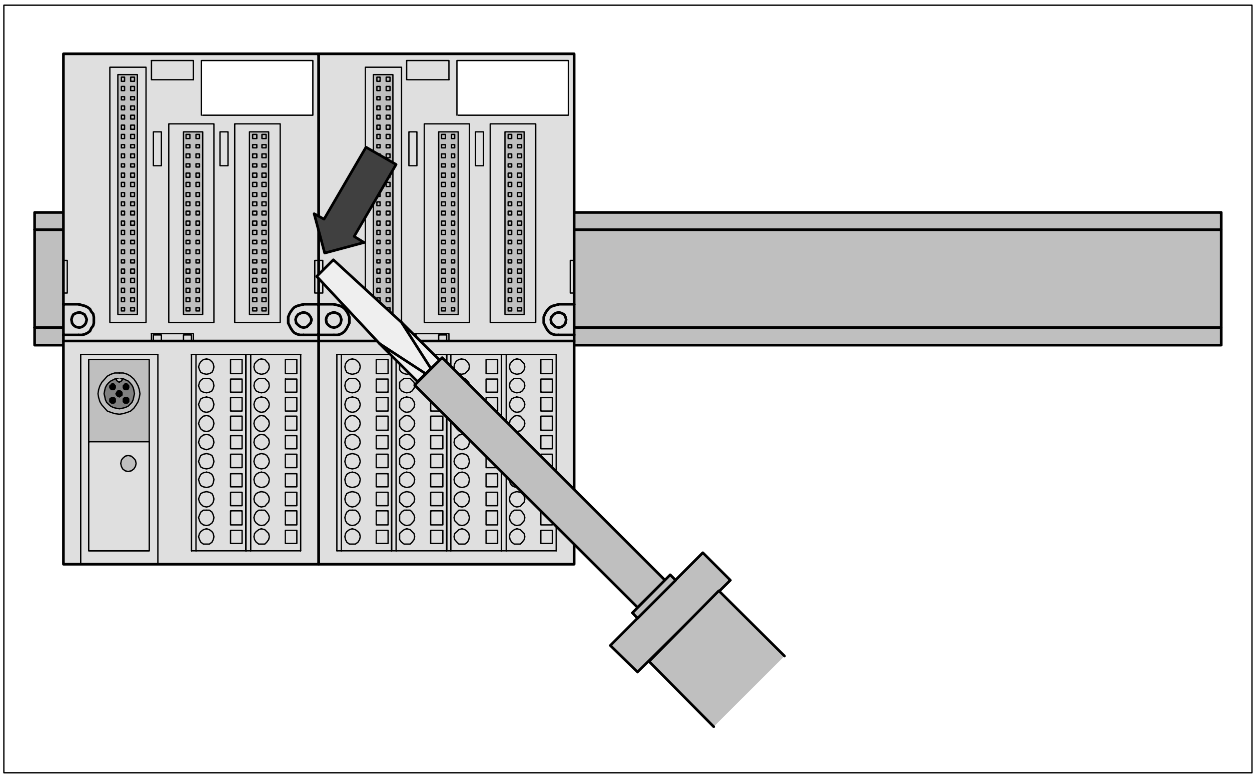


Figure: **Disassembly** of the I/O Terminal Unit (TU515, TU516, TU531 or TU532)

A screwdriver is inserted in the indicated place to separate the Terminal Units.

Step 4: Mount the modules

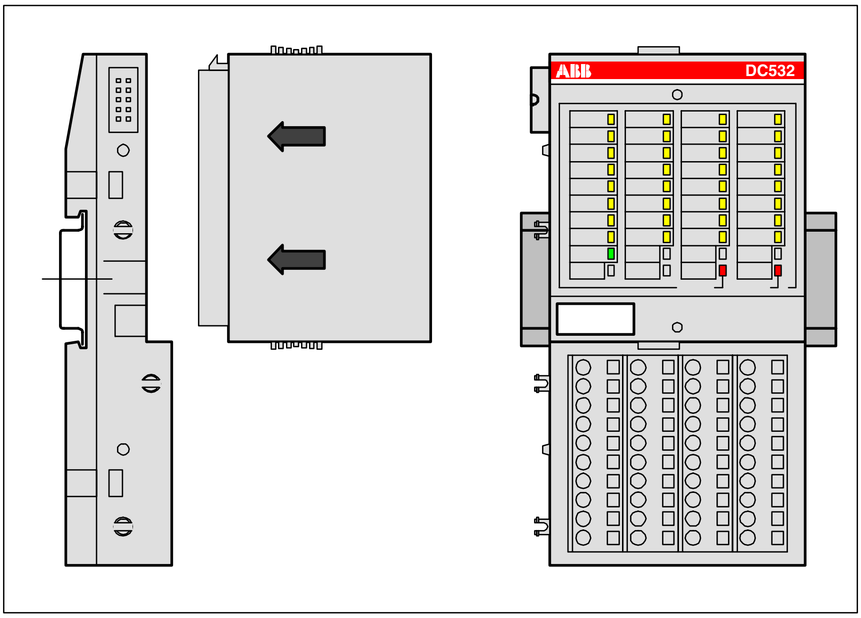


Figure: **Assembly** of the modules

Press the electronic module into the Terminal Unit until it locks in place.

The disassembly is carried out in a reversed order.

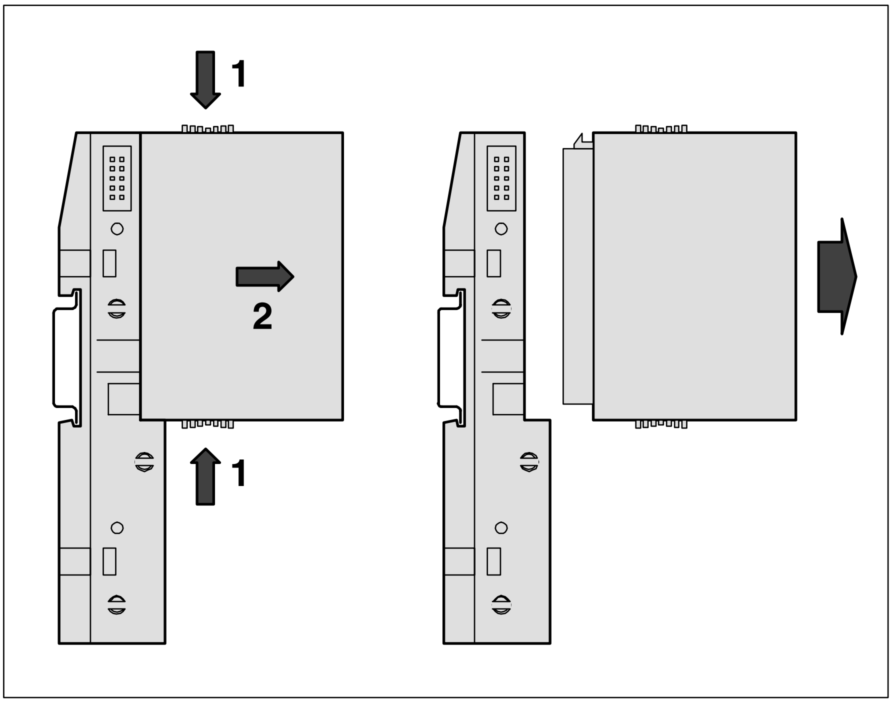


Figure: **Disassembly** of the modules

Disassembly: Press above and below, then remove the module.

Assembly with screws

If the Terminal Unit should be mounted with screws, a Wall Mounting Accessory TA526 must be inserted at the rear side first. This plastic part prevents bending of the Terminal Unit while screwing on.

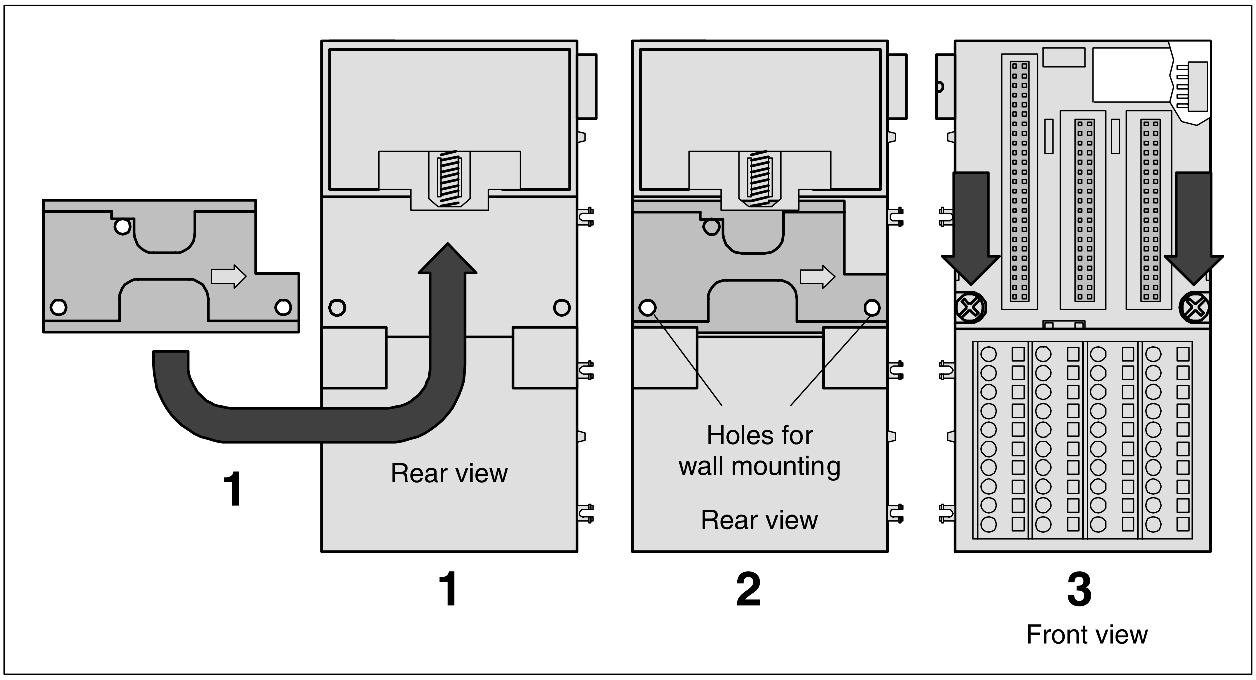


Figure: Fastening with screws of the Terminal Unit TU516 (as an example)

1 The Wall Mounting Accessory TA526 is snapped on the rear side of the Terminal Unit like a DIN rail. The arrow points to the right side.

2 Accessory for wall mounting inserted

3 Terminal Unit, fastened with screws

By wall mounting, the Terminal Unit is earthed through the screws. It is necessary that

- the screws have a conductive surface (e.g. steel zinc-plated or brass nickel-plated)
- the **mounting plate is earthed**
- the screws have a good electrical contact to the mounting plate

Mechanical dimensions AC500

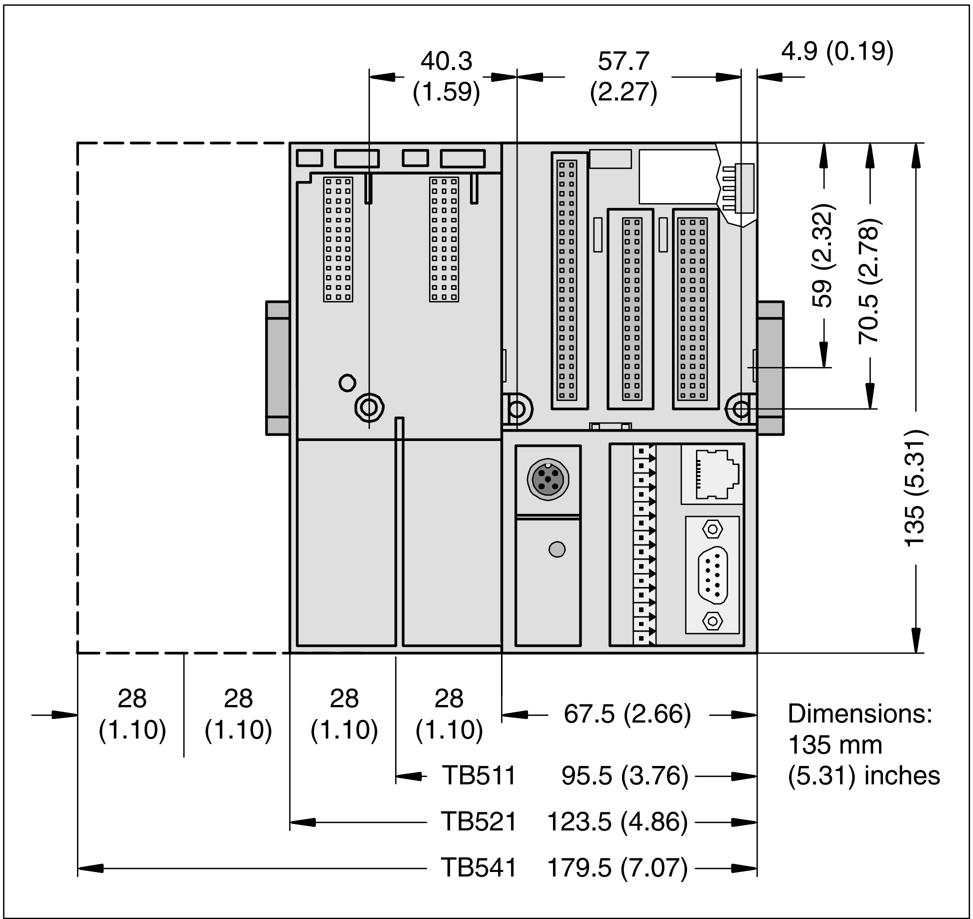


Figure: Dimensions of the AC500 CPU Terminal Bases TB511, TB521 and TB541

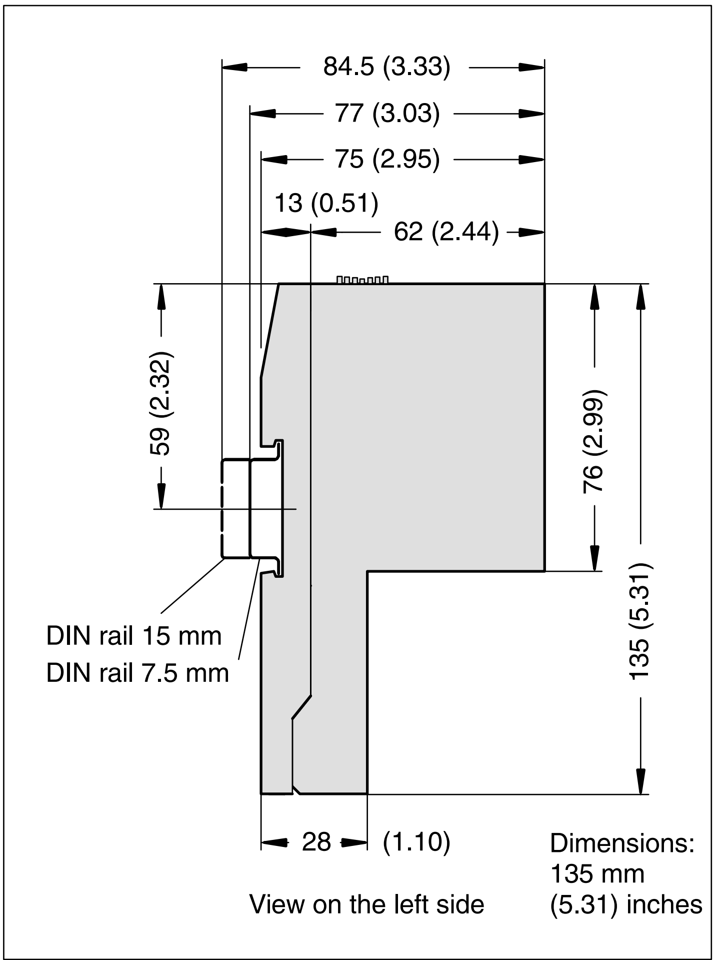


Figure: Terminal Base with coupler, view from the left side

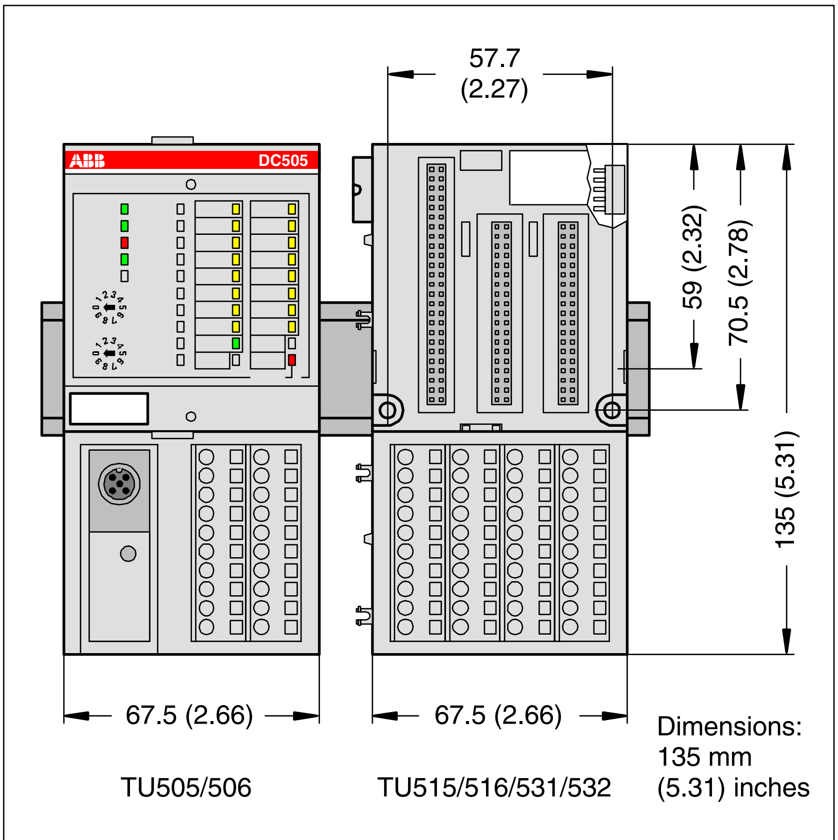


Figure: Dimensions of the S500 Terminal Units (front view)

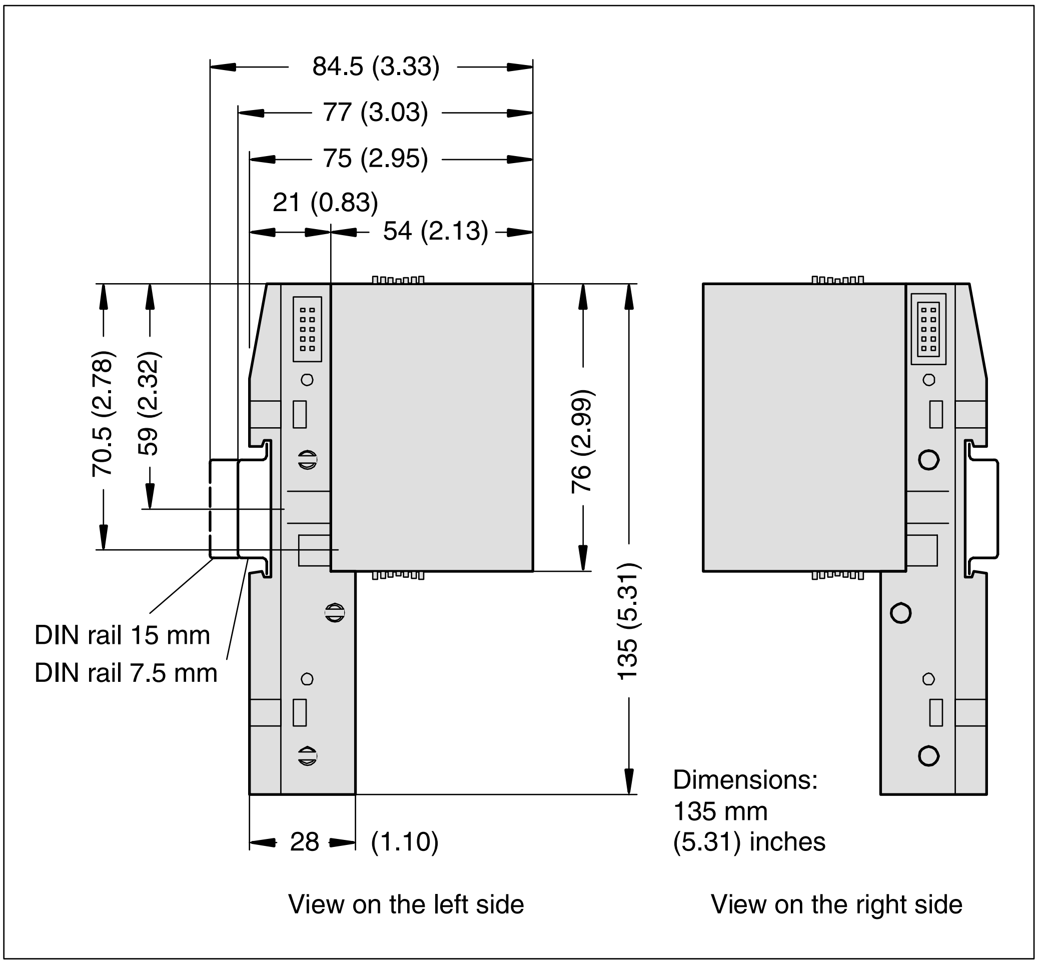


Figure: Dimensions of the S500 Terminal Units (view from the left and the right side)

Switch-gear cabinet assembly

Basically, it is recommended to mount the modules on an earthed mounting plate, independent of the mounting location.

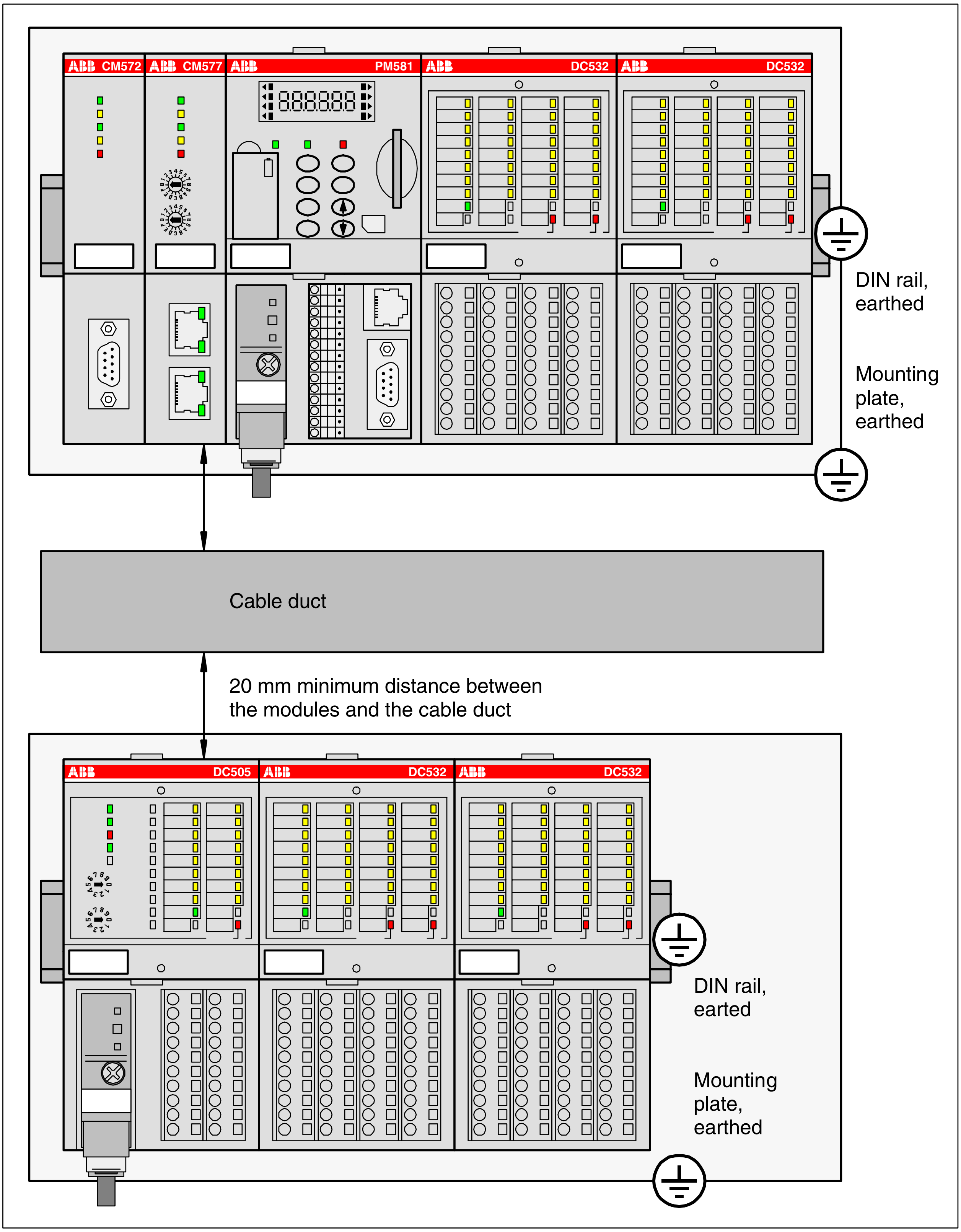


Figure: Installation of AC500/S500 modules in a switch-gear cabinet

Important: Horizontal mounting is highly recommended. Vertical mounting is possible, however, derating consideration should be made to avoid problems with poor air circulation and the potential for excessive temperatures (see also the AC500 system data, operating and ambient conditions, for reduction of ambient temperature).

Note: By vertical mounting, always place an end-stop terminal block at the bottom and on the top of the module to properly secure the modules.

By high-vibration applications, we also recommend to place end-stop terminals at the right and the left side of the device to properly secure the modules:

e.g. type BADL, P/N: 1SNA 399 903 R0200

Insertion / replacement of the Lithium battery

AC500 CPUs are supplied without a Lithium battery. It therefore must be ordered separately. The TA521 Lithium Battery is used to save RAM contents of AC500 CPUs and back-up the real-time clock. Although the CPUs can work without a battery, its use is still recommended in order to avoid process data being lost.

The CPU monitors the battery status. A low battery error is output before the battery condition becomes critical (about 2 weeks before). After the error message appears, the battery should be replaced as soon as possible.

Attention: The TA521 Lithium Battery is the only one, which can be used with AC500 CPUs.

The following procedures describe the insertion / replacement of the Lithium battery.

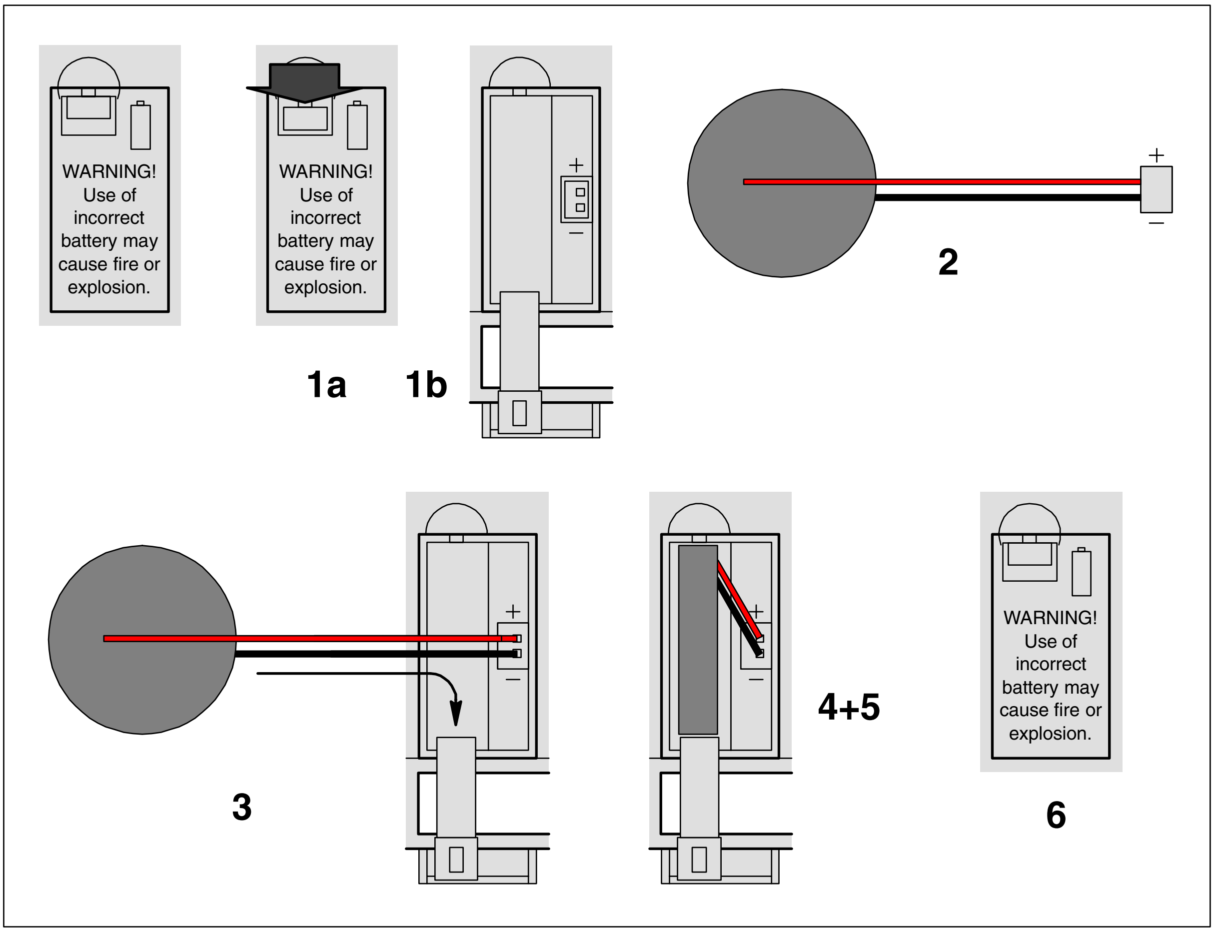


Figure: Insertion / replacement of the Lithium battery

Insertion of the battery:

1. Open the battery compartment by inserting a fingernail in the small locking mechanism, press it down and slip down the door. The door is attached to the front face of the CPU and cannot be removed.
2. Remove the TA521 battery from its package and hold it by the small cable.
3. Insert the battery connector into the small connector port of the compartment. The connector is keyed to find the correct polarity (red = plus-pole = above).
4. Insert first the cable and then the battery into the compartment, push it until it reaches the bottom of the compartment.
5. Arrange the cable in order not to inhibit the door to close.
6. Pull-up the door and press until the locking mechanism snaps.

Note: In order to prevent data losses or problems, the battery should be replaced after 3 years of utilisation or **at least** as soon as possible after receiving the "Low battery warning" indication.
Do not use a battery older than 3 years for replacement, do not keep batteries too long in stock.

Replacement of the battery:

Attention: In order to avoid any data losses (if needed), the battery replacement should be done with the system under power. Without battery and power supply there is no data buffering possible.

1. Open the battery compartment by inserting a fingernail in the small locking mechanism, press it down and slip down the door. The door is attached to the front face of the CPU and cannot be removed.
2. Remove the old TA521 battery from the battery compartment by pulling it by the small cable. Remove then the small connector from the socket, do this best by lifting it out with a screwdriver (see photo).

3. Follow the previous instructions to insert a new battery.

Attention: Lithium batteries must not be re-charged, not be disassembled and not be disposed of in fire. They must be stored in a dry place. Exhausted batteries must be recycled to respect the environment.

The technical data sheet for the Lithium battery can be found in the chapter "Accessories / Lithium Battery TA521".

Insertion of the SD Memory Card

AC500 CPUs are supplied without an SD Memory Card. It therefore must be ordered separately. The SD Memory Card is used to back-up user data and store user programs as well as to update the internal CPU firmware. AC500 CPUs can be operated with and without SD Memory Cards.

The CPU uses a standard file system. This allows standard card readers to read the MC502 SD Memory Cards.

⚠ **Attention:** The use of memory cards other than the MC502 SD Memory Card is prohibited. ABB is not responsible nor liable for consequences resulting from the use of unapproved memory cards.

⚠ **Attention:** In operation, the plugged-in SD Memory Card withstands vibrations up to 1 g. Without using an SD Memory Card, the CPU itself withstands vibrations up to 4 g.

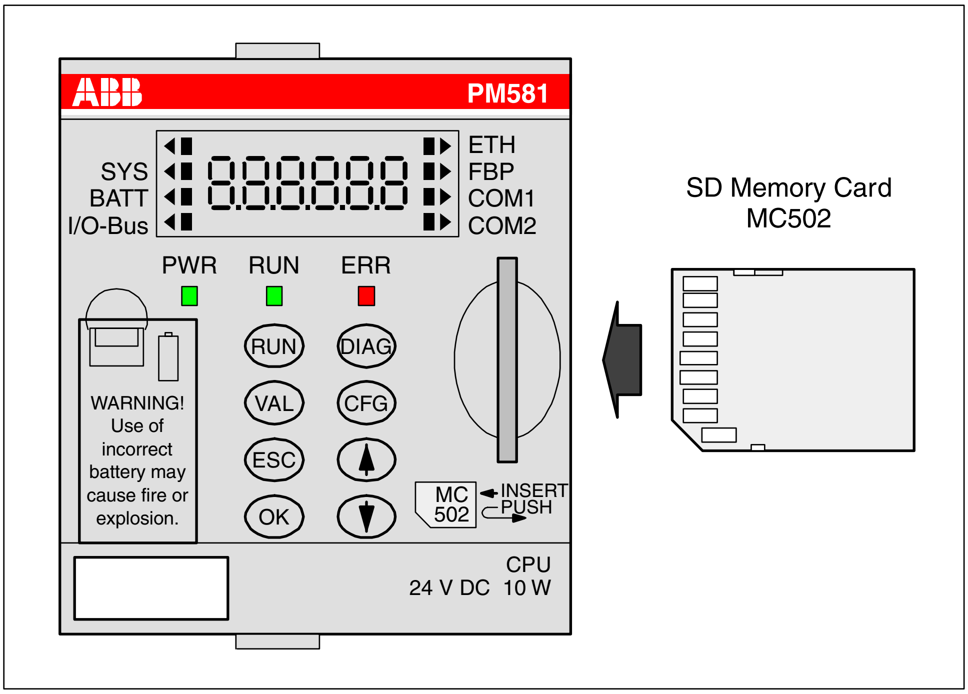


Figure: Insertion of the SD Memory Card

To insert the SD Memory Card, follow the procedure shown below.

1. Remove the SD Memory Card from its package.
2. Insert the memory card into the opening of the front face of the CPU with the memory aligned as shown above (contacts are visible on the left side, bevelled edge below).
3. Push on the card until it moves forward, then release your pressure, the SD card comes slightly backward and it locks into the card slot.

Removing the SD Memory Card

To remove the card, first push on the card until it moves forward (that unlocks the card), then release your pressure, the card will go forward out of the slot and can be easily removed.

The technical data sheet for the SD Memory Card can be found in the chapter "Accessories / SD Memory Card MC502".

Connection system

Terminals for power supply and the COM1 interface (CPU Terminal Base AC500)

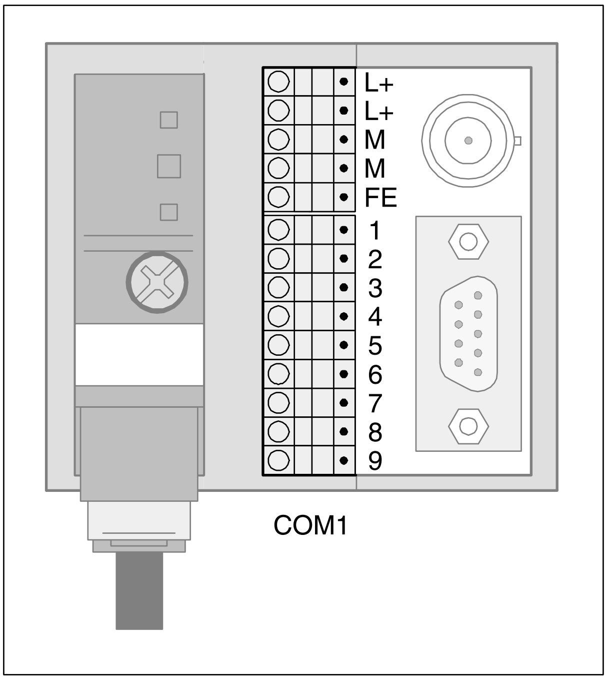


Figure: Terminals for power supply and the COM1 interface (CPU Terminal Base AC500)

Terminal type: **Screw-type terminal**

Number of cores per terminal	Conductor type	Cross section
1	solid	0.08 mm² to 1.5 mm²
1	flexible	0.08 mm² to 1.5 mm²
1 with wire end ferrule (without plastic sleeve)	flexible	0.25 mm² to 1.5 mm²
1 with wire end ferrule (with plastic sleeve)	flexible	0.25 mm² to 0.5 mm²
1 (TWIN wire end ferrule)	flexible	0.5 mm²
2 (with the same cross section)	solid	0.08 mm² to 0.5 mm²
2 (with the same cross section)	flexible	0.08 mm² to 0.75 mm²
2 (with the same cross section) in wire end ferrule, without plastic sleeve	flexible	0.25 mm² to 0.34 mm²

Terminal type: **Spring terminal**

Number of cores per terminal	Conductor type	Cross section
1	solid	0.08 mm² to 1.5 mm²
1	flexible	0.08 mm² to 1.5 mm²
1 with wire end ferrule (without plastic sleeve)	flexible	0.25 mm² to 1.5 mm²
1 with wire end ferrule (with plastic sleeve)	flexible	0.25 mm² to 0.5 mm²
1 (TWIN wire end ferrule)	flexible	0.5 mm²
2 (with the same cross section)	solid	0.08 mm² to 0.5 mm²
2 (with the same cross section)	flexible	0.08 mm² to 0.75 mm²
2 (with the same cross section) in wire end ferrule, without plastic sleeve	flexible	0.25 mm² to 0.34 mm²

Terminals at the Terminal Units (I/O, FBP)

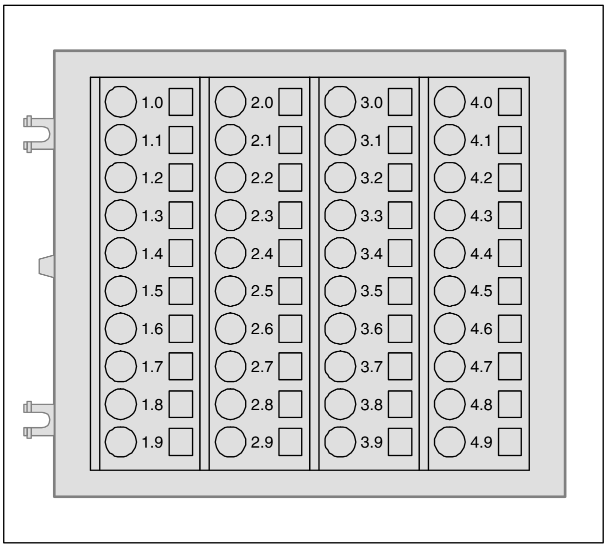


Figure: Terminals at the Terminal Units (I/O, FBP)

Terminal type: **Screw-type terminal**

Number of cores per terminal	**Conductor type**	**Cross section**
1	solid	0.08 mm² to 2.5 mm²
1	flexible	0.08 mm² to 2.5 mm²
1 with wire end ferrule	flexible	0.25 mm² to 1.5 mm²
TWIN wire end ferrule	flexible	2 x 0.25 mm² or 2 x 0,5 mm² or 2 x 0,75 mm², with square cross-section of the wire-end ferrule also 2 x 1.0 mm²
2	solid	not intended
2	flexible	not intended

Terminal type: **Spring terminal**

Number of cores per terminal	**Conductor type**	**Cross section**
1	solid	0.08 mm² to 2.5 mm²
1	flexible	0.08 mm² to 2.5 mm²
1 with wire end ferrule	flexible	0.25 mm² to 1.5 mm²
TWIN wire end ferrule	flexible	2 x 0.25 mm² or 2 x 0,5 mm² or 2 x 0,75 mm², with square cross-section of the wire-end ferrule also 2 x 1.0 mm²
2	solid	not intended
2	flexible	not intended

Connection of wires at the spring terminals

Connect the wire to the spring terminal

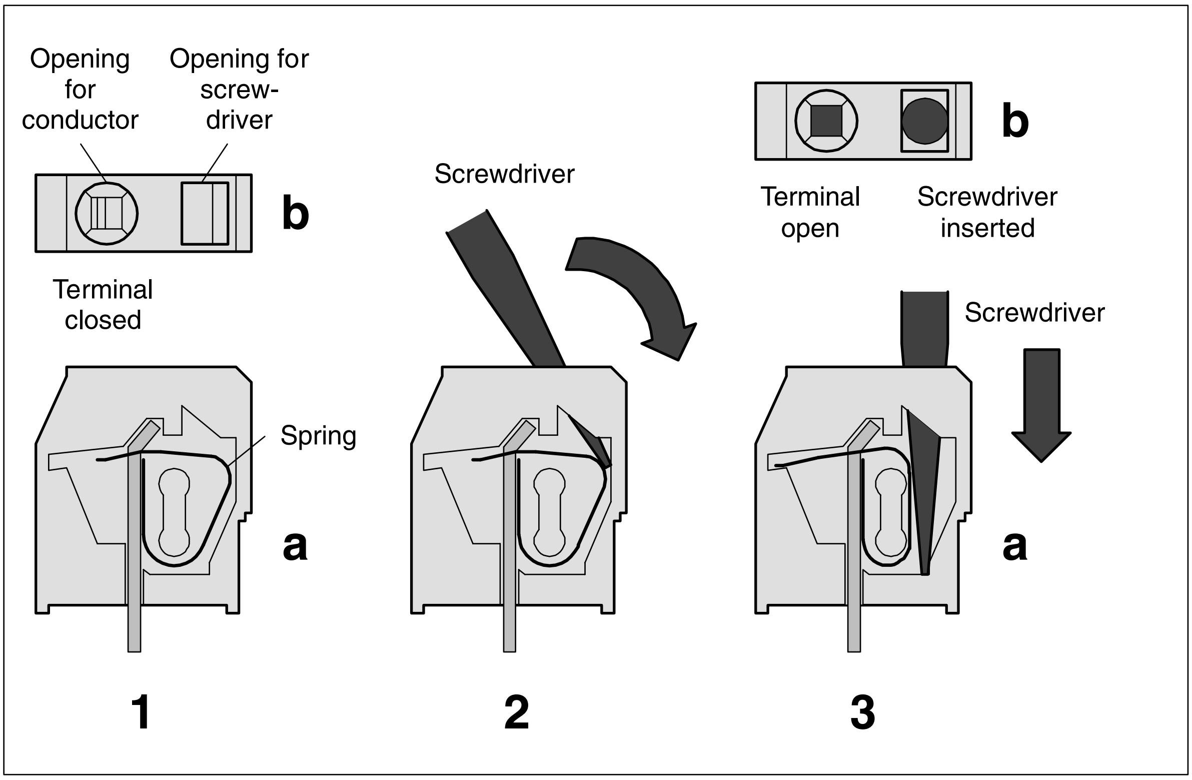


Figure: Connect the wire to the spring terminal (steps 1 to 3)

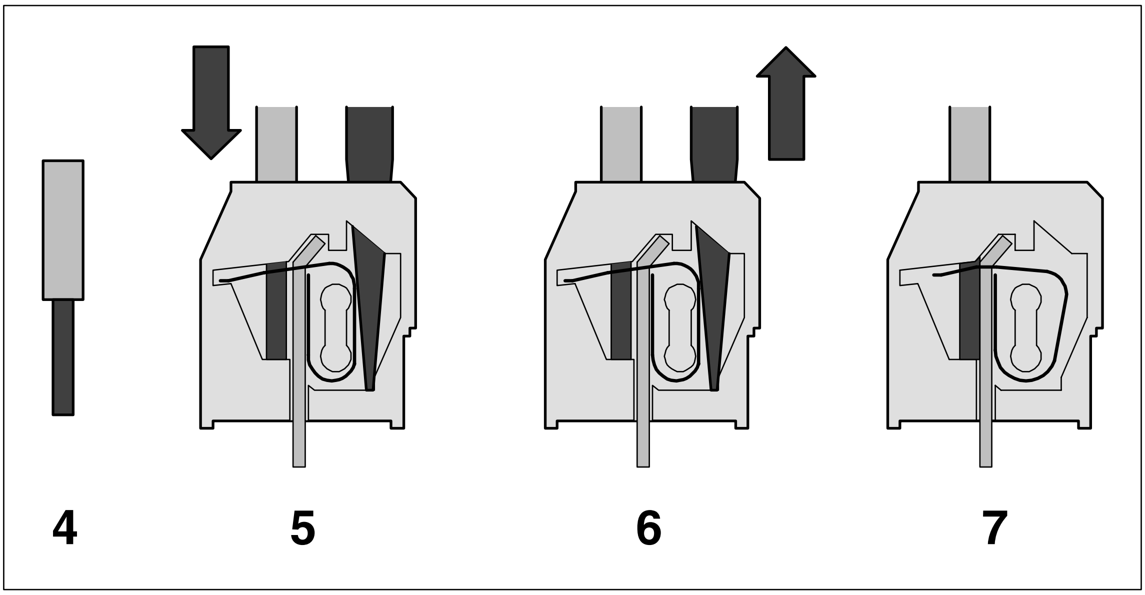


Figure: Connect the wire to the spring terminal (steps 4 to 7)

1 a	Side view (open terminal drawn for illustration)
1 b	The top view shows the openings for wire and screwdriver
2	Insert screwdriver (2.5 x 0.4 to 3.5 x 0.5 mm) at an angle, screwdriver must be at least 15 mm free of insulation at the tip
3 a	While erecting the screwdriver, insert it until the stop (requires a little strength)
3 b	Screwdriver inserted, terminal open
4	Strip the wire for 7 mm (and put on wire end ferrule)
5	Insert wire into the open terminal
6	Remove the screwdriver
7	Done

Disconnect wire from the spring terminal

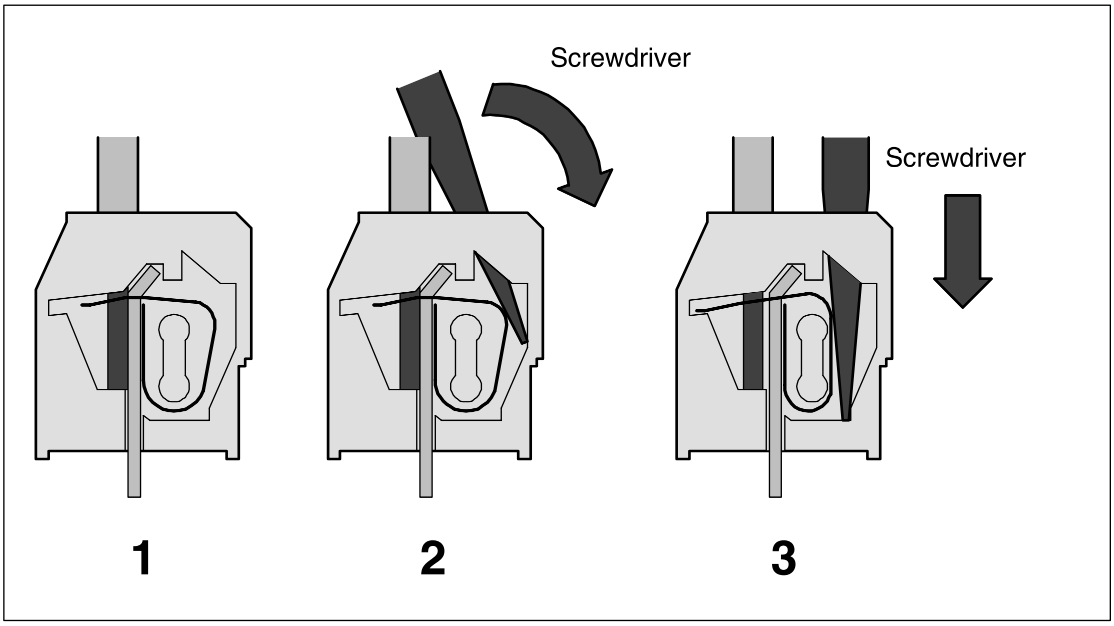


Figure: Disconnect wire from the spring terminal (steps 1 to 3)

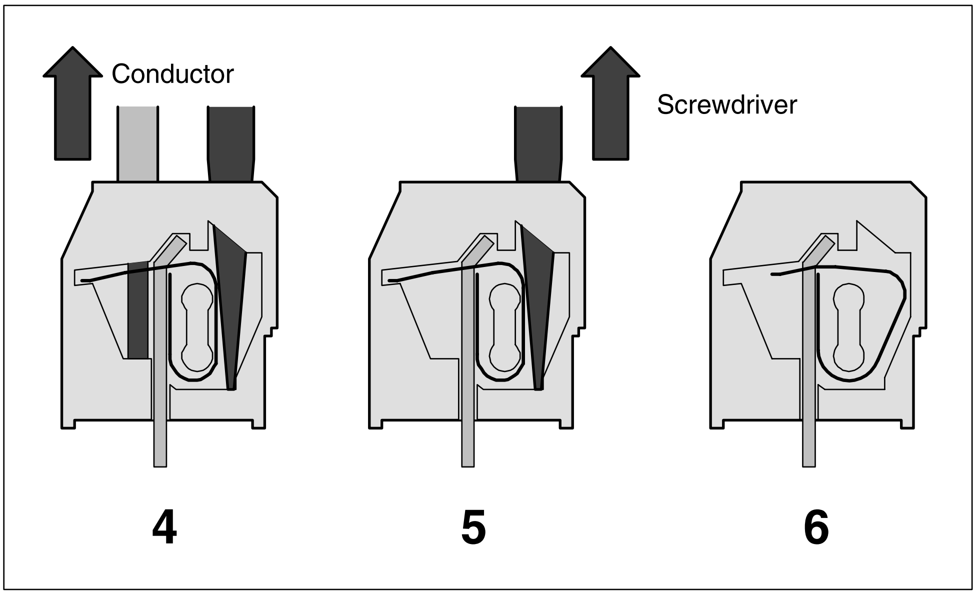


Figure: Disconnect wire from the spring terminal (steps 4 to 6)

1	Terminal with wire connected
2	Insert screwdriver (2.5 x 0.4 to 3.5 x 0.5 mm) at an angle, screwdriver must be at least 15 mm free of insulation at the tip
3	While erecting the screwdriver, insert it until the stop (requires a little strength), terminal is now open
4	Remove wire from the open terminal
5	Remove the screwdriver
6	Done

Mechanical encoding

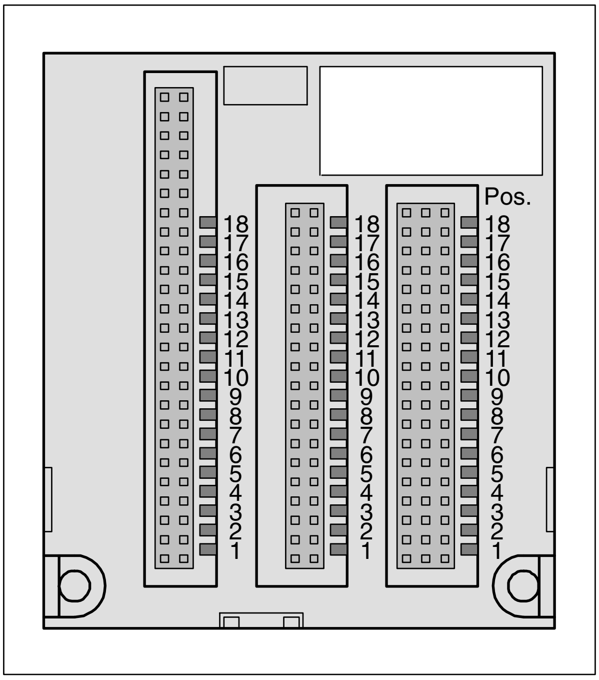


Figure: Possible positions for mechanical encoding (1 to 18)

Terminal Units (S500) and CPU Terminal Bases (AC500) have an mechanical coding which prevents that modules are inserted to wrong places. Otherwise

- dangerous parasitic voltages could occur or
- modules could be destroyed.

The coding either makes it impossible to insert the module to the wrong place or blocks its electrical function (outputs are not activated).

The following figure shows the possible codings.

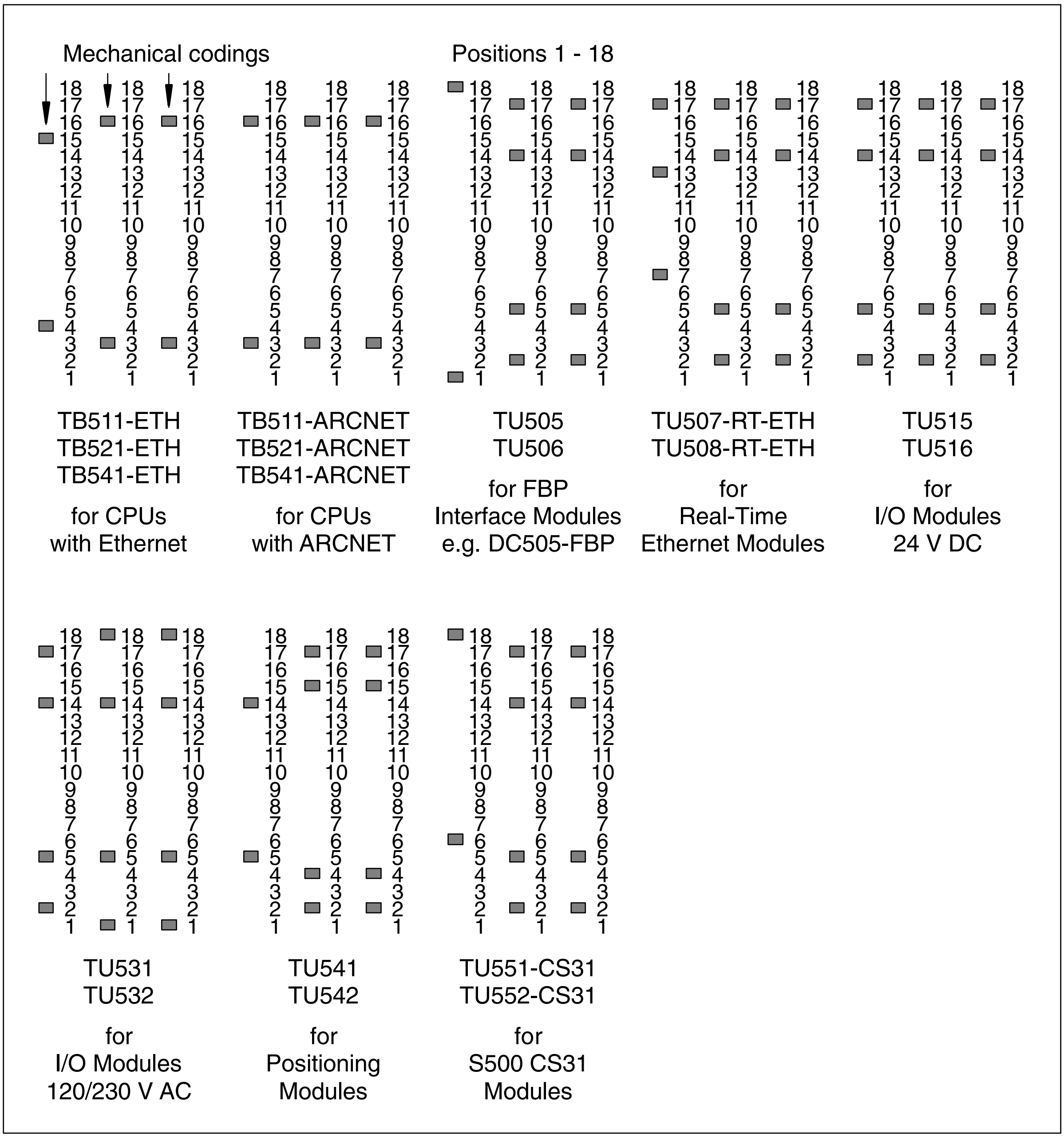


Figure: Mechanical coding

General wiring recommendations

Bad wiring on power supply terminals

Attention: The product should be installed by trained people who have the knowledge of wiring electronic devices. In case of bad wiring, although the modules are protected against various errors (reverse polarity, short circuit, etc.), some problems could always happen:

- On the CPU Terminal Base, the terminals L+ and M are doubled. If the power supply is badly connected, a short circuit could happen and lead to a destruction of the power supply or its fuse. If no suitable fuse exists, the Terminal Base itself could be destroyed.

- The CPUs (Terminal Bases) and all electronic modules (and Terminal Units) are protected against reverse polarity.

- All necessary measures should be carried out to avoid damages to modules and wiring. Notice the wiring plans and connection examples.

Bad wiring on I/O terminals

Attention: All I/O channels (digital and analog) are protected against reverse polarity, reverse supply, short circuit and continuous overvoltage up to 30 V DC.

Behaviour of the system in case of power supply interruptions and power recovering

AC500 system supply (terminals L+, M)

As soon as the CPU power supply is higher than 19.2 V DC, the power supply detection is activated and the CPU is started. When during operation the power supply is going down to lower than 19.2 V DC for more than 10 ms, the CPU is switched to safety mode (see System Technology of the CPUs).

A warm restart of the CPU only occurs by switching the power supply off and on again (see also the description of the function modes of the CPU in the "AC500 System Technology" chapters.

S500 system supply (is provided through the FBP plug)

AC500 or S500 process power supply (terminals UP and ZP)

I/O-Bus

General

The synchronized serial I/O-Bus connects the I/O expansion modules with the AC500 CPU or with the S500 FBP Interface Module.

The I/O-Bus provides the following signals:

- Supply voltage of 3.3 V DC for feeding the electronic interface components
- 3 data lines for the synchronized serial data exchange
- several control signals

With its fast data transmission, the I/O-Bus obtains very low reaction times. Up to 7 I/O expansion modules can be connected to a AC500 CPU or an FBP Interface Module.

If both of the following conditions are fulfilled, **max. 10 I/O expansion modules can be connected to the I/O-Bus of the CPU:**
- PS501 as of version V1.2
- CPUs as of firmware V1.2.0

General data:

Supply voltage, signal level	3.3 V DC ± 10 %
Max. supply current	30 mA per expansion module
Max. number of I/O expansion modules (slaves on the I/O-Bus)	7 with the S500 FBP Interface Module with max. 4 analog modules (with up to 16 channels each), 7 with the AC500 CPU (digital or analog), 10 with the AC500 CPU (PS501 as of V1.2 with CPUs with firmware as of V1.2.0)
Type of the data interface	synchronized serial data exchange
Bus data transmission speed	1.8 Mb/s
Minimum bus cycle time	500 µs [1])
Electrical isolation	no isolation between the modules, but isolation against the process supply voltage and the I/O terminals
Protection against electrostatic discharge (ESD)	with an internal varistor
Max. bus length	1 m

[1]) Minimum bus cycle time: This value is valid for all module combinations (from 1 to 7 expansion modules)

Wiring (bus connection)

Bus connection	left-side and right-side connection from module to module via a 10-pole HE plug (male at the left side, female at the right side)
Mechanical connection	established by the Terminal Units
Max. bus length	1 m

Number of user data, bus cycle time and data security

See details before

Replacement of modules on the I/O bus

The I/O-Bus is not designed for plugging and unplugging modules while in operation. If a module is plugged or replaced while the bus is in operation, the following consequences are possible

- reset of the station or of the CPU
- system lockup

> ⚠ **Caution:** Removal of energized modules is not permitted. All power sources (supply and process voltages) must be switched off while working on any AC500 system.

Serial interfaces of the CPU Terminal Bases

Interface standards

The serial interfaces COM1 and COM2 are designed according to the standards EIA RS-232 and EIA RS-485. Both interfaces can be operated either in RS-232 or in RS-485 mode.

Technical data

Standard of the serial interfaces	EIA RS-232 or EIA RS-485
Interface connectors	COM1: 9-pole removable terminal block COM2: 9-pole Sub-D connector (female)
Electrical isolation	yes, against the CPU, 500 V DC
Serial interface parameters	configurable by the software
Operating modes	programming or data exchange
Supported protocols	Modbus or serial data exchange using special software function blocks

COM1 can be configured and terminated for either RS-232 or RS-485 (depending on used terminals). Please terminate according to the pin-out information for the COM1 port below and follow the appropriate rules and practices for RS-232 and RS-485 communication.

Serial interface COM1 of the CPU Terminal Bases

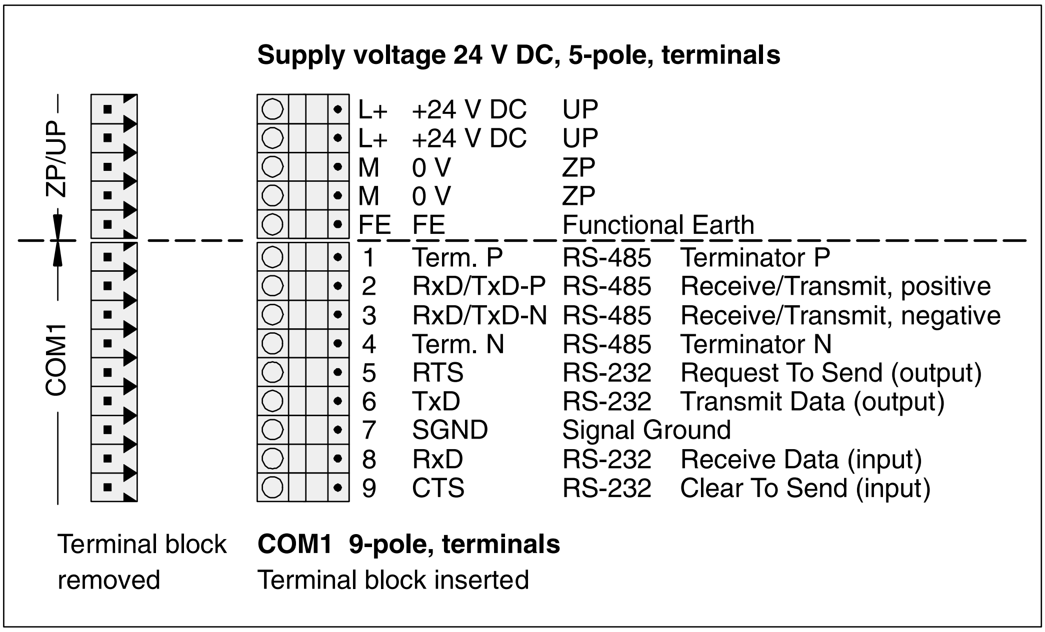


Figure: Serial interface COM1

The serial interface COM1 is connected via a removable 9-pole terminal block. It is configurable for RS-232 or RS-485 and can be used for

- an online access (RS-232 programming interface for PC/Control Builder)
- a free protocol (communication via the COMSND and COMREC function blocks)
- Modbus RTU, master and slave or
- a CS31 system bus (RS-485), as master only

If the RS-485 bus is used, each interconnected bus line (each bus segment) must be electrically terminated. The following is necessary:

- two resistors of 120 Ohms each at both line ends (to avoid signal reflections)
- in addition, a pull-up resistor at RxD/TxD-P and a pull-down resistor at RxD/TxD-N. These two resistors care for a defined high level on the bus, while there is no data exchange.

It is useful, to activate both the pull-up and the pull-down resistors, which only are necessary once on every bus line, at the bus master. For this reason, these two resistors are already integrated within the COM1 interface of the AC500 Terminal Bases. They can be activated by connecting the terminals 1-2 and 3-4 of COM1.

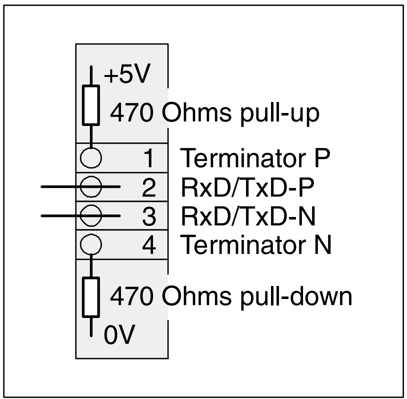


Figure: Integrated resistors (pull-up, pull-down) at COM1, can be activated by connections between 1-2 and 3-4

The following drawing shows an RS-485 bus with the bus master at one line end.

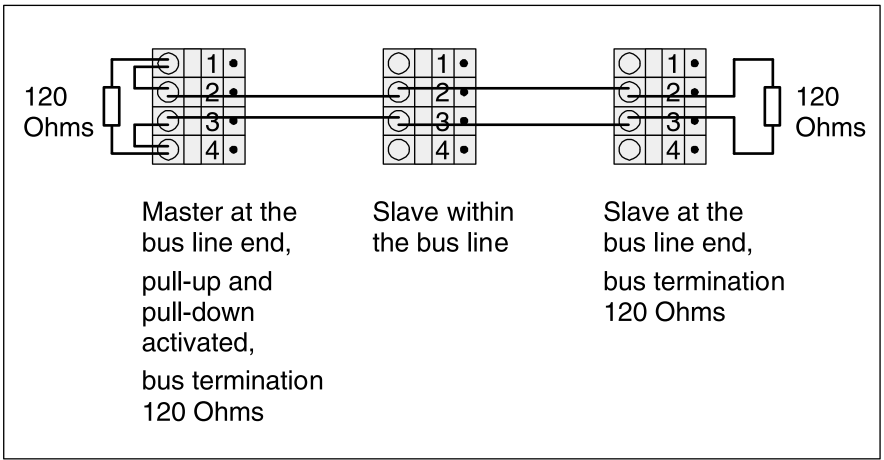


Figure: RS-485 bus with the master at one line end

If the master is located within the bus line, it does not need a terminating resistor. The pull-up and the pull-down resistors, however, must be activated (see the following drawing).

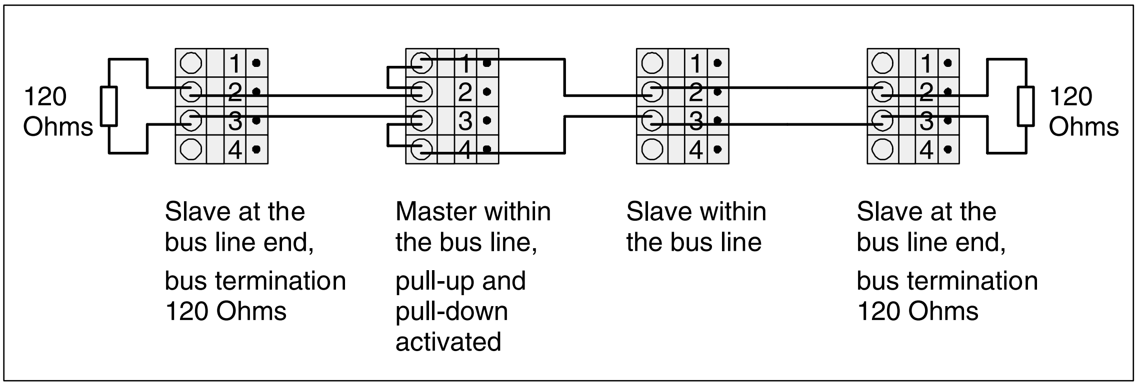


Figure: RS-485 bus with the master within the bus line

The following photo shows a wiring example "master within the bus line".

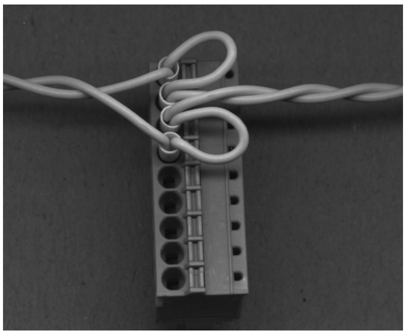


Figure: "Master within the bus line", wired at the COM1 bus connector of the Terminal Base

Attention: If the bus is operated with several masters, the pull-up and pull-down resistors may only be activated at one master.

The earthing of the cable shields of the bus lines are described in the chapter "CS31 system bus" of the AC500 system data.

CS31 system bus

Connection of the AC500 CPU to the CS31 system bus using COM1 of the Terminal Base

The AC500 CPU can be used as a CS31 bus master. The connection is performed via the serial interface COM1 used as a CS31 system bus. The following drawing shows the connection of the bus signals BUS1 and BUS2.

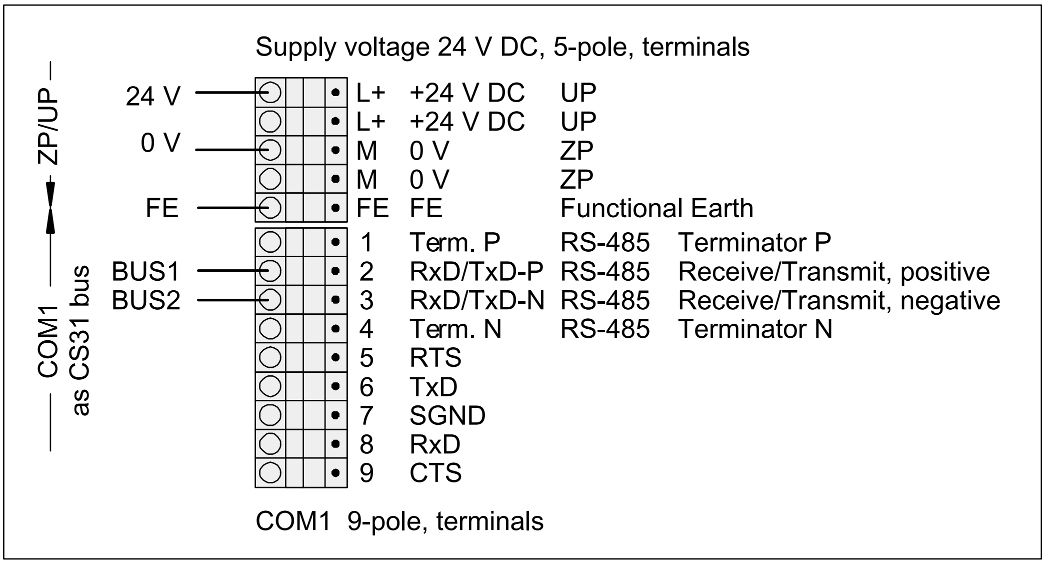


Figure: AC500 CPU connected to the CS31 system bus via the serial interface COM1

With connecting the terminals 1-2 and 3-4, a pull-up and a pull-down resistor can be activated (see chapter "Serial interface COM1" for details).

Wiring

Bus line	
Construction	2 cores, twisted, **with** common **shield**
Conductor cross section	≥ 0.22 mm² (24 AWG)
- recommendation	0.5 mm² corresponds to Ø 0.8 mm
Twisting rate	> 10 per meter (symmetrically twisted)
Core insulation	Polyethylene (PE)
Resistance per core	< 100 Ω/km
Characteristic impedance	ca. 120 Ω (100...150 Ω)
Capacitance between the cores	< 55 nF/km (if higher, the max. bus length must be reduced)
Terminating resistors	120 Ω ¼ W at both line ends
Remarks	Commonly used telephone cables with PE insulation and a core diameter of ≥ 0.8 mm are normally good.
	Cables with PVC core insulation and a core diameter of 0.8 mm can be used up to a length of ca. 250 m. In this case, the bus terminating resistor is ca. 100 Ω.

Bus topology

A CS31 system bus always contains only one bus master (CPU or coupler) which controls all actions on the bus. Up to 31 slaves can be connected to the bus, e.g. remote modules or slave-configured CPUs. Besides the wiring instructions shown below, the wiring and earthing instructions provided with the descriptions of the modules are valid additionally.

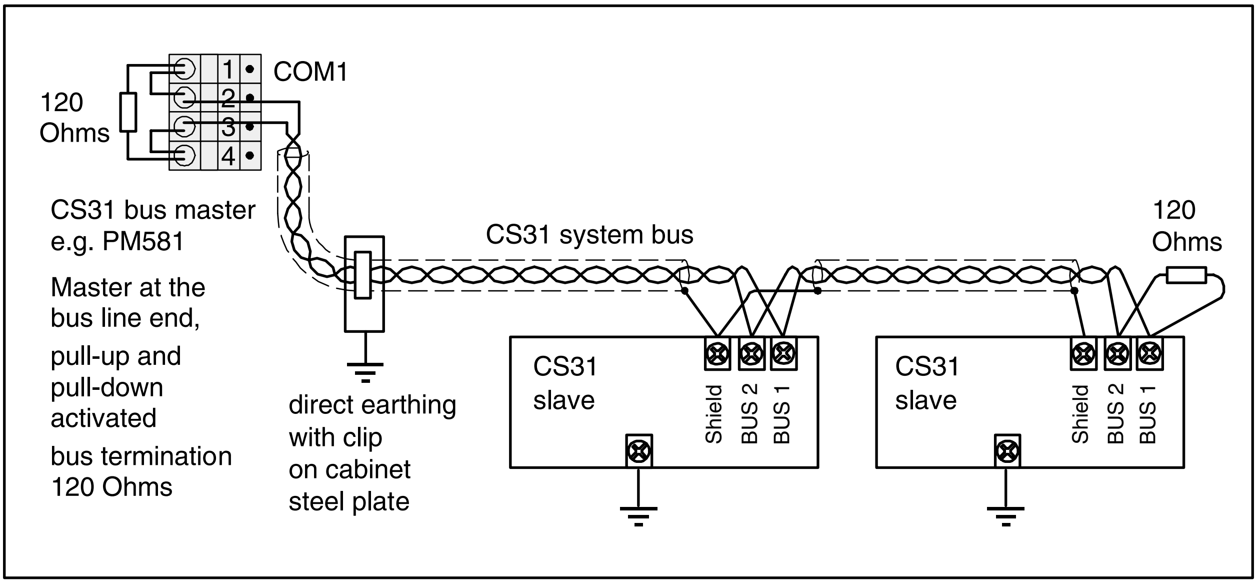


Figure: Bus topology for a CS31 system bus at COM1 (bus master at one end of the bus line)

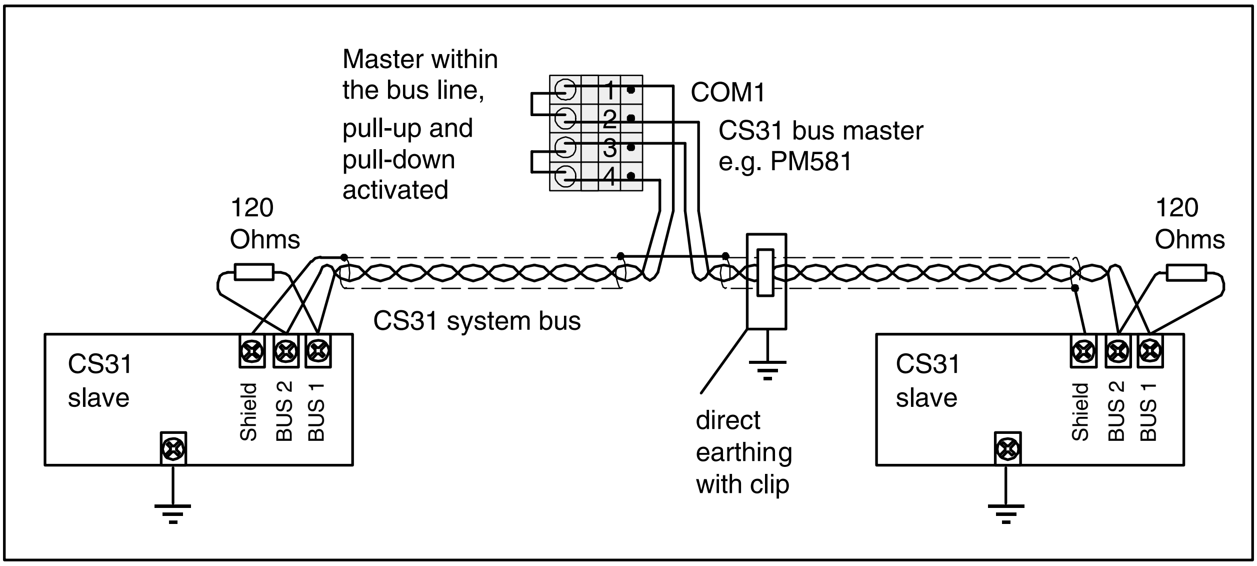


Figure: Bus topology for a CS31 system bus at COM1 (bus master within the bus line)

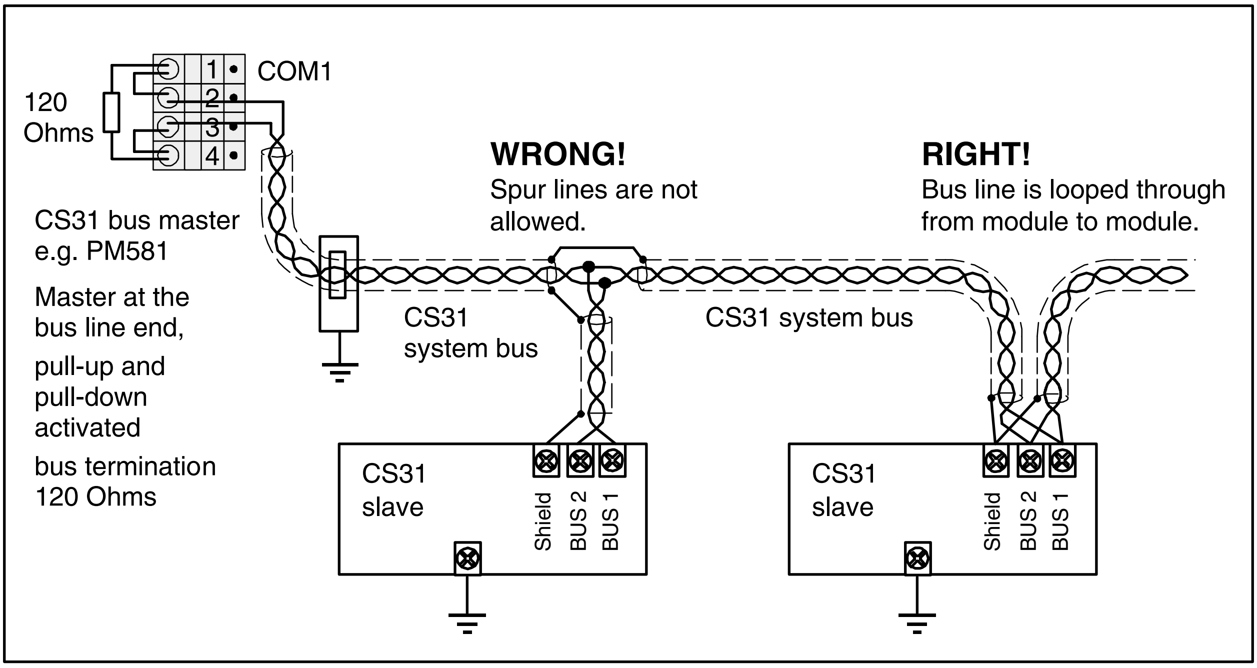


Figure: Wiring with spur lines is not allowed

Earthing

In order to avoid disturbance, the cable shields must be earthed directly.

Case a:

Multiple switch-gear cabinets: If it can be guaranteed that no potential differences can occur between the switch-gear cabinets by means of current-carrying metal connections (earthing bars, steel constructions etc.), the direct earthing is chosen.

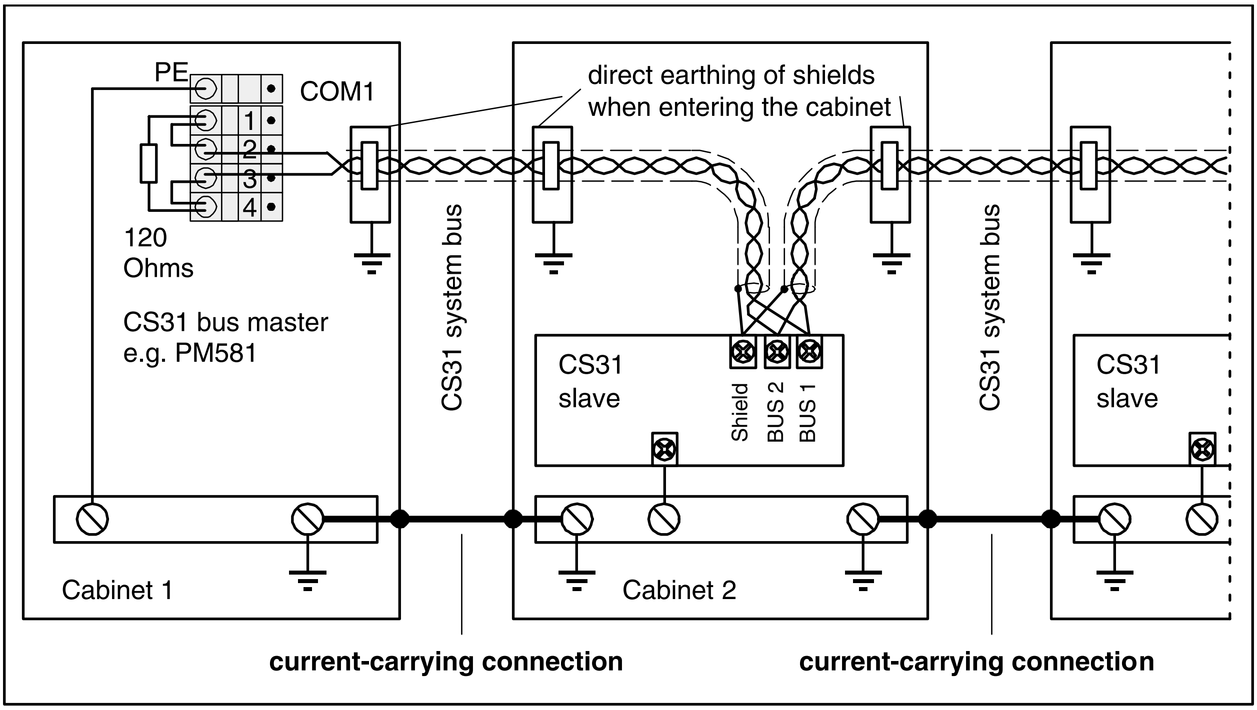


Figure: Direct earthing

Case b:

Multiple switch-gear cabinets: If potential differences can occur between the switch-gear cabinets, the capacitive earthing method is chosen in order to avoid circulating currents on the cable shields.

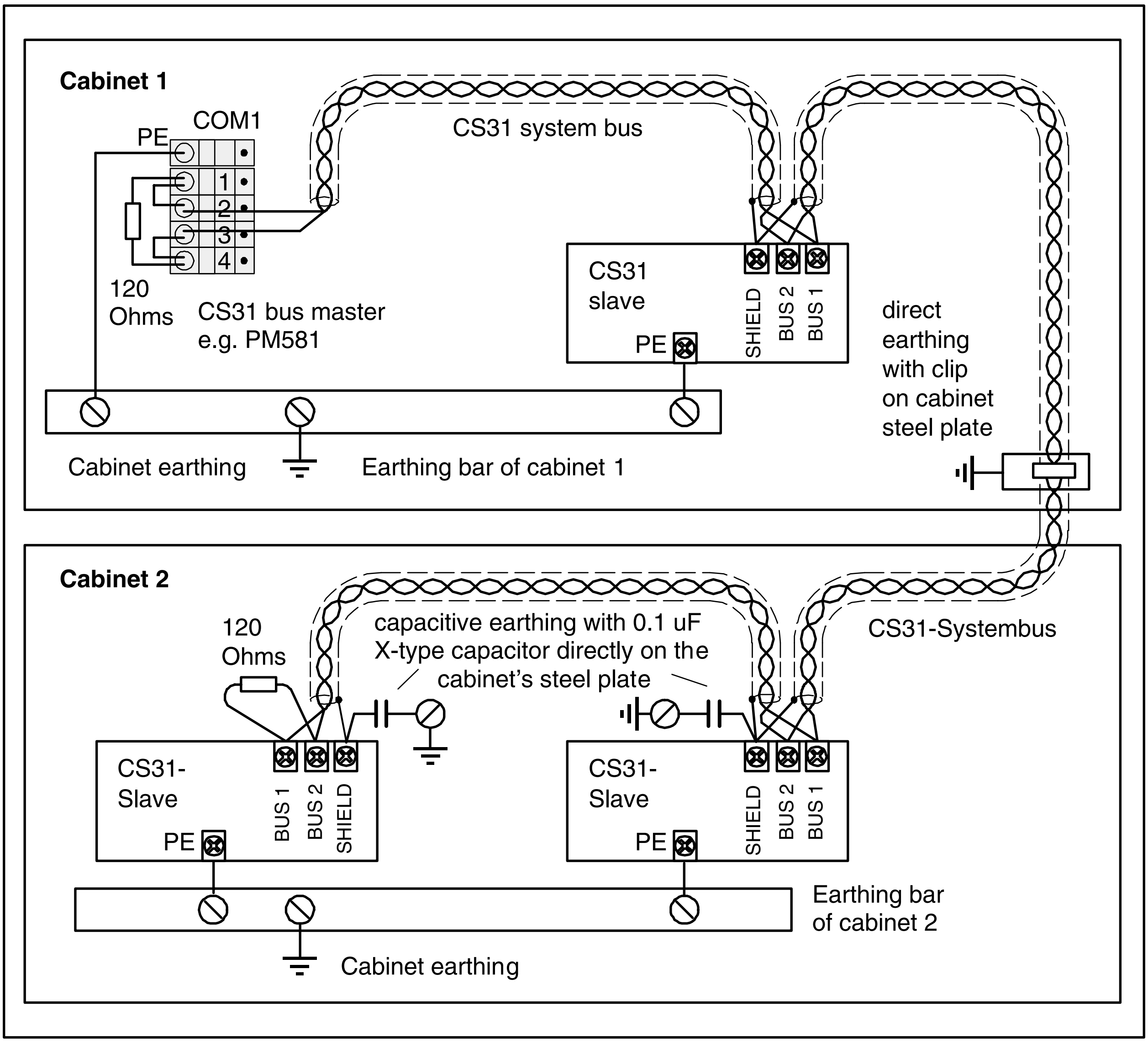


Figure: Earthing concept with several switch-gear cabinets: direct earthing of cable shields when cables enter the first switch-gear cabinet (containing the master), and capacitive earthing at the modules

Everywhere is valid: The total length of the earthing connections between the shield of the Terminal Base and the earthing bar must be as short as possible (max. 25 cm). The conductor cross section must be at least 2.5 mm².

VDE 0160 requires, that the shield must be earthed directly at least once per system.

Number of user data, bus cycle time and data security

See the relevant chapters in the user handbook.

Replacement of modules on the CS31 system bus

Serial interface COM2 of the CPU Terminal Bases

The serial interface COM2 is connected via a 9-pole SUB-D plug. It is configurable for RS-232 or RS-485 and can be used for

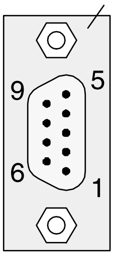
- an online access (RS-232 programming interface for PC/Control Builder)
- a free protocol (communication via the COMSND and COMREC function blocks)
- Modbus RTU, master and slave

It is not intended to use COM2 to establish a CS31 system bus.

If the RS-485 bus is used, each interconnected bus line (each bus segment) must be electrically terminated. The following is necessary:

- two resistors of 120 Ohms each at both line ends (to avoid signal reflections)
- in addition, a pull-up resistor at RxD/TxD-P and a pull-down resistor at RxD/TxD-N. These two resistors care for a defined high level on the bus, while there is no data exchange.

It is useful, to activate both the pull-up and the pull-down resistors, which only are necessary once on every bus line, at the bus master.

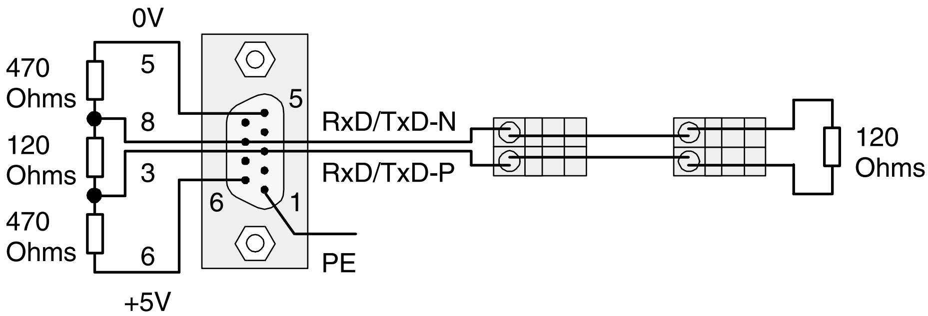


Housing	FE	Functional Earth		
1	FE	Functional Earth		
2	TxD	RS-232	Transmit Data	output
3	RxD/TxD-P	RS-485	Receive/Transmit	positive
4	RTS	RS-232	Request To Send	output
5	SGND	Signal Ground	0 V supply out	
6	+5 V		5 V supply out	
7	RxD	RS-232	Reiveive Data	input
8	RxD/TxD-N	RS-485	Receive/Transmit	negative
9	CTS	RS-232	Clear To Send	input

COM2 9-pole, female

Figure: Pin assignment of the serial interface COM2

The following drawing shows an RS485 bus with the bus master at the line end.



Master at the bus line end,
pull-up 470 Ohms
pull-down 470 Ohms
bus termination 120 Ohms

Slave within the bus line

Slave at the bus line end,
bus termination 120 Ohms

Figure: RS-485 bus, master at a line end

If the master is located within the bus line, it does not need a terminating resistor. The pull-up and the pull-down resistors, however, are necessary (see the following drawing).

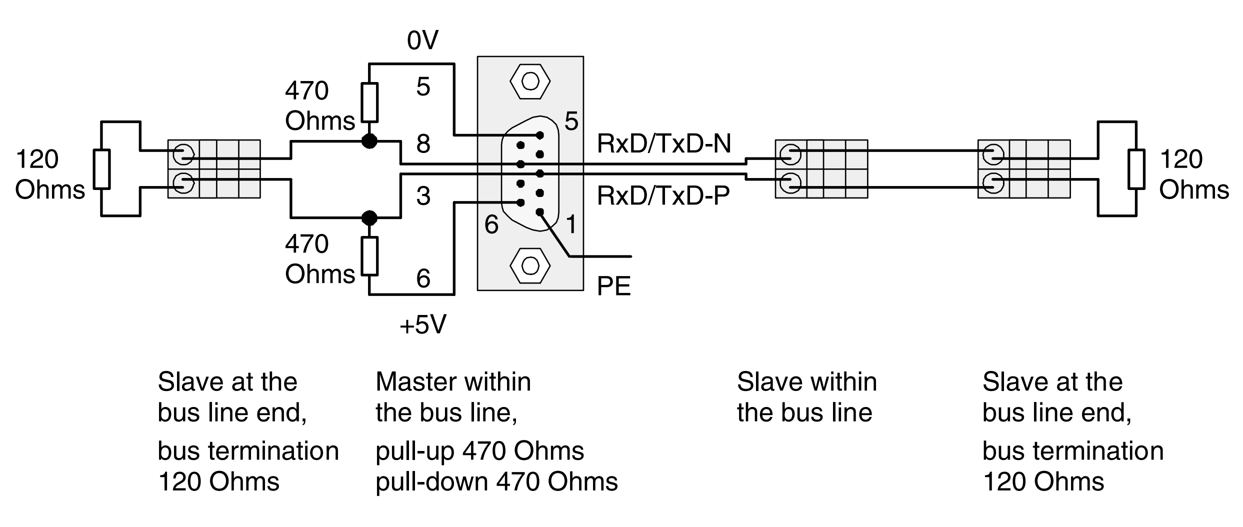


Figure: RS-485 bus, master within the bus line

Attention: If the bus is operated with several masters, the pull-up and pull-down resistors may only be installed at one master.

The cable shields must be earthed (refer to the chapter "CS31 system bus" of the AC500 system data.

FieldBusPlug / FBP

Wiring

For example, refer to description of the PROFIBUS DP FBP, documentation 2CDC 192 001 D010x.PDF

Bus topology

For example, refer to description of the PROFIBUS DP FBP, documentation 2CDC 192 001 D010x.PDF

Modbus

General

The Modbus protocol is used all over the world. The MODICON Modbus® RTU protocol is integrated in the AC500 CPUs.

Numerous automation devices, such as PLC installations, displays, variable-frequency inverters or monitoring systems, for instance, have a Modbus® RTU interface by default or as an option and can therefore communicate with the AC500 CPUs without any problems via the serial interfaces COM1 and COM2 (RS-232 or RS-485).

Modbus® is a master-slave protocol. The master sends a request to the slave and receives its response.

Both interfaces COM1 and COM2 can work as Modbus® interfaces simultaneously.

The Modbus® operating mode of an interface is set with several function blocks.

Bus topology

Point-to-point with RS-232 or bus topology with RS-485. Modbus® is a master-slave protocol..

Technical data

Supported standards	EIA RS-232 or EIA RS-485
Number of connection points	1 master max. 1 slave with RS-232 interface max. 32 slaves with RS-485 interface
Protocol	Modbus® (master/slave)
Check sum	CRC 16
Data transmission rate	up to 19200 baud
Character frame	1 start bit, 8 data bits, 1 parity bit, even or odd (optional) 1 or 2 stop bit(s)
Maximum cable length	for RS-485: 1200 m with 19200 Baud

Number of user data, bus cycle time and data security

See relevant chapters in the operating manual

PROFIBUS

ISO/OSI model

At the moment, PROFIBUS DP is the Field bus most frequently used worldwide for industrial applications. It is standardized under IEC 61158 together with other field bus protocols.

The definition of the PROFIBUS is based on the experience concerning data transmission collected during long years.

One base is the ISO/OSI model (Open Systems Interconnection Reference Model). It is an open layer model with 7 layers for the communication in information processing systems. The model describes uniformed procedures and rules for the exchange of data.

Fieldbus systems normally use only three of the 7 layers:

ISO/OSI	Transmitting CPU		Receiving CPU		
Layer 7	Application layer		Application layer	=	Interface to the application program (CPU) with application oriented commands (read, write)
...	...		...		
Layer 2	Data-link layer		Data-link layer	=	Access control (to the line), telegram (start, length,..), data security (e.g. CRC=Cyclic Redundancy Code)
Layer 1	Physical layer		Physical layer	=	Definition of the medium (Twinax, optical fiber, ..), coding ("1"=-4V), transmission speed (baud rate)..
Transmission medium (physical)					

As a result of the ISO/OSI layer model, each layer can be defined separately and (nearly) independent of the other layers.

Indeed, it is possible and common to use conventional cables, but also optical fibers as physical layer for the PROFIBUS DP or have a mixture of both in a single bus configuration.

For the application layer, there are also different versions possible, e.g. PROFIBUS DP-V0, PROFIBUS DP-V1 but also others that are not regarded here.

Typical Field Bus Topologies

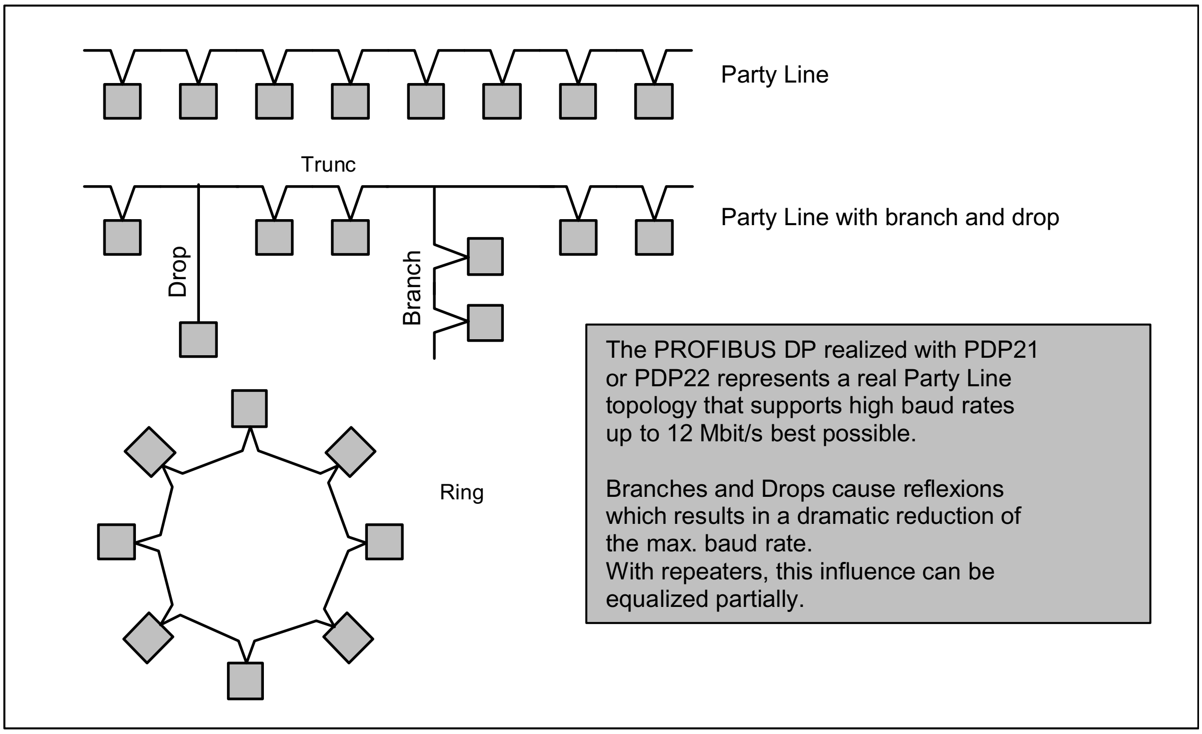
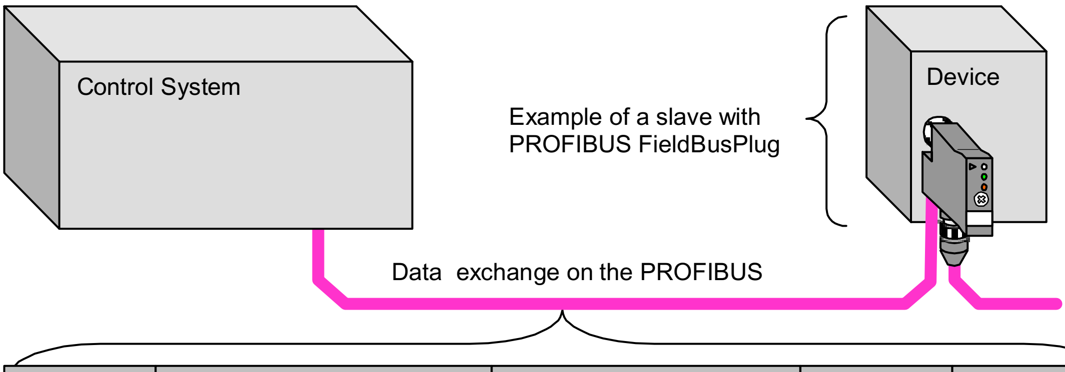


Figure: Typical field bus topologies

Overview of transferred data



	Group	Type / example *	Direction	Comment
Cyclic data exchange	Monitored signals (inputs)	DI = digital input	read	
		AI = analog input	read	
	Commands (outputs)	DO=digital output	write	
		AO=analog output	write	
other basic data transfer	Diagnosis	Faults and warnings	read	DP/V0 and DP/V1
	Configuration, Identification	Qty. of DI, DO,...+ product code..	read / write	
	Bus specific data	baud rate, time-out..	read / write	
	Block parameters**	Control function… trip class …	write	
Acyclic data exchange	Single parameters	Control function… trip class …	read / write	DP/V1 only

* The quantities of bytes/words are defined by the connected device.

** Block parameters are transferred during power-up.
The PDP22 (PROFIBUS DP-V1) allows to suppress the block parameter transfer (executed e.g. during power-up) setting the appropriate parameter. This parameter is not sent to the device and cannot be set via the device.
In the Control Builder AC500 used for the CPU AC500, the parameter is 'Ignore Block Parameters' or 'Use Block Parameters' respectively in the PDP22 parameter part.

Figure: Overview of transferred data

PROFIBUS DP-V0 <---> PROFIBUS DP-V1

Commands and monitoring signals

The transfer of commands and monitoring signals is the essential task of the field bus and the connected units. They control and inform mainly about the process, e.g. start a motor and inform if it runs correctly, and are the same for DP-V0 and DP-V1.

Command and monitoring telegrams represent the cyclic data transfer.

Diagnosis

The diagnosis telegram provides detailed information if there is any problem, particularly in the process. A trip caused by overload of a motor is an example. Diagnosis data are automatically read by the PROFIBUS DP master if it gets a general fault info within a monitoring telegram.

Complete diagnosis telegram:

PROFIBUS DP	
6 bytes	Standard diagnosis data
x bytes	User-specific diagnosis data

PROFIBUS DP with PDP21, PDP22	
6 bytes	Standard diagnosis data
1 byte + 1 byte	PDP21, PDP22 itself + length of slave diagnosis
n bytes	Device-specific

Remark: Diagnosis function blocks provide additional 3 bytes diagnosis data that are created by the bus master.

Configuration, Identification and other data

Configuration, identification and other data are necessary to start the operation and communication with the PROFIBUS DP slave. These data is created during configuring/selecting the bus line including the slaves/devices and is sent to the FieldBusPlugs directly after power-up.

All slaves compare the expected configuration with their real configuration and confirm if they agree as a supposition to start the data exchange.

Additionally some general data such as baud rate and time-out are transferred.

Parameters

Parameters are necessary to adapt the device to the process.

E.g., for the device UMC22 the parameter "Set current" that has to be set correctly to enable the UMC22 to protect the connected motor perfectly against overload.

Parameters can also include service-oriented data such as "Operation hours".

The main difference between the PROFIBUS DP versions DP-V0 and DP-V1 is:

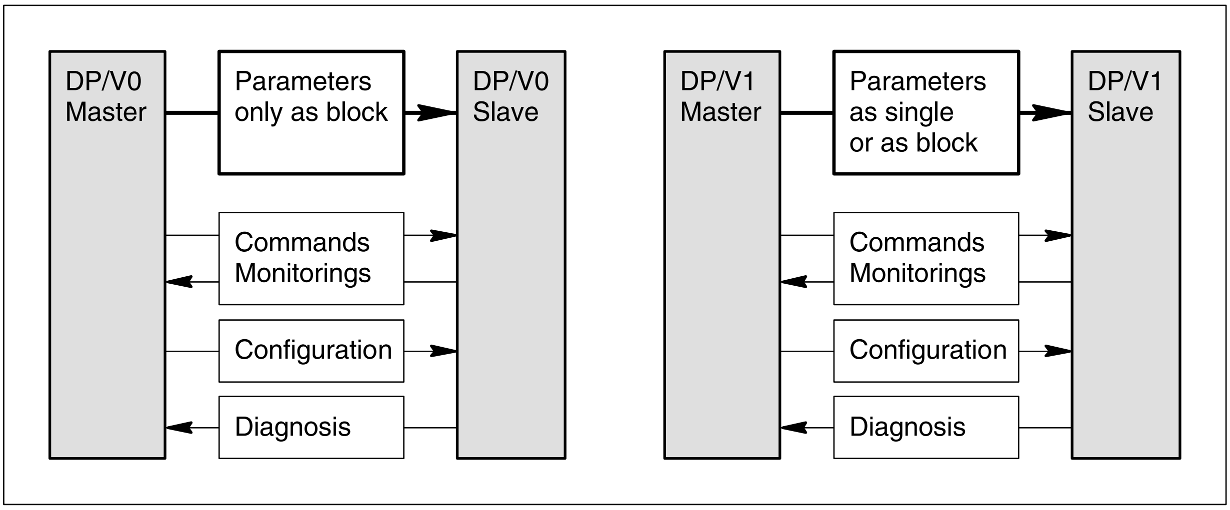


Figure: Parameters DP-V0 and DP-V1

DP-V0 only allows to write the complete parameter set in one block.

The bus master sends the parameter block to the slave during power-up of the slave/device. Some control systems also allow to send the parameter block during normal operation.

DP-V1 offers reading and writing single parameters.

The possibility to read single parameters is an important advantage: If e.g. during commissioning the "Set current" for a motor is modified locally by the electrician, then the control system must be able to read this value to back it up into its data base.

The PDP22 (PROFIBUS DP-V1) also allows to suppress the block parameter transfer. This avoids that the parameters are overwritten during power-up of the slave / device.

The appropriate parameter is evaluated in the PDP21 / PDP22 and is not sent to the device and cannot be set via the device.

The appropriate parameter is "Ignore V0 Parameters" or "Use V0 Parameters" respectively and is available in the .GSD file for DP-V1.

In former times a separate master class 2 was needed to read and write single parameters. Currently, most of the control systems offer a class 1 master capable to perform acyclic DP-V1 services to read and write all data types.

Note: In all cases only the bus master can start the data exchange on the PROFIBUS DP bus.

PROFIBUS DP Master Class 1, PROFIBUS DP Master class 2

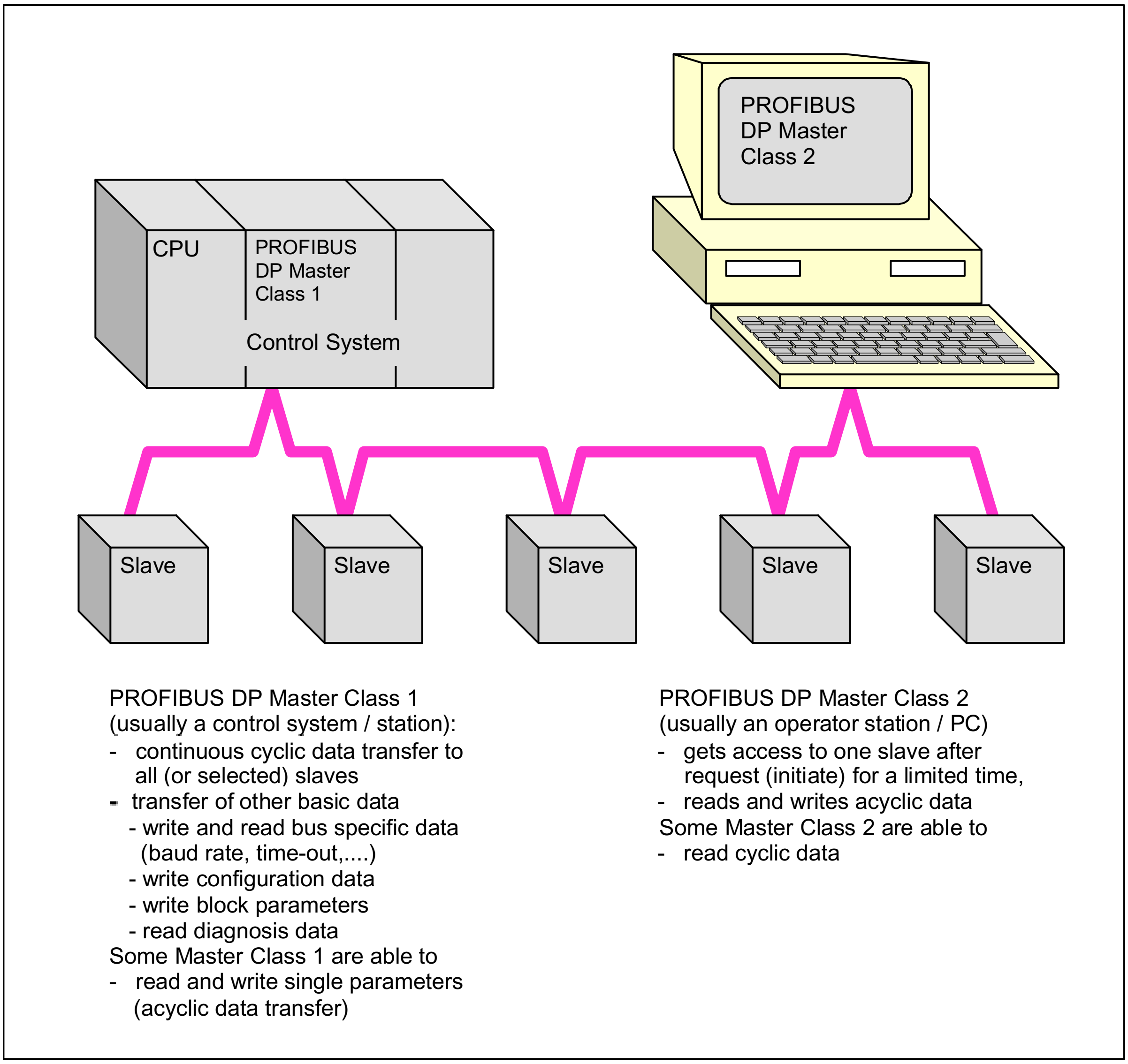


Figure: PROFIBUS DP Master, class 1 and class 2

Wiring

Bus line

Type	twisted wires (2 cores, shielded)
Characteristic impedance	135...165 Ω
Cable capacitance	< 30 pF/m
Diameter of the cores (copper)	≥ 0.64 mm
Conductor cross section of the cores	≥ 0.34 mm²
Wire resistance per core	≤ 55 Ω/km
Loop resistance (resistance of two cores)	≤ 110 Ω/km

Cable lengths

Within one segment, the maximum possible cable length of a PROFIBUS subnet depends on the transmission speed.

Baud rate	**Max. cable length**
9.6 kbaud to 187.5 kbaud	1000 m
500 kbaud	400 m
1.5 Mbaud	200 m
3 Mbaud to 12 Mbaud	100 m

Table: Maximum cable length of a segment within a PROFIBUS subnet

The cable ends of the bus segments must be equipped with terminating resistors according to the following drawing. The terminating resistors are commonly integrated into the bus connectors.

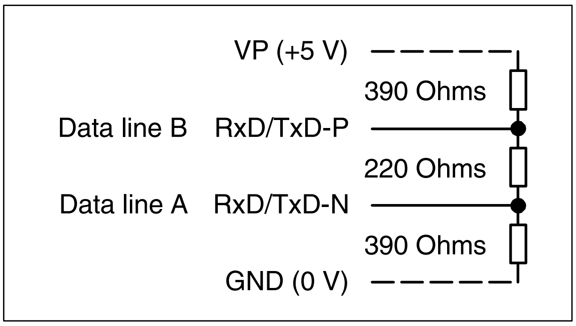


Figure: Configuration of the terminating resistors

Ethernet

Wiring

Bus line

Parameter	**100Base-TX [100 MHz]**
Attenuation [dB/100 m]	23.2
NEXT [dB/100 m]	24
ACR [dB/100 m]	4
Return Loss [db/100 m]	10
Characteristic impedance [Ω]	100
Category	5
Class	D or higher

Cable length restrictions

For the maximum possible cable lengths within an Ethernet network various factors have to be taken into account. So, for twisted pair cables (for transmission rates of 10 Mbit/s and 100 Mbit/s) the maximum length of a segment which is the maximum distance between two network components is restricted to 100 m due to the electric properties of the cable.

Furthermore the length restriction for one collision domain has to be observed. A collision domain is the area within a network which can be affected by a possibly occurring collision (i.e. the area the collision can propagate over). This, however, only applies if the components operate in half duplex mode since the CSMA/CD access method is only used in this mode. If the components operate in full duplex mode, no collisions can occur.

Reliable operation of the collision detection method is important which means that it has to be able to detect possible collisions even for the smallest possible frame size of 64 bytes (512 bits). But this is only guaranteed if the first bit of the frame arrives at the most distant subscriber within the collision domain before the last bit has left the transmitting station. Furthermore the collision must be able to propagate to both directions within the same time. Therefore, the maximum distance between two ends must not be longer than the distance corresponding to the half signal propagation time of 512 bits. Thus, the resulting maximum possible length of the collision domain is 2000 m for a transmission rate of 10 Mbit/s and 200 m for 100 Mbit/s. In addition, the bit delay times caused by the passed network components have also to be considered.

ARCNET

The ARCNET system (Attached Resource Computer Network)

- ARCNET is a system for data transmission in local networks.
- The ARCNET protocol is based on the Token Passing principle.
- By passing an identifier (token) from station to station it is guaranteed, that only one station can start a data transmission (transmission without collision).
- The order of sequence, in which the stations are accessed, is automatically adapted by the existing conditions in the network, i.e. that the network is reconfigured automatically each time a station is added to the network or switched off.

ARCNET bus topology

The networking possibilities of Linear ARCNET

- The Linear ARCNET connects the individual stations directly to each other, i.e. without using any distribution units.
- Each station is connected to the network by using a T connector.
- Both cable ends must be terminated by termination resistors.
- A maximum of 8 stations can be connected to one Linear ARCNET.
- The maximum cable length of the network is 300 m.
- An additional segment can be connected at the end of the wired segment via an Active Hub (active distribution unit), see next but one drawing.

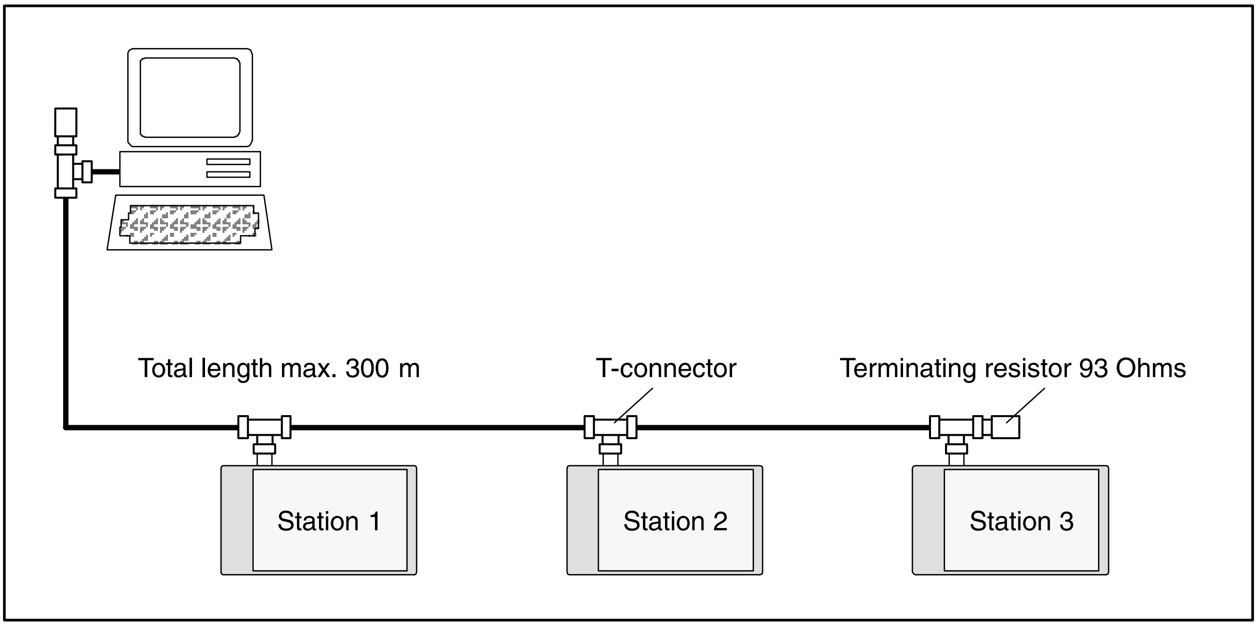


Figure: Linear ARCNET

Linear ARCNET, expanded by active distribution units (Active Hubs)

Active Hubs amplify the arriving signals. So they stabilize the network configuration and allow especially for high distances. The Active Hub decouples the station connectors from each other. Therefore, the entire network does not fail when one of the connections fails.

The maximum length of the network is 6 km.

A maximum of 255 stations can be used.

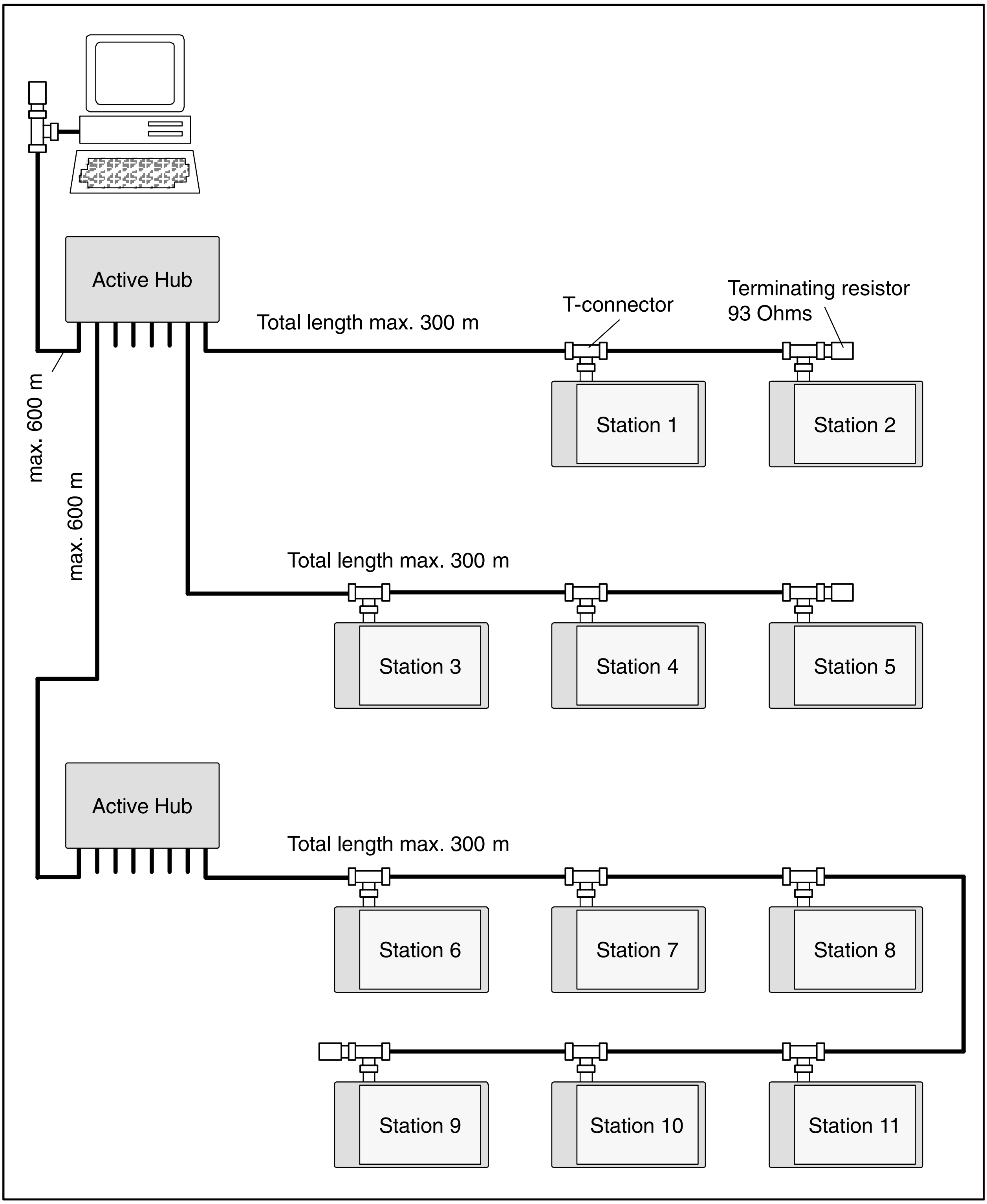


Figure: Linear ARCNET, expanded by active distribution units (Active Hubs)

Wiring

Bus cable:

Cable RG 62 A/U:
e.g. Lapp Kabel, Stuttgart
Telephone: 0711/7838-0

Plugs for bus cable:

BNC plugs 75 Ω: Order No. B-9005
BNC T plug 75 Ω: OrderNo. B-9083
BNC termination 93 Ω: Order No. B-9093
Rufenach Vertriebs-GmbH, Heidelberg
Telephon: +49 6221/8443-0
Telefax: +49 6221/8443-99

General considerations for EMC-conforming assembly and construction

Electric and electronical devices have to work correctly on site. This is also valid when electro-magnetic influences affect them in defined and/or expected strength. The devices themselves must not emit electro-magnetic noises.

Advant Controller components are developed and constructed so that they have a very high noise immunity. When the wiring and earthing instructions under "System data and system configuration" are met, an error-free operation is given.

However, there are applications where high electro-magnetic noises must be taken into due consideration already during the planning phase: e.g. when frequency converters, compressors, small-power pumps (high inductance) or mediumvoltage switchgear are mounted nearby. An EMC-compatible earthing concept will also guarantee an error-free operation here.

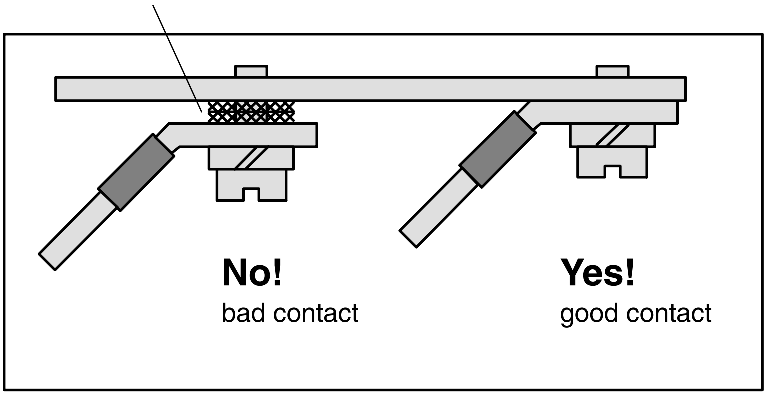
General principles

There are three important principles to be especially considered:

- Keep all connections as short as possible (in particular the earthing conductors)
- Use large conductor cross sections (in particular for the earthing conductors)
- Create low-impedance, i.e. good and large-sized contacts (in particular for the earthing conductors)

In particular:

- vibration-resistant connections
- clean metallic contact areas (remove paint, clean surfaces)
- if possible, do not use aluminium parts (they oxidize)
- solid plug and screw-type connections
- earth cable shields with clips on a well-grounded metallic surface
- do not use sheath wires
- do not use toothed lock washers under screw connections



Make a connection between the DIN rails and PE (Protective Earth). For this, use an earthing wire with a minimum conductor cross section of 10 mm². The wire is connected to the DIN rail with an M6 screw according to the drawing above. A large-area contact of the DIN rail with the metallic mounting plate improves the EMC behaviour significantly, as the disturbances can be discharged more effective.

Cable routing

- Route cables meeting the standards.
- Sort the cables into cable groups (power current cables, power supply cables, signal cables and data cables)
- Rout signal cables and data cables separately from the power cables, i.e. in separate cable ducts or cable bundles. The distance should be 20 cm or greater.
- Lay signal and data cables close to earthed surfaces.

Cable shields

- Only use shielded data cables. The shield should be earthed at both ends. Make sure that no parasitic currents can flow through the cable shields. This can be done by installing current-carrying equipotential bondings.
- A cable shield only earthed at one end can only protect from capacitively coupled interference and low-frequency disturbances (50 Hz hum).
- Use only cables with braided shields. Foil shields are not robust enough, cannot be contacted well and have poor HF properties.
- Only use metallic or metal-plated plugs for shielded data cables.
- For analog signals, only use shielded cables. Earth the shield only at one end for small signals.
- Earth the cable shield directly with a clip when entering the switch-gear cabinet. Do not cut the shield until the cable reaches the module connected.
- The connection between the PE bar and the shield bar must have a low impedance.

Switch-gear cabinet

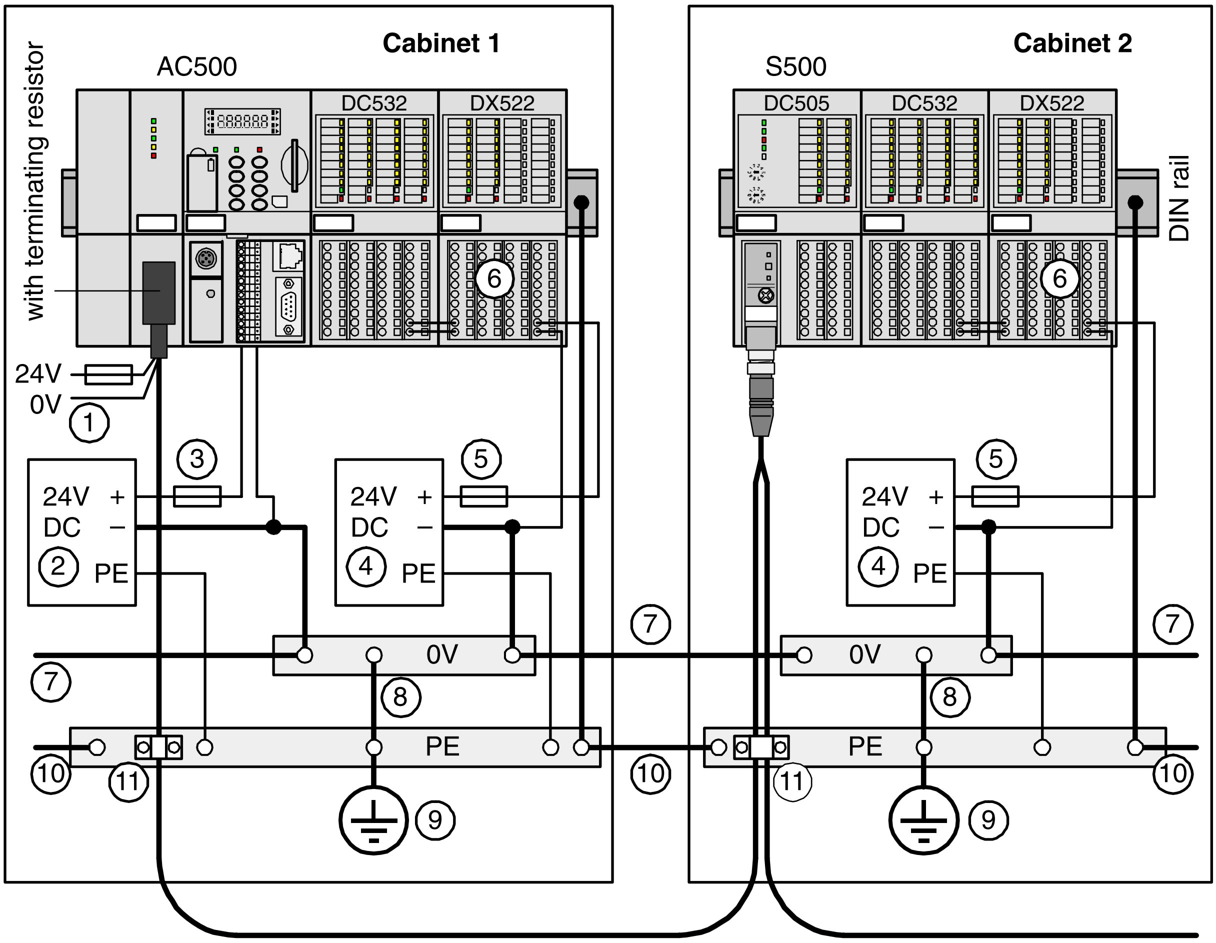
- The connections between the switch-gear cabinet, the mounting plates, the PE bar and the shield bar must have a low impedance.
- Earth the switch-gear cabinet doors with short and highly flexible conductors.
- For illumination of the switch-gear cabinet, only use filament lamps (bulbs) or fluorescent tubes with interference suppression to prevent the control system being disturbed.
- For supplying the PC, use the mains socket which is located inside the switch-gear cabinet. In this way, all earthing measures are performed with short conductors and no parasitic currents can flow even in case of non-isolated interfaces.

Reference potential

- Provide a uniform reference potential in the entire installation and earth all electrical appliances if possible.
- Route your earthing conductors in a star configuration so that no earth loops can occur.

Equipotential bonding

- Install sufficiently dimensioned equipotential bondings, if potential differences are present or have to be expected in your application between different parts of the installation.
- The impedance of a equipotential bonding must be equal or lower than 10 % of the shield impedance of the shielded signal cables between the same points.
- The conductor cross section of a equipotential bonding must be able to withstand the maximum possible compensating current. By experience, a conductor cross section of 16 mm² has proven to be sufficient.
- Equipotential bondings and shielded signal cables should be laid close to each other. This prevents coming up inductive loops in which disturbances could be induced.
- Equipotential bondings must be connected to PE with low impedance.



1 24V power supply FBP
2 Power supply for the CPU
3 Fuse for the CPU power
4 Power supply for the I/Os
5 Fuse for the I/O modules power
(2–5: only one power supply is also possible)
6 For fuses for the contacts of the relay outputs see the descriptions of the relevant modules
7 0V rail (reference potential for signals)
8 Earthing of the 0V rail
9 Cabinet earthing
10 Equipotential bonding between the cabinets min. 16 mm²
11 Cable shields earthing

Figure: AC500, equipotential bondings

Power consumption of an entire station

The power consumption of a complete station consists of the sum of all individual consumptions.

An AC500 CPU cluster has

- a power consumption of the CPU itself over the terminals L+ and M of the Terminal Base. After conversion of the voltage, also the I/O-Bus for the attached I/O modules is supplied then.
- a power consumption over the process supply voltage terminals ZP and UP of the Terminal Units. Through this the digital and analog outputs are also supplied.

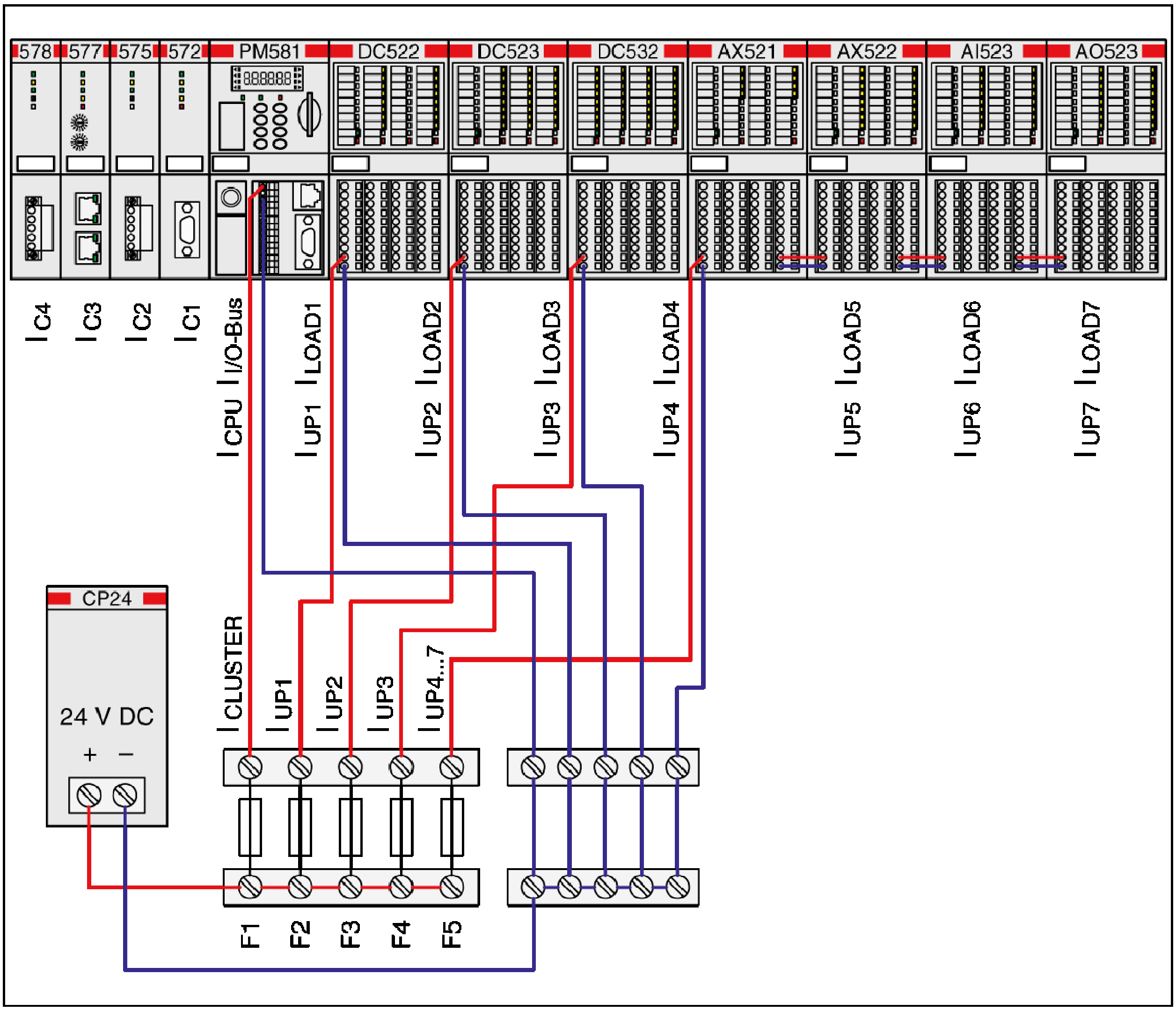
The two supply voltages can be provided by the same power supply unit. The CPU and the I/O modules should, however, be fused separately. Of course also separate power supplies are possible. See the previous chapters regarding equipotential bonding and cable routing.

Product	**Main power supply**	**Voltage** **V DC**	**Current consump-tion in A**	**Melting integral in A²s**	**Process voltage UP**	**Voltage** **V DC**	**Current consump-tion in A**	**Melting integral in A²s**
CPUs								
PM571 PM571-ETH PM581 PM581-ETH PM581-ARCNET PM582 PM582-ETH PM591 PM591-ETH PM591-ARCNET	Terminals L+ and M	24	0.050 0.110 0.050 0.110 0.050 0.110 0.090 0.150	1 *)	-	-	-	-
Communication modules (couplers)								
CM572-DP CM575-DN CM577-ETH CM578-CN	Coupler bus (of the CPU)	-	0.050 0.050 0.085 0.050	*)	-	-	-	-
I/O modules								
AI523 AO523 AX521 AX522 DC522 DC523 DC532 DC541 DI524 DX522 DX531	I/O-Bus (of the CPU)	-	0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002	-	Terminals ZP and UP	24	0.150 0.150 0.150 0.150 0.150 0.150 0.150 0.150 0.150 0.150	0.050 0.040 0.020 0.020 0.005 0.008 0.007 0.008 0.010 0.004
FieldBusPlug								
PDP22-FBP.xxx	M12 plug pins 1 and 3	24	0.040	-	-	-	-	-
Remote I/O modules								
DC505-FBP DC551-CS31	FBP process supply	24 -	0.020 -	- -	ZP and UP ZP and UP	24 24	0.050 0.100	0.008 0.040
*) The melting integral for the CPU is dependent on the integrated CPU supply, couplers and I/O-Bus are taken into account.								

Calculation of the total current consumption

In the following example, the aC500 control system consists of

- the CPU PM581-ETH
- the 4 communication modules CM572-DP (1x), CM575-DN (1x), CM577-ETH (1x), CM578-CN (1x)
- the 7 expansion modules DC522 (1x), DC523 (1x), DC532 (1x), AX521 (1x), AX522 (1x), AI523 (1x), AO523 (1x)
- as well as the required Terminal Bases and Terminal Units



Remark: Because of the high total current consumption of the digital I/O modules (from UP = 24 DC), the supply is divided up into several electric circuits fused separately. The maximum permitted total current over the supply terminals of the I/O Terminal Units is 8 A.

The total current can be calculated as follows:

$\mathbf{I_{Total} = I_{CLUSTER} + I_{UP}}$

with the following assumptions

$\mathbf{I_{CLUSTER} = I_{CPU} + I_{I/O\text{-}Bus} + I_{C1} + I_{C2} + I_{C3} + I_{C4}}$ (CPU + couplers + I/O-Bus)

$\mathbf{I_{I/O\text{-}Bus}}$ **= Number of expansion modules x Current consumption through the I/O-Bus per module**

and

$\mathbf{I_{UP} = I_{UP1} + I_{LOAD1} + I_{UP2} + I_{LOAD2} + I_{UP3} + I_{LOAD3} + I_{UP4} + I_{LOAD4} + I_{UP5} + I_{LOAD5} + I_{UP6} + I_{LOAD6} + I_{UP7} + I_{LOAD7}}$

If one assumes that all outputs are switched on and are operated with their maximum permitted load currents (under compliance with the maximum permitted currents at the supply terminals), then the following values are the result for the example shown above:

	I_{CPU}	I_{Cx}	$I_{I/O-Bus}$	I_{UPx}	I_{LOADx}
CPU part					
PM581-ETH	0.110 A	-	-	-	-
CM572-DP	-	0.050 A	-	-	-
CM575-DN	-	0.050 A	-	-	-
CM577-ETH	-	0.085 A	-	-	-
CM578-CN	-	0.050 A	-	-	-
I/O part					
AI523	-	-	0.002 A	0.150 A	-
AO523	-	-	0.002 A	0.150 A	0.160 A
AX521	-	-	0.002 A	0.100 A	0.080 A
AX522	-	-	0.002 A	0.100 A	0.080 A
DC522	-	-	0.002 A	0.050 A	8.000 A *)
DC523	-	-	0.002 A	0.050 A	8.000 A *)
DC532	-	-	0.002 A	0.050 A	8.000 A *)
Sums	0.110 A	0.235 A	0.014 A	0.650 A	24.320 A
	$I_{CLUSTER}$ = 0.359 A			**I_{UP} = 24.970 A**	
	I_{Total} = 25.329 A				
*) The maximum permitted total current over the supply terminals of the I/O Terminal Units is 8 A.					

Dimensioning of the fuses

To be able to select the fuses for the station correctly, both the current consumption and the inrush currents (melting integral for the series-connected fuse) must be taken into consideration.

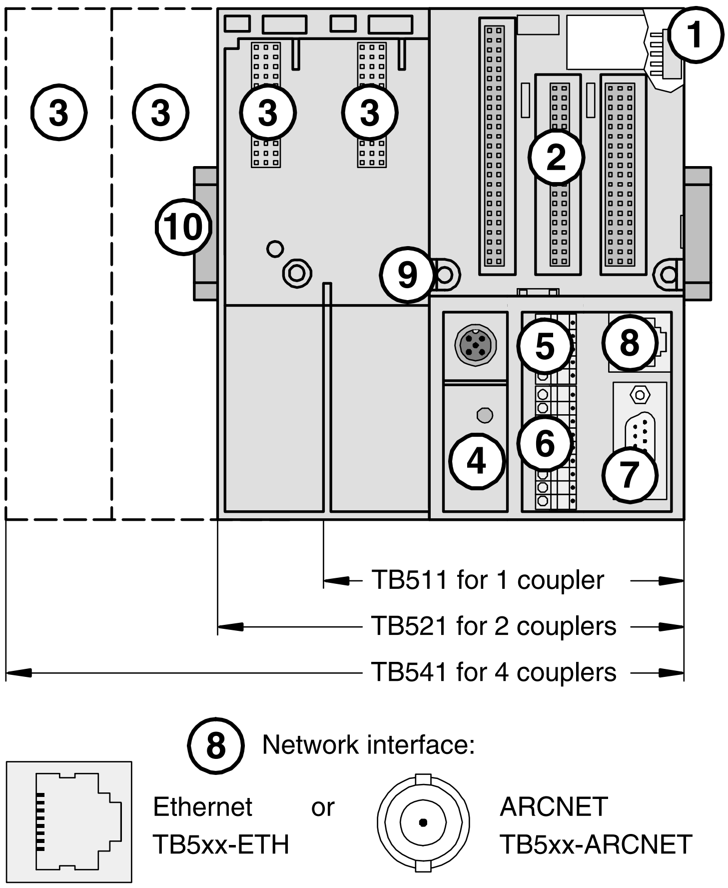
Fuse	for	Sum of the melting integrals in A²s	$I_{Cluster}$ A	I_{UPx} A	Recommended fuse Type	Recommended fuse Value
F1	CPU cluster	1.000	0.359		quick	10 A
F2	Module DC522	0.005		8.050	quick	10 A
F3	Module DC523	0.008		8.050	quick	10 A
F4	Module DC532	0.007		8.050	quick	10 A
F5	Modules AX521 + AX522 + AI523 + AO523	0.130		0.820	quick	10 A

Contents

CPU Terminal Bases

CPU Terminal Bases TB511-TB541

- TB511-ETH: 1 CPU, 1 coupler, with networking interface Ethernet RJ45
- TB521-ARCNET: 1 CPU, 2 couplers, with networking interface ARCNET BNC
- TB521-ETH: 1 CPU, 2 couplers, with networking interface Ethernet RJ45
- TB541-ETH: 1 CPU, 4 couplers, with networking interface Ethernet RJ45



Elements of the CPU Terminal Base

1 I/O-Bus (10-pole, female) to electrically connect the first I/O Terminal Unit
2 Slot for the CPU
3 Slots for couplers (max. 4)
4 Interface for FieldBusPlug
5 Supply for 24 V DC
6 Serial interface COM1
7 Serial interface COM2
8 Network interface (Ethernet or ARCNET)
9 Holes for wall mounting
10 DIN rail

Figure: CPU Terminal Bases TB 511-TB541, for CPU and couplers

The CPU Terminal Bases TB511 to TB541 are used as sockets for CPUs and communication modules (couplers) of the ABB control system AC500. Up to 7 I/O Terminal Units for I/O expansion modules can be added to these CPU Terminal Bases.

If both of the following conditions are fulfilled, **max. 10 I/O expansion modules can be connected to the I/O-Bus of the CPU:**
- PS501 as of version V1.2
- CPUs as of firmware V1.2.0

Contents

Short description

Note: Mounting, disassembling, electrical connection and dimensioned drawings for the Terminal Bases, CPUs, communication modules, I/O Terminal Units and the I/O expansion modules are described in detail in the AC500 system data chapters.

The CPU Terminal Bases have slots for one CPU and for communication modules (couplers) as well as terminals and interfaces for power supply, expansion and networking.

Number of slots

Terminal Base	**TB511**	**TB521**	**TB541**
Slots for CPUs	1	1	1
Slots for communication modules	1	2	4

Terminals and interfaces

Terminal Base	**TB511-**		**TB521-**		**TB541-**	
available = (x)	**ETH (x)**	**ARCNET**	**ETH (x)**	**ARCNET (x)**	**ETH (x)**	**ARCNET**
Connection						
I/O-Bus	I/O interface for directly adding up to 7 I/O Terminal Units *)					
Power supply	5-pole removable terminal block with spring connections					
COM1	serial interface, 9-pole removable terminal block with spring connections					
COM2	serial interface, 9-pole SUB-D connector (female)					
Network interface (type must be equal to the type of the used CPU)	Ethernet RJ45	ARCNET BNC	Ethernet RJ45	ARCNET BNC	Ethernet RJ45	ARCNET BNC
FBP interface	Fieldbus-neutral slave interface (M12, 5-pole, male, fastening with screw)					

***)** If both of the following conditions are fulfilled, **max. 10 I/O expansion modules can be connected to the I/O-Bus of the CPU:**
- PS501 as of version V1.2
- CPUs as of firmware V1.2.0

Connections

I/O-Bus

The I/O-Bus is the I/O data bus for the S500 expansion modules. Through this bus, I/O and diagnosis data are transferred between the AC500 CPU and the I/O expansion modules. Up to 7 I/O Terminal Units (for 1 I/O expansion module each) can be added to one Terminal Base. The I/O Terminal Units have a bus input at the left side and a bus output at the right side. Thus the length of the I/O-Bus increases with the number of the I/O expansion modules used.

If both of the following conditions are fulfilled, **max. 10 I/O expansion modules can be connected to the I/O-Bus of the CPU:**
- PS501 as of version V1.2
- CPUs as of firmware V1.2.0

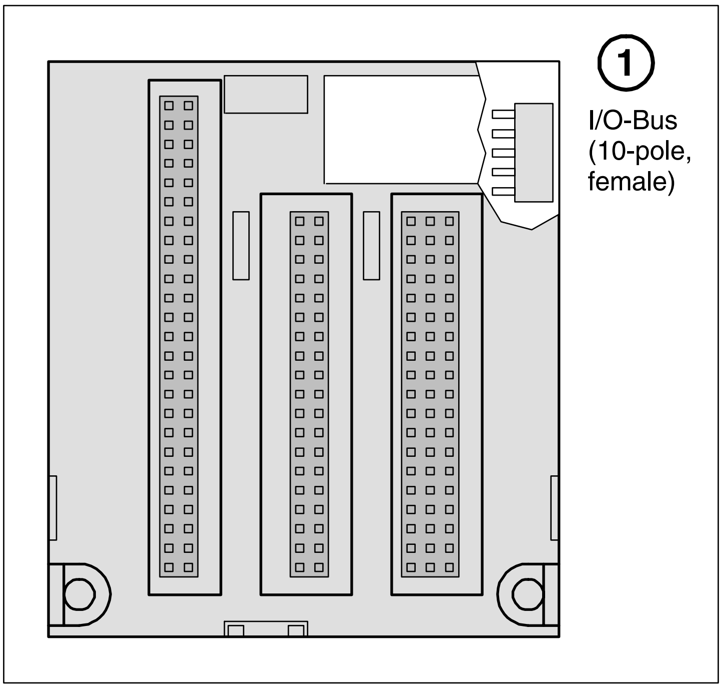
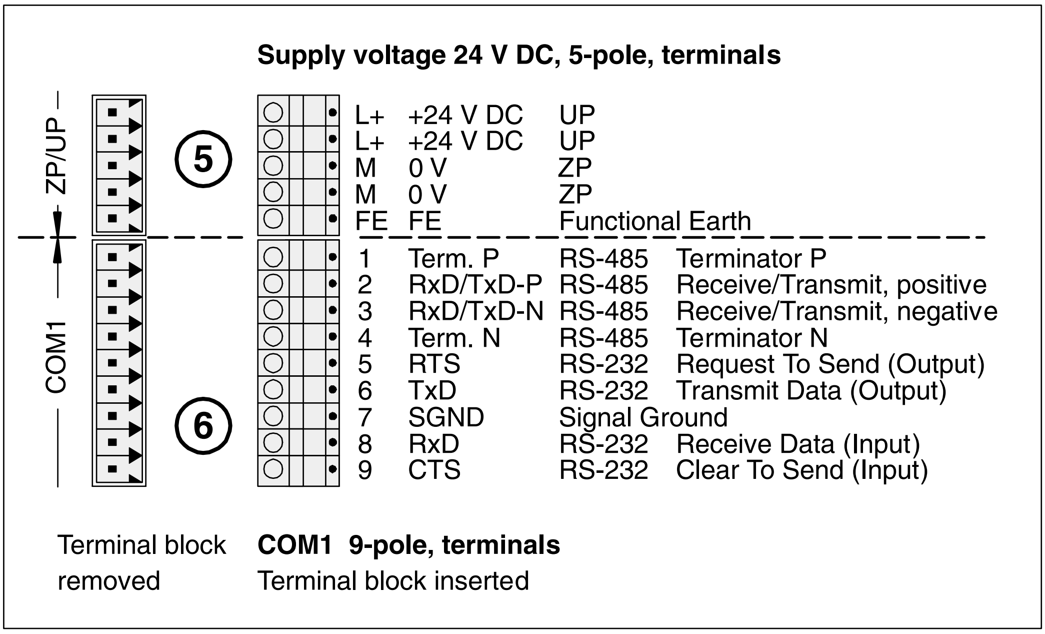


Figure: I/O-Bus

Power supply

The supply voltage of 24 V DC is connected to a 5-pole removable terminal block. ZP and UP exist twice. So it is possible to supply external sensors from these terminals, for instance.



Figure, upper part: Power supply via a 5-pole terminal block
Figure, lower part: Terminal assignment of the serial interface COM1

Important: Exceeding the maximum power supply voltage (>30 V DC) for process or supply voltages could lead to unrecoverable damage of the system. The system could be destroyed.

Important: On the CPU Terminal Bases, the terminals L+ and M are doubled. If the power supply is badly connected (e.g. +/- of power supply is connected to both L+/L+ or both M/M), a short circuit will happen and lead to a destruction of the power supply, its fuse or the Terminal Base itself.

Serial interface COM1 (see above)

The serial interface COM1 is connected to a removable 9-pole terminal block. It is configurable for RS-232 and RS-485 and can be used for

- an online access (RS-232 programming interface for PC/Control Builder)
- a free protocol (communication via the function blocks COMSND and COMREC)
- Modbus RTU, master and slave or
- a CS31 system bus (RS-485), as master only

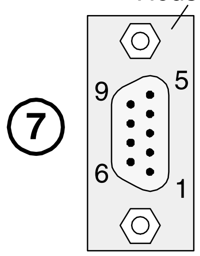
A detailed description for COM1 can be found under "Hardware AC500 / System data / System data and System construction / Serial interface COM1 or Serial interfaces".

Serial interface COM2

The serial interface COM2 is connected to a 9-pole SUB-D connector. It is configurable for RS-232 and RS-485 and can be used for

- an online access (RS-232 programming interface for PC/Control Builder)
- a free protocol (communication via the function blocks COMSND and COMREC)
- MODBUS RTU, master and slave

COM2 is not intended to establish a CS31 system bus.



Housing	FE	Functional Earth		
1	FE	Functional Earth		
2	TxD	RS-232	Transmit Data	output
3	RxD/TxD-P	RS-485	Receive/Transmit	positive
4	RTS	RS-232	Request To Send	output
5	SGND	Signal Ground	0 V supply out	
6	+5 V		5 V supply out	
7	RxD	RS-232	Reiceive Data	input
8	RxD/TxD-N	RS-485	Receive/Transmit	negative
9	CTS	RS-232	Clear To Send	input

COM2 9-pole, female

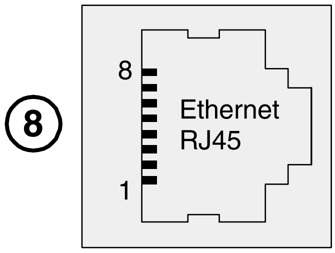
Figure: Pin assignment of the serial interface COM2

A detailed description for COM2 can be found under "Hardware AC500 / System data / System data and System construction / Serial interface COM2 or Serial interfaces".

Ethernet networking interface

This interface is the connection to the internal Ethernet coupler of the CPUs PM5xx-ETH. Applications are:

- TCP/IP for PC/Control Builder (programming)
- UDP (communication via function blocks ETH_UDP_SEND and ETH_UDP_REC)
- Modbus on TCP/IP (Modbus on TCP/IP, master and slave)

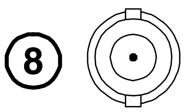


8	NC	not used
7	NC	not used
6	RxD–	Receive Data
5	NC	not used
4	NC	not used
3	RxD+	Receive Data
2	TxD–	Transmit Data
1	TxD+	Transmit Data
Shield	Cable shield / Signal Ground	

Figure: Pin assignment of the Ethernet interface

ARCNET networking interface

This interface is the connection to the internal ARCNET coupler of the CPUs PM5xx-ARCNET.

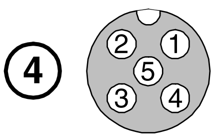


ARCNET BNC

Figure: ARCNET interface

FBP interface

Through this 5-pole fieldbus-neutral interface, the AC500 CPU can be connected **as a slave** to a fieldbus master. The FieldBusPlug is fastened by a screw.



male

Pin assignment in serial mode

1	+24 V	standard power supply
2	Diagnosis pin	
3	0 V	standard power supply
4	Serial data	
5	Serial data	

Figure: Pin assignment of the FBP interface

Technical data

Connection of the 24 V DC process voltage	with a 5-pole removable terminal block
Slots	TB511: 1 CPU, 1 communication module
	TB521: 1 CPU, 2 communication modules
	TB541: 1 CPU, 4 communication modules
Interfaces	I/O-Bus, COM1, COM2, FBP
Networking interfaces	TB5xx-ETH: Ethernet
	TB5xx-ARCNET: ARCNET
Connection system	see AC500 system data
Dimensions	for details see AC500 system data
Width x height x depth (with CPU inserted)	TB511: 95.5 x 135 x 75 mm
	TB521: 123.5 x 135 x 75 mm
	TB541: 179.5 x 135 x 75 mm
Weight	TB511: xxx g
	TB521: 215 g
	TB541: xxx g
Mounting position	horizontal or vertical

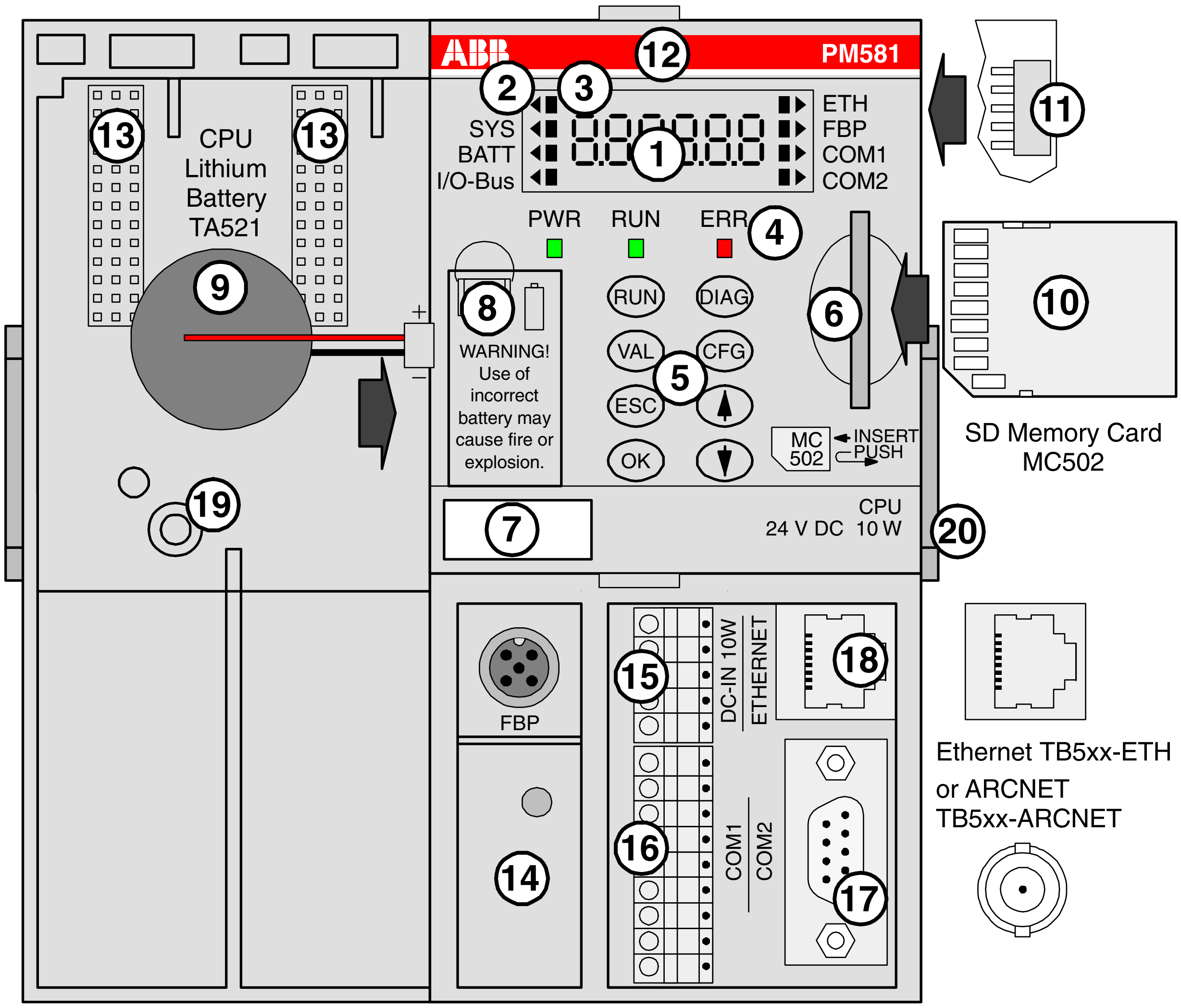
Ordering data

Order No.	Scope of delivery
1SAP 111 100 R0170	TB511-ETH, CPU Terminal Base AC500, slots: 1 CPU, 1 communication module, Ethernet RJ45 connector
1SAP 112 100 R0160	TB521-ARCNET, CPU Terminal Base AC500, slots: 1 CPU, 2 communication modules, ARCNET COAX connector
1SAP 112 100 R0170	TB521-ETH, CPU Terminal Base AC500, slots: 1 CPU, 2 communication modules, Ethernet RJ45 connector
1SAP 114 100 R0170	TB541-ETH, CPU Terminal Base AC500, slots: 1 CPU, 4 communication modules, Ethernet RJ45 connector
1SAP 212 200 R0001	TU515, I/O Terminal Unit, 24 V DC, screw-type terminals
1SAP 212 000 R0001	TU516, I/O Terminal Unit, 24 V DC, spring terminals
1SAP 217 200 R0001	TU531, I/O Terminal Unit, 230 V AC, relays, screw-type terminals
1SAP 217 000 R0001	TU532, I/O Terminal Unit, 230 V AC, relays, spring terminals

Contents

AC500 CPUs

AC500 CPUs PM571, PM581, PM582, PM590 and PM591
- PM5xx-ETH: CPU with network interface Ethernet RJ45
- PM5xx-ARCNET: CPU with network interface ARCNET BNC



Elements of the CPU

1 Six 7-segment status displays with background lighting
2 Triangle displays for "Item"
3 Square displays for "Status"
4 Status LEDs
5 Pushbuttons
6 Slot for the SD Memory Card
7 Label
8 Compartment for the Lithium battery
9 Lithium battery TA521
10 SD Memory Card MC502

Elements of the CPU Terminal Base

11 I/O-Bus (10-pole, female) to electrically connect the first I/O Terminal Unit
12 Slot for the CPU (CPU is mounted)
13 Slots for couplers (max. 4)
14 Interface for FieldBusPlug
15 Supply for 24 V DC
16 Serial interface COM1
17 Serial interface COM2
18 Network interface (Ethernet or ARCNET)
19 Holes for wall mounting
20 DIN rail

Figure: CPU PM581-ETH plugged on a Terminal Base TB521

The CPUs PM571, PM581, PM582, PM590 and PM591 are the central units (basic units) of the control system Advant Controller 500 (AC500). The types differ in their performance (memory size, speed etc.). Each CPU must be mounted on a suitable Terminal Base. The Terminal Base type depends on the number of communication modules (couplers) which are used together with the CPU and on the CPU-own network interface type (Ethernet or ARCNET). At the right side of the CPU, up to 7 I/O expansion modules can be attached.

If both of the following conditions are fulfilled, **max. 10 I/O expansion modules can be connected to the I/O-Bus of the CPU:**
- PS501 as of version V1.2
- CPUs as of firmware V1.2.0

The CPUs have several interfaces.

Note: Mounting, disassembling, electrical connection and dimensioned drawings for the Terminal Bases, CPUs, communication modules, I/O Terminal Units and the I/O expansion modules are described in detail in the AC500 system data chapters.

Contents

Short description

Important: Currently, the AC500 CPU can only be used as slave together with the PROFIBUS DP **"Modular"** FBP V0/V1 (order No. 1SAJ 240 100 R10xx) and the corresponding GSD file ABB_091F.GSD.

Hardware configuration

Each CPU can operate up to 4 couplers through its coupler interface. The couplers are mounted on the left side of the CPU on the same Terminal Base. On the right side of the CPU, up to 7 digital or analog I/O expansion modules can be attached which are automatically interconnected by the I/O-Bus. Each of these modules requires its own I/O Terminal Unit, whose type depends on the module type.

If both of the following conditions are fulfilled, **max. 10 I/O expansion modules can be connected to the I/O-Bus of the CPU:**
- PS501 as of version V1.2
- CPUs as of firmware V1.2.0

Terminal Bases, Terminal Units, I/O modules, couplers and accessories have their own technical descriptions which can be found under "Hardware AC500" and "Hardware S500".

Each CPU can be used as

- bus master within the control system AC500 together with several field buses and networkings
- slave (remote processor together with the FieldBusPlug) within the control system AC500
- stand-alone CPU

The CPUs are powered with 24 V DC.

CAUTION: Removal of energized modules is not permitted. All power sources (supply and process voltages) must be switched off while working on any AC500 system.

The following figure shows a CPU with Terminal Base, couplers and I/O modules.

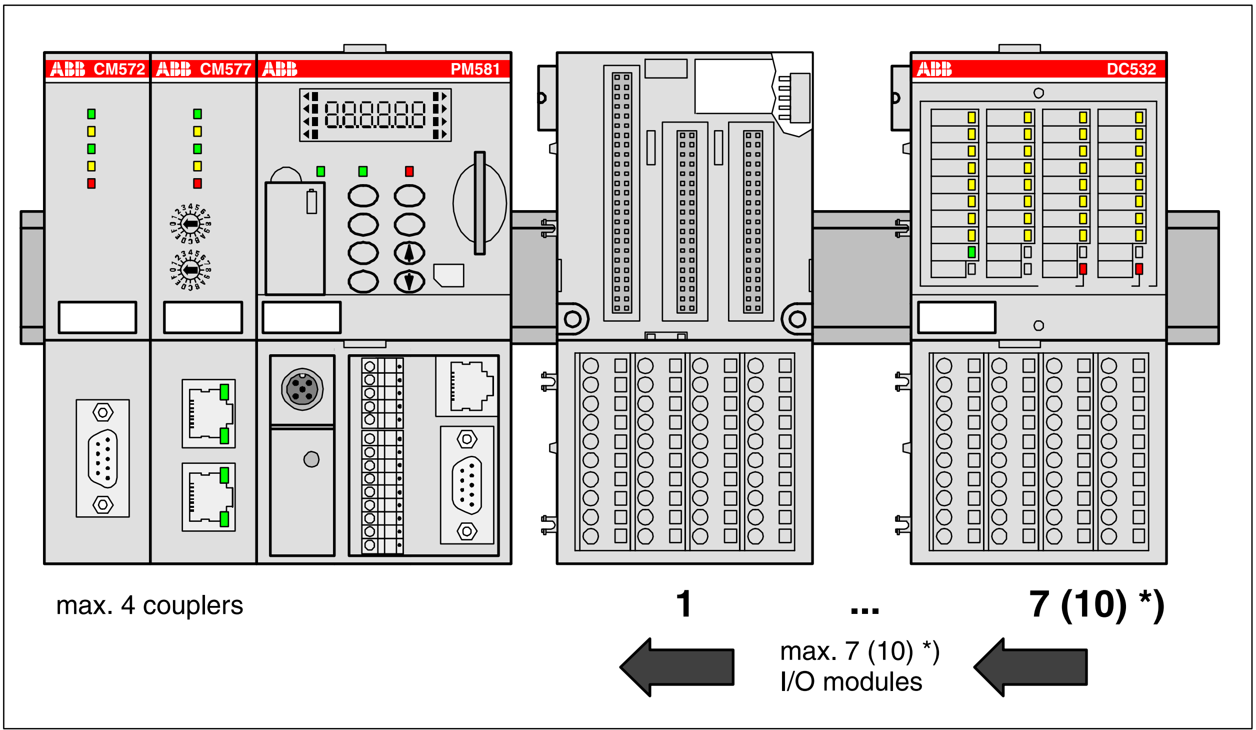


Figure: CPU with Terminal Base, couplers and I/O modules

***)** If both of the following conditions are fulfilled, **max. 10 I/O expansion modules can be connected to the I/O-Bus of the CPU:**
- PS501 as of version V1.2
- CPUs as of firmware V1.2.0

Assortment

CPUs

CPU	Program memory	Cycle time for 1000 instructions	Network interface		Other interfaces	Suitable Terminal Bases
			Ether-net	ARC-NET		
PM571	64 kB	Binary: 0.3 ms Word: 0.3 ms Floating point: 6 ms			Serial interfaces COM1 and COM2, FBP, coupler interface, I/O-Bus	TB5xx-xx
PM571-ETH			yes			TB5xx-ETH
PM581	256 kB	Binary: 0.15 ms Word: 0.15 ms Floating point: 3 ms				TB5xx-xx
PM581-ETH			yes			TB5xx-ETH
PM581-ARCNET				yes		TB5xx-ARCNET
PM582	512 kB					TB5xx-xx
PM582-ETH			yes			TB5xx-ETH
PM590	2 MB	Binary: 0.02 ms Word: 0.01 ms Floating point: 0.02 ms				TB5xx-xx
PM590-ETH			yes			TB5xx-ETH
PM590-ARCNET				yes		TB5xx-ARCNET
PM591	4 MB					TB5xx-xx
PM591-ETH			yes			TB5xx-ETH
PM591-ARCNET				yes		TB5xx-ARCNET

For further information see Technical data and Ordering data

Terminal Bases

Number of slots

Terminal Base	TB511	TB521	TB541
Slots for CPUs	1	1	1
Slots for communication modules	1	2	4

Terminals and interfaces

Terminal Base	TB511-		TB521-		TB541-	
available = (x)	ETH (x)	ARCNET	ETH (x)	ARCNET (x)	ETH (x)	ARCNET
Connection						
I/O-Bus	I/O interface for directly adding up to 7 I/O Terminal Units *)					
Power supply	5-pole removable terminal block					
COM1	serial interface, 9-pole removable terminal block					
COM2	serial interface, 9-pole SUB-D connector (female)					
Network interface (type must be equal to the type of the used CPU)	Ethernet RJ45	ARCNET BNC	Ethernet RJ45	ARCNET BNC	Ethernet RJ45	ARCNET BNC
FBP interface	Fieldbus-neutral slave interface (M12, 5-pole, male, fastening with screw)					

***)** If both of the following conditions are fulfilled, **max. 10 I/O expansion modules can be connected to the I/O-Bus of the CPU:**
- PS501 as of version V1.2
- CPUs as of firmware V1.2.0

Connections

I/O-Bus

The I/O-Bus is the I/O data bus for the S500 expansion modules. Through this bus, I/O and diagnosis data are transferred between the AC500 CPU and the I/O expansion modules. Up to 7 I/O Terminal Units (for 1 I/O expansion module each) can be added to one Terminal Base.

If both of the following conditions are fulfilled, **max. 10 I/O expansion modules can be connected to the I/O-Bus of the CPU:**
- PS501 as of version V1.2
- CPUs as of firmware V1.2.0

The I/O Terminal Units have a bus input at the left side and a bus output at the right side. Thus the length of the I/O-Bus increases with the number of the I/O expansion modules used.

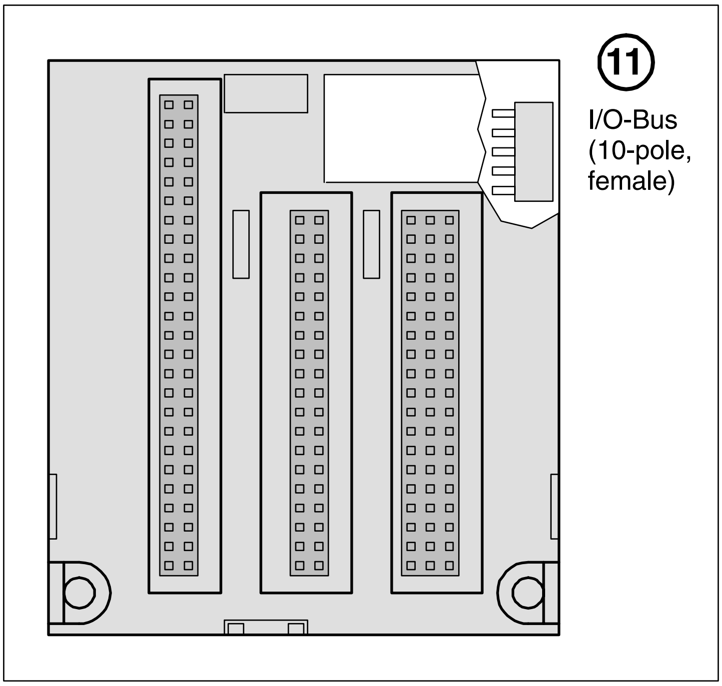
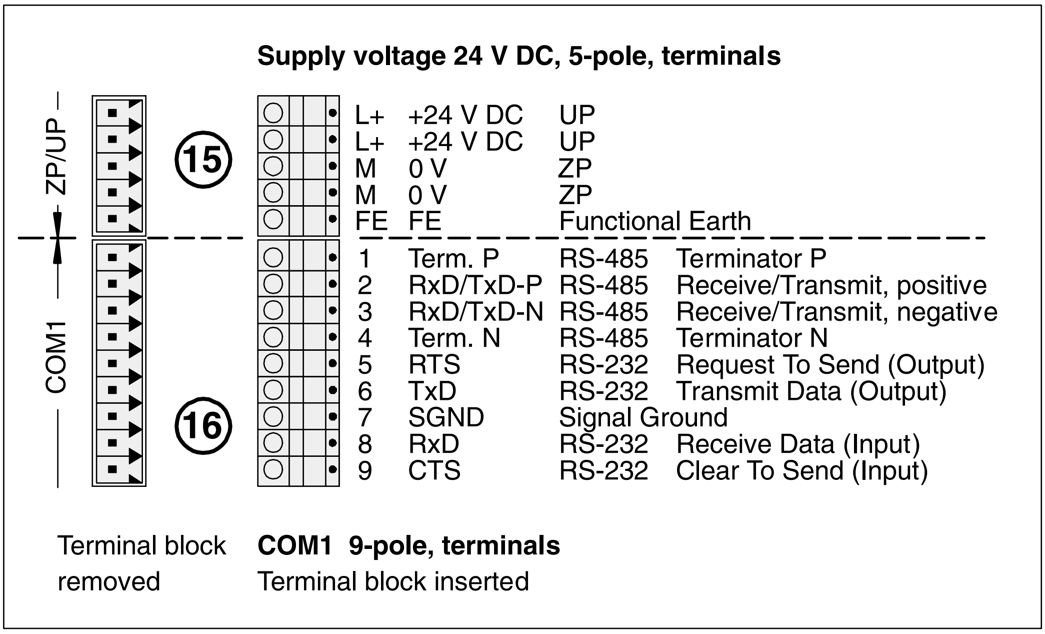


Figure: I/O-Bus

Power supply

The supply voltage of 24 V DC is connected to a 5-pole removable terminal block. ZP and UP exist twice. So it is possible to supply external sensors from these terminals, for instance.

> ⚠ **Important:** Exceeding the maximum power supply voltage (>30 V DC) for process or supply voltages could lead to unrecoverable damage of the system. The system could be destroyed.



Figure, upper part: Power supply via a 5-pole terminal block
Figure, lower part: Terminal assignment of the serial interface COM1

Bad wiring on power supply terminals

> ⚠ **Attention:** The product should be installed by trained people who have the knowledge of wiring electronic devices. In case of bad wiring, although the modules are protected against various errors (reverse polarity, short circuit, etc.), some problems could always happen:
>
> - On the CPU Terminal Base, the terminals L+ and M are doubled. If the power supply is badly connected, a short circuit could happen and lead to a destruction of the power supply or its fuse. If no suitable fuse exists, the Terminal Base itself could be destroyed.
>
> - The CPUs (Terminal Bases) and all electronic modules (and Terminal Units) are protected against reverse polarity.
>
> - All necessary measures should be carried out to avoid damages to modules and wiring. Notice the wiring plans and connection examples.

Serial interface COM1 (for terminal assignment see the figure above)

The serial interface COM1 is connected to a removable 9-pole terminal block. It is configurable for RS-232 and RS-485 and can be used for

- an online access (RS-232 programming interface for PC/Control Builder)
- a free protocol (communication via the function blocks COMSND and COMREC)
- Modbus RTU, master and slave or
- a CS31 system bus (RS-485), as master only

A detailed description for COM1 can be found under "Hardware AC500 / System data / System data and System construction / Serial interface COM1 or Serial interfaces".

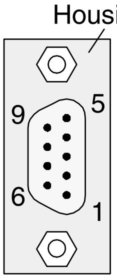
Serial interface COM2

The serial interface COM2 is connected to a 9-pole SUB-D connector. It is configurable for RS-232 and RS-485 and can be used for

- an online access (RS-232 programming interface for PC/Control Builder)
- a free protocol (communication via the function blocks COMSND and COMREC)
- MODBUS RTU, master and slave

COM2 is not intended to establish a CS31 system bus.

17



Housing	FE	Functional Earth		
1	FE	Functional Earth		
2	TxD	RS-232	Transmit Data	Output
3	RxD/TxD-P	RS-485	Receive/Transmit	positive
4	RTS	RS-232	Request To Send	Output
5	SGND	Signal Ground	0 V supply out	
6	+5 V		5 V supply out	
7	RxD	RS-232	Reiceive Data	Input
8	RxD/TxD-N	RS-485	Receive/Transmit	negative
9	CTS	RS-232	Clear To Send	Input

COM2 9-pole, female

Figure: Pin assignment of the serial interface COM2

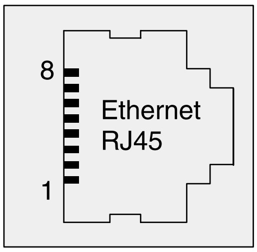
A detailed description for COM2 can be found under "Hardware AC500 / System data / System data and System construction / Serial interface COM2 or Serial interfaces".

Network interface Ethernet

This interface is the connection to the internal Ethernet coupler of the CPUs PM5xx-ETH. Applications are:

- TCP/IP for PC/Control Builder (programming)
- UDP (communication via function blocks ETH_UDP_SEND and ETH_UDP_REC)
- Modbus on TCP/IP (Modbus on TCP/IP, master and slave)

18



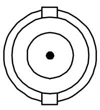
8	NC	not used
7	NC	not used
6	RxD–	Receive Data
5	NC	not used
4	NC	not used
3	RxD+	Receive Data
2	TxD–	Transmit Data
1	TxD+	Transmit Data
Shield	Cable shield / Signal Ground	

Figure: Pin assignment of the Ethernet interface

Network interface ARCNET

This interface is the connection to the internal ARCNET coupler of the CPUs PM5xx-ARCNET.

18



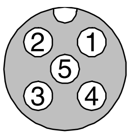
ARCNET BNC

Figure: ARCNET interface

FBP interface

Through this 5-pole fieldbus-neutral interface, the AC500 CPU can be connected **as a slave** to a fieldbus master. The FieldBusPlug is fastened by a screw.

14



male

Pin assignment in serial mode

1	+24 V	Standard power supply
2	Diagnosis pin	
3	0 V	Standard power supply
4	Serial data	
5	Serial data	

Figure: Pin assignment of the FBP interface

Insertion / replacement of the Lithium battery TA521

AC500 CPUs are supplied without a Lithium battery. It therefore must be ordered separately. The TA521 Lithium Battery is used to save RAM contents of AC500 CPUs and back-up the real-time clock. Although the CPUs can work without a battery, its use is still recommended in order to avoid process data being lost.

The CPU monitors the battery status. A low battery error is output before the battery condition becomes critical (about 2 weeks before). After the error message appears, the battery should be replaced as soon as possible.

Attention: The TA521 Lithium Battery is the only one, which can be used with AC500 CPUs.

The following procedures describe the insertion / replacement of the Lithium battery.

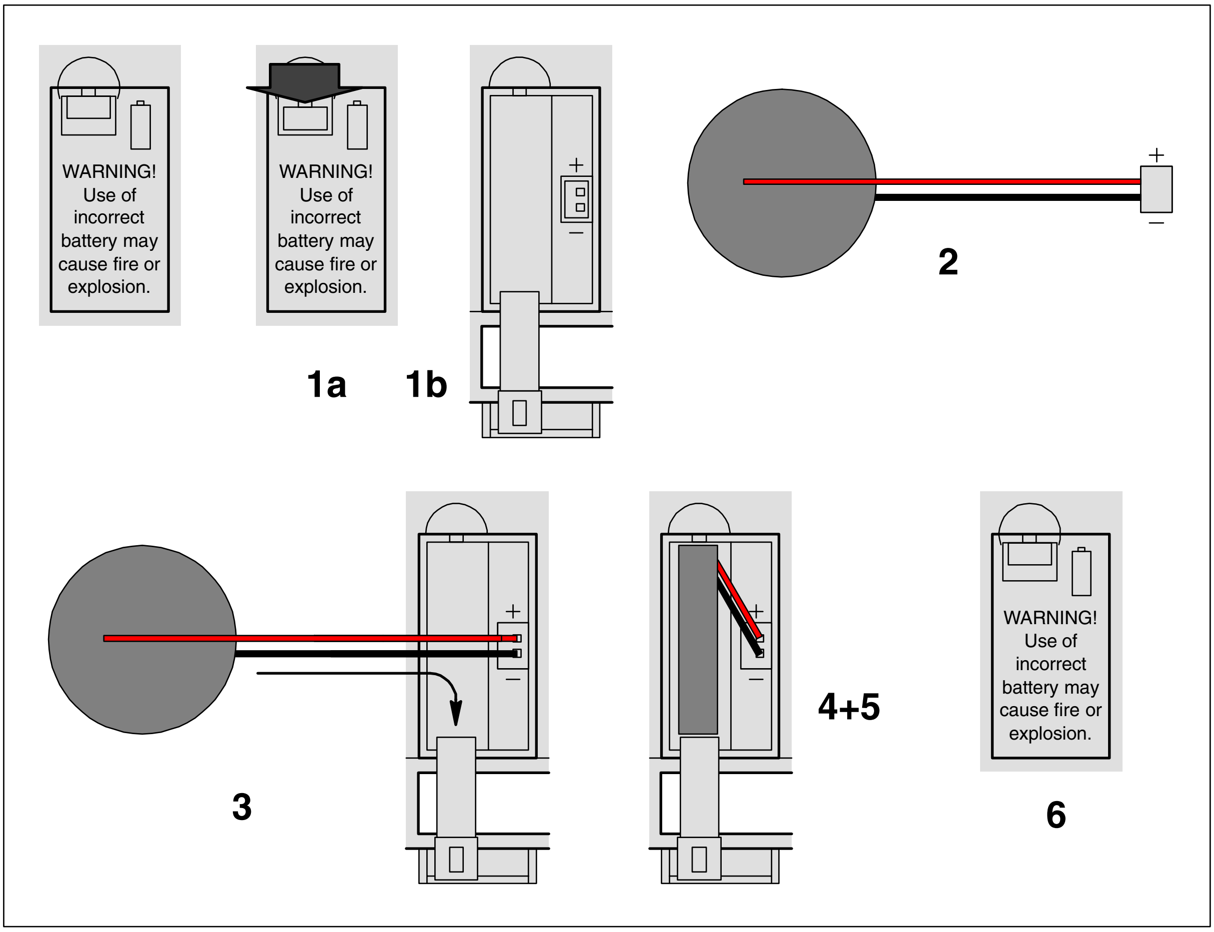


Figure: Insertion / replacement of the Lithium battery

Insertion of the battery:

1. Open the battery compartment by inserting a fingernail in the small locking mechanism, press it down and slip down the door. The door is attached to the front face of the CPU and cannot be removed.
2. Remove the TA521 battery from its package and hold it by the small cable.
3. Insert the battery connector into the small connector port of the compartment. The connector is keyed to find the correct polarity (red = plus-pole = above).
4. Insert first the cable and then the battery into the compartment, push it until it reaches the bottom of the compartment.
5. Arrange the cable in order not to inhibit the door to close.

6. Pull-up the door and press until the locking mechanism snaps.

Note: In order to prevent data losses or problems, the battery should be replaced after 3 years of utilisation or **at least** as soon as possible after receiving the "Low battery warning" indication.
Do not use a battery older than 3 years for replacement, do not keep batteries too long in stock.

Replacement of the battery:

Attention: In order to avoid any data losses (if needed), the battery replacement should be done with the system under power. Without battery and power supply there is no data buffering possible.

1. Open the battery compartment by inserting a fingernail in the small locking mechanism, press it down and slip down the door. The door is attached to the front face of the CPU and cannot be removed.

2. Remove the old TA521 battery from the battery compartment by pulling it by the small cable. Remove then the small connector from the socket, do this best by lifting it out with a screwdriver (see photo).

3. Follow the previous instructions to insert a new battery.

Attention: Lithium batteries must not be re-charged, not be disassembled and not be disposed of in fire. They must be stored in a dry place. Exhausted batteries must be recycled to respect the environment.

The technical data sheet for the Lithium battery can be found in the chapter "Accessories / Lithium Battery TA521".

Insertion of the SD Memory Card MC502

AC500 CPUs are supplied without an SD Memory Card. It therefore must be ordered separately. The SD Memory Card is used to back-up user data and store user programs as well as to update the internal CPU firmware. AC500 CPUs can be operated with and without SD Memory Cards.

The CPU uses a standard file system. This allows standard card readers to read the MC502 SD Memory Cards.

⚠ **Attention:** The use of memory cards other than the MC502 SD Memory Card is prohibited. ABB is not responsible nor liable for consequences resulting from the use of unapproved memory cards.

⚠ **Attention:** In operation, the plugged-in SD Memory Card withstands vibrations up to 1 g. Without using an SD Memory Card, the CPU itself withstands vibrations up to 4 g.

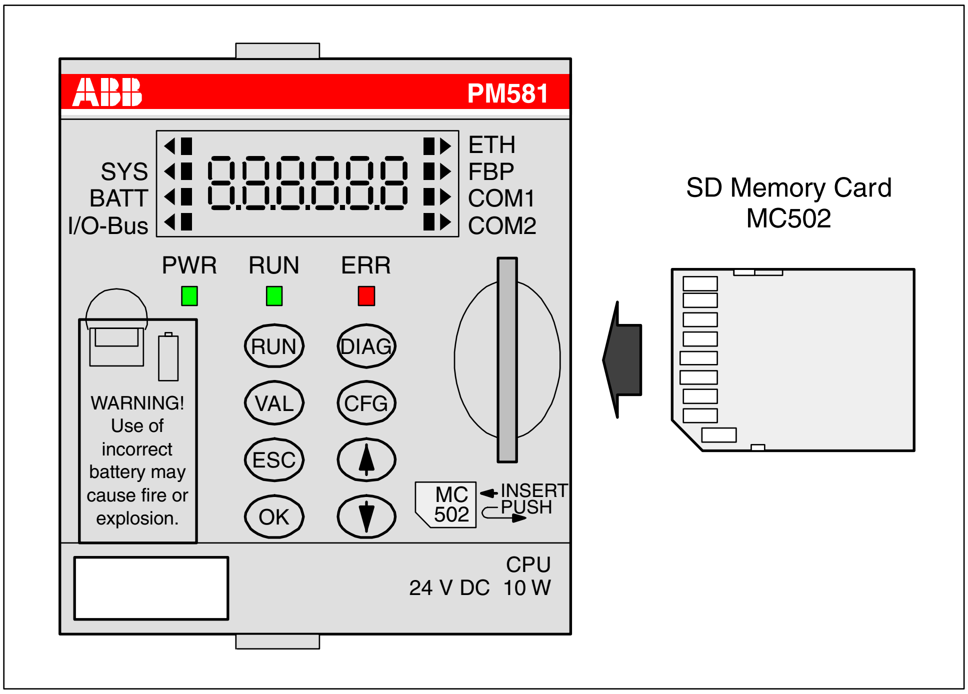


Figure: Insertion of the SD Memory Card

To insert the SD Memory Card, follow the procedure shown below.

1. Remove the SD Memory Card from its package.
2. Insert the memory card into the opening of the front face of the CPU with the memory aligned as shown above (contacts are visible on the left side, bevelled edge below).
3. Push on the card until it moves forward, then release your pressure, the SD card comes slightly backward and it locks into the card slot.

Removing the SD Memory Card

To remove the card, first push on the card until it moves forward (that unlocks the card), then release your pressure, the card will go forward out of the slot and can be easily removed.

The technical data sheet for the SD Memory Card can be found in the chapter "Accessories / SD Memory Card MC502".

Project planning / start-up

Programming is carried out with the AC500 Control Builder software, which is based on the CodeSys standard. The software can be run on the operating systems Windows 2000 and XP.

A fast Online Program Modification of the user program is possible without interrupting the running operation.

If data areas should be saved during power OFF/ON, they can be stored in the Flash EPROM. The installed Lithium battery saves data in the RAM.

Behaviour of the system in case of power supply interruptions and power recovering

AC500 system supply (terminals L+, M)

As soon as the CPU power supply is higher than 19.2 V DC, the power supply detection is activated and the CPU is started. When during operation the power supply is going down to lower than 19.2 V DC for more than 10 ms, the CPU is switched to safety mode (see System Technology of the CPUs).

A warm restart of the CPU only occurs by switching the power supply off and on again (see also the description of the function modes of the CPU in the "AC500 System Technology" chapters.

Displays and operating elements on the front panel of the CPU

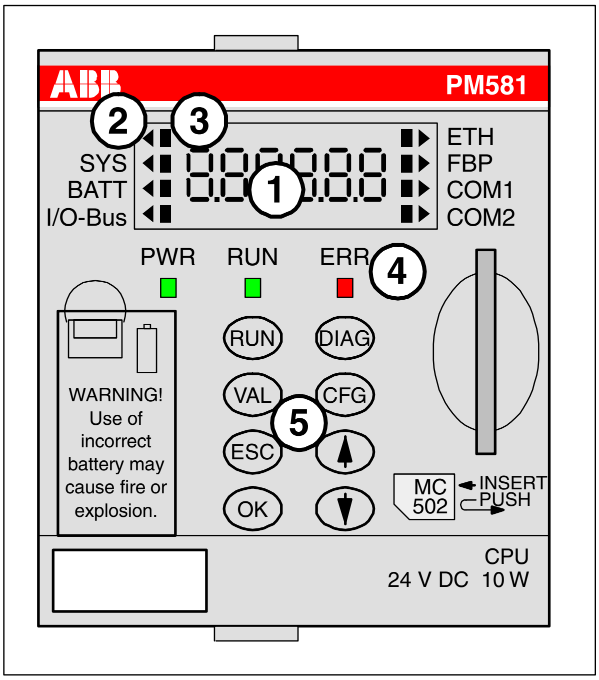


Figure: Displays and operating elements on the front panel of the CPU

LCD display with background lighting

1 Six 7-segment status displays for displaying

- the CPU status (e.g. RUN or STOP)
- error codes and error classes
- address modifications and parameters of the integrated couplers (Ethernet or ARCNET)
- values at the channels of I/O modules

2 Triangle displays

- show what is just selected (active)

3 Square displays

- show that the communication is running between the CPU and the bus

Status LEDs

4 Meaning of the status LEDs

LED	Color	Function
PWR	green	indicates that the power supply of the CPU is ON
RUN	green	indicates that the CPU is running (is OFF with STOP)
ERR	red	indicates an error occurred (goes off after error acknowledgement)

Pushbuttons

5 The CPU can be operated manually using the eight pushbuttons on the front panel. Meaning of the pushbuttons:

Button	Meaning
RUN	toggles the CPU between RUN and STOP mode
VAL	reserved for future use
ESC	ESC, quit menu without saving
OK	OK, leave menu after saving
DIAG	diagnosis, evaluate error message in detail
CFG	set address for ARCNET, CS31 and FBP
↑	Move up selection or increase value (e.g. address) by 1
↓	Move down selection or decrease value (e.g. address) by 1

The entire functionality of the CPUs is described in detail under "System technology of the CPUs".

In the following examples, the use of the displays and pushbuttons is represented in detail.

Examples for the use of the displays and pushbuttons

Example 1: Setting of the slave address of the FBP plug onto the AC500 CPU (if needed, but not recommended)

The FieldBusPlug must have a properly assigned slave module address. The AC500 CPU gives them an address at system power-up. The address could be set with the use of the display and the pushbutton on the top of the module, but it is mainly assigned by the AC500 Control Builder configuration.

Attention: The **local** setting of an FBP address by means of pushbuttons and display has a higher priority than an FBP address configured by the AC500 Control Builder!

The locally set address replaces the address configured by the software.

It is highly recommended to be extremely careful when modifying the address locally, because it has high influence on the behaviour of the application.

Up to 99 addresses can be then set with the display.

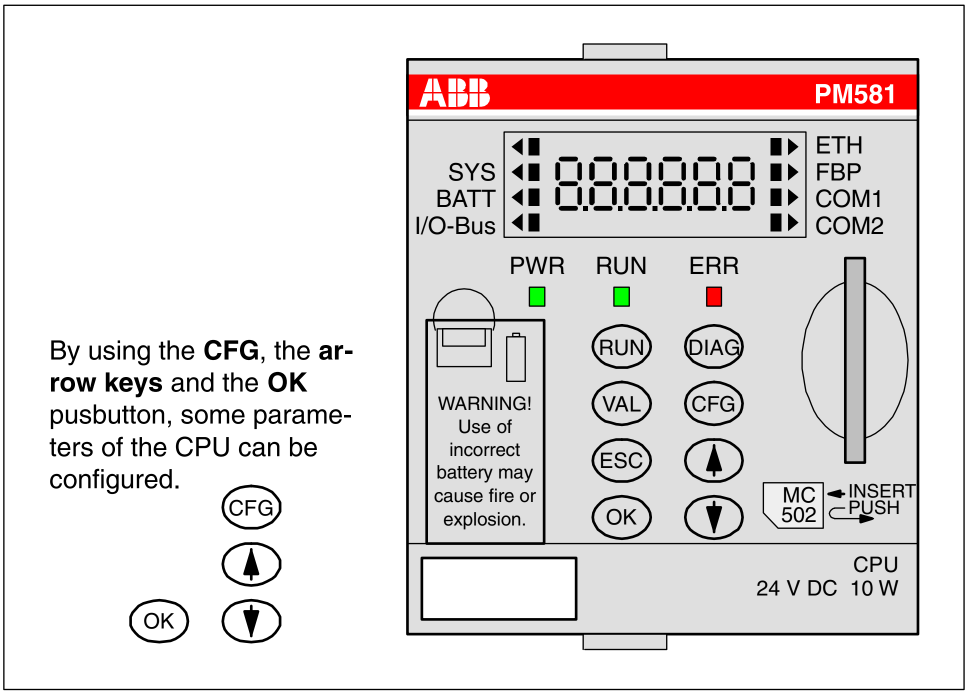


Figure: Configuration on the CPU

Attention: If the FBP address set on the AC500 CPU module (or by the AC500 Control Builder software) is different from that address assigned by the Master device for the same station, the station cannot be accessed and the complete Fieldbus cannot work properly or is completely down!

To configure the FBP address, please follow the procedure described below:

1. First select the item to be configured by pressing the **CFG** key, the CPU changes to configuration mode and a small triangle is displayed on the LCD on the first right up position of the display beside the ETH inscription and the already configured address is displayed.
   Press one time more the **CFG** key to move the triangle to the position below "FBP". The FBP is then selected, and the current address is shown.
2. Press then the arrow keys UP or DOWN to increase or decrease the address, the modified value blinks to indicate that it differs from the previously stored one.
3. Once the desired address is reached, press **OK** to accept and quit or only **ESC** to exit the menu without saving the changes. The CPU status is then displayed **run/StoP.**

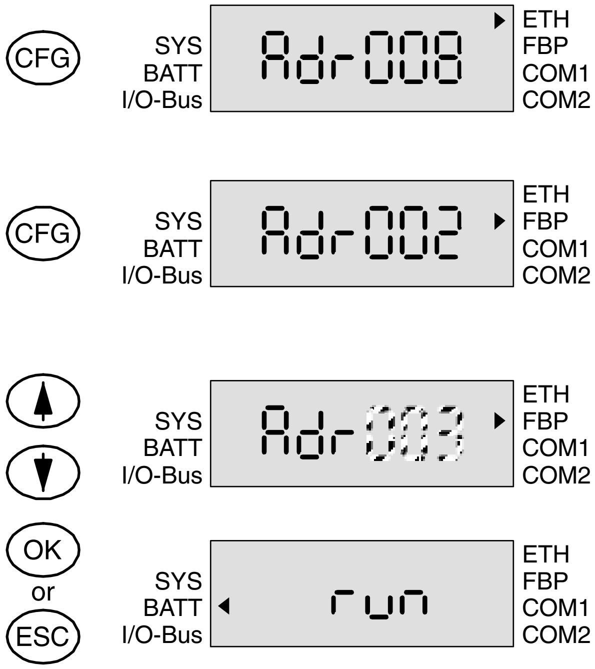


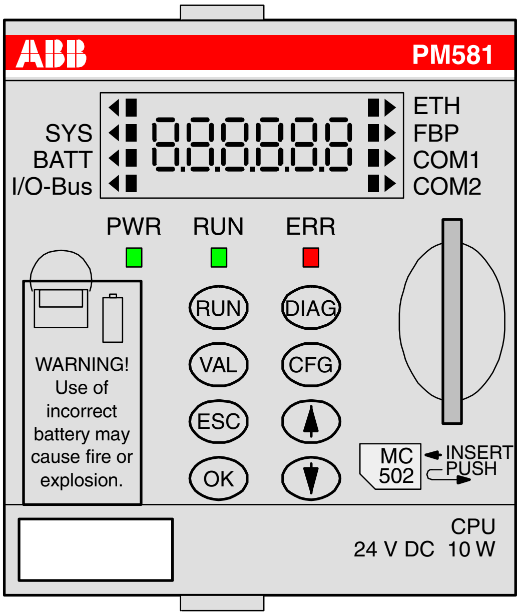
Figure: Configuration of an FBP address

A AC500 CPU equipped with a FieldBusPlug is always a slave device on the bus. To act as a master, a AC500 CPU should be equipped with master couplers (e.g CM572-DP for PROFIBUS DP).

Attention: The locally modified address will only be valid after a power OFF/ON of the CPU!

Example 2: AC500-CPU, status display and error indication

All AC500 CPUs have LEDs and a LC Display for indicating operating statuses and errors. The following drawing shows the front face of a AC500 CPU.



The CPU statuses are displayed on the CPU front face with 3 LEDs:

- PWR
- RUN
- ERR
- and by means of a background-lighted display

The display contains the following indications:

- ▮ small black squares indications acting as a LED status for the device written beneath
- ▸ small black arrows used for indication by pointing the selected device to be configured or read
- 6 x 7-segment displays for ”plain text” or error codes display

Figure: Front face of a AC500 CPU

The display is normally OFF and the status of the CPU is shown as plain text "run" or "Stop", which reflects the operating status of the CPU program.

By pressing one of the dialog keys **"RUN, DIAG, CFG** or **VAL"**, the background lighting is turned ON and the desired function is performed.

In case of a function error, the display background lighting is also switched on and an error code is displayed.

The meaning of the LEDs and of LCD is given in the following table.

AC500 CPU module LEDs

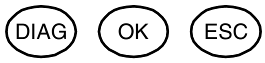
LED	Status	Color	LED = ON	LED = OFF	LED flashes
PWR	24 V DC power supply is provided	green	voltage is present	voltage is missing	--
RUN	activity status	green	CPU is in RUN mode	CPU is in STOP mode	If flashes fast (4 Hz): The CPU is reading/writing the SD card, indicates together with the blinking error LED that the CPU is writing the internal Flash EEPROM. If flashes slow (1 Hz): The firmware update from the SD card is finished without errors.
ERR	error indication	red	An error has occurred. After pressing the DIAG key, the error type and code is displayed in the LC Display. The error codes can be shown by means of the DIAG and OK keys.	No errors are encountered or only warnings (E4 errors). This is configurable (by error 2 - 4, the LED behaviour is configurable.	Flashing fast (4 Hz): Indicates together with RUN a firmware update process and a Flash EEPROM write.
■	Working activity of the beneath described device (e.g. top right of the display ETH communication line).	black	Device is present and OK (e.g. the battery is present and OK).	No activity or device not present	Flashing according to the device activity, e.g. when data exchange on ETH, COM1, etc... communication lines.
► or ◄	Indicates the selected device to be read or configured. Acts as a cursor moving with the arrow ▲▼ keys	black	Points out the selected device of which the name is written beneath (e.g. top right of the display ETH communication line).	No device selected	--

Displaying error messages (error codes) on the AC500 CPU

When an error occurs, the red error LED goes on.

By pressing the **DIAG** key, the complete error code can be shown and an acknowledgement of the error can be performed.

By using the **DIAG** and the **OK** or the **ESC** push-buttons, the error message/code can be displayed and the error can be acknowledged.



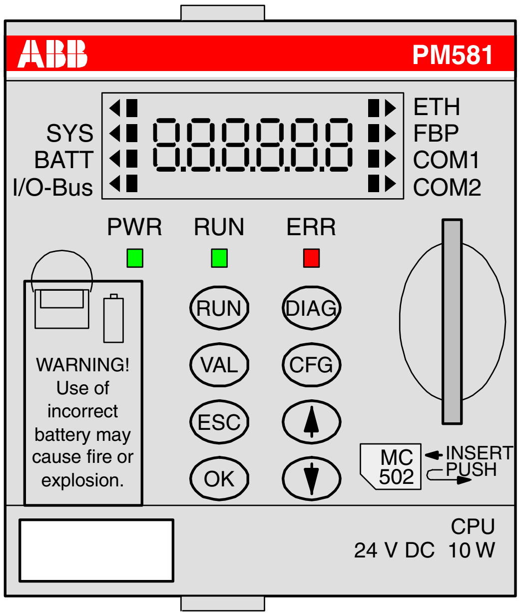


Figure: Error display on the CPU

The AC500 CPU can display various errors according to the error classes. The following error classes are possible. The reaction of the CPU is different for each type of error.

Error class	Type	Meaning	Example
E1	Fatal error	A safe function of the operating system is no longer guaranteed.	Checksum error in the system Flash or RAM error
E2	Severe error	The operating system is functioning without problems, but the error-free processing of the user program is no longer guaranteed.	Checksum error in the user Flash, independent of the task duration
E3	Light error	It depends on the application, if the user program should be stopped by the operating system or not. The user should decide, which reaction is necessary.	Flash could not be programmed, I/O module has failed.
E4	Warning	Error in the periphery (e.g. I/O) which only can have influence in the future. The user should decide the reaction to provide.	Short-circuit at an I/O module, the battery is exhausted or not inserted.

How an error message is built-up in the display

An error always consists of an Error Class (E1 to E4, see the previous table) and a number (0 to 63) which indicates the identifier of the error for direct error recognition. Moreover, there are further four detailed error codes from d1 to d4 which define the error in detail:

E1...E4 = 00...63 (error identifier)		e.g. wrong value, checksum error, short-circuit, exhausted or missing battery, etc. which is directly displayed in the LCD
->	d1 = 000...015	indicates the component which has sent the error (coupler, CPU, COM1, FBP, IO-Bus, etc.)
	d2 = 000...255	defines the faulty device within the component
	d3 = 000...030	defines the part of the module with an error (slot)
	d4 = 000...031	defines the channel within the module

Example of an error display for an exhausted battery

To display the complete error codes, please follow the procedure described below:

The CPU is running. The display only shows the RUN status and the background lighting is OFF.

When an error occurs, the red ERR LED goes on. An error message is output after pressing the **DIAG** key and, for example, the screen shown to the right displays "E4=008". According to the error level, E1 to E4 can be displayed.

In this example, "**E4=008**" is a warning **(E4)** and **"008"** means "Empty/Missing".

By pressing on the **DIAG** button, the LCD background lighting is turned ON, the error codes can be displayed to achieve more (deaper) diagnostic. The display shows "d1=009" (detail level 1) and "009" indicates that the CPU has sent the error.

By pressing **DIAG** one more time, the display shows "d2=022" (detail level 2) and "022" indicates that the device type = battery.

By pressing **DIAG** one more time, the display shows "d3=031" (detail level 3) and "031" means "no module type" (= device itself).

By pressing **DIAG** one more time, the display shows "d4=031" (detail level 4) and "031" means "no channel" (= device itself).

By pressing **OK,** the error is acknowledged and the display returns to the normal state. ESC returns to the normal state without acknowledging the error!

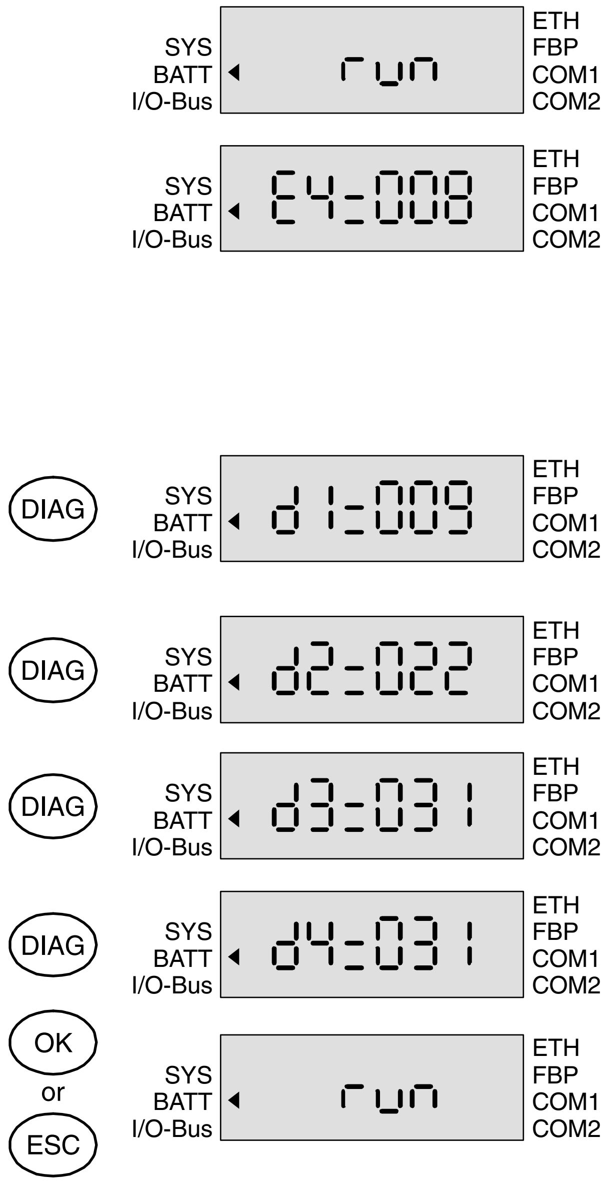


Figure: Example of an error display for an exhausted battery

Technical data

The system data of AC500 and S500 are valid here. Only additional details are therefore documented below.

General data of the CPUs and the Terminal Bases

For more information, please refer to the "AC500 System Data" chapters.

Connection of the supply voltage 24 V DC at the Terminal Base of the CPU	at a 5-pole removable terminal block with spring connection
Current consumption from 24 V DC	PM571: 50 mA PM571-ETH: 110 mA
	PM581: 50 mA PM581-ETH: 110 mA PM581-ARCNET: 110 mA
	PM582: 50 mA PM582-ETH: 110 mA
	PM59x: 90 mA PM59x-ETH: 150 mA PM59x-ARCNET: 150 mA
Inrush current at 24 V DC	PM571: 1 A^2s PM571-ETH: 1 A^2s
	PM581: 1 A^2s PM581-ETH: 1 A^2s PM581-ARCNET: 1 A^2s
	PM582: 1 A^2s PM582-ETH: 1 A^2s
	PM59x: 1 A^2s PM59x-ETH: 1 A^2s PM59x-ARCNET: 1 A^2s
Max. power dissipation within the module	10 W
Slots on the Terminal Bases	TB511: 1 CPU, 1 communication module
	TB521: 1 CPU, 2 communication modules
	TB524: 1 CPU, 4 communication modules
CPU interfaces at the Terminal Bases	I/O-Bus, COM1, COM2, FBP
CPU network interfaces at the Terminal Bases	TB5xx-ETH / PM5xx-ETH: Ethernet
	TB5xx-ARCNET / PM5xx-ARCNET: ARCNET
Connection system	see AC500 system data
Dimensions	further details see AC500 system data
Width x height x depth	TB511 with CPU: 95.5 x 135 x 75 mm
	TB521 with CPU: 123.5 x 135 x 75 mm
	TB541 with CPU: 179.5 x 135 x 75 mm
Weight (CPU without Terminal Base)	PM571: 135 g PM571-ETH: 150 g
	PM581: 135 g PM581-ETH: 150 g PM581-ARCNET: 160 g
	PM582: 135 g PM582-ETH: 150 g
	PM59x: 135 g PM59x-ETH: 150 g PM59x-ARCNET: 160 g
Mounting position	horizontal or vertical with derating (50 % output load, reduction of temperature to 40°C)

Detailed data of the CPUs

CPU	PM571	PM571 -ETH	PM58x	PM58x -ETH	PM581- ARCNET	PM59x	PM59x -ETH	PM59x- ARCNET
Program memory Flash EPROM and RAM	64 kB		PM581: 256 kB PM582: 512 kB			PM590: 2048 kB PM591: 4096 kB		
Data memory, integrated	24 kB, incl. 4 kB RETAIN		288 kB, incl. 32 kB RETAIN			PM590: 2048 kB, PM591:3072 kB, incl. 512 kB RETAIN		
Expandable memory	none		none			none		
Pluggable SD Memory Card for: - User data storage - Program storage - Firmware update	128 MB		128 MB			128 MB		
Cycle time for 1000 instructions - Binary - Word - Floating point	 0.3 ms 0.3 ms 6.0 ms		 0.15 ms 0.15 ms 3.0 ms			 0.05 ms 0.05 ms 0.5 ms		
Max. number of central inputs and outputs (up to 7 exp. modules): - Digital inputs - Digital outputs - Analog inputs - Analog outputs	 224 168 112 112		 224 168 112 112			 224 168 112 112		
Max. number of central inputs and outputs (up to 10 exp. modules): *) - Digital inputs - Digital outputs - Analog inputs - Analog outputs	 320 240 160 160		 320 240 160 160			 320 240 160 160		
Number of decentralized inputs and outputs	depends on the used field bus (as an info on the CS31 bus: up to 31 stations with up to 120 DI / 120 DO each)							
Data backup	battery		battery			battery		
Data buffering time at 25°C	about 3 years							
Battery low indication	warning indication issued about 2 weeks before the battery charge becomes critical							
Real-time clock - with battery back-up	 X		 X			 X		
Program execution - cyclic - time-controlled - multitasking	 X X X		 X X X			 X X X		
Protection of the user program by a password	X		X			X		
Serial interface COM1 - Physical link: - Connection: - Usage:	 configurable for RS-232 or RS-485 (from 0.3 to 187.5 kB/s) pluggable terminal block, spring connection for programming, as Modbus (master/slave), as serial ASCI communication, as CS31 master							
Serial interface COM2 - Physical link: - Connection: - Usage:	 configurable for RS-232 or RS-485 (from 0.3 to 187.5 kB/s) SUB-D connector for programming, as Modbus (master/slave), as serial ASCI communication							
Integrated coupler, ETH = Ethernet RJ45 ARCNET = ARCNET BNC		ETH		ETH	ARCNET		ETH	ARCNET

Number of external couplers	up to 4 communication couplers like PROFIBUS DP, Ethernet, CANopen, DeviceNet. There is no restriction concerning the coupler types and coupler combinations (e.g. up to 4 PROFIBUS DP couplers are possible)		
LEDs, LCD display, 8 function keys	for RUN/STOP switch-over, status displays and diagnosis		
Number of timers	unlimited	unlimited	unlimited
Number of counters	unlimited	unlimited	unlimited
Programming languages - Instruction List IL - Function Block Diagram FBD - Ladder Diagram LD - Sequential Function Chart SFC - Continuous Function Chart (CFC)	 X X X X X	 X X X X X	 X X X X X
Certifications	CE, GL, DNV, BV, RINA, LRS, cUL		

***)** If both of the following conditions are fulfilled, **max. 10 I/O expansion modules can be connected to the I/O-Bus of the CPU:**
- PS501 as of version V1.2
- CPUs as of firmware V1.2.0

Ordering data

Order No.	Scope of delivery
1SAP 130 100 R0100	PM571, CPU, memory 64 kB, 24 V DC, Memory Card Slot, interfaces 2 x RS-232/485 (programming, Modbus/CS31), 1 x FBP, Display
1SAP 130 100 R0170	PM571-ETH, CPU, memory 64 kB, 24 V DC, Memory Card Slot, interfaces 2 x RS-232/485 (programming, Modbus/CS31), 1 x FBP, Display, integrated coupler Ethernet TCP/IP
1SAP 140 100 R0100	PM581, CPU, memory 256 kB, 24 V DC, Memory Card Slot, interfaces 2 x RS-232/485 (programming, Modbus/CS31), 1 x FBP, Display
1SAP 140 100 R0160	PM581-ARCNET, CPU, memory 256 kB, 24 V DC, Memory Card Slot, interfaces 2 x RS-232/485 (programming, Modbus/CS31), 1 x FBP, Display, integrated coupler ARCNET
1SAP 140 100 R0170	PM581-ETH, CPU, memory 256 kB, 24 V DC, Memory Card Slot, interfaces 2 x RS-232/485 (programming, Modbus/CS31), 1 x FBP, Display, integrated coupler Ethernet TCP/IP
1SAP 140 200 R0100	PM582, CPU, memory 512 kB, 24 V DC, Memory Card Slot, interfaces 2 x RS-232/485 (programming, Modbus/CS31), 1 x FBP, Display
1SAP 140 200 R0170	PM582-ETH, CPU, memory 512 kB, 24 V DC, Memory Card Slot, interfaces 2 x RS-232/485 (programming, Modbus/CS31), 1 x FBP, Display, integrated coupler Ethernet TCP/IP
1SAP 150 000 R0100	PM590, CPU, memory 2 MB, 24 V DC, Memory Card Slot, interfaces 2 x RS-232/485 (programming, Modbus/CS31), 1 x FBP, Display
1SAP 150 000 R0160	PM590-ARCNET, CPU, memory 2 MB, 24 V DC, Memory Card Slot, interfaces 2 x RS-232/485 (programming, Modbus/CS31), 1 x FBP, Display, integrated coupler ARCNET
1SAP 150 000 R0170	PM590-ETH, CPU, memory 2 MB, 24 V DC, Memory Card Slot, interfaces 2 x RS-232/485 (programming, Modbus/CS31), 1 x FBP, Display, integrated coupler Ethernet TCP/IP
1SAP 150 100 R0100	PM591, CPU, memory 4 MB, 24 V DC, Memory Card Slot, interfaces 2 x RS-232/485 (programming, Modbus/CS31), 1 x FBP, Display
1SAP 150 100 R0160	PM591-ARCNET, CPU, memory 4 MB, 24 V DC, Memory Card Slot, interfaces 2 x RS-232/485 (programming, Modbus/CS31), 1 x FBP, Display, integrated coupler ARCNET
1SAP 150 100 R0170	PM591-ETH, CPU, memory 4 MB, 24 V DC, Memory Card Slot, interfaces 2 x RS-232/485 (programming, Modbus/CS31), 1 x FBP, Display, integrated coupler Ethernet TCP/IP
1SAP 180 300 R0001	TA521, Lithium Battery
1SAP 180 100 R0001	MC502, SD Memory Card 128 MB
1SAP 180 200 R0001	TK501, Programming cable SUB-D / SUB-D, length: 5 m
1SAP 180 200 R0101	TK502, Programming cable terminal block / SUB-D, length: 5 m
1SAP 180 800 R0001	TA526, Wall Mounting Accessory
1SAP 111 100 R0170	TB511-ETH, CPU Terminal Base AC500, slots: 1 CPU, 1 communication module, Ethernet RJ45 connector
1SAP 112 100 R0160	TB521-ARCNET, CPU Terminal Base AC500, slots: 1 CPU, 2 communication modules, ARCNET COAX connector
1SAP 112 100 R0170	TB521-ETH, CPU Terminal Base AC500, slots: 1 CPU, 2 communication modules, Ethernet RJ45 connector
1SAP 114 100 R0170	TB541-ETH, CPU Terminal Base AC500, slots: 1 CPU, 4 communication modules, Ethernet RJ45 connector
1SAP 212 200 R0001	TU515, I/O Terminal Unit, 24 V DC, screw-type terminals
1SAP 212 000 R0001	TU516, I/O Terminal Unit, 24 V DC, spring terminals
1SAP 217 200 R0001	TU531, I/O Terminal Unit, 230 V AC, relays, screw-type terminals
1SAP 217 000 R0001	TU532, I/O Terminal Unit, 230 V AC, relays, spring terminals

Contents

AC500 Communication Modules

Overview of the AC500 communication modules

Contents

Short description

AC500 communications modules (couplers) make communications on different field busses possible. The couplers are mounted on the left side of the CPU on the same Terminal Base. The communication between the CPU and the couplers take place through the coupler bus (coupler interface), which is integrated in the Terminal Base. The data interchange is realized by a dual-port RAM. Depending on the used Terminal Base, 1, 2 or 4 couplers can be employed (see also the description of the Terminal Bases).

There are no restrictions, which couplers can be arranged for a CPU, also not in connection with the CPU's internal coupler (Ethernet or ARCNET).

Assortment

Coupler	Protocol	Usable CPUs			Fieldbus connector	Usable Terminal Bases
		PM571-xxx	PM581-xxx	PM591-xxx		
CM572-DP	PROFIBUS DP Master V0 / V1	x	x	x	SUB-D, 9-pole, female	all
CM575-DN	DeviceNet	x	x	x	Pluggable terminal block, spring term.	all
CM577-ETH	Ethernet TCP/IP UDP/IP, Modbus TCP	x	x	x	2 x RJ45, with integrated switch	all
CM578-CN	CANopen	x	x	x	Pluggable terminal block, spring term.	all

Mounting of the couplers

The following figure shows a CPU with two couplers, put together on a Terminal Base TB521.

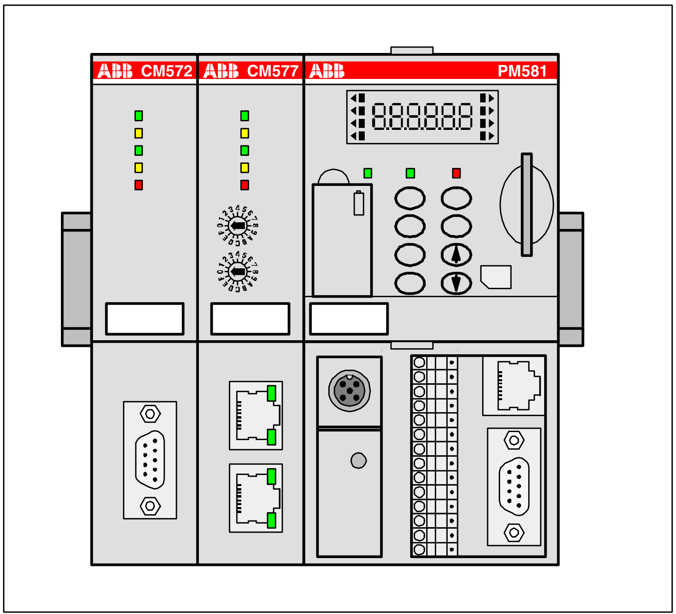


Figure: CPU with 2 couplers on a Terminal Base TB521

Note: Mounting, disassembling, electrical connection and dimensioned drawings for the Terminal Bases, CPUs, communication modules, I/O Terminal Units and the I/O expansion modules are described in detail in the AC500 system data chapters.

The following figures show how to mount and disassemble the couplers.

Mount the coupler (communication module)

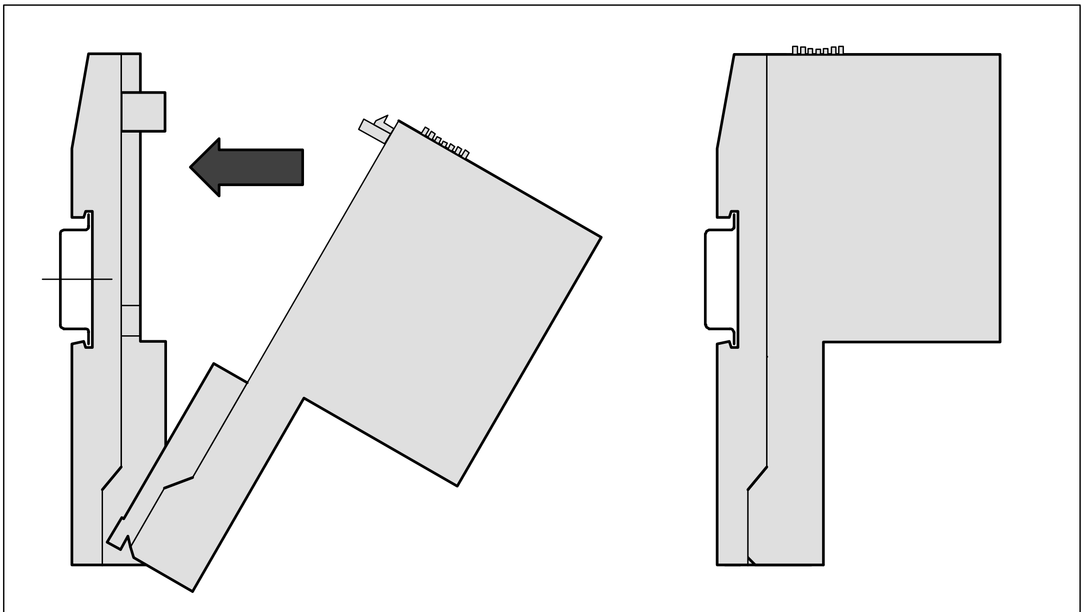


Figure: **Mounting** a coupler

The coupler is first inserted below, then clicked-in above.

The disassembly is carried out in a reversed order.

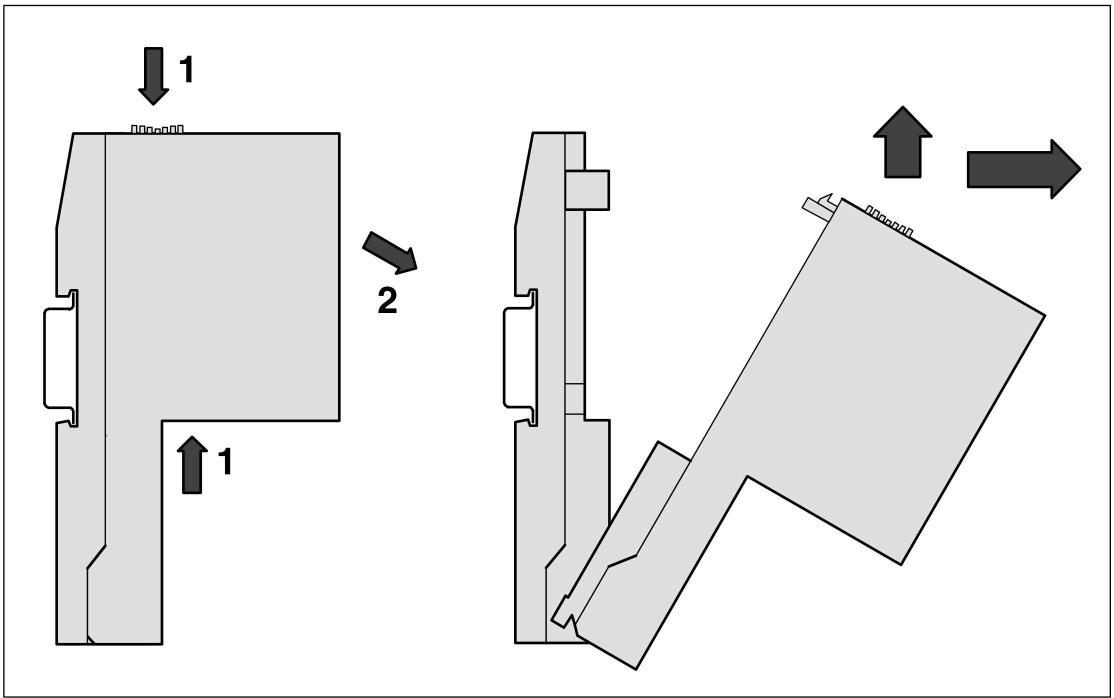


Figure: **Disassembly** of a coupler

Disassembly: (1) Press above and below, then (2) swing out the coupler and remove it.

Hardware configuration

Each CPU can operate up to 4 external couplers (in addition the internal coupler, if existing).

Depending on the selected communication protocol, each coupler can be used as

- Bus master within the AC500 control system together with several field busses and networks

The couplers are directly powered over the internal coupler bus of the Terminal Base. A separate voltage source is not required.

⚠ **CAUTION:** Removal of energized modules is not permitted. All power sources (supply and process voltages) must be switched off while working on any AC500 system.

Technical data (overview)

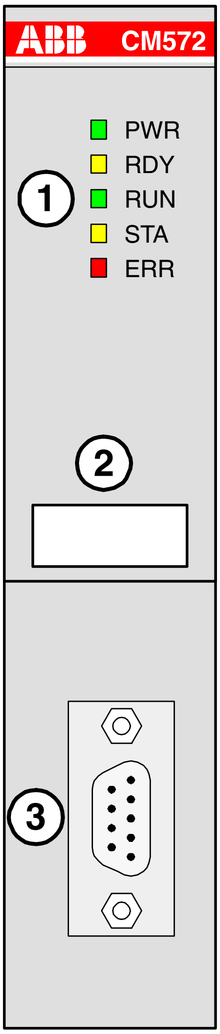
The system data of AC500 and S500 are valid here. Only additional details are therefore documented below.

	CM572-DP	CM577-ETH	CM575-DN	CM578-CN
Field bus	PROFIBUS DP	2 x Ethernet	DeviceNet	CANopen
Transmission rate	9.6 kBit/s to 12 MBit/s	10 MBit/s or 100 MBit/s	125 kBit/s 250 kBit/s 500 kBit/s	10 kBit/s to 1 MBit/s
Field bus connector	D-SUB, 9-pole, female, bended	2 x RJ45	COMBICON 5-pole, bended	COMBICON 5-pole, bended
Processor	EC1, 160 pins			
Clock frequency	48 MHz			
Ambient temperature	0 °C...60 °C			
Coupler interface	Dual-port memory, 8 kByte			
Current consumption over the coupler bus	typ. 330 mA	typ. 420 mA	typ. 180 mA	typ. 290 mA
internal RAM memory (EC1)	256 kByte	256 kByte	256 kByte	256 kByte
external RAM memory	-	2 x 128 kByte (for webserver option)	-	-
External Flash memory	512 kByte (firmware)	512 kByte (firmware) 2 MByte (for Webserver option)	512 kByte (firmware)	512 kByte (firmware)
Status display	PWR, RDY, RUN, STA, ERR	PWR, RDY, RUN, STA, ERR, 2 x LINK, 2 x ACT	PWR, RDY, RUN, NET, MOD	PWR, RDY, RUN, STA, ERR
Weight	150 g	150 g	150 g	150 g

Ordering data

Order No.	Scope of delivery
1SAP 170 200 R0001	CM572-DP, Communication module PROFIBUS DP Master, 12 MBit/s
1SAP 170 500 R0001	CM575-DN, Communication module DeviceNet Master
1SAP 170 700 R0001	CM577-ETH, Communication module Ethernet TCP/IP with integrated 2-port switch
1SAP 170 800 R0001	CM578-CN, Communication module CANopen Master
1SAP 130 100 R0100	PM571, CPU, memory 64 kB, 24 V DC, Memory Card Slot, interfaces 2 x RS-232/485 (programming, Modbus/CS31), 1 x FBP, Display
1SAP 130 100 R0170	PM571-ETH, CPU, memory 64 kB, 24 V DC, Memory Card Slot, interfaces 2 x RS-232/485 (programming, Modbus/CS31), 1 x FBP, Display, integrated coupler Ethernet TCP/IP
1SAP 140 100 R0100	PM581, CPU, memory 256 kB, 24 V DC, Memory Card Slot, interfaces 2 x RS-232/485 (programming, Modbus/CS31), 1 x FBP, Display
1SAP 140 100 R0160	PM581-ARCNET, CPU, memory 256 kB, 24 V DC, Memory Card Slot, interfaces 2 x RS-232/485 (programming, Modbus/CS31), 1 x FBP, Display, integrated coupler ARCNET
1SAP 140 100 R0170	PM581-ETH, CPU, memory 256 kB, 24 V DC, Memory Card Slot, interfaces 2 x RS-232/485 (programming, Modbus/CS31), 1 x FBP, Display, integrated coupler Ethernet TCP/IP
1SAP 150 100 R0100	PM591, CPU, memory 4 MB, 24 V DC, Memory Card Slot, interfaces 2 x RS-232/485 (programming, Modbus/CS31), 1 x FBP, Display
1SAP 150 100 R0160	PM591-ARCNET, CPU, memory 4 MB, 24 V DC, Memory Card Slot, interfaces 2 x RS-232/485 (programming, Modbus/CS31), 1 x FBP, Display, integrated coupler ARCNET
1SAP 150 100 R0170	PM591-ETH, CPU, memory 4 MB, 24 V DC, Memory Card Slot, interfaces 2 x RS-232/485 (programming, Modbus/CS31), 1 x FBP, Display, integrated coupler Ethernet TCP/IP
1SAP 180 600 R0001	TA524, Dummy Coupler Module
1SAP 180 800 R0001	TA526, Wall Mounting Accessory
1SAP 111 100 R0170	TB511-ETH, CPU Terminal Base AC500, slots: 1 CPU, 1 communication module, Ethernet RJ45 connector
1SAP 112 100 R0160	TB521-ARCNET, CPU Terminal Base AC500, slots: 1 CPU, 2 communication modules, ARCNET COAX connector
1SAP 112 100 R0170	TB521-ETH, CPU Terminal Base AC500, slots: 1 CPU, 2 communication modules, Ethernet RJ45 connector
1SAP 114 100 R0170	TB541-ETH, CPU Terminal Base AC500, slots: 1 CPU, 4 communication modules, Ethernet RJ45 connector

Communication module PROFIBUS DP CM572-DP
- Master 12 MBit/s



Elements of the coupler

1 Five LEDs for status display
2 Label
3 Communication interface PROFIBUS DP SUB-D, 9-pole, female

Figure: Communication module PROFIBUS DP CM572-DP

Contents

Purpose

The AC500 communications module CM572-DP makes a communication over the PROFIBUS DP field bus possible. The coupler is mounted on the left side of the CPU on the same Terminal Base. The communication between the CPU and the coupler takes place through the coupler bus (coupler interface), which is integrated in the Terminal Base. The data interchange is realized by a dual-port RAM. Depending on the used Terminal Base, 1, 2 or 4 couplers (also different types) can be employed (see also the description of the Terminal Bases).

Functionality

Coupler CM572-DP	
Protocol	PROFIBUS DP Master V0 / V1
Usable CPUs	PM571-xxx, PM581-xxx, PM591-xxx
Usable Terminal Bases	all of the TB5xx
Field bus connector	D-SUB, 9-pole, female
Internal power supply	through the coupler interface of the Terminal Base

Mounting and electrical connection

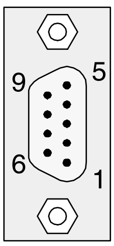
The coupler is mounted on the left side of the CPU on the same Terminal Base. The electrical connection is established automatically when mounting the coupler.

Note: Mounting, disassembling, electrical connection and dimensioned drawings for the Terminal Bases, CPUs, communication modules, I/O Terminal Units and the I/O expansion modules are described in detail in the AC500 system data chapters.

CAUTION: Removal of energized modules is not permitted. All power sources (supply and process voltages) must be switched off while working on any AC500 system.

Field bus interface

The PROFIBUS DP connector has the following pin assignment:



1	Shield	Shield, Functional Earth
2	NC	unused
3	RxD/TxD-P	Receive/Transmit Line, positive
4	CNTR-P	Control signal for repeater, positive
5	DGND	Reference potential for data exchange and +5 V
6	VP	+5 V (power supply for the bus terminating resistors)
7	NC	unused
8	RxD/TxD-N	Receive/Transmit Line, negative
9	CNTR-N	Control signal for repeater, negative

PROFIBUS DP

9-pole, female

Figure: Pin assignment of the field bus interface PROFIBUS DP

Bus cable

Type	twisted pair (shielded)
Characteristic impedance	135...165 Ω
Cable capacity	< 30 pF/m
Conductor diameter of the cores	≥ 0.64 mm
Conductor cross section of the cores	≥ 0.34 mm²
Cable resistance per core	≤ 55 Ω/km
Loop resistance (resistance of two cores)	≤ 110 Ω/km

Cable lengths

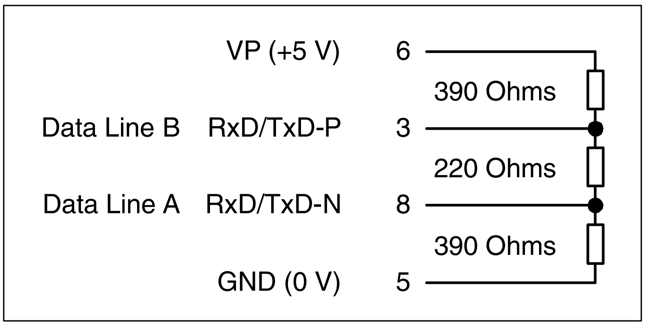
The maximum possible cable length of a PROFIBUS subnet within a segment depends on the baud rate (transmission rate).

Baud rate	maximum cable length
9.6 kBaud to 187.5 kBaud	1200 m
500 kBaud	400 m
1.5 MBaud	200 m
3 MBaud to 12 MBaud	100 m

Table: Maximum cable length within a segment in a PROFIBUS subnet

Bus termination

The line ends of the bus segment must be equipped with bus termination resistors. Normally, these resistors are integrated in the interface connectors.



LED status displays

The status of the PROFIBUS coupler is displayed by means of 5 status LEDs. After power ON, the coupler initializes a self-test. If this test was successful, the yellow RDY LED goen ON. Otherwise the LED starts flashing and aborts the further initialization. If the RDY LED remains OFF, the coupler is defective.

In the course of initialization, the RUN LED is OFF for the first time. The LED is only activated after configuration data has been sent to the coupler and the operating mode of the coupler was set. If the operating system of the coupler detects a parameterization or a a configuration error, the green RUN LED flashes non-cyclically. If this LED flashes cyclically, the coupler is ready for communication, but the communication is not active yet. In case of an active communication, the RUN LED lights continuously.

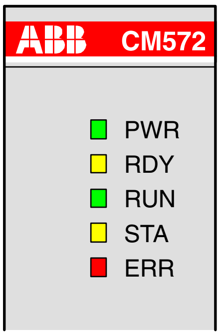
The red ERR LED indicates errors on the PROFIBUS interface.

In the "DP slave" operating mode, the yellow STA LED indicates the active I/O data exchange with the DP master. In the "DP master" operating mode, the STA LED indicates the ownership of the token and therefore the I/O data exchange with the involved DP slaves.

During the initialization procedure and also if the coupler is configured (anew) - in particular if the operating mode was changed - it can occur that all or some LEDs light up for a short period of time, before reaching a defined condition.

The green PWR LED indicates, that the supply voltage is present.

The following figure shows the positions of the LEDs. The table after that shows the LED statuses and their meanings.



LED	Color	Status	Meaning
PWR	green	ON (light)	Voltage is present
		OFF (dark)	Voltage is missing
RDY	yellow	ON	Coupler is ready
		flashes cyclic	Bootstrap Loader is active
		flashes non-cyclic	Hardware or system error
		OFF	Defective hardware
RUN	green	ON	Communication is running
		flashes cyclic	Ready for communication
		flashes non-cyclic	Parameterization error
		OFF	No communication
STA	yellow	ON	DP master: Transmits data or token on the network
		OFF	DP master: no token
ERR	red	ON	PROFIBUS error
		OFF	No error

Further important information

PROFIBUS basics

PROFIBUS DP is intended for fast data exchange in the field area. Here, central control units (e.g. PLC/PC) communicate with decentralized field devices like I/O, drives and valves via a fast serial connection. The data exchange with the decentralized modules is mainly performed cyclically.

The communication functions, required for data exchange, are defined by the PROFIBUS DP basic functions in accordance to EN 50170.

For parameterization, diagnosis and alarm handling during the running cyclic data exchange also non-cyclic communication functions are necessary for intelligent field devices.

Definitions, terms, abbreviations

PROFIBUS DP	**PRO**cess **FI**eld**BUS** - **D**ecentral **P**eriphery
DP master (class 1)	Normal bus master
DP master (class 2)	Commissioning device
DP slave (DPS)	I/O module
DPV1	Guideline for extended functions for PROFIBUS DP
PNO	**P**ROFIBUS **N**utzer-**O**rganisation (user organization)

Standardizations

EN 50170, DIN 19245 Part 1, DIN 19245 Part 3, DPV1

Important address

PROFIBUS Nutzerorganisation e. V. (PNO)
Haid-und Neu-Staße 7
D-76131 Karlsruhe
Germany
Telephone: (+49) 721 9658 590
Telefax: (+49) 721 9658 589
Internet: http://www.profibus.com

Technical data

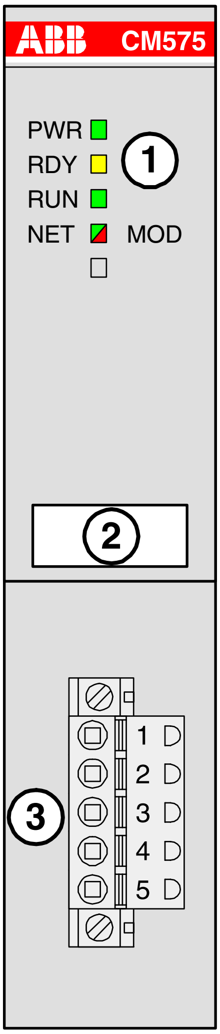
The system data of AC500 and S500 are valid here. Only additional details are therefore documented below.

Coupler CM572-DP	
Field bus	PROFIBUS DP
Transmission rate	9.6 kBit/s to 12 MBit/s
Protocol	PROFIBUS DP Master V0 /V1
Field bus connector	D-SUB, 9-pole, female
Processor	EC1, 160 pins
Clock frequency	48 MHz
Usable CPUs	PM571-xxx, PM581-xxx, PM591-xxx
Usable Terminal Bases	all
Ambient temperature	0 °C...60 °C
Coupler interface	Dual-port memory, 8 kByte
Current consumption over the coupler bus	typ. 330 mA
Internal RAM memory (EC1)	256 kByte
External RAM memory	-
External Flash memory	512 kByte (firmware)
Status display	PWR, RDY, RUN, STA, ERR
Weight	ca. 150 g

Ordering data

Order No.	**Scope of delivery**
1SAP 170 200 R0001	CM572-DP, Communication module PROFIBUS DP Master, 12 MBit/s
Link to other ordering data	see Overview of the AC500 communication modules

CM575-DN Communication module DeviceNet
- DeviceNet Master 500 kbit/s



Elements of the coupler

1 Four LEDs for status display

2 Label

3 Communication interface
5-pole, Combicon, male,
removable plug (female) with
spring terminals

Figure: Communication module DeviceNet CM575-DN

Contents

Purpose

The AC500 communications module CM575-DN makes a communication over the DeviceNet field bus possible. The coupler is mounted on the left side of the CPU on the same Terminal Base. The communication between the CPU and the coupler takes place through the coupler bus (coupler interface), which is integrated in the Terminal Base. The data interchange is realized by a dual-port RAM. Depending on the used Terminal Base, 1, 2 or 4 couplers (also different types) can be employed (see also the description of the Terminal Bases).

Functionality

Coupler CM575-DN	
Protocol	DeviceNet
Usable CPUs	PM571-xxx, PM581-xxx, PM591-xxx
Usable Terminal Bases	all of the TB5xx
Field bus connector	Pluggable connector COMBICON, 5-pole
Internal power supply	via the coupler interface of the Terminal Base

Mounting and electrical connection

The coupler is mounted on the left side of the CPU on the same Terminal Base. The electrical connection is established automatically when mounting the coupler.

Note: Mounting, disassembling, electrical connection and dimensioned drawings for the Terminal Bases, CPUs, communication modules, I/O Terminal Units and the I/O expansion modules are described in detail in the AC500 system data chapters.

Caution: Removal of energized modules is not permitted. All power sources (supply and process voltages) must be switched off while working on any AC500 system.

Field bus interface

The DeviceNet connector has the following pin assignment:

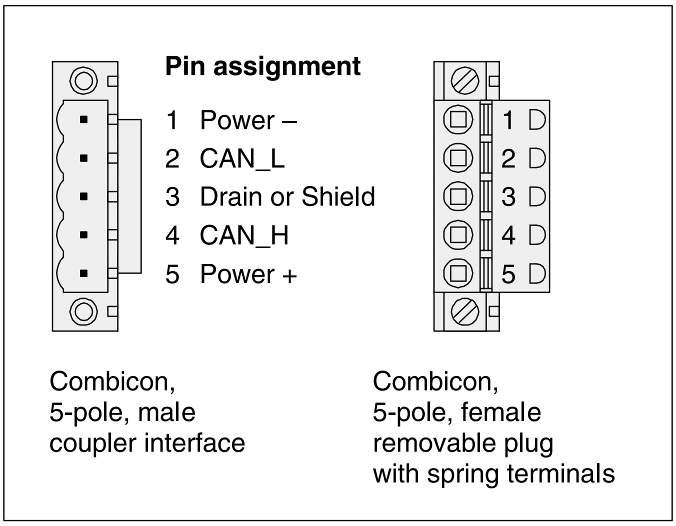


Figure: Pin assignment of the DeviceNet field bus interface

Bus cable

DeviceNet uses a trunk-line/drop-line topology that provides separate twisted pair busses for both signal and power distribution. The possible variants of this topology are shown in the next figure. Thick or thin cable can be used for either trunk lines or drop lines. End-to-end network length varies with data rate and cable thickness as shown in the next table.

DeviceNet supports both isolated and non-isolated physical layer design of devices. An opto-isolated design option allows externally powered devices (e.g. AC Drives starters and solenoid valves) to share the same bus cable. The DeviceNet Specifications contain additional information concerning component requirements, protection from mis-wiring, and examples.

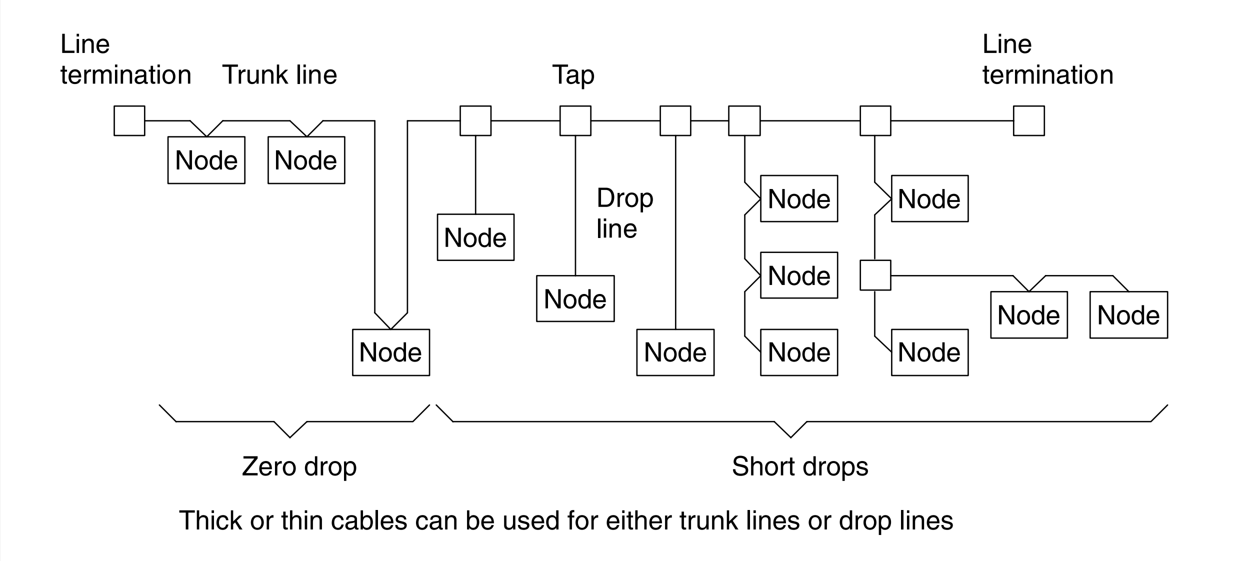


Figure: Variants of bus topology

DeviceNet supports both isolated and non-isolated physical layer design of devices. An opto-isolated design option allows externally powered devices (e.g. AC Drives starters and solenoid valves) to share the same bus cable.

Design characteristics		
Cable type	Thick	Thin
Data/power pair	Data/power	Data/power
Conductor size	18 AWG = 0.823 mm² 14 AWG = 2.080 mm²	24 AWG = 0.205 mm² 22 AWG = 0.324 mm²
Individual screen	Aluminium/polyester tape	
Drain wire size	18 AWG = 0.823 mm²	22 AWG = 0.324 mm²
Braided shield	Tin coated annealed copper wires	
Sheath	Oil resistant PVC	
Outer diameter	ca. 12 mm	ca. 7 mm
Electrical characteristics		
Conductor resistance	22.6 Ω/km 9.1 Ω/km	91.8 Ω/km 57.4 Ω/km
Impedance (@ 1 MHz)	120 ± 12 Ω	
Attenuation		
At 125 kHz	max. 1.426 dB/100 m	max. 0.951 dB/100 m
At 500 kHz	max. 0.820 dB/100 m	max. 1.64 dB/100 m
At 1 MHz	max. 1.31 dB/100 m	max. 2.29 dB/100 m
Propagation delay	max. 4.4 ns/m	max. 4.4 ns/m

Cable lengths

The maximum possible cable length of a DeviceNet network depends on the baud rate (transmission rate).

Network size	125 kbit/s	250 kbit/s	500 kbit/s
Thick trunk length	500 m (1640 ft)	250 m (820 ft)	100 m (328 ft)
Thin trunk length	100 m (328 ft)	100 m (328 ft)	100 m (328 ft)
Flat trunk length	380 m (1250 ft)	200 m (656 ft)	75 m (246 ft)
Maximum drop length	6 m (20 ft)	6 m (20 ft)	6 m (20 ft)
Cumulative drop length	156 m (512 ft)	78 m (256 ft)	39 m (128 ft)
The end-to-end network distance varies with data rate and cable thickness.			

Table: Maximum cable length within a DeviceNet field bus

Bus termination

Caution: A power supply voltage always comes together with the bus lines. This power supply should imperatively be connected, otherwise the DeviceNet drivers will not be powered and a coupler error will occur.

The following figure shows how to connect this power supply.

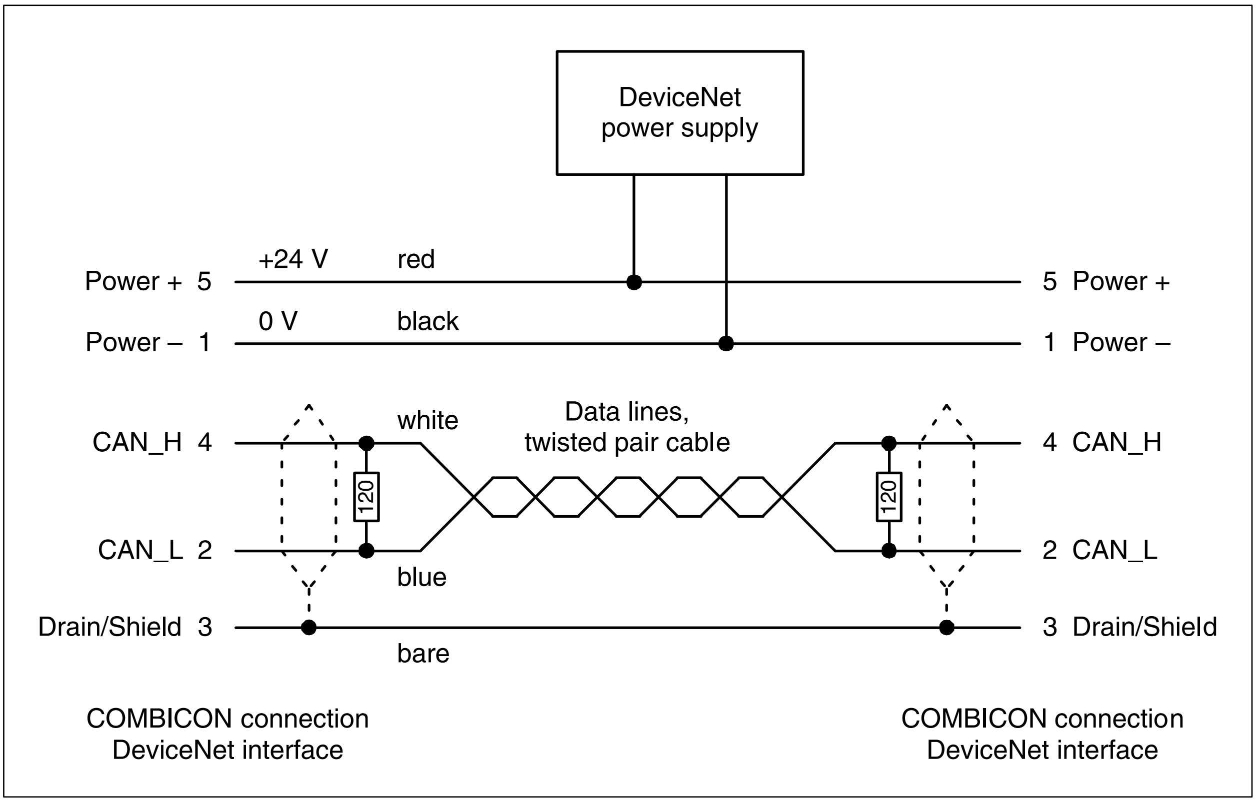


Figure: Connecting the power supply

The data line ends must be equipped with 120-Ohm bus terminating resistors. Normally, the resistors are integrated in the interface connectors.

The following table shows the correspondence between the cable colours and the wire identities and connections of the DeviceNet coupler.

Coupler connector pinout (top to bottom)	Wire identity	Cable wire colour	Used as
1	Power –	Black	Power V–
2	CAN_L	Blue	Signal
3	Drain	Bare	Shield
4	CAN_H	White	Signal
5	Power +	Red	Power V+

LED status displays

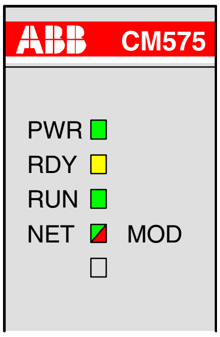
The status of the DeviceNet coupler is displayed by means of 4 status LEDs. After power ON, the coupler initializes a self-test. If this test was successful, the yellow RDY LED goes ON. Otherwise the LED starts flashing and aborts the further initialization. If the RDY LED remains OFF, the coupler is defective.

In the course of initialization, the RUN LED is OFF for the first time. The LED is only activated after configuration data has been sent to the coupler and the operating mode of the coupler was set. If the operating system of the coupler detects a parameterization or a configuration error, the green RUN LED flashes non-cyclically. If this LED flashes cyclically, the coupler is ready for communication, but the communication is not active yet. In case of an active communication, the RUN LED lights continuously.

During the initialization procedure and also if the coupler is configured (anew) - in particular if the operating mode was changed - it can occur that all or some LEDs light up for a short period of time, before reaching a defined condition.

The green PWR LED indicates, that the supply voltage is present.

The following figure shows the positions of the LEDs. The table after that shows the LED statuses and their meanings.



LED	Color	Status	Meaning
PWR	green	ON (light)	Voltage is present
		OFF (dark)	Voltage is missing
RDY	yellow	ON	Coupler is ready
		flashes cyclic	Bootstrap Loader is active
		flashes non-cyclic	Hardware or system error
		OFF	Defective hardware or no power supply
RUN	green	ON	Communication is running
		flashes cyclic	Ready for communication
		flashes non-cyclic	Parameterization error
		OFF	No communication or no power supply
NET/ MOD	green/ red	ON green	Device is online and has one or more connections in established state.
		Green flashes cyclic	Device is online and has no connection in the established state.
		Green/red flash cyclic	Communication failed
		ON red	Critical link failure; device has detected a network error (duplicate MAC-ID or bus off).
		Red flashes cyclic	Connection timeout
		OFF	After start of the device and during duplicate MAC-ID check

Further important information

DeviceNet basics

DeviceNet is a digital, multi-drop network that connects and serves as a communication network between industrial controllers and I/O devices. Each device and/or controller is a node on the network. DeviceNet is a producer-consumer network that supports multiple communication hierarchies and message prioritization.

DeviceNet systems can be configured to operate in a master-slave or a distributed control architecture using peer-to-peer communication. DeviceNet systems offer a single point of connection for configuration and control by supporting both I/O and explicit messaging. DeviceNet also has the unique feature of having power on the network. This allows devices with limited power requirements to be powered directly from the network, reducing connection points and physical size.

DeviceNet follows the Open Systems Interconnection (OSI) model, an ISO standard for network communications that is hierarchical in nature. Networks that follow this model define all necessary functions from the physical implementation up to the protocol and methodology to communicate control and information data within and across networks.

Network size	Up to 64 nodes
Network length	Selectable end-to-end network distance varies with speed. 125 kbit/s 500 m (1640 ft) 250 kbit/s 250 m (820 ft) 500 kbit/s 100 m (328 ft)
Data packets	0-8 bytes
Bus topology	Linear (trunk line/drop line); power and signal on the same network cable
Bus addressing	Peer-to-peer with Multi-Cast (one-to-many); Multi-Master and Multi-Slave special case; polled of change-of-state (exception-based)
System features	Selectable end-to-end network distance varies with speed

Important address

ODVA Headquarters

Technology and Training Center
1099 Highland Drive, Suite A
Ann Arbor, Michigan 48108-5002
U. S. A.

Telephone +1 734-975-8840
Fax +1 734-922-0027
E-mail odva@odva.org
Internet www.odva.org

Technical data

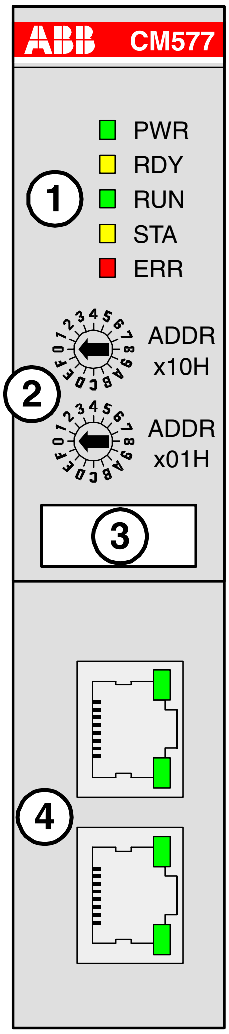
The system data of AC500 and S500 are valid here. Only additional details are therefore documented below.

Coupler CM575-DN	
Field bus	DeviceNet
Transmission rate	125 kBit/s to 500 kBit/s
Protocol	DeviceNet Master
Field bus connector	Pluggable connector COMBICON, 5-pole
Processor	EC1, 160 pins
Clock frequency	48 MHz
Usable CPUs	PM571-xxx, PM581-xxx, PM591-xxx
Usable Terminal Bases	all
Ambient temperature	0 °C...55 °C
Coupler interface	Dual-port memory, 8 kByte
Current consumption over the coupler bus	typ. 180 mA
Internal RAM memory (EC1)	256 kByte
External RAM memory	-
External Flash memory	512 kByte (firmware)
Status display	PWR, RDY, RUN, NET, MOD
Weight	ca. 150 g

Ordering data

Order No.	Scope of delivery
1SAP 170 500 R0001	CM575-DN, Communication module DeviceNet Master
Link to other ordering data	See Overview of the AC500 communication modules

Communication module Ethernet CM577-ETH
- TCP/IP with integrated 2-port switch



Elements of the coupler

1 Five LEDs for status display

2 Two rotary switches for address setting

3 Label

4 Two communication interfaces Ethernet RJ45

Figure: Communication module Ethernet CM577-ETH

Contents

Purpose

The AC500 communications module CM577-ETH makes a communication over the Ethernet bus possible. The coupler is mounted on the left side of the CPU on the same Terminal Base. The communication between the CPU and the coupler takes place through the coupler bus (coupler interface), which is integrated in the Terminal Base. The data interchange is realized by a dual-port RAM. Depending on the used Terminal Base, 1, 2 or 4 couplers (also different types) can be employed (see also the description of the Terminal Bases).

The Ethernet coupler includes an internal Ethernet switch. The connection to the Ethernet can be established directly to the coupler. An additional switch is not necessary.

The Ethernet coupler is an intelligent 100-Base-T-Ethernet communication interface based on the highly integrated EC1 micro-controller. The coupler supports the complete TCP/IP protocol and the application layers, too.

The user interface is based on a dual-port memory. The coupler meets the PC/104 standard. The Ethernet communication runs via RJ45 interfaces.

The coupler is configured via the dual-port memory, the diagnosis interface or a TCP/IP connection by means of a system configurator. The configuration is saved non-volatile in a Flash EPROM.

Applications:

- TCP/IP for PC/Control Builder (programming)
- UDP (communication via the function blocks ETH_UDP_SEND and ETH_UDP_REC)
- Modbus on TCP/IP (Modbus on TCP/IP, master and slave)

Functionality

Coupler CM577-ETH	
Protocol	Ethernet TCP/IP, UDP/IP, Modbus TCP
Usable CPUs	PM571-xxx, PM581-xxx, PM591-xxx
Usable Terminal Bases	all
Field bus connector	2 x RJ45, with integrated 2-port switch
Internal power supply	via the coupler interface of the Terminal Base

Mounting and electrical connection

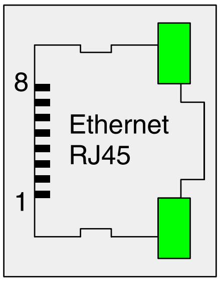
The coupler is mounted on the left side of the CPU on the same Terminal Base. The electrical connection is established automatically when mounting the coupler.

Note: Mounting, disassembling, electrical connection and dimensioned drawings for the Terminal Bases, CPUs, communication modules, I/O Terminal Units and the I/O expansion modules are described in detail in the AC500 system data chapters.

CAUTION: Removal of energized modules is not permitted. All power sources (supply and process voltages) must be switched off while working on any AC500 system.

Field bus interfaces

The Ethernet coupler has 2 RJ45 interfaces with the following pin assignment:



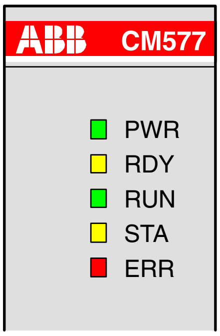
8	NC	unused
7	NC	unused
6	RxD–	Receive Data –
5	NC	unused
4	NC	unused
3	RxD+	Receive Data +
2	TxD–	Transmit Data –
1	TxD+	Transmit Data +
Shield	Cable shield + Signal Ground	

Ethernet RJ45

Figure: Pin assignment of the Ethernet interfaces RJ45

LED status displays

The status of the Ethernet coupler is displayed by means of 5 status LEDs. The following figure shows the positions of the LEDs. The table after that shows the LED statuses and their meanings.



LED	Color	Status	Meaning
PWR	green	ON (light)	Voltage is present
		OFF (dark)	Voltage is missing
RDY	yellow	ON	Coupler is ready
		flashes cyclic	Bootstrap Loader is active
		flashes non-cyclic	Hardware or system error
		OFF	defective hardware
RUN	green	ON	Communication is running
		flashes cyclic	Ready for communication
		flashes non-cyclic	Parameterization error
		OFF	No communication
STA	yellow	flashes	Ethernet Frame detected on the network
ERR	red	ON	Error
		OFF	No error

Technical data

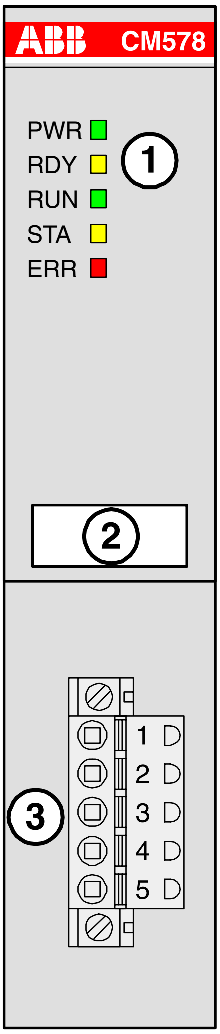
The system data of AC500 and S500 are valid here. Only additional details are therefore documented below.

Coupler CM577-ETH	
Field bus	2 x Ethernet
Transmission rate	10 MBit/s or 100 MBit/s
Protocol	Ethernet TCP/IP, UDP/IP, Modbus TCP
Field bus connectors	2 x RJ45, with integrated 2-port switch
Processor	EC1, 160 pins
Clock frequency	48 MHz
Usable CPUs	PM571-xxx, PM581-xxx, PM591-xxx
Usable Terminal Bases	all
Ambient temperature	0 °C...60 °C
Coupler interface	Dual-port memory, 8 kByte
Current consumption over the coupler bus	typ. 420 mA
Internal RAM memory (EC1)	256 kByte
External RAM memory	2 x 128 kByte (for webserver option)
External Flash memory	512 kByte (firmware), 2 MByte (for webserver option)
Status display	PWR, RDY, RUN, STA, ERR, 2 x LINK, 2 x ACT
Weight	ca. 150 g

Ordering data

Order No.	**Scope of delivery**
1SAP 170 700 R0001	CM577-ETH, Communication module Ethernet TCP/IP with integrated 2-port switch
Link to other ordering data	see Overview of the AC500 communication modules

CM578-CN Communication module CANopen
- CANopen Master 1 Mbit/s



Elements of the coupler

1 Five LEDs for status display

2 Label

3 Communication interface
5-pole, Combicon, male,
removable plug (female) with
spring terminals

Figure: Communication module CANopen CM578-CN

Contents

Purpose

The AC500 communications module CM578-CN makes a communication over the CANopen field bus possible. The coupler is mounted on the left side of the CPU on the same Terminal Base. The communication between the CPU and the coupler takes place through the coupler bus (coupler interface), which is integrated in the Terminal Base. The data interchange is realized by a dual-port RAM. Depending on the used Terminal Base, 1, 2 or 4 couplers (also different types) can be employed (see also the description of the Terminal Bases).

Functionality

Coupler CM578-CN	
Protocol	CANopen
Usable CPUs	PM571-xxx, PM581-xxx, PM591-xxx
Usable Terminal Bases	all of the TB5xx
Field bus connector	Pluggable connector COMBICON, 5-pole
Internal power supply	via the coupler interface of the Terminal Base

Mounting and electrical connection

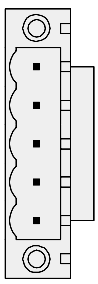
The coupler is mounted on the left side of the CPU on the same Terminal Base. The electrical connection is established automatically when mounting the coupler.

Note: Mounting, disassembling, electrical connection and dimensioned drawings for the Terminal Bases, CPUs, communication modules, I/O Terminal Units and the I/O expansion modules are described in detail in the AC500 system data chapters.

Caution: Removal of energized modules is not permitted. All power sources (supply and process voltages) must be switched off while working on any AC500 system.

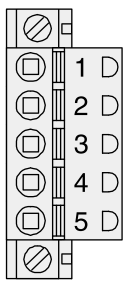
Field bus interface

The CANopen connector has the following pin assignment:



Pin assignment

1 CAN_GND
2 CAN_L
3 CAN_SHLD
4 CAN_H
5 unused



Combicon,
5-pole, male
coupler interface

Combicon,
5-pole, female
removable plug
with spring terminals

Figure: Pin assignment of the CANopen field bus interface

Cable lengths

The maximum possible cable length of a CANopen network depends on the baud rate (transmission rate).

Bit rate (speed)	Bus length
1 Mbit/s	30 m
800 bkit/s	50 m
500 bkit/s	100 m
250 bkit/s	250 m
125 bkit/s	500 m
62.5 bkit/s	1000 m
20 bkit/s	2500 m
10 bkit/s	5000 m

Table: Maximum cable length within a CANopen field bus

Bus termination

The data line ends must be equipped with 120-Ohm bus terminating resistors. Normally, the resistors are integrated in the interface connectors.

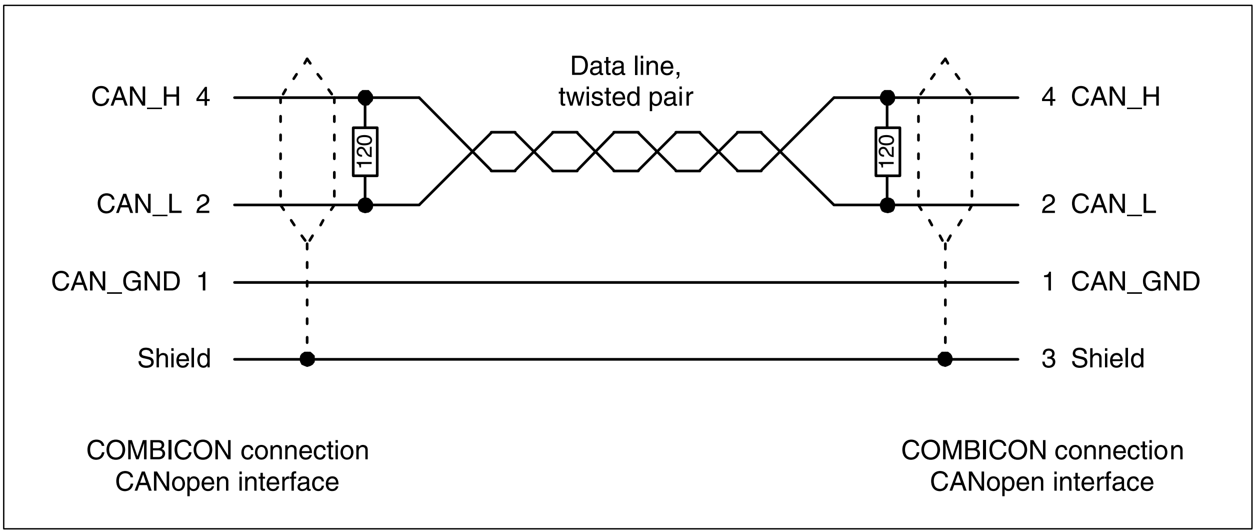


Figure: CANopen interface, bus terminating resistors at the line ends

LED status displays

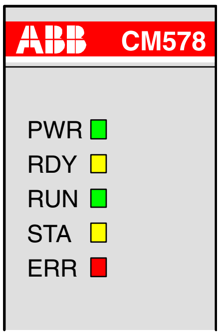
The status of the CANopen coupler is displayed by means of 5 status LEDs. After power ON, the coupler initializes a self-test. If this test was successful, the yellow RDY LED goes ON. Otherwise the LED starts flashing and aborts the further initialization. If the RDY LED remains OFF, the coupler is defective.

In the course of initialization, the RUN LED is OFF for the first time. The LED is only activated after configuration data has been sent to the coupler and the operating mode of the coupler was set. If the operating system of the coupler detects a parameterization or a configuration error, the green RUN LED flashes non-cyclically. If this LED flashes cyclically, the coupler is ready for communication, but the communication is not active yet. In case of an active communication, the RUN LED lights continuously.

During the initialization procedure and also if the coupler is configured (anew) - in particular if the operating mode was changed - it can occur that all or some LEDs light up for a short period of time, before reaching a defined condition.

The green PWR LED indicates, that the supply voltage is present.

The following figure shows the positions of the LEDs. The table after that shows the LED statuses and their meanings.



LED	Color	Status	Meaning
PWR	green	ON (light)	Voltage is present
		OFF (dark)	Voltage is missing
RDY	yellow	ON	Coupler is ready
		flashes cyclic	Bootstrap Loader is active
		flashes non-cyclic	Hardware or system error
		OFF	Defective hardware or no power supply
RUN	green	ON	Communication is running
		flashes cyclic	Ready for communication
		flashes non-cyclic	Parameterization error
		OFF	No communication or no power supply
STA	yellow	ON	CANopen master: transmits data
		OFF	CANopen master: no data
ERR	red	ON	CANopen error
		OFF	No error

Further important information

CANopen basics

CANopen is a standardized 7-layer protocol for decentralized industrial automation systems, based on the Controller Area Network (CAN) and the CAN Application Layer (CAL).

CANopen bases on a communication profile in which the basic communication mechanisms and their descriptions are defined, e.g. mechanisms for interchange of process data in real time or transmitting of alarm messages.

The different CANopen device profiles make use of this common communication profile. The device profiles describe the specific functionality of a device class or its parameters. For the most important device classes used in the industrial automation technology, such as digital and analog input/output modules, sensors, drives, operator panels, loop controllers, programmable control systems and encoders, suitable device profiles exist. Others are in preparation.

A central element of the CANopen standard is the description of the device functionality in an object directory. The object directory is subdivided into a general part and a device-specific part. The general part contains details on the device, such as device identification, name of manufacturer, communication parameters etc. The device specific part describes the specific functionality of the concerned device. These features of a CANopen device are described in a standardized Electronic Data Sheet (EDS).

A CANopen network consists of a maximum of 128 devices, one NMT master and a maximum of 127 NMT slaves. In contrast to other typical master-slave systems such as PROFIBUS, the CANopen terms Master and Slave have a different meaning.

In operational mode, all devices are able to transmit messages via the bus. In addition, the master can change the operating mode of the slaves.

Normally a CANopen master is realized by a PLC or a PC. The bus address of a CANopen slave can be set from 1 to 127. By the device address, a number of identifiers are created, which are then used by the device.

Important address

CAN in automation

Am Weichselgarten 26
D-91058 Erlangen
Germany/Deutschland

Telephone +49-9131-69086-0
Fax +49-9131-69086-79
E-Mail headquarters@can-cia.org
Internet www.can-cia.org

Technical data

The system data of AC500 and S500 are valid here. Only additional details are therefore documented below.

Coupler CM578-CN	
Field bus	CANopen
Transmission rate	10 kBit/s to 1 MBit/s
Protocol	CANopen Master
Field bus connector	Pluggable connector COMBICON, 5-pole
Processor	EC1, 160 pins
Clock frequency	48 MHz
Usable CPUs	PM571-xxx, PM581-xxx, PM591-xxx
Usable Terminal Bases	all
Ambient temperature	0 °C...60 °C
Coupler interface	Dual-port memory, 8 kByte
Current consumption over the coupler bus	typ. 290 mA
Internal RAM memory (EC1)	256 kByte
External RAM memory	-
External Flash memory	512 kByte (firmware)
Status display	PWR, RDY, RUN, STA, ERR
Weight	ca. 150 g

Ordering data

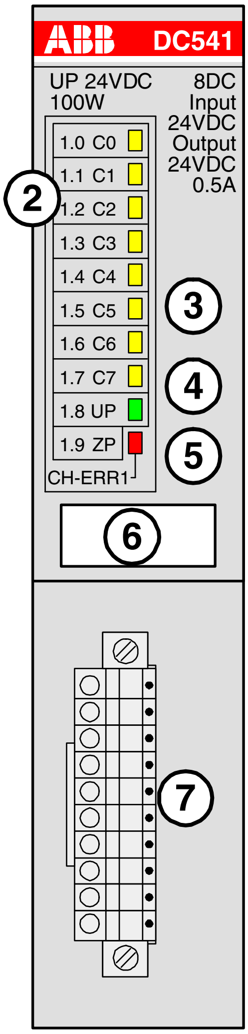
Order No.	**Scope of delivery**
1SAP 170 800 R0001	CM578-CN, Communication module CANopen Master
Link to other ordering data	See Overview of the AC500 communication modules

Contents

Digital Input/Output Modules AC500

Digital Input/Output Module DC541-CM

- 8 configurable digital inputs/outputs 24 V DC, in a coupler housing
- module-wise electrically isolated



Elements of the digital input/output module DC541-CM

1 Internal coupler bus on the Terminal Base for data exchange between couplers (or the digital I/O module) and the CPU

2 Allocation between terminal No. and signal name

3 8 yellow LEDs to display the signal statuses at the inputs/outputs C0 to C7

4 1 green LED to display the process voltage UP

5 1 red LED to display errors (CH-ERR1)

6 Label

7 Terminal block with 10 terminals for 8 inputs/outputs and process power supply (ZP/UP)

8 DC541, inserted in a coupler slot to the left of the CPU

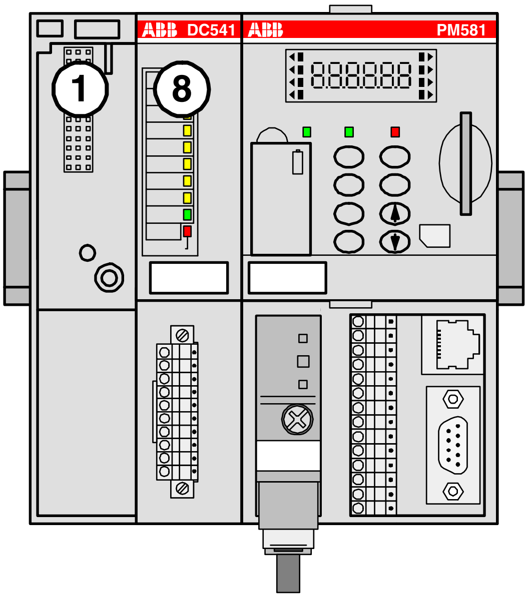


Figure: Digital input/output module DC541-CM, combined with CPU on a Terminal Base TB5xx

Contents

Intended purpose

In contrast to other I/O modules, the digital I/O module (multi-function module) DC541-CM is installed on a coupler slot to the left of the AC500 CPU. It contacts the internal coupler bus there. In this way, the full functionality of the coupler bus is available for the module DC541-CM.

The multi-function module DC541-CM can optionally (not at the same time) be configured as an interrupt module or as a high-speed counter module for 24V signals (e.g. 24V incremental encoder). The configuration is simply done using the AC500 Control Builder programming software in the PLC configuration (see also System Technology DC541-CM / Configuration of the module DC541-CM).

The module contains 8 fast channels (C0...C7) with the following features:

- 8 digital inputs/outputs in one group (1.0...1.7), of which each can be used
    - as an input,
    - as a transistor output with short-circuit and overload protection, 0.5 A rated current or
    - as a re-readable output (combined input/output) with the technical data of the digital inputs and outputs.

The status of the inputs/outputs are indicated by yellow LEDs (one per channel). There is no potential separation between the channels.

Functionality

Digital inputs/outputs	8 (24 V DC)
High-speed counter	integrated, many configurable operating modes
LED displays	for signal statuses, errors and supply voltage
Internal power supply	through the coupler bus
External power supply	via the terminals ZP and UP (process voltage 24 V DC)

In the operating mode **Interrupt IO device**, the channels can be configured as follows:

- Input
- Output
- Interrupt input

In this way, important input information can be evaluated independent of the program cycle and outputs can be set.

In the operating mode **Counter**, the channels can be configured as follows:

- Input
- Output
- 32-bit up/down counter (uses C0...C3) as a 32-bit counter without limit
- 32-bit periodic counter as a 32-bit counter with a limit
- Limiter for a 32-bit counter (limit channel 0)
- 32-bit up counter (forward counter) with the frequencies 50 kHz, 5 kHz and 2.5 kHz
- Pulse-width modulation (PWM) with a resolution of 10 kHz
- Time and frequency measurement
- Frequency output

Used as a high-speed counter module, the 8 channels of the multi-function module DC541-CM can be configured and combined singly, simply and versatilely in the PLC configuration. So it is excellently usable also for universal high-frequency counting tasks up to 50 kHz. In addition, it has measuring functions for rotational speed, time and frequency.

These configurations per channel can now be combined on-board differently for the 8 channels.

Example 1: 32-bit up/down counter incl. zero trace and touch-trigger for max. 50 kHz plus 4 accompanying limiting values (comparison values). When the counter reaches one of the comparison values, the corresponding output can be set in order to trigger control functions at the machine or installation directly.

Example 2: 2 counters for 50 kHz plus frequency measurement with a resolution of 200 µs plus 4 digital I/Os.

Further examples and a detailed description of the fields of application are contained in the chapter "System Technology of the DC541" (see also System Technology DC541-CM / Configuration of the module DC541-CM).

Commissioning is carried out via the user program by using the appropriate function blocks.

Electrical connection

The I/O module DC541-CM is mounted to the left of an AC500 CPU on the same Terminal Base. The connection to the coupler bus is automatically established while mounting.

The electrical connection of the I/O channels is carried out using the 10 terminals of the removable terminal block. I/O modules can be replaced without re-wiring.

Note: Mounting, disassembling, wiring technique and dimensioned drawings for the Terminal Bases, CPUs, communication modules, I/O Terminal Units and the I/O expansion modules are described in detail in the AC500 system data chapters.

Caution: Removal of energized modules is not permitted. All power sources (supply and process voltages) must be switched off while working on any AC500 system.

The process voltage is connected in the following way:

Terminal 1.8: Process voltage UP = +24 V DC
Terminal 1.9: Process voltage ZP = 0 V

The assignment of the other terminals:

Terminals	Signal	Meaning
1.0 to 1.7	C0 to C7	8 digital inputs/outputs

The internal supply voltage for the module's electroc circuitry comes from the coupler bus. The process voltage for the inputs/outputs is supplied over ZP and UP.

The module provides several diagnostic functions (see chapter "Diagnosis and display").

The following figure shows the electrical connection of the input/output module DC541-CM.

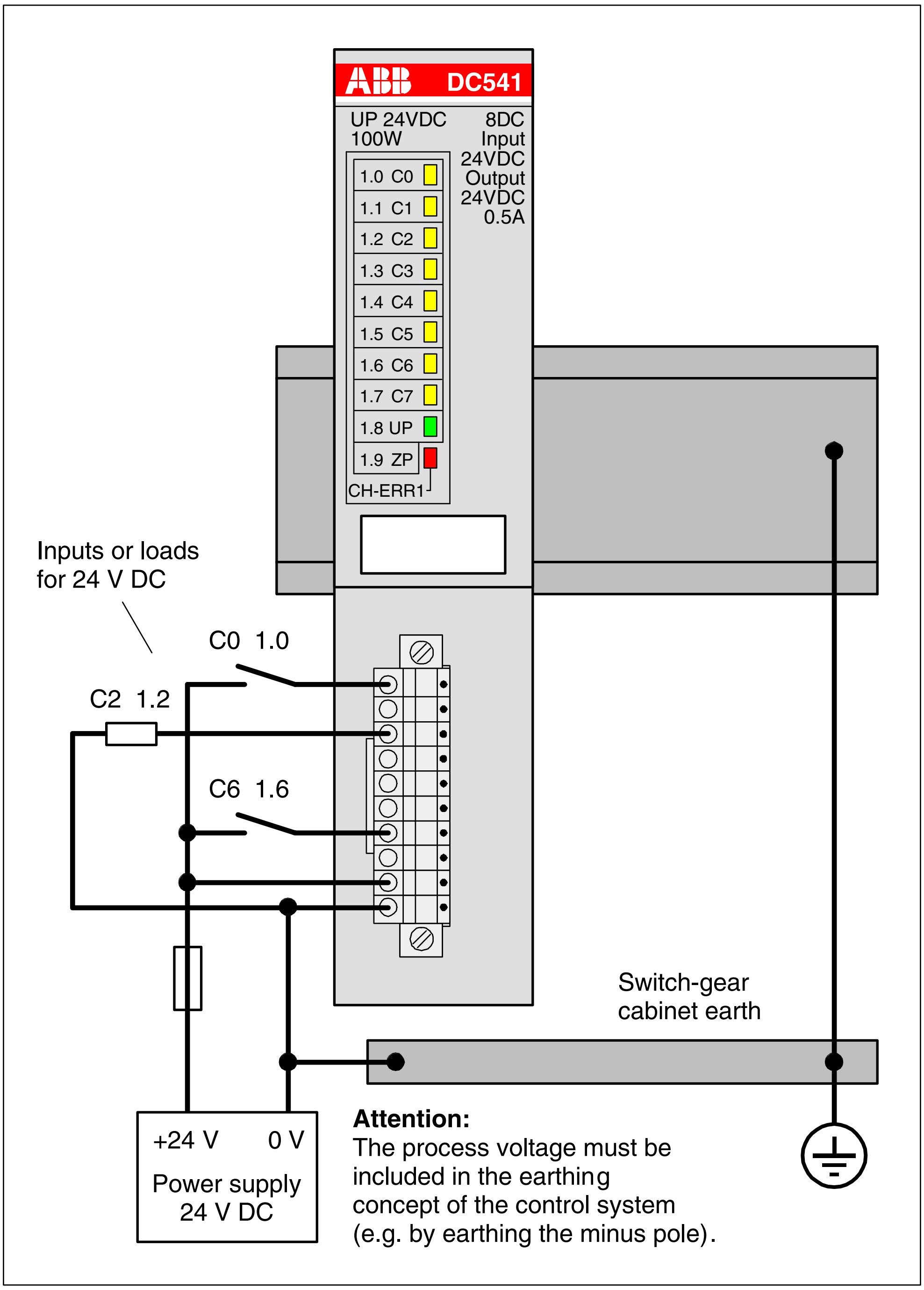


Figure: Electrical connection of the input/output module DC541-CM

I/O configuration and parameterization

The DC541-CM module does not store configuration data itself. Configuration and parameterization are performed with the AC500 Control Builder software in the PLC configuration (see also System Technology DC541-CM / Configuration of the module DC541-CM).

Diagnosis and display

In case of overload or short-circuit, the outputs switch off automatically and try to switch on again cyclically. Therefore an acknowledgement of the outputs is not necessary.

Status of the LEDs

LED	Status	Colour	LED = OFF	LED = ON
Inputs/ outputs C0...C7	Digital input or digital output	yellow	Input/output = OFF	Input/output = ON (the input voltage is even displayed if the supply voltage is OFF).
UP	Process voltage 24 V DC via terminal	green	Process voltage is missing	Process supply voltage OK and initialization terminated
CH-ERR1	Module Error	red	No error	Error

Technical data

The system data of AC500 and S500 are valid here. Only additional details are therefore documented below.

Process supply voltage UP	
- Connections	Terminals 1.8 for +24 V (UP) and 1.9 for 0 V (ZP)
- Rated value	24 V DC
- max. ripple	5 %
- Protection against reversed voltage	yes
- Rated protection fuse on UP	10 A fast
- Electrical isolation	yes, per module
Current consumption	
- internal (via coupler bus)	on request
- Current consumption from UP at normal operation / with outputs	on request
- Inrush current from UP (at power up)	on request
Max. power dissipation within the module	6 W (outputs unloaded)
Max. power dissipation within the module	on request
Weight (without terminal block)	ca. 125 g
Mounting position	horizontal or vertical with derating (output load reduced to 50 % at 40°C per group)
Cooling	The natural convection cooling must not be hindered by cable ducts or other parts in the switch-gear cabinet.

Attention: All I/O channels (digital or analog) are protected against reverse polarity, reverse supply, short circuit and continuous overvoltage up to 30 V DC.

Technical data of the configurable digital inputs/outputs

Each of the configurable I/O channels is defined as input or output by the user program. This is done by interrogating or allocating the corresponding channel.

Number of channels per module	8 inputs/outputs (with transistors)
Distribution of the channels into groups	1 group of 8 channels
if the channels are used as inputs	
- channels C0...C7	terminals 1.0...1.7
if the channels are used as outputs	
- channels C0...C7	terminals 1.0...1.7
Reference potential for all inputs/outputs	terminal 1.9 (ZP = Minus pole of the process supply voltage)
Indication of the input/output signals	one yellow LED per channel, the LED is ON when the input/output signal is high (signal 1)
Electrical isolation	from the rest of the module

Technical data of the digital inputs/outputs if used as inputs

Number of channels per module	max. 8 digital inputs
Reference potential for all inputs	terminal 1.9 (minus pole of the process supply voltage, signal name ZP)
Input current per channel	
- input voltage +24 V	typ. 5 mA
- input voltage +5 V	> 1 mA
- input voltage +15 V	> 5 mA
- input voltage +30 V	< 8 mA
Input type acc. to EN 61131-2	Type 1
Input delay (0->1 or 1->0)	typ. 8 ms, configurable from 0.1 to 32 ms
Input signal voltage	24 V DC
Signal 0	-3 V...+5 V *
undefined signal	> +5 V...< +15 V
Signal 1	+15 V...+30 V
Ripple with signal 0	within -3 V...+5 V *
Ripple with signal 1	within +15 V...+30 V
Max. cable length	
shielded	1000 m
unshielded	600 m

* Due to the direct connection to the output, the demagnetizing varistor is also effective at the input (see figure) above. This is why the difference between UPx and the input signal may not exceed the clamp voltage of the varistor. The varistor limits the voltage to approx. 36 V. Following this, the input voltage must range from - 12 V to + 30 V when UPx = 24 V and from - 6 V to + 30 V when UPx = 30 V.

Technical data of the digital inputs/outputs if used as outputs

Number of channels per module	max. 8 transistor outputs
Common power supply voltage	for all outputs: terminal 1.8 (plus pole of the process supply voltage, signal name UP)
Output voltage for signal 1	UP (-0.8 V)
Output delay (0->1 or 1->0)	typ. 10 µs
Output current	
rated value, per channel	500 mA at UP = 24 V
maximum value (all channels together)	8 A
Leakage current with signal 0	< 0.5 mA
Rated protection fuse for UP	10 A fast
De-magnitization when inductive loads are switched off	with varistors integrated in the module (see figure below)
Switching frequency	
with resistive load	on request
with inductive loads	max. 0.5 Hz
with lamp loads	max. 11 Hz with max. 5 W
Short-circuit proof / overload proof	yes
Overload message (I > 0.7 A)	yes, after ca. 100 ms
Output current limitation	yes, automatic reactivation after short-circuit/overload
Resistance to feedback against 24V signals	yes
Max. cable length	
shielded	1000 m
unshielded	600 m

The following drawing shows the circuitry of a digital input/output with the varistors for demagnitization when inductive loads are switched off.

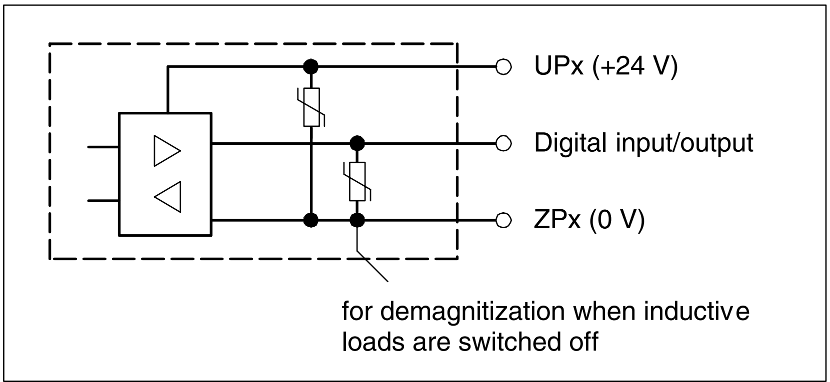


Figure: Digital input/output (circuit diagram)

Technical data of the high-speed counters

Used inputs for the traces A and B	C0 / C1
Used input for the zero trace, touch trigger	C2 / C3
Used outputs	C4 to C7, if needed
Counting frequency	max. 50 kHz
Operating modes	see chapter "Functionality"
Detailed description	see AC500 System Technology DC541

Ordering data

Order No.	Scope of delivery
1SAP 270 000 R0001	DC541-CM, Digital input/output module, 8 DC, 24 V DC / 0.5 A, 1-wire

Contents

AC500 Accessories

SD Memory Card MC502
- Secure Digital Card 128 MB
- Solid State Flash Memory Storage

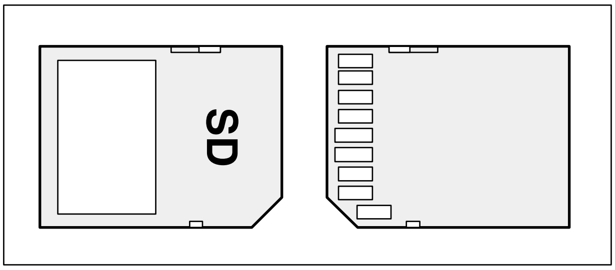


Figure: SD Memory Card MC502

Contents

Purpose
Insertion of the SD Memory Card
Technical data
Ordering data

Purpose

The SD Memory Card is used to back-up user data and store user programs as well as to update the internal CPU firmware. AC500 CPUs are supplied without an SD Memory Card. It therefore must be ordered separately. AC500 CPUs can be operated with and without SD Memory Cards.

The CPU uses a standard file system. This allows standard card readers to read the MC502 SD Memory Cards.

> ⚠ **Attention:** The use of memory cards other than the MC502 SD Memory Card is prohibited. ABB is not responsible nor liable for consequences resulting from the use of unapproved memory cards.

The SD Memory Card has a Write Protect Switch. In the position "LOCK", the card can only be read.

Insertion of the SD Memory Card

Insertion and removal of the SD Memory Card is described in detail under "AC500 system data".

Technical data

The system data of AC500 and S500 are valid here. Only additional details are therefore documented below.

Memory capacity	128 MB
Temperature range	-25 °C...85 °C
No. of writing cycles	> 100 000
No. of reading cycles	no limitation
Data safety	> 10 years
Write Protect Switch	yes, at the edge of the card
Weight	2 g
Dimensions	24 mm x 32 mm x 2.1 mm

Ordering data

Order No.	Scope of delivery
1SAP 180 100 R0001	MC502, SD Memory Card 128 MB

Lithium Battery TA521
- Manganese Dioxide Lithium Button Cell, 3 V, 560 mAh
- Primary cell, non-rechargeable

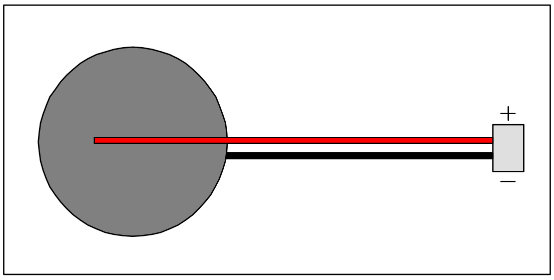


Figure: Lithium Battery TA521

Contents

Purpose

The TA521 Lithium Battery is used to save RAM contents of AC500 CPUs and back-up the real-time clock. AC500 CPUs are supplied without a Lithium battery. It therefore must be ordered separately. Although the CPUs can work without a battery, its use is still recommended in order to avoid process data being lost.

The CPU monitors the discharge degree of the battery. An error is output, before the battery condition becomes critical (about 2 weeks before). After the error message has appeared, the battery should be replaced as soon as possible.

The TA521 Lithium Battery is the only one, which can be used with AC500 CPUs. It is a primary cell and cannot be re-charged.

Note: In order to prevent data losses or problems, the battery should be replaced after 3 years of utilisation or **at least** as soon as possible after receiving the "Low battery warning" indication.
Do not use a battery older than 3 years for replacement, do not keep batteries too long in stock.

Handling instructions

- Use the TA521 battery only for AC500 CPUs.
- **Do not short-circuit or re-charge the battery!** It can cause excessive heating and explosion.
- **Do not disassemble the battery!**
- **Do not heat up the battery and not put into fire!** Risk of explosion.
- Store the battery in a dry place.
- Replace the battery with supply voltage ON in order not to risk data being lost.
- Please recycle exhausted batteries meeting the environmental standards.

⚠ **Attention:** In order to avoid any data losses (if needed), the battery replacement should be done with the system under power. Without battery and power supply there is no data buffering possible.

Electrical connection

Assembling and electrical connection of the battery is described in detail under the AC500 system data.

Battery lifetime

The battery lifetime is the time the battery can store data while the CPU is not powered. As long as the CPU is powered, the battery will only be discharged by its own leakage current.

Technical data

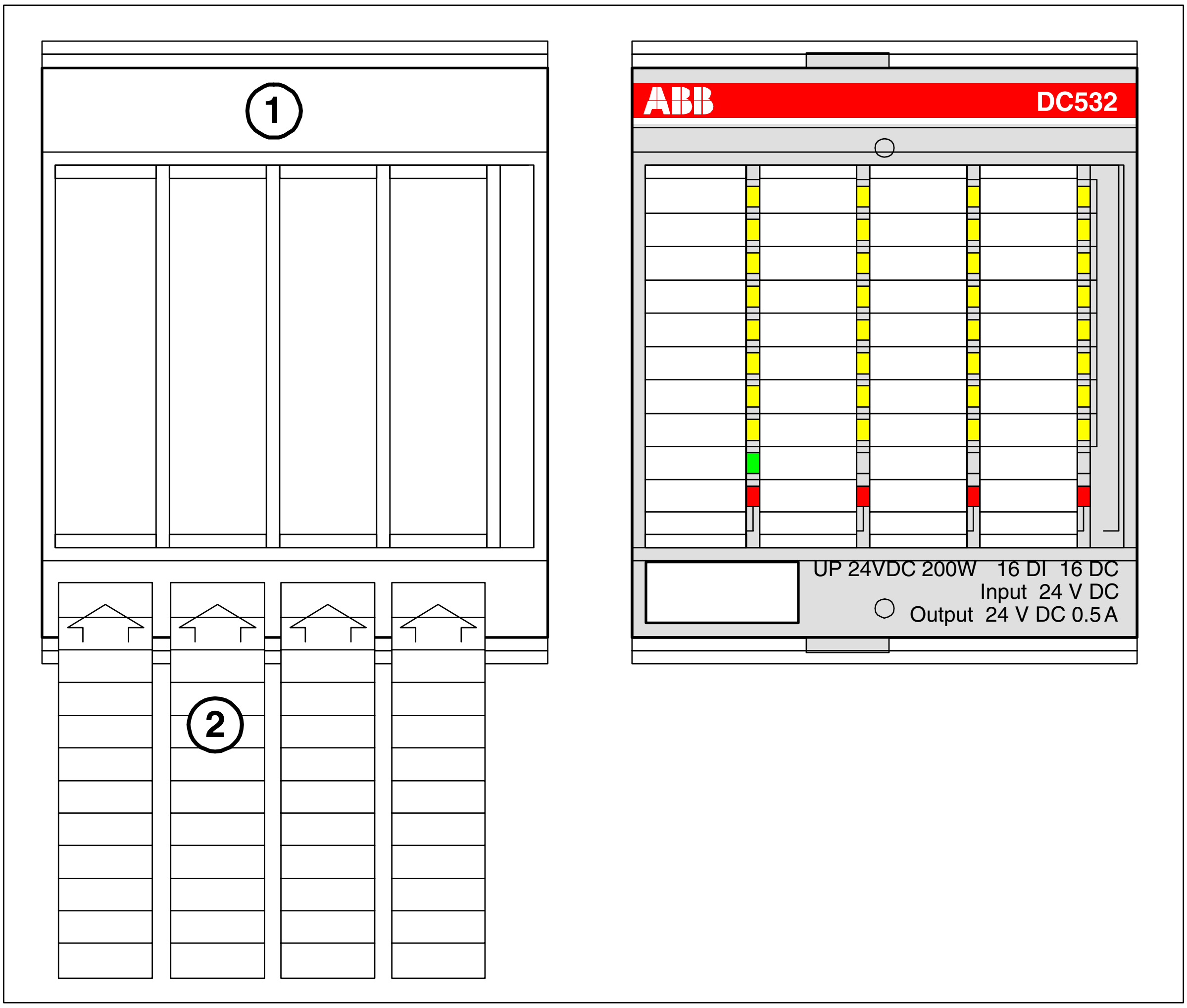
The system data of AC500 and S500 are valid here. Only additional details are therefore documented below.

Nominal voltage	3 V
Nominal capacity	560 mAh
Temperature range	-20 °C...60 °C
Pre-warning information	The CPU monitors the battery level and sends a warning message about 2 weeks before the battery charge becomes critical.
Battery lifetime	CPU PM571, CPU PM581, CPU PM591: 3 years
Self-discharge	2 % per year at 25 °C 5 % per year at 40 °C 20 % per year at 60 °C
Pretection against reverse polarity	yes, by mechanical coding of the plug
Insulation	The battery is completely insulated.
Connection	red = plus pole = above at plug, black = minus pole, for assembling see AC500 system data
Weight	7 g
Dimensions	Diameter of the button cell: 24.5 mm, Thickness of the button cell: 5 mm

Ordering data

Order No.	**Scope of delivery**
1SAP 180 300 R0001	TA521, Lithium Battery

Pluggable Marker Holder TA523
- for labelling the channels of S500 I/O modules



(1) Pluggable Marking Holder TA523

(2) Marking stripes to be inserted into the holder

(3) Pluggable Marking Holder, snapped on an I/O module

Contents

Purpose
Handling instructions
Technical data
Ordering data

Purpose

The Pluggable Marking Holder is used to hold 4 marking stripes, on which the meaning of the I/O channels of I/O modules can be written down. The holder is transparent so that after snapping it onto the module the LEDs shine through.

Handling instructions

The marking stripes can be printed out from a Word file.

Template: ...\Documentation\2-Hardware-AC500\TA523.doc

Technical data

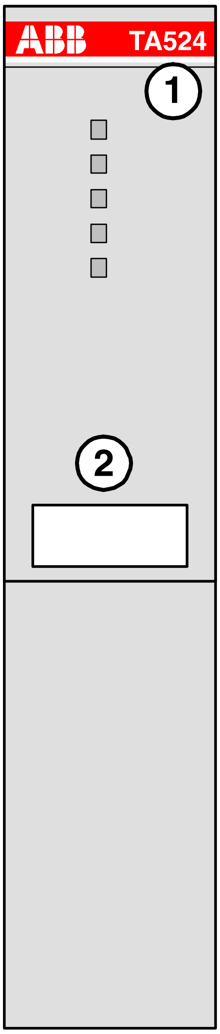
The system data of AC500 and S500 are valid here. Only additional details are therefore documented below.

Use	for labelling channels of I/O modules
Mounting	snap-on to the module
Weight	20 g
Dimensions	82 mm x 67 mm x 13 mm

Ordering data

Order No.	Scope of delivery
1SAP 180 500 R0001	TA523, Pluggable Marker Holder (10 pieces)

Dummy Coupler Module TA524
- to cover an unused coupler slot of a Terminal Base



Elements of the Dummy Coupler Module

1 Type
2 Label

Figure: Dummy Coupler Module TA524

Contents

Purpose
Handling instructions
Technical data
Ordering data

Purpose

If a coupler slot is not used on a Terminal Base (TB511-TB541), it is useful to protect it from dust and touch using a Dummy Coupler Module TA524.

Handling instructions

The Dummy Coupler Module is mounted in the same way as with couplers. The mounting of couplers is described in the AC500 System Data chapter.

Technical data

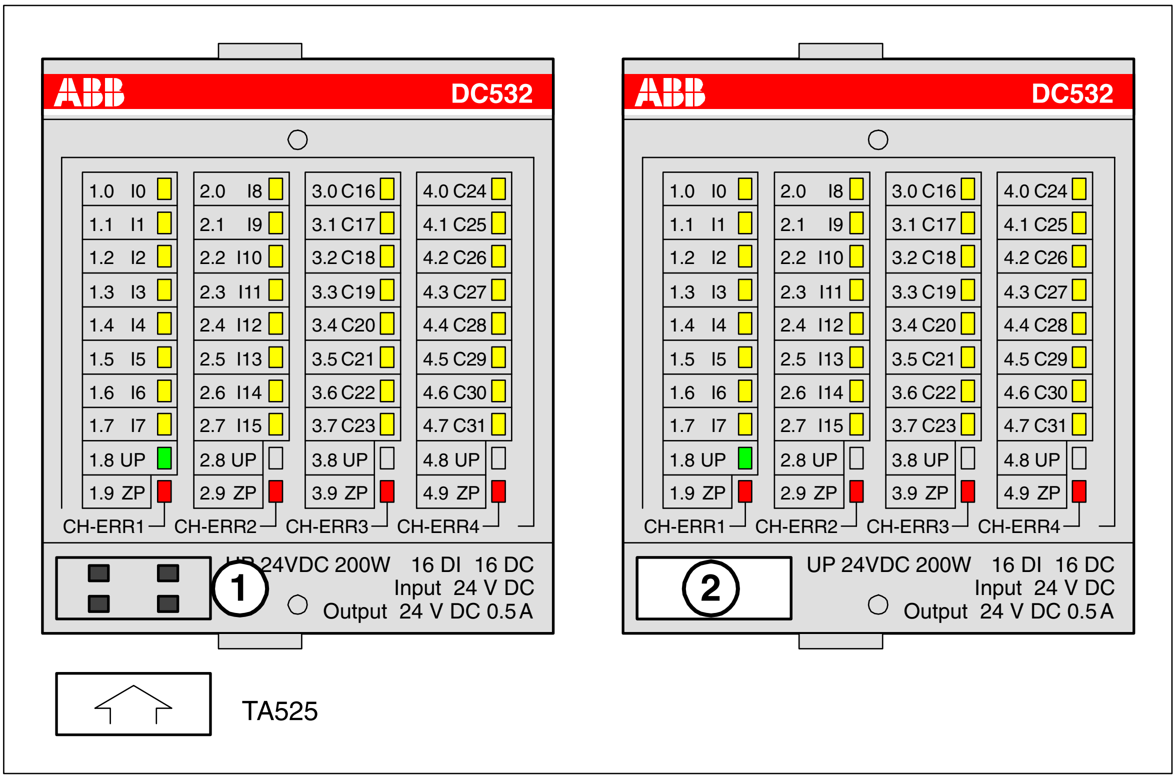
The system data of AC500 and S500 are valid here. Only additional details are therefore documented below.

Use	to protect an unused coupler slot from dust and touch
Mounting	in the same way as with a coupler
Weight	50 g
Dimensions	135 mm x 28 mm x 62 mm

Ordering data

Order No.	Scope of delivery
1SAP 180 600 R0001	TA524, Dummy Coupler Module

Set of 10 white Plastic Markers TA525
- to label AC500 and S500 modules



(1) Module without Plastic Marker TA525

(2) Module with Plastic Marker TA525

Contents

Purpose

The Plastic Markers are suitable for labelling AC500 and S500 modules (CPUs, couplers and I/O modules). The small plastic parts can be written with a standard waterproof pen.

Handling instructions

The Plastic Markers are inserted under a slight pressure. For disassembly, a small screwdriver is inserted at the lower edge of the module.

Technical data

The system data of AC500 and S500 are valid here. Only additional details are therefore documented below.

Use	for labelling AC500 and S500 modules
Mounting	insertion under a slight pressure
Disassembly	with a small screwdriver
Scope of delivery	10 pieces
Weight	1 g per piece
Dimensions	8 mm x 20 mm x 5 mm

Ordering data

Order No.	**Scope of delivery**
1SAP 180 700 R0001	TA525, Set of 10 white Plastic Markers

Wall Mounting Accessory TA526
- for insertion at the rear side of Terminal Bases and Terminal Units

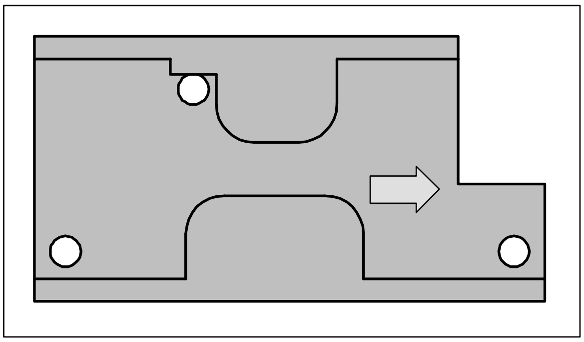


Figure: Wall mounting accessory TA526

Contents

Purpose

If the Terminal Bases TB5xx or Terminal Units TU5xx should be mounted with screws, Wall Mounting Accessories TA526 must be inserted at the rear side first. This plastic parts prevent bending of Terminal Bases and Terminal Units while screwing up.

Handling instructions

The handling of the Wall Mounting Accessories is described in detail under "AC500 system data" and "S500 system data".

Technical data

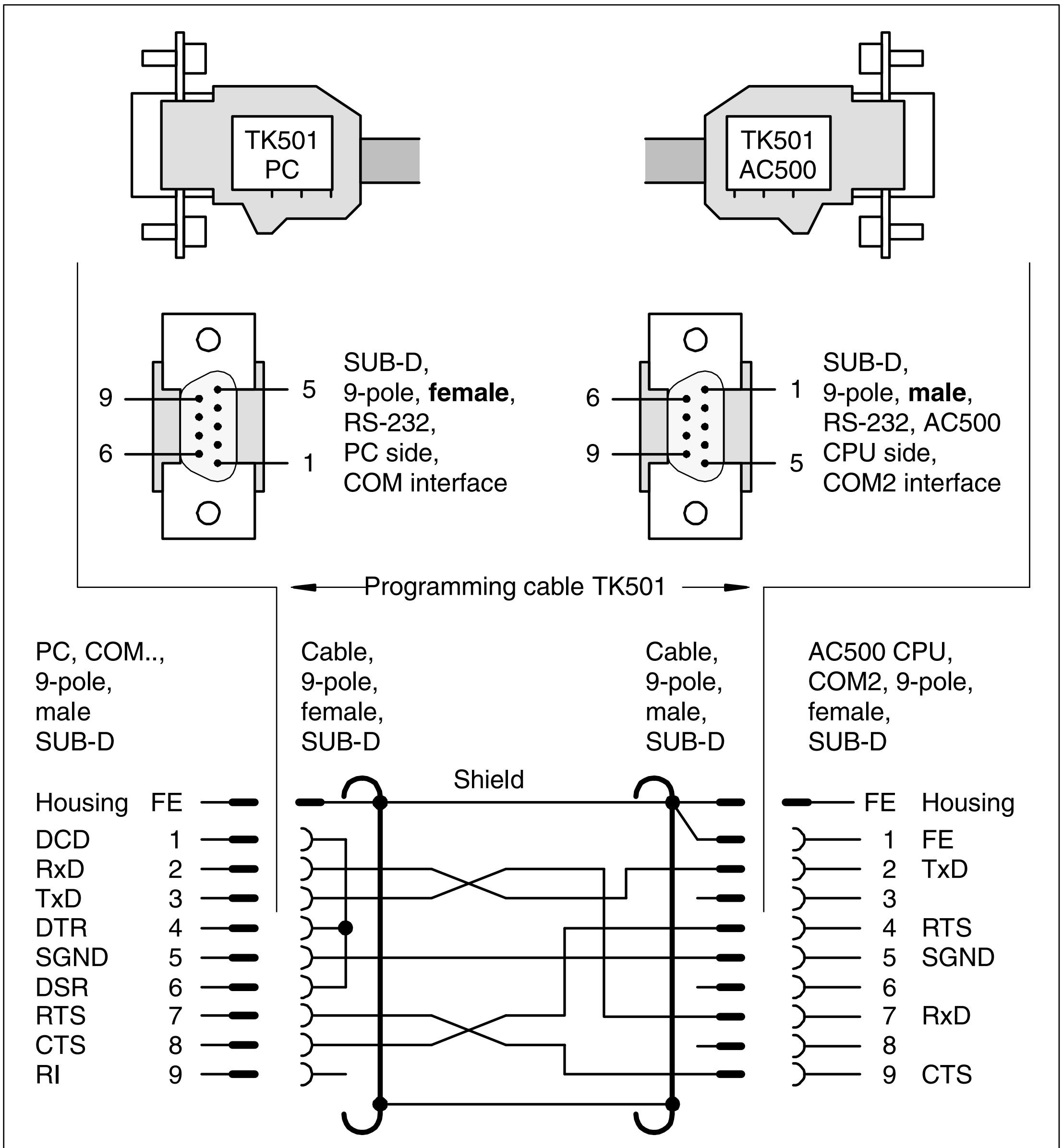
The system data of AC500 and S500 are valid here. Only additional details are therefore documented below.

Use	with wall mounting of Terminal Bases and Terminal Units
Assembly	see system data of AC500 and S500
Weight	5 g
Dimensions	67 mm x 35 mm x 5,5 mm

Ordering data

Order No.	**Scope of delivery**
1SAP 180 800 R0001	TA526, Wall Mounting Accessory

Programming Cable TK501
- PC side: SUB-D, 9-pole, female
- AC500 side: SUB-D, 9-pole, male
- Length: 5 m



FE	Functional Earth	DCD	Data Carrier Detect
TxD	Transmit Data	DSR	Data Set Ready
RxD	Receive Data	DTR	Data Terminal Ready
RTS	Request To Send	SGND	Signal Ground
CTS	Clear TO Send	RI	Ring Indicator

Figure: Programming cable TK501

Contents

Purpose

The TK501 cable connects a 9-pole serial COM interface of a PC with the serial COM2 interface of an AC500 CPU. It is used for programming purposes.

Electrical connection

The two plugs are put on the two COM interfaces and screwed up there.

Technical data

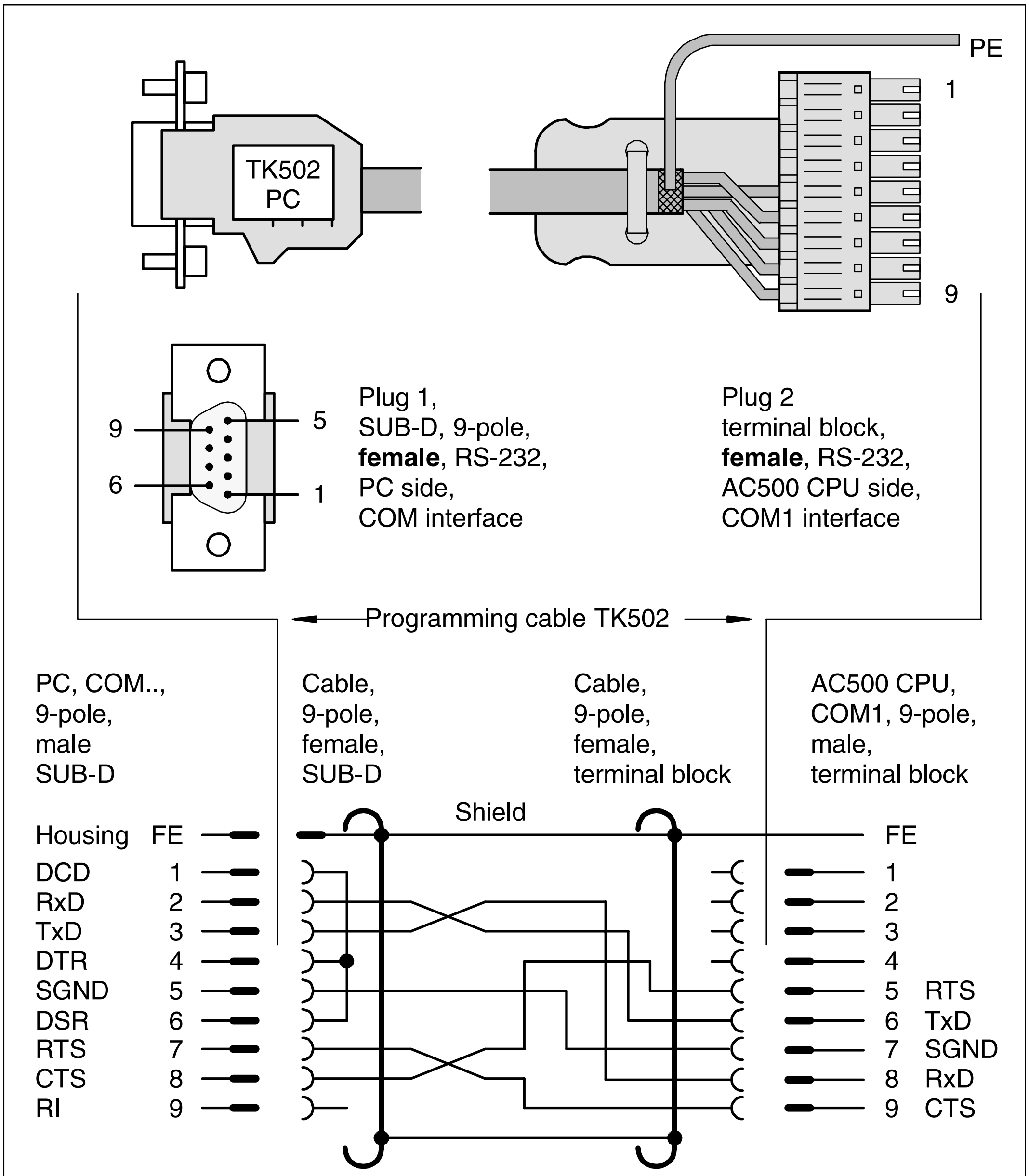
The system data of AC500 and S500 are valid here. Only additional details are therefore documented below.

Connector at the PC (COM interface)	SUB-D, 9-pole, female
Connector at the AC500 CPU (COM2)	SUB-D, 9-pole, male
Cable length	5 m
Cable type	LiYCY 5 x 0,14 mm², shielded
Weight	220 g

Ordering data

Order No.	**Scope of delivery**
1SAP 180 200 R0001	TK501, Programming cable SUB-D / SUB-D, length: 5 m

Programming Cable TK502
- PC side: SUB-D, 9-pole, female
- AC500 side: terminal block, 9-pole, female
- Length: 5 m



FE	Functional Earth	DCD	Data Carrier Detect
TxD	Transmit Data	DSR	Data Set Ready
RxD	Receive Data	DTR	Data Terminal Ready
RTS	Request To Send	SGND	Signal Ground
CTS	Clear TO Send	RI	Ring Indicator

Figure: Programming cable TK502

Contents

Purpose

The TK502 cable connects a 9-pole serial COM interface of a PC with the serial COM1 interface of an AC500 CPU. It is used for programming purposes.

Electrical connection

The two plugs are put on the two COM interfaces and the plug at the PC side is screwed up then.

Technical data

The system data of AC500 and S500 are valid here. Only additional details are therefore documented below.

Connector at the PC (COM interface)	SUB-D, 9-pole, female
Connector at the AC500 CPU (COM1)	terminal block, 9-pole, female
Cable length	5 m
Cable type	LiYCY 5 x 0,14 mm², shielded
Weight	220 g

Ordering data

Order No.	**Scope of delivery**
1SAP 180 200 R0101	TK502, Programming cable terminal block / SUB-D, length: 5 m

24 V DC Power supplies which can be used with the system
- as system power supply or process supply

Figure: Power supply units CP24..

Contents

Features

- **Switching power supplies, primary switch mode**
- **High effiency**
- **Wide-range input voltage**
- **Mounting on DIN rail**
- **Compact design**
- **Tested according to EN 60950**
- **Complies with EMC directives EN 61000-6-2 and EN 61000-6-4**

Characteristics

- Versions with output voltages from 5 V DC to 48 V DC and output currents form 300 mA to 20 A are available.
- Fixed or adjustable output voltage (depending on type).
- Most of the types provide a wide input voltage range from 90 V AC to 260 V AC and a frequency range from 47 Hz to 440 Hz. No adjustment is necessary.

- Integrated input fuse.
- Almost all types can also be supplied with DC voltage from 105 V DC to 260 V DC.
- High efficiency of up to 90 %.
- Extended lifetime due to low power dissipation and low heating.
- No-load proof, overload proof, continuous short-circuit proof, automatic restart.
- Fast and easy mounting on DIN rail.
- Compact slim design.

Special characteristics

- Power factor correction (PFC) according to EN 61000-3-2 for CP-24/5.0 and CP-24/5.0 adj.
- Parallel connection possible for CP-24/10 adj. and CP-24/20 adj.
- Redundancy module available.

Ordering data

Ordering data CP Range, switching power supplies

Order No.	Type	Input	Output
1SVR 423 418 R0000	CP-24/1.0	90-260 V AC or 105-260 V DC	24 V DC, 1 A
1SVR 423 417 R0000	CP-24/2.0	90-140 V AC	24 V DC, 2 A
1SVR 423 417 R1000	CP-24/2.0	140-260 V AC	24 V DC, 2 A
1SVR 423 417 R1100	CP-24/2.0 adj.	140-260 V AC or 160-260 V DC	24 V DC, 2 A adj.
1SVR 423 416 R0000	CP-24/5.0	90-260 V AC or 127-260 V DC	24 V DC, 5 A
1SVR 423 416 R0100	CP-24/5.0 adj.	90-260 V AC or 127-260 V DC	24 V DC, 5 A adj.
1SVR 423 416 R1000	CP-24/4.2	90-260 V AC or 127-260 V DC	24 V DC, 4,2 A

Ordering data CP-S Range, switching power supplies

Order No.	Type	Input	Output
1SVR 427 014 R0000	CP-S 24/5.0	110-240 V AC	24 V DC, 5 A
1SVR 427 015 R0100	CP-S 24/10.0	110-120 V AC or 220-240 V AC (with selector switch)	24 V DC, 10 A
1SVR 427 016 R0100	CP-S 24/20.0	110-120 V AC or 220-240 V AC (with selector switch)	24 V DC, 20 A

Ordering data CP-C Range, switching power supplies

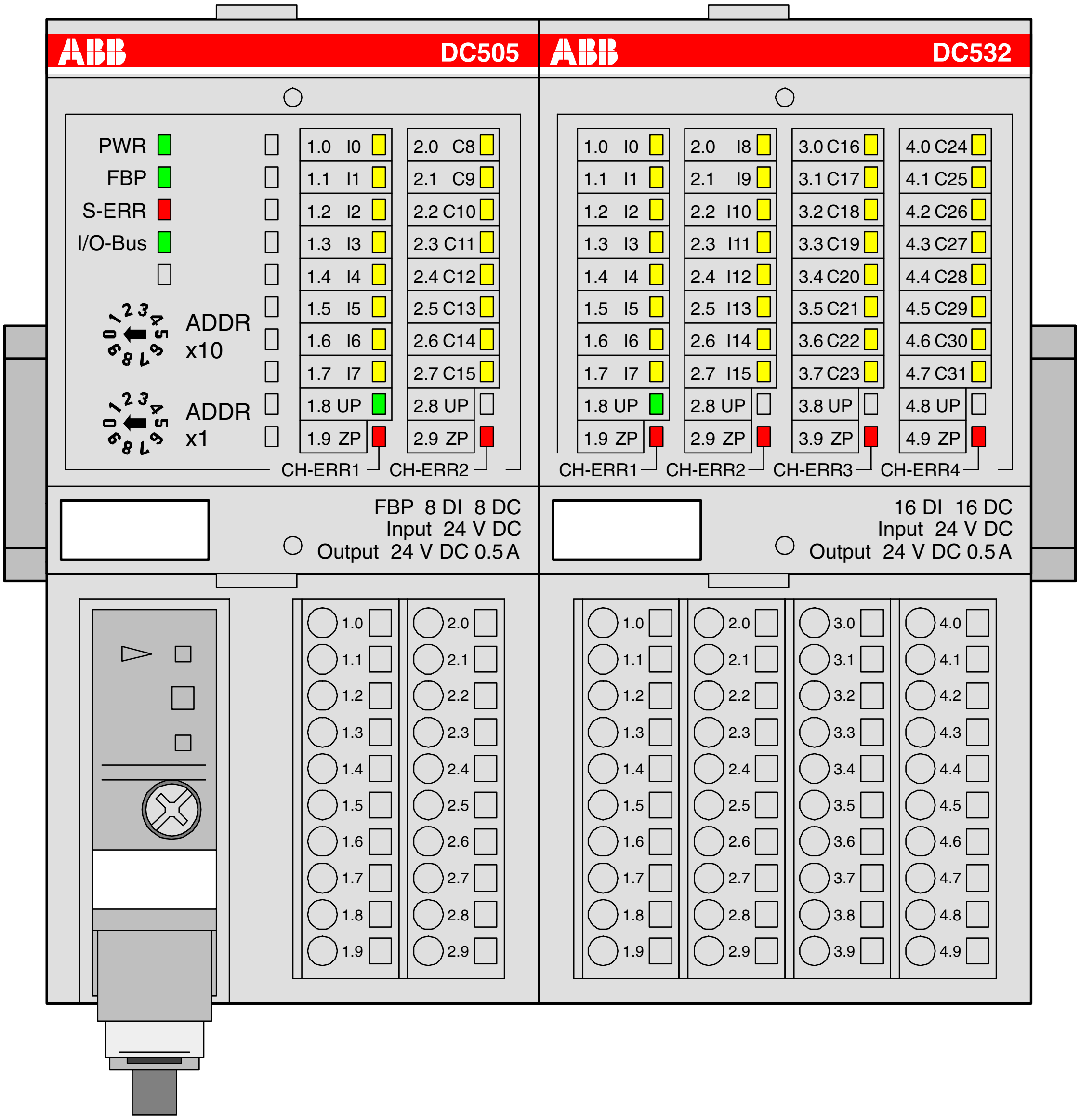
Order No.	Type	Input	Output
1SVR 427 024 R0000	CP-C 24/5.0	110-240 V AC	22-28 V DC, 5 A
1SVR 427 025 R0000	CP-C 24/10.0	110-240 V AC	22-28 V DC, 10 A
1SVR 427 026 R0000	CP-C 24/20.0	110-240 V AC	22-28 V DC, 20 A

System Description

S500-FBP

The Innovative I/O System with Fieldbus-Neutral FBP Technology

Handbook
English



Contents Hardware S500

System data and system construction

Terminal Units

FBP Interface Modules

CS31 Bus Modules

Digital input and output modules

Analog input and output modules

Accessories

System Data S500, Overview

S500 System data

The same system data as for the system AC500 apply to the system S500-FBP. Only additional details are therefore documented here.

Assortment

Parts of the S500-FBP system are

- the FBP Interface Module DC505-FBP
- digital I/O modules
- analog I/O modules
- Terminal Units for the FBP Interface Module and the I/O modules
- accessories

The FBP Interface Module DC505-FBP serves for the data interchange between a fieldbus and the I/O modules attached to the FBP Interface Module. The FBP interface module itself also has some digital inputs and outputs. The fieldbus type is defined by the choice of the FieldBusPlug (see documentation FieldBusPlug / FBP).

Subjects (overview)

Use of the S500 I/O modules

The S500 I/O modules either can be attached directly to an AC500 CPU (central expansion) or be operated by the FBP Interface Module DC505-FBP (decentralized expansion).

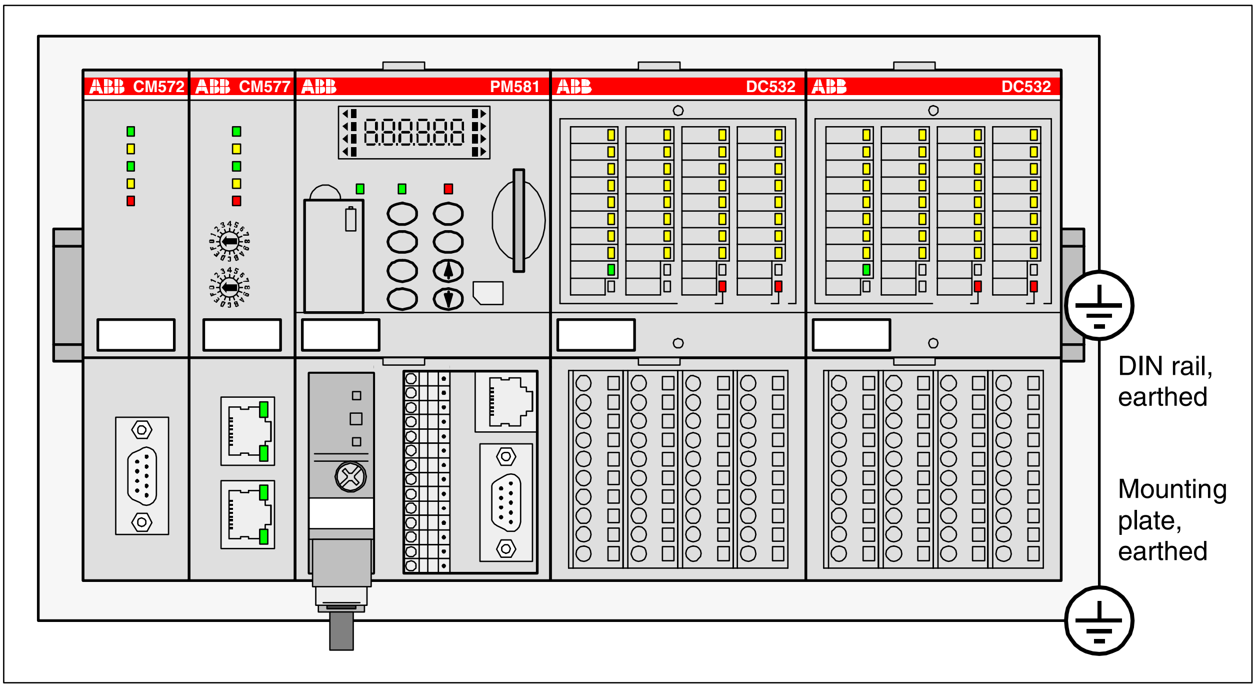


Figure: S500 I/O modules directly attached to an AC500 CPU (central I/O expansion)

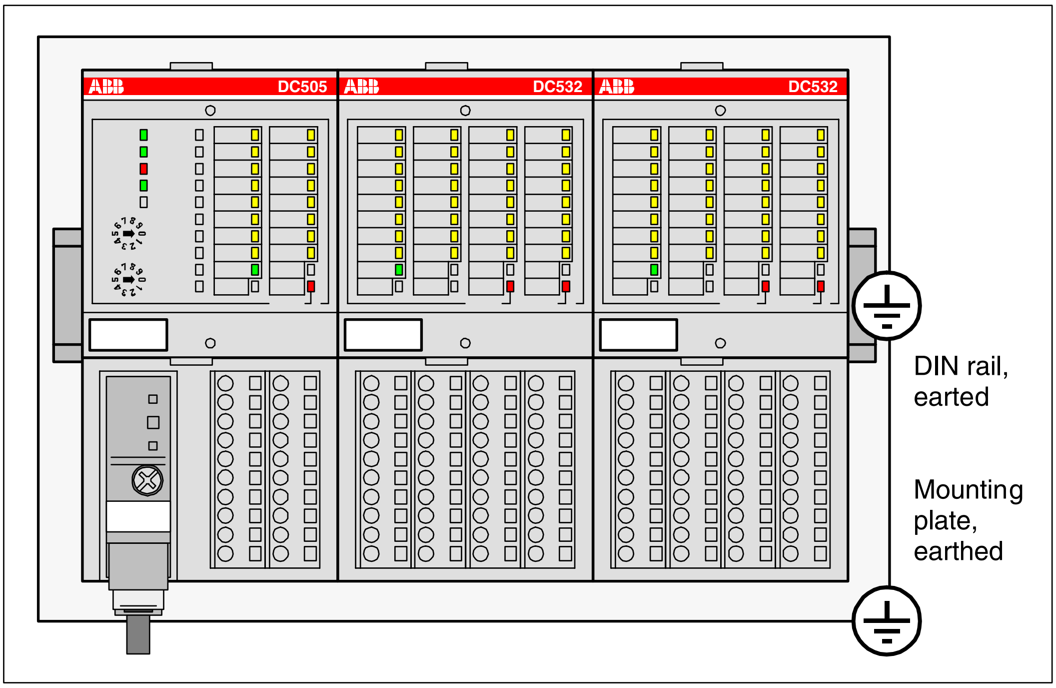


Figure: S500 I/O modules attached to the FBP Interface Module DC505-FBP (decentralized expansion)

Diagnosis LEDs

All S500 modules have LEDs for the display of operating statuses and error messages. They indicate:

LED	Status	Color	LED = ON	LED = OFF	LED flashes
Input	digital input	yellow	input = ON	input = OFF	--
	analog input	yellow	brightness depends on the value of the analog signal		--
Output	digital output	yellow	output = ON	output = OFF	--
	analog output	yellow	brightness depends on the value of the analog signal		--
UP	process voltage 24 V DC via terminal	green	voltage is present	voltage is missing	--
PWR	supply voltage 24 V DC via FBP	green	voltage is present	voltage is missing	--
S-ERR	Sum Error	red	serious error, data exchange is stopped, depends on the behaviour of the master	no error	error (e.g. error on one channel, data exchange is not stopped
FBP	FBP communication	green	communication between FBP and FBP Interface Module is running	communication between FBP and FBP Interface Module is broken	during initialization
I/O-Bus	I/O-Bus communication	green	communication between FBP Interface Module and the I/O modules is running	no communication between FBP Interface Module and the I/O modules	error on one I/O expansion module (e.g. one output short-circuited)
CH-ERR1	Channel Error, error messages in groups (digital or analog inputs and outputs combined into the groups 1, 2, 3, 4)	red	serious error within the corresponding group	no error	error on one channel of the corresponding group (e.g. one output short-circuited)
CH-ERR2		red			
CH-ERR3		red			
CH-ERR4		red			
CH-ERR *)	Module Error	red	error within the I/O module	--	--
*) All of the LEDs CH-ERR1 to CH-ERR4 (as far as they exist) light up together					

Display, if the FBP is not plugged

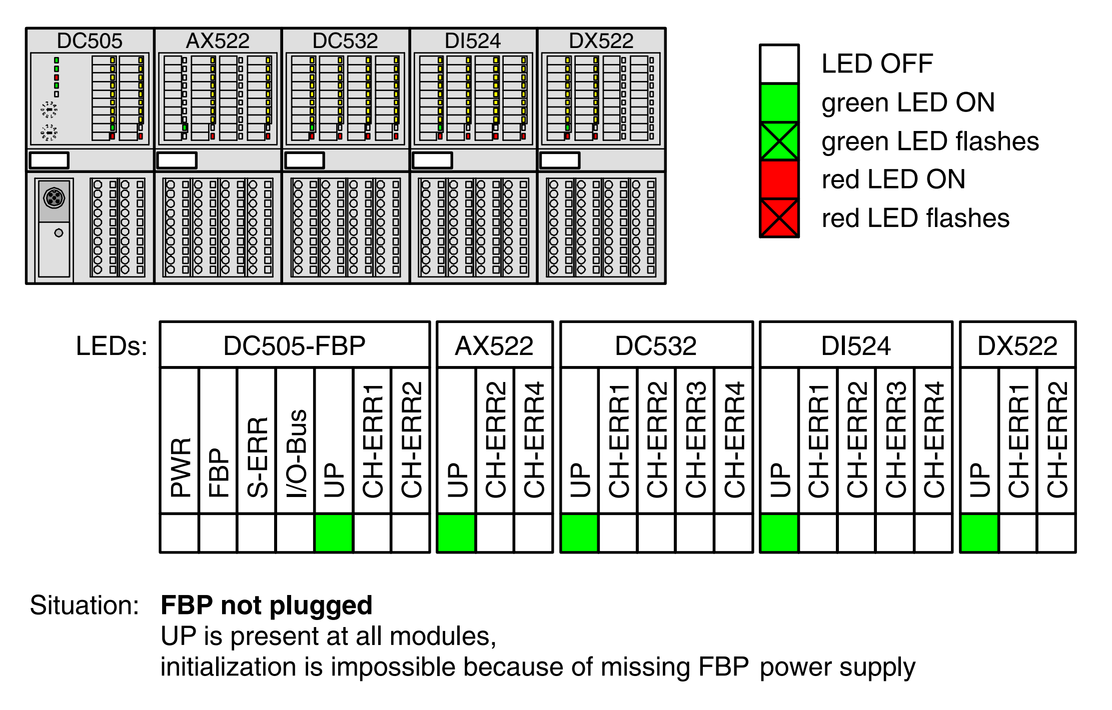


Figure: LED displays, if the FBP is not plugged

Display examples during the initialization

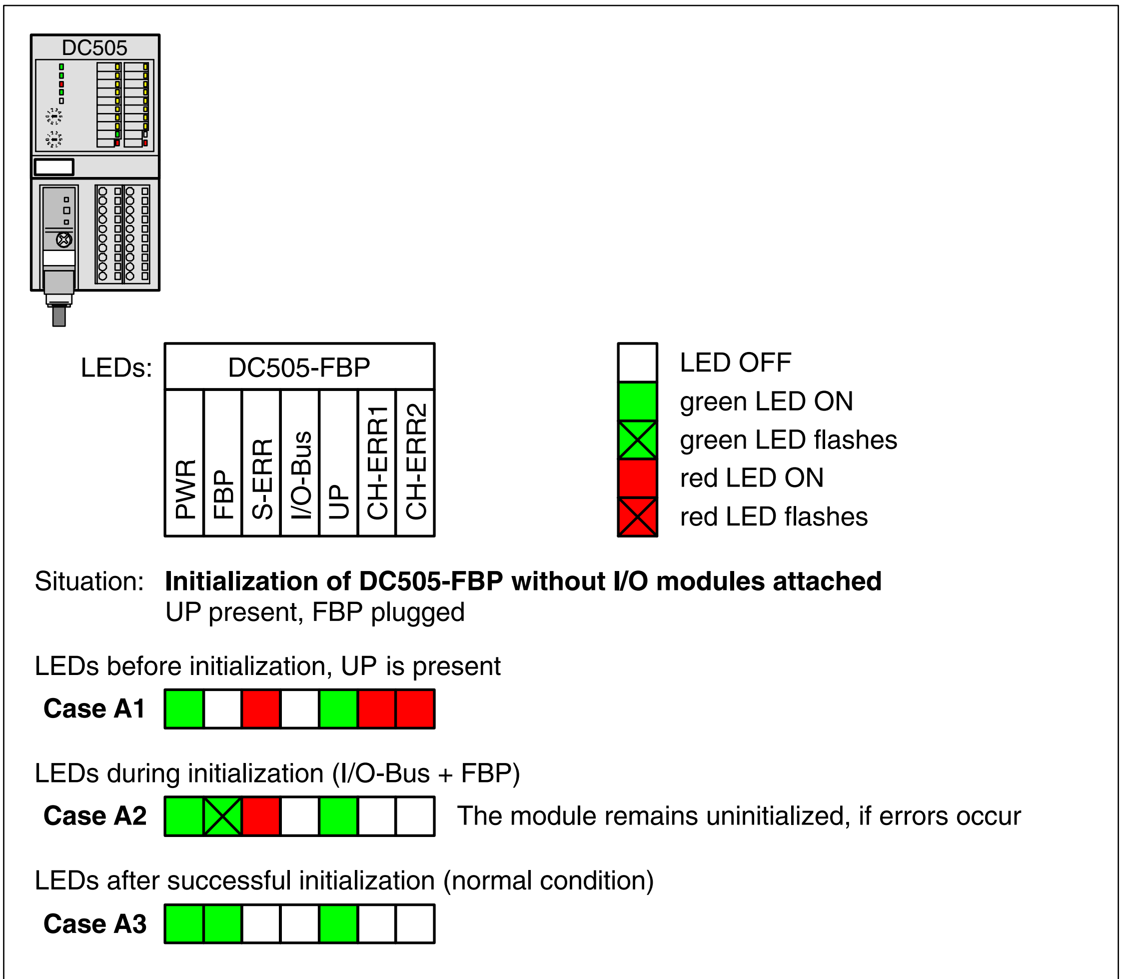


Figure: Initialization DC505-FBP without I/O modules attached

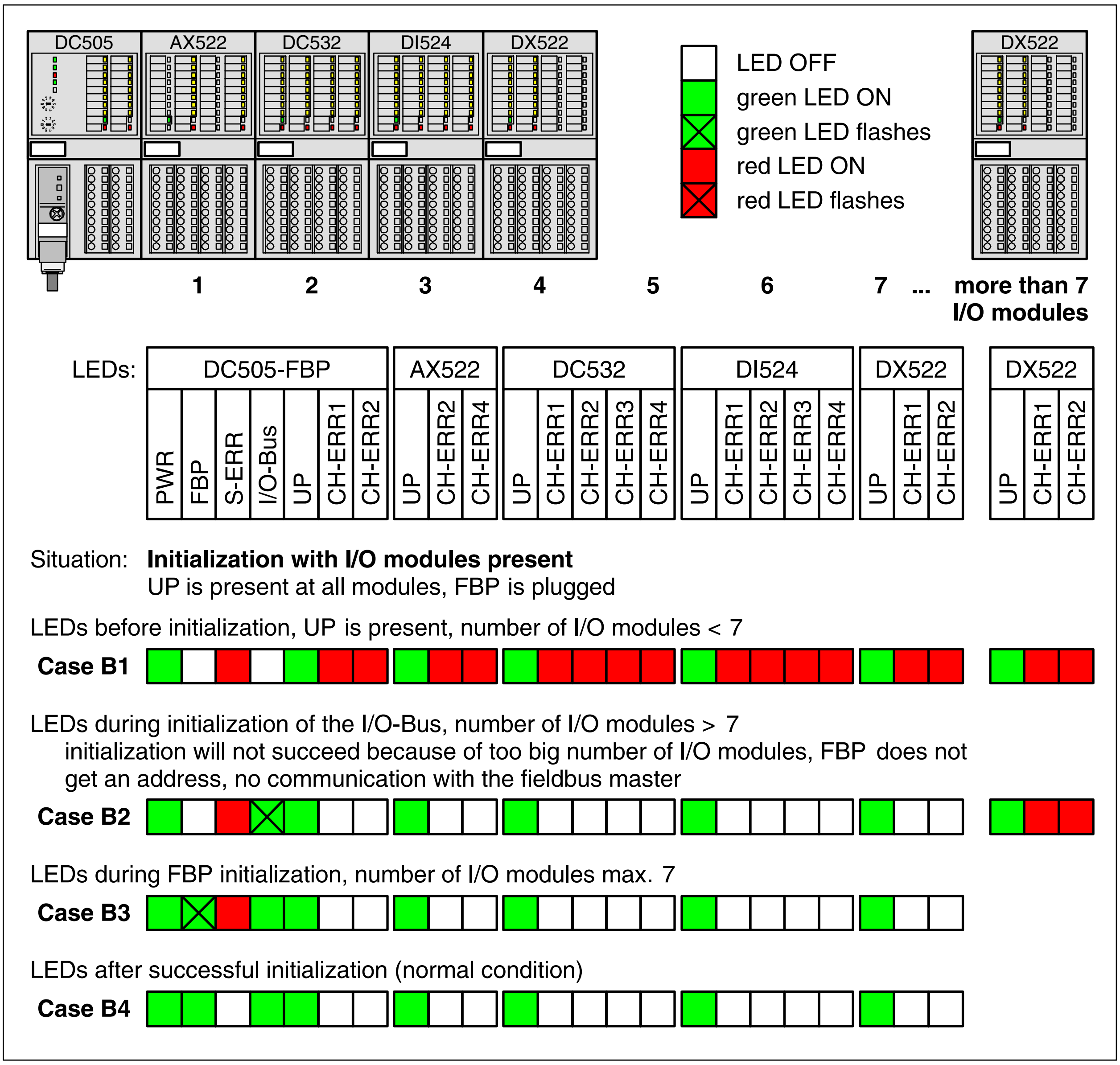


Figure: Initialization DC505-FBP with I/O modules attached

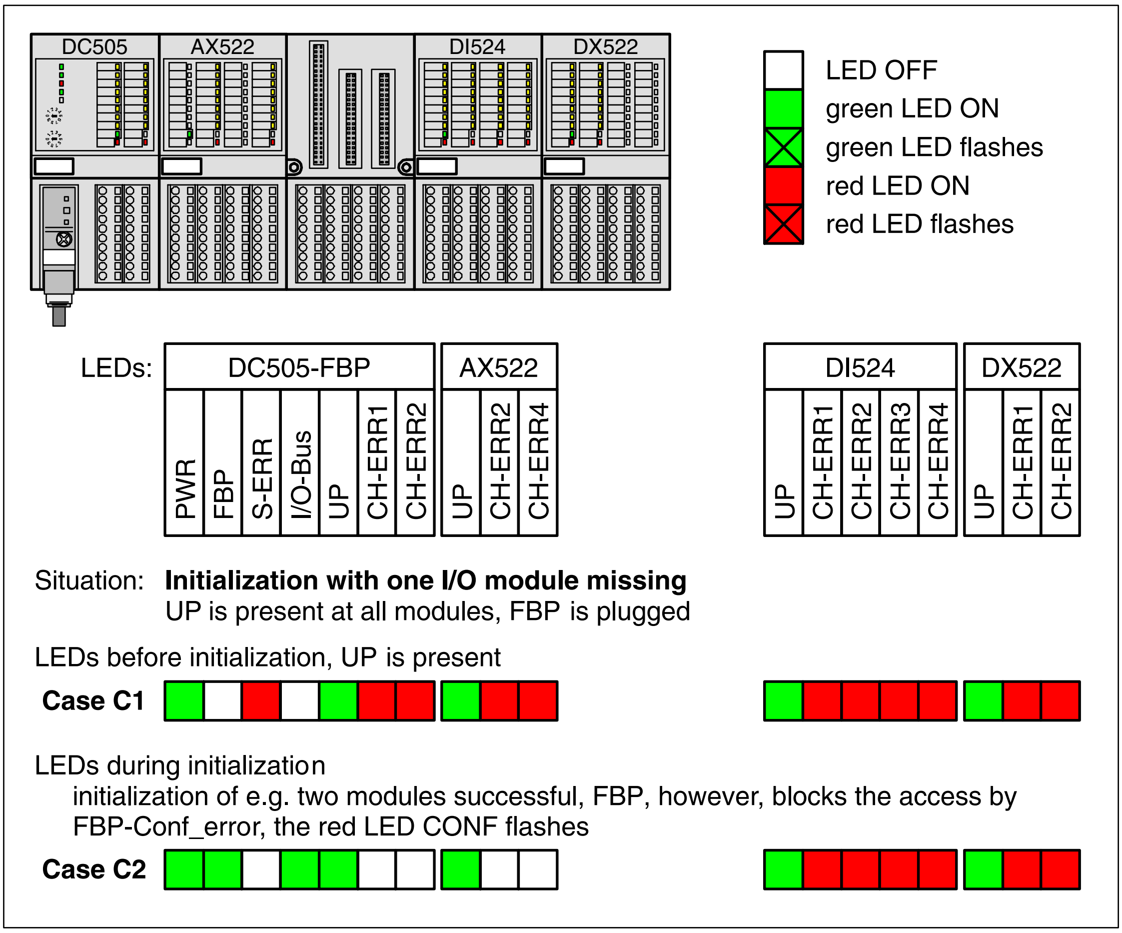


Figure: Initialization with one I/O module missing

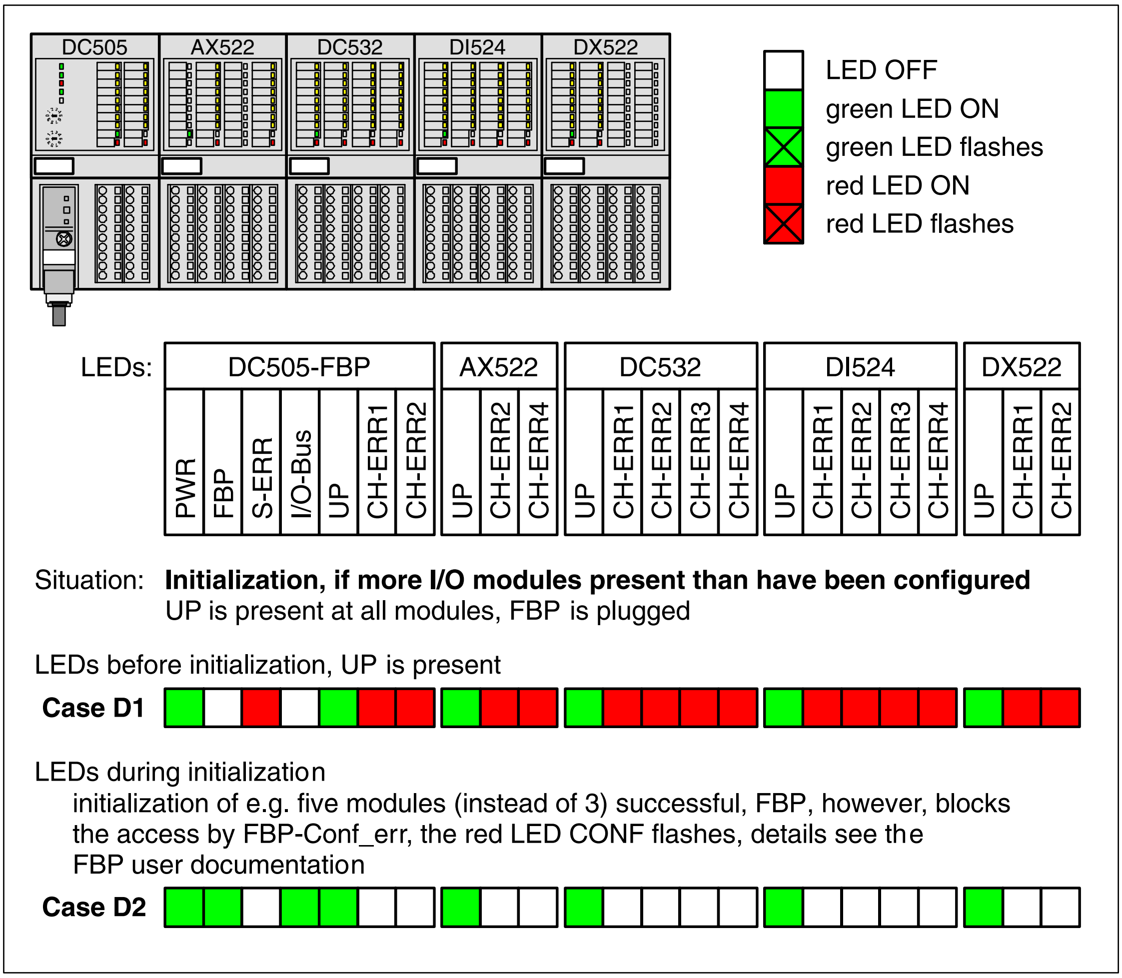


Figure: Initialization, if more I/O modules present than have been configured

Display examples for running operation

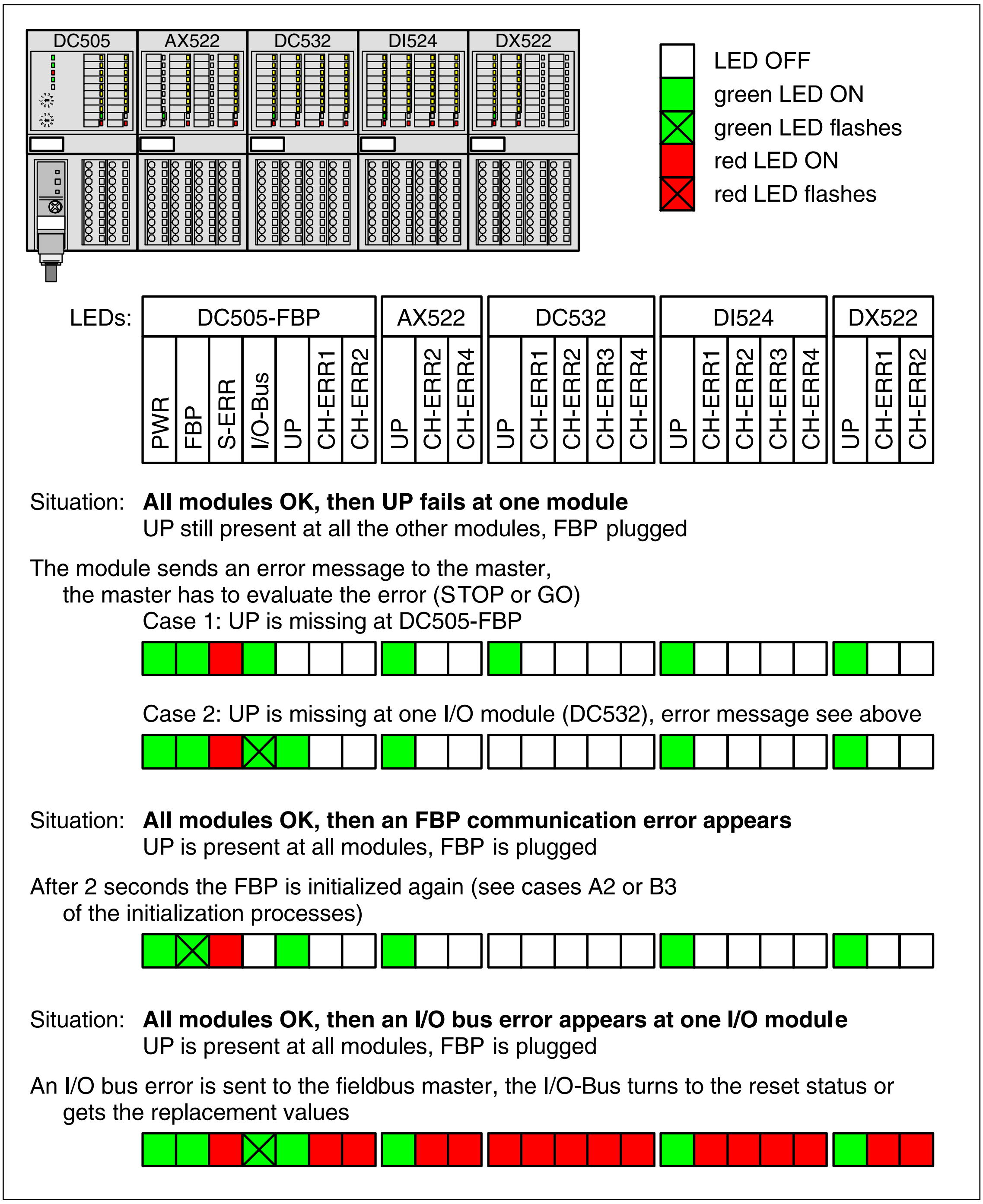


Figure: Appearance of errors in running operation

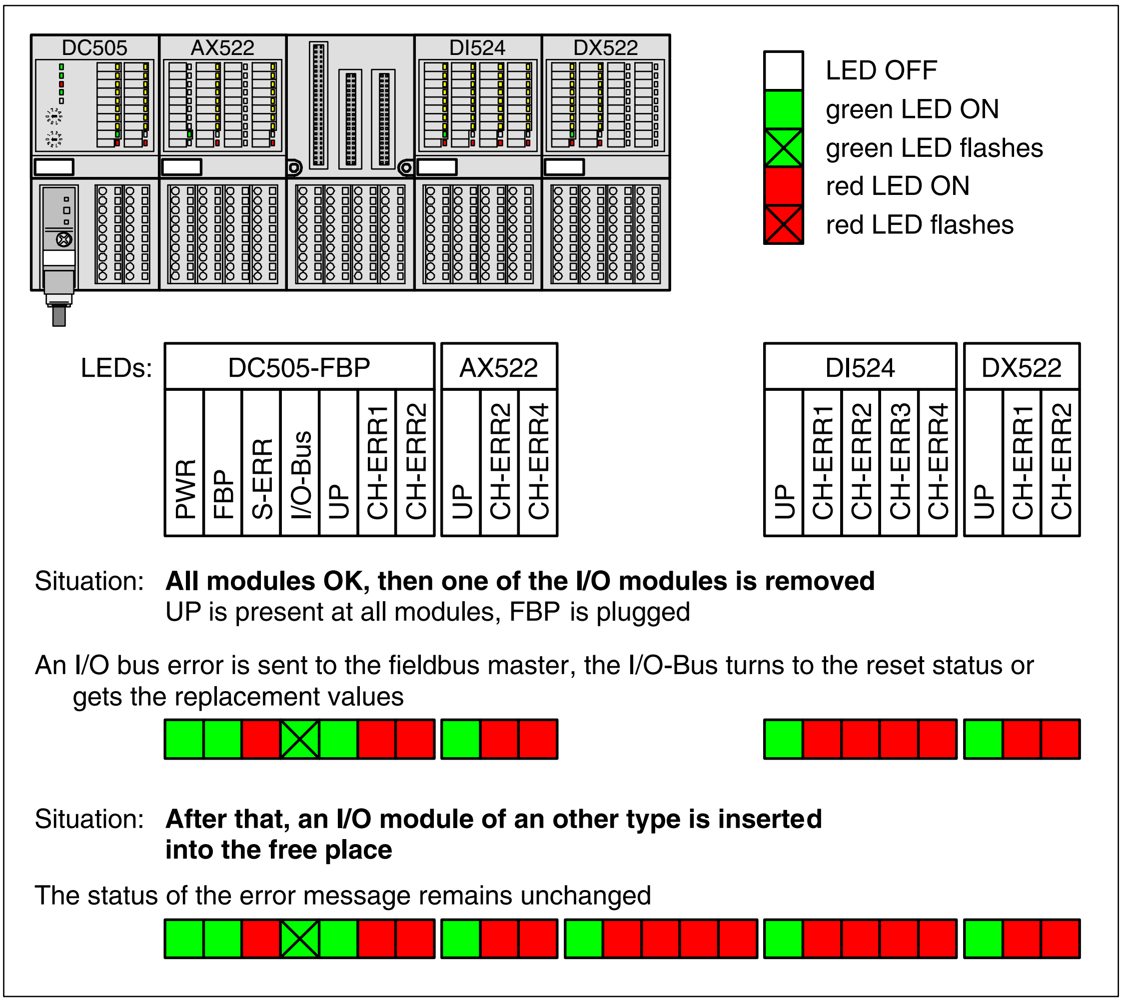


Figure: One module was removed and then replaced by a module of an other type

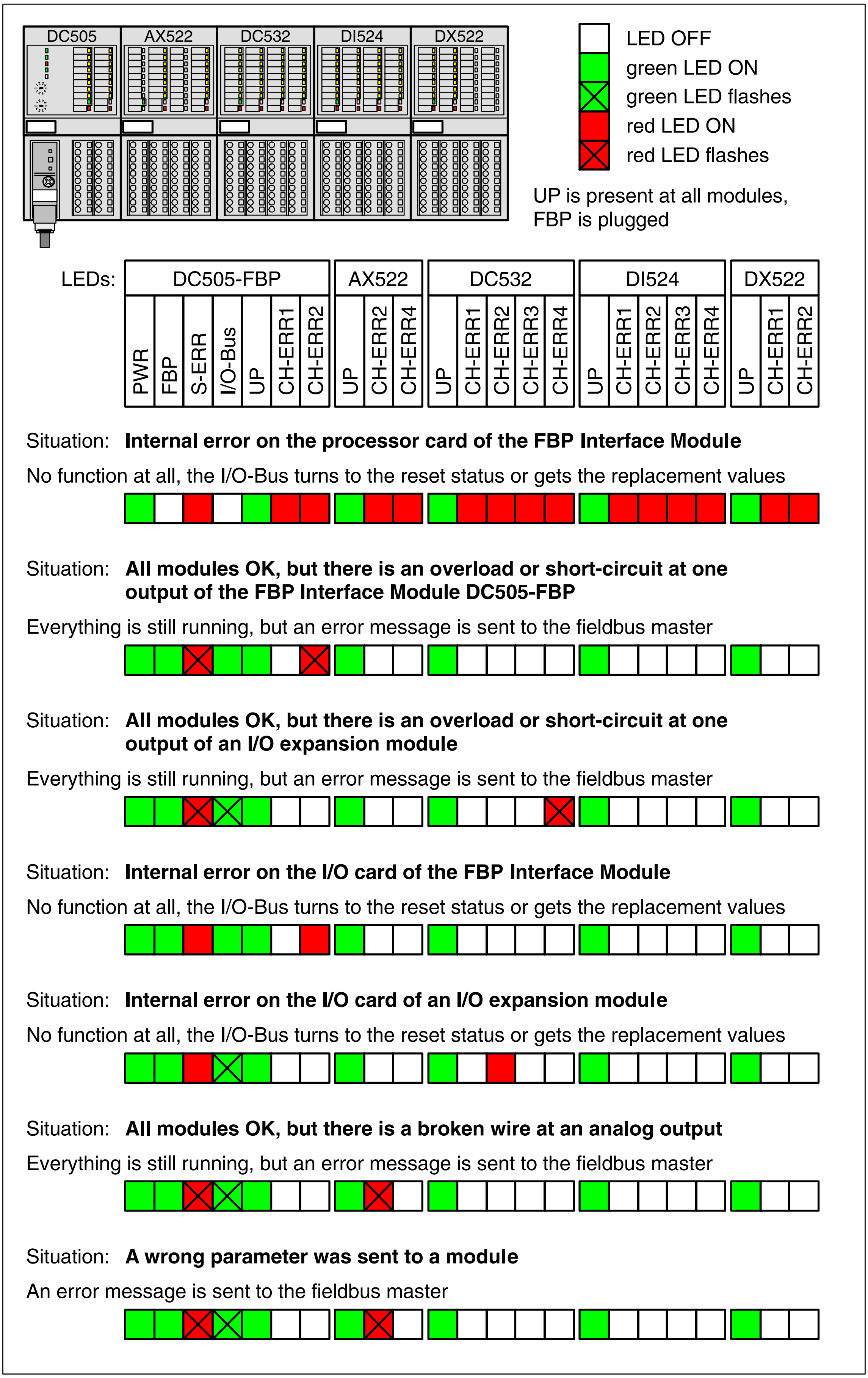


Figure: Displays in case of different errors

Mounting and disassembling the Terminal Units and the I/O modules

Assembly on DIN rail

Step 1: Mount DIN rail 7.5 mm or 15 mm

Step 2: Mount FBP Terminal Unit (TU505 or TU506)

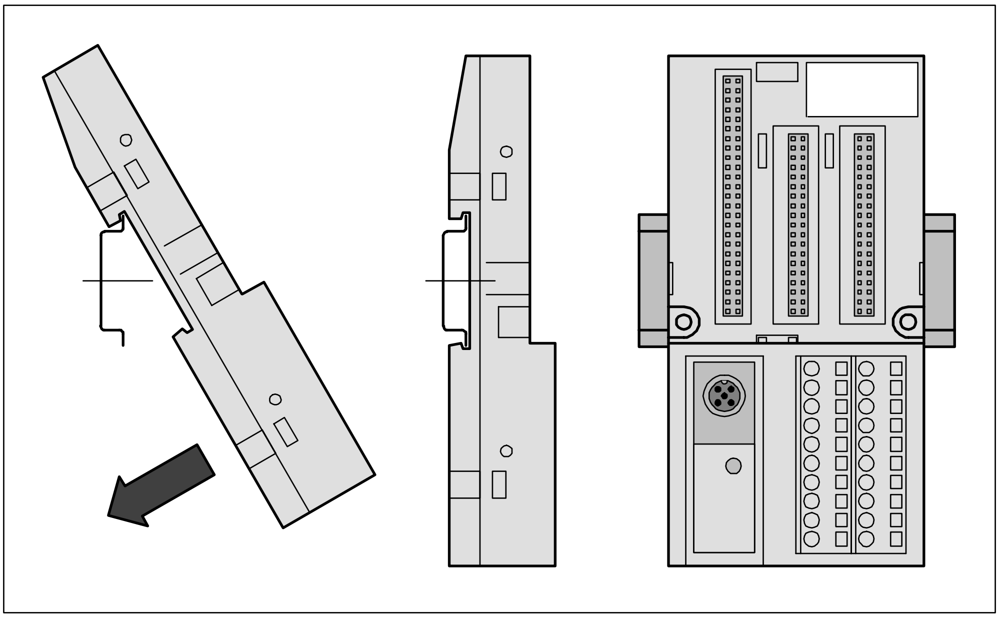


Figure: **Assembly** of the FBP Terminal Unit (TU505 or TU506)

The FBP Terminal Unit is put on the DIN rail above and then snapped-in below. The disassembly is carried out in a reversed order.

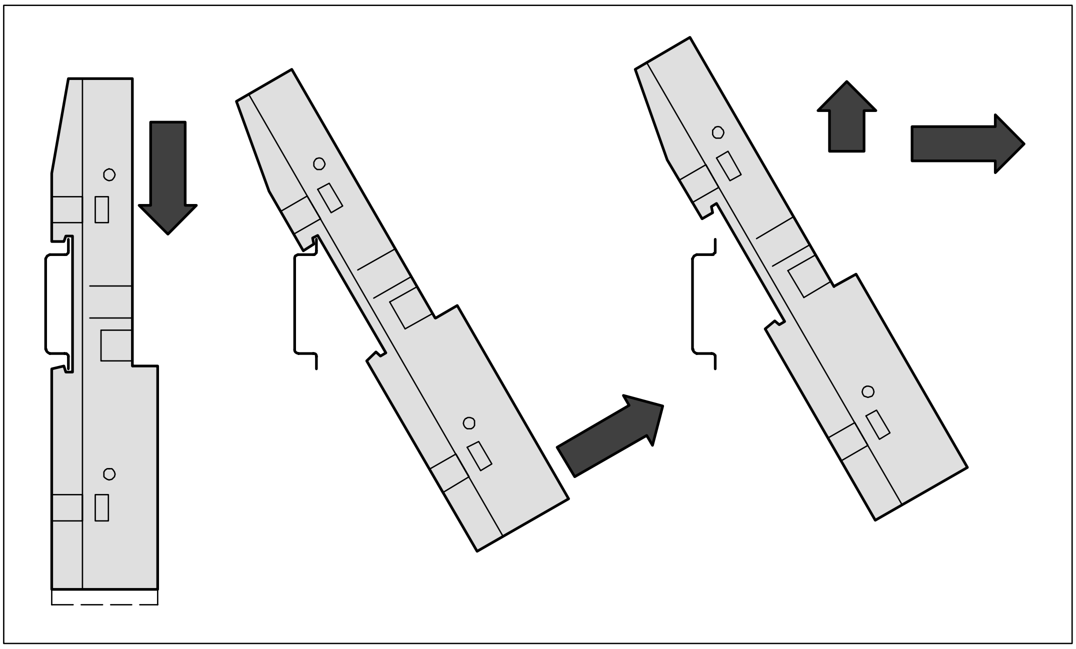


Figure: **Disassembly** of the FBP Terminal Unit (TU505 or TU506)

Step 3: Mount I/O Terminal Unit (TU515, TU516, TU531 or TU532)

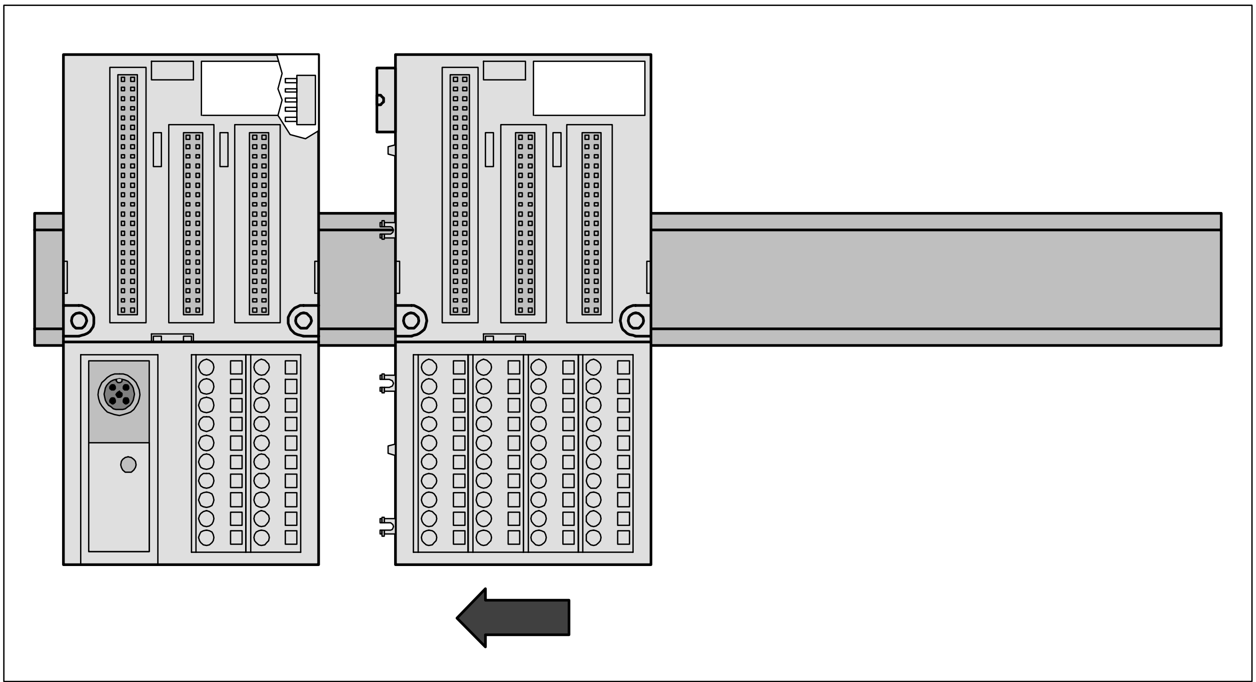


Figure: **Assembly** of the I/O Terminal Unit (TU515, TU516, TU531 or TU532)

The I/O Terminal Unit is installed on the DIN rail in the same way as the FBP Terminal Unit. Once secured on the DIN rail, slide the I/O unit to the left until it fully locks into place creating a solid mechanical and electrical connection.

Altogether 7 I/O Terminal Units can be combined with the FBP Terminal Unit.

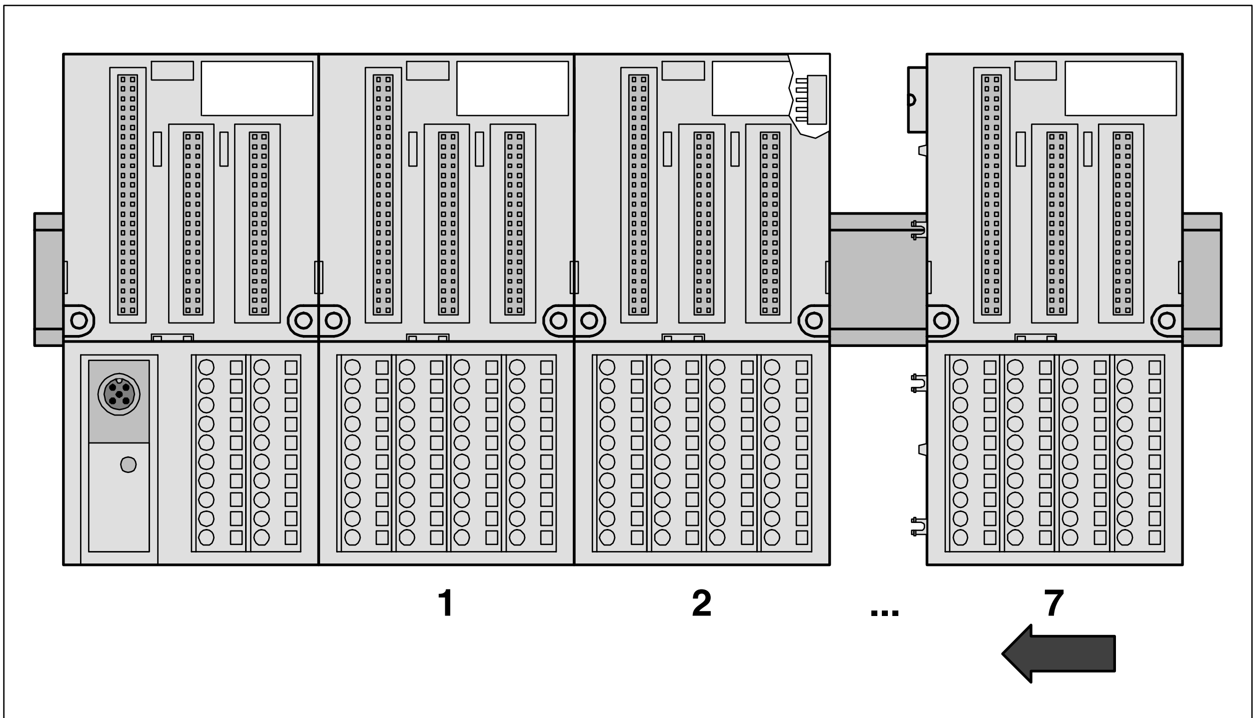


Figure: Maximum configuration (1 FBP Terminal Unit plus 7 I/O Terminal Units)

⚠ **Important:** Up to 7 I/O modules can be used, of which up to **4 analog I/O modules** are possible.

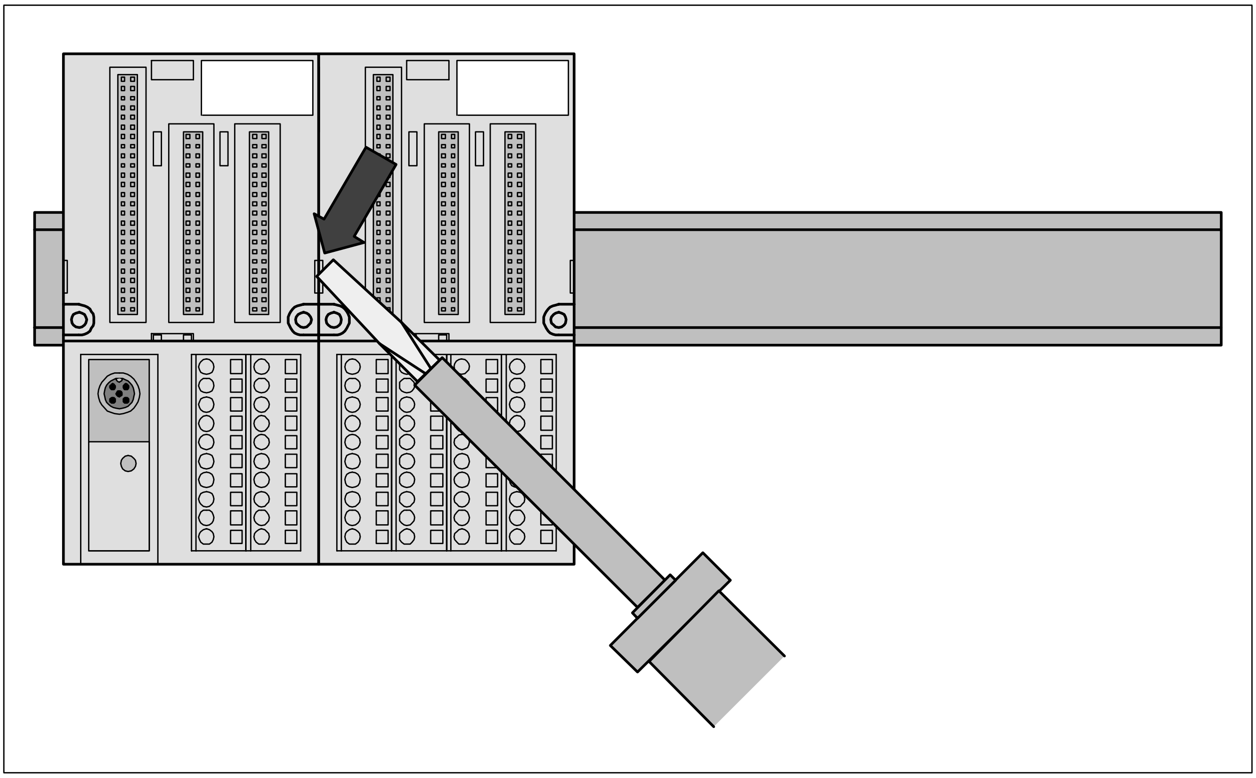


Figure: **Disassembly** of the I/O Terminal Unit (TU515, TU516, TU531 or TU532)

A screwdriver is inserted in the indicated place to separate the Terminal Units.

Step 4: Mount the modules

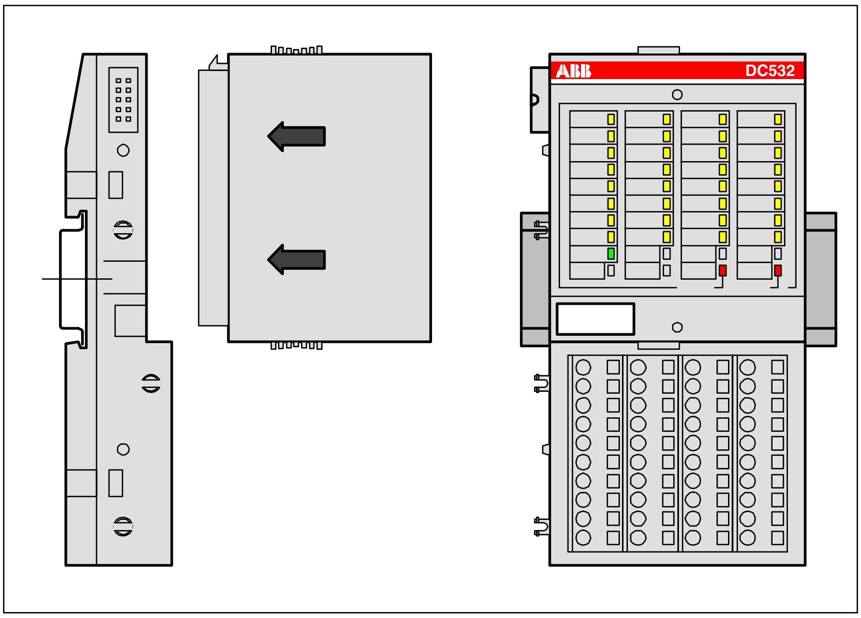


Figure: **Assembly** of the modules

Press the electronic module into the Terminal Unit until it locks in place.

The disassembly is carried out in a reversed order.

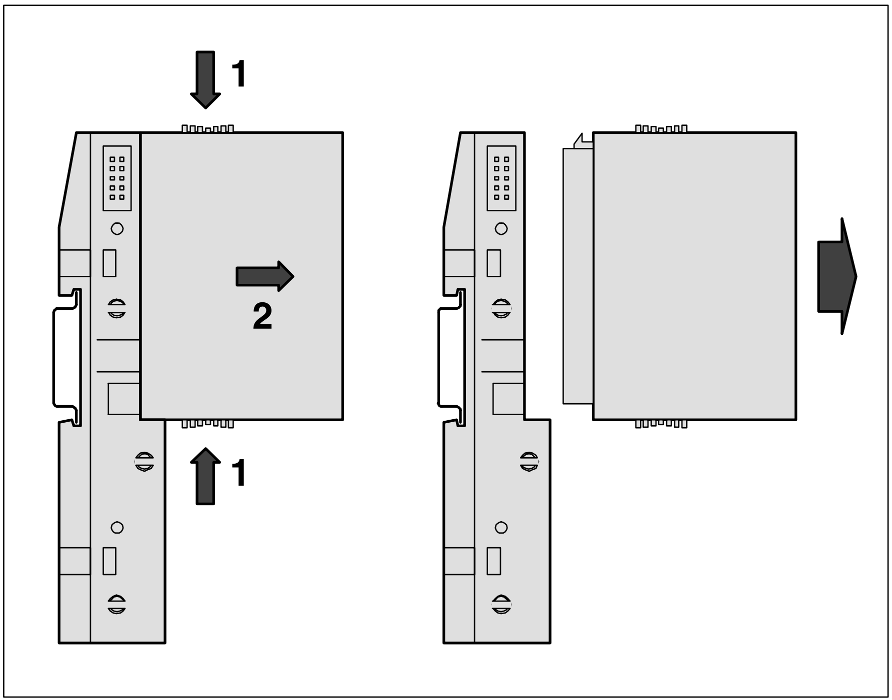


Figure: **Disassembly** of the modules

Disassembly: Press above and below, then remove the module.

Assembly with screws

If the Terminal Unit should be mounted with screws, a Wall Mounting Accessory TA526 must be inserted at the rear side first. This plastic part prevents bending of the Terminal Unit while screwing on.

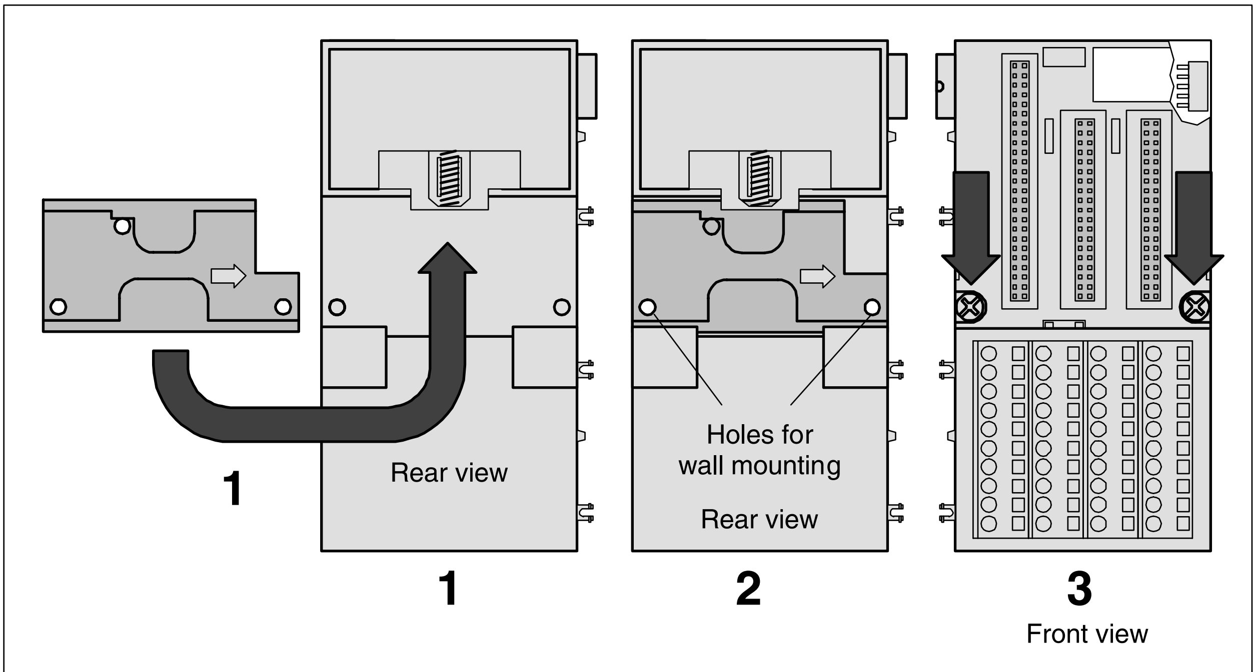


Figure: Fastening with screws of the Terminal Unit TU516 (as an example)

1 The Wall Mounting Accessory TA526 is snapped on the rear side of the Terminal Unit like a DIN rail. The arrow points to the right side.

2 Accessory for wall mounting inserted

3 Terminal Unit, fastened with screws

By wall mounting, the Terminal Unit is earthed through the screws. It is necessary that

- the screws have a conductive surface (e.g. steel zinc-plated or brass nickel-plated)
- the **mounting plate is earthed**
- the screws have a good electrical contact to the mounting plate

Mechanical dimensions S500

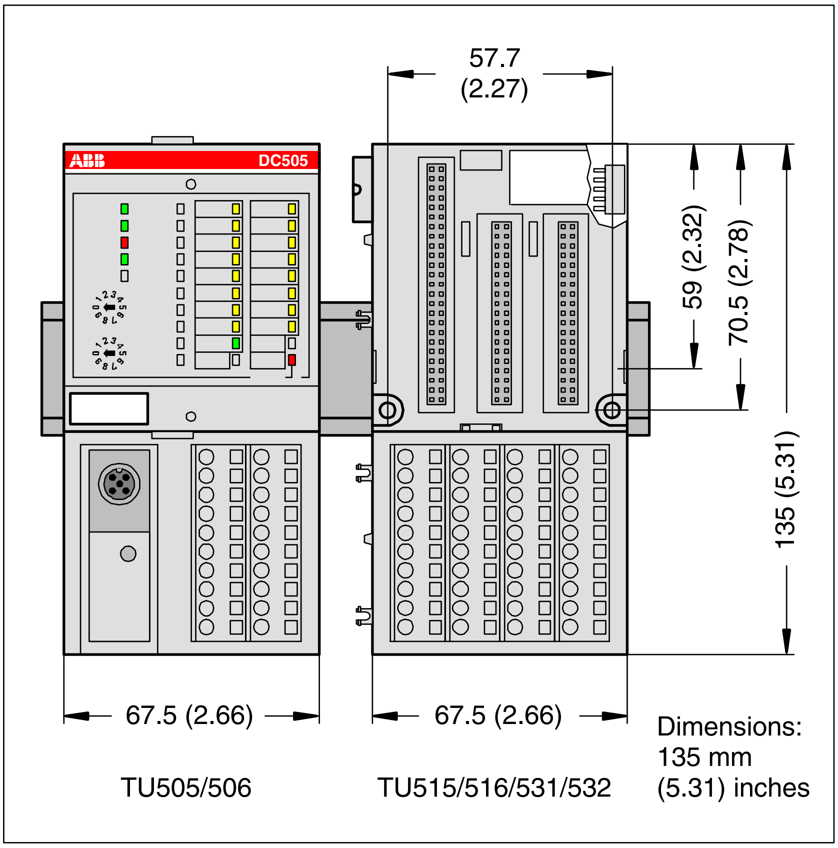


Figure: Dimensions of the Terminal Units (front view)

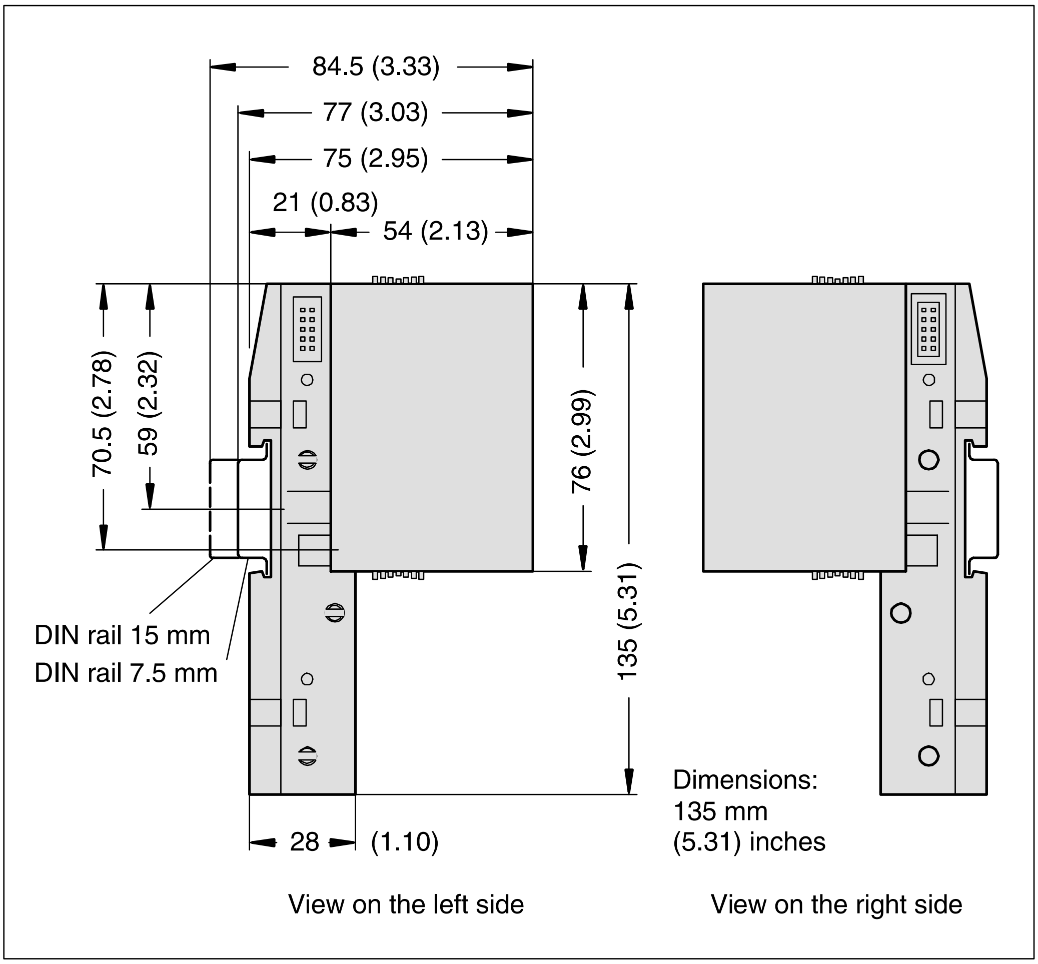


Figure: Dimensions of Terminal Units and modules (lateral views)

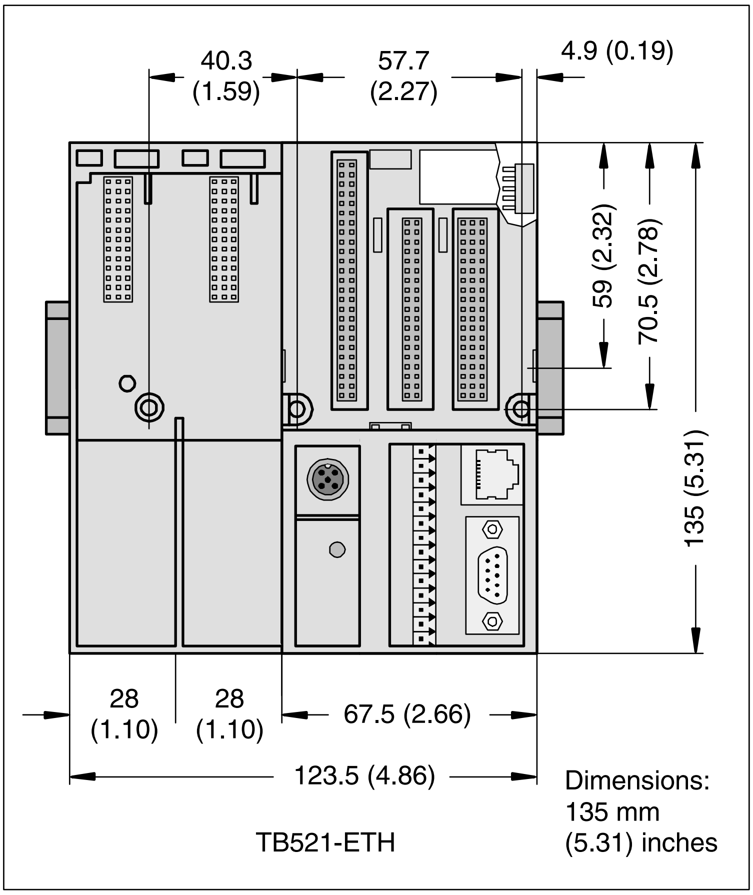


Figure: Dimensions of the AC500 CPU Terminal Base TB521-ETH (for comparison)

Switch-gear cabinet assembly

Basically, it is recommended to mount the modules on an earthed mounting plate, independent of the mounting location.

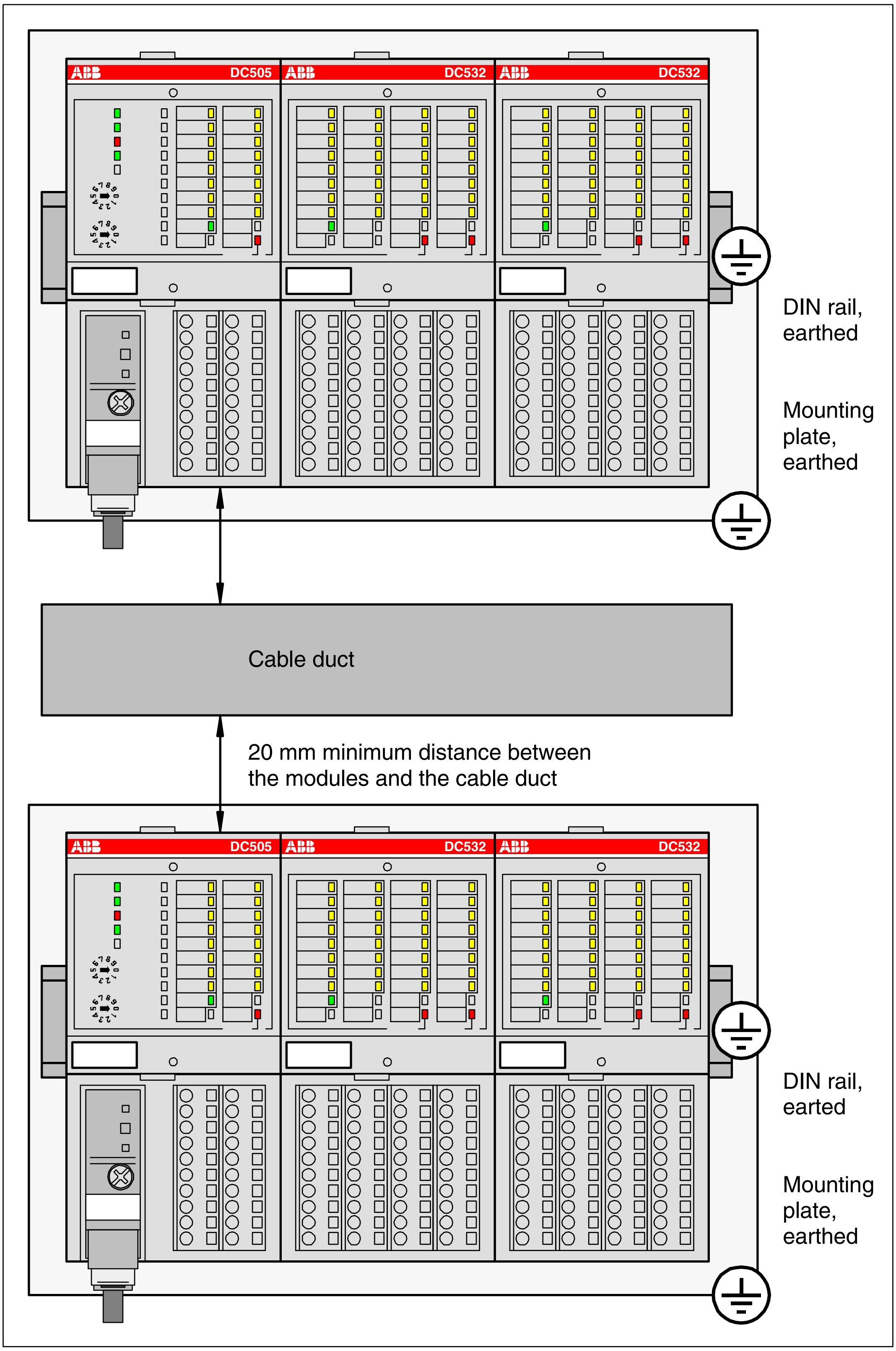


Figure: Installation of AC500/S500 modules in a switch-gear cabinet

Important: Horizontal mounting is highly recommended. Vertical mounting is possible, however, derating consideration should be made to avoid problems with poor air circulation and the potential for excessive temperatures (see also the AC500 system data, operating and ambient conditions, for reduction of ambient temperature).

Note: By vertical mounting, always place an end-stop terminal block at the bottom and on the top of the module to properly secure the modules.

By high-vibration applications, we also recommend to place end-stop terminals at the right and the left side of the device to properly secure the modules:

e.g. type BADL, P/N: 1SNA 399 903 R0200

Connection system

Terminals for power supply and the COM1 interface (CPU Terminal Base AC500)

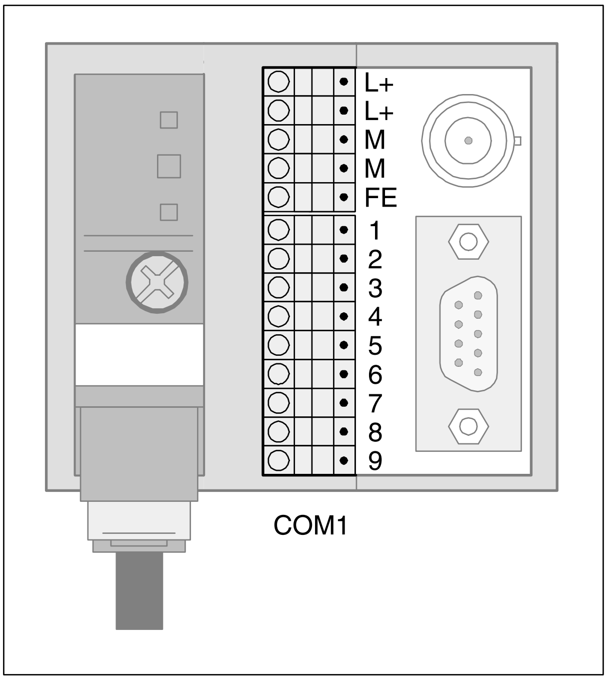


Figure: Terminals for power supply and the COM1 interface (CPU Terminal Base AC500)

Terminal type: **Screw-type terminal**

Number of cores per terminal	Conductor type	Cross section
1	solid	0.08 mm² to 1.5 mm²
1	flexible	0.08 mm² to 1.5 mm²
1 with wire end ferrule (without plastic sleeve)	flexible	0.25 mm² to 1.5 mm²
1 with wire end ferrule (with plastic sleeve)	flexible	0.25 mm² to 0.5 mm²
1 (TWIN wire end ferrule)	flexible	0.5 mm²
2 (with the same cross section)	solid	0.08 mm² to 0.5 mm²
2 (with the same cross section)	flexible	0.08 mm² to 0.75 mm²
2 (with the same cross section) in wire end ferrule, without plastic sleeve	flexible	0.25 mm² to 0.34 mm²

Terminal type: **Spring terminal**

Number of cores per terminal	Conductor type	Cross section
1	solid	0.08 mm² to 1.5 mm²
1	flexible	0.08 mm² to 1.5 mm²
1 with wire end ferrule (without plastic sleeve)	flexible	0.25 mm² to 1.5 mm²
1 with wire end ferrule (with plastic sleeve)	flexible	0.25 mm² to 0.5 mm²
1 (TWIN wire end ferrule)	flexible	0.5 mm²
2 (with the same cross section)	solid	0.08 mm² to 0.5 mm²
2 (with the same cross section)	flexible	0.08 mm² to 0.75 mm²
2 (with the same cross section) in wire end ferrule, without plastic sleeve	flexible	0.25 mm² to 0.34 mm²

Terminals at the Terminal Units (I/O, FBP)

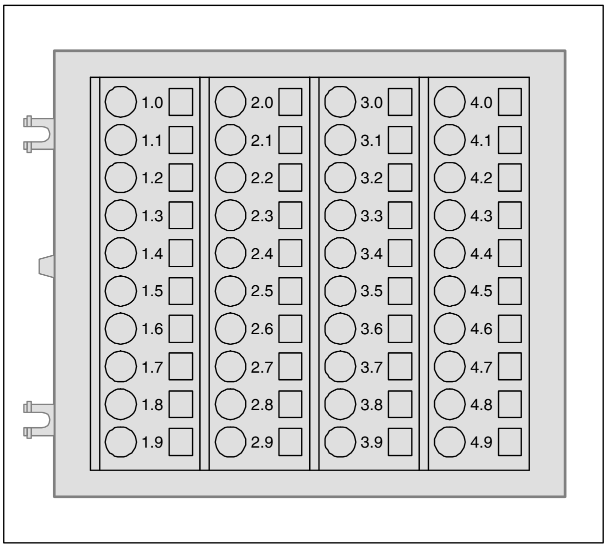


Figure: Terminals at the Terminal Units (I/O, FBP)

Terminal type: **Screw-type terminal**

Number of cores per terminal	Conductor type	Cross section
1	solid	0.08 mm² to 2.5 mm²
1	flexible	0.08 mm² to 2.5 mm²
1 with wire end ferrule	flexible	0.25 mm² to 1.5 mm²
TWIN wire end ferrule	flexible	2 x 0.25 mm² or 2 x 0,5 mm² or 2 x 0,75 mm², with square cross-section of the wire-end ferrule also 2 x 1.0 mm²
2	solid	not intended
2	flexible	not intended

Terminal type: **Spring terminal**

Number of cores per terminal	Conductor type	Cross section
1	solid	0.08 mm² to 2.5 mm²
1	flexible	0.08 mm² to 2.5 mm²
1 with wire end ferrule	flexible	0.25 mm² to 1.5 mm²
TWIN wire end ferrule	flexible	2 x 0.25 mm² or 2 x 0,5 mm² or 2 x 0,75 mm², with square cross-section of the wire-end ferrule also 2 x 1.0 mm²
2	solid	not intended
2	flexible	not intended

Connection of wires at the spring terminals

Connect the wire to the spring terminal

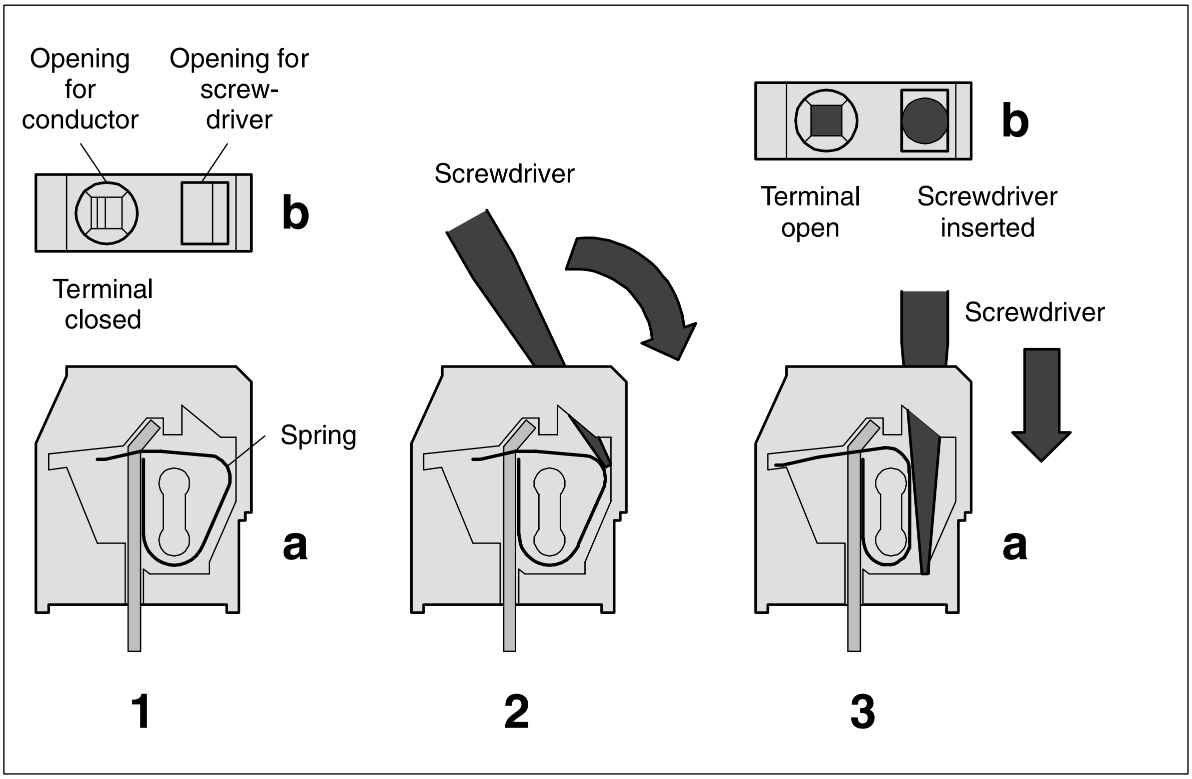


Figure: Connect the wire to the spring terminal (steps 1 to 3)

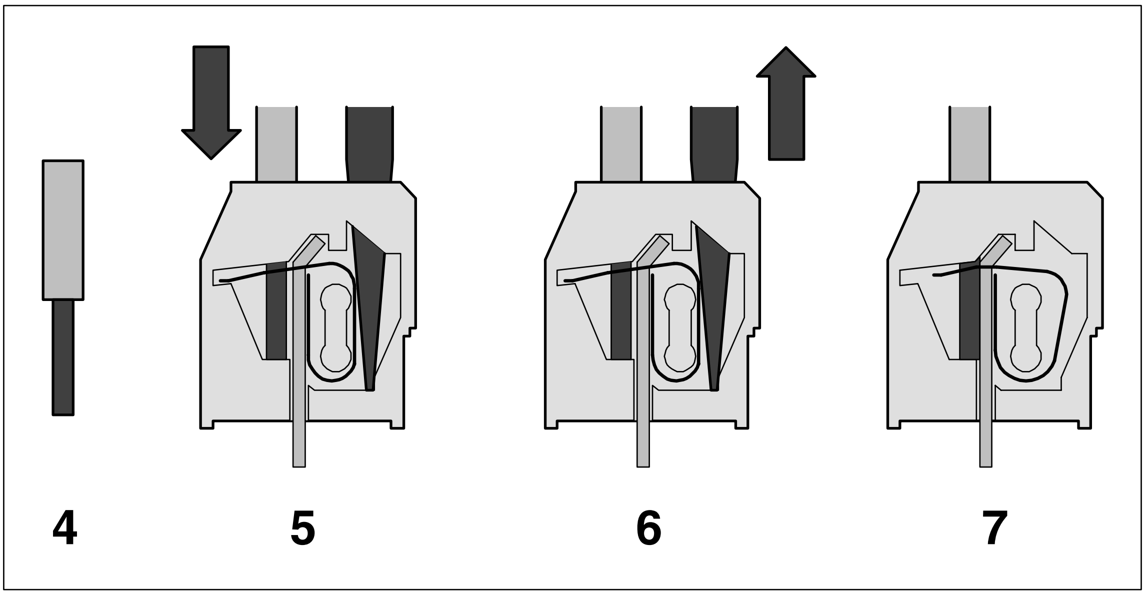


Figure: Connect the wire to the spring terminal (steps 4 to 7)

1 a	Side view (open terminal drawn for illustration)
1 b	The top view shows the openings for wire and screwdriver
2	Insert screwdriver (2.5 x 0.4 to 3.5 x 0.5 mm) at an angle, screwdriver must be at least 15 mm free of insulation at the tip
3 a	While erecting the screwdriver, insert it until the stop (requires a little strength)
3 b	Screwdriver inserted, terminal open
4	Strip the wire for 7 mm (and put on wire end ferrule)
5	Insert wire into the open terminal
6	Remove the screwdriver
7	Done

Disconnect wire from the spring terminal

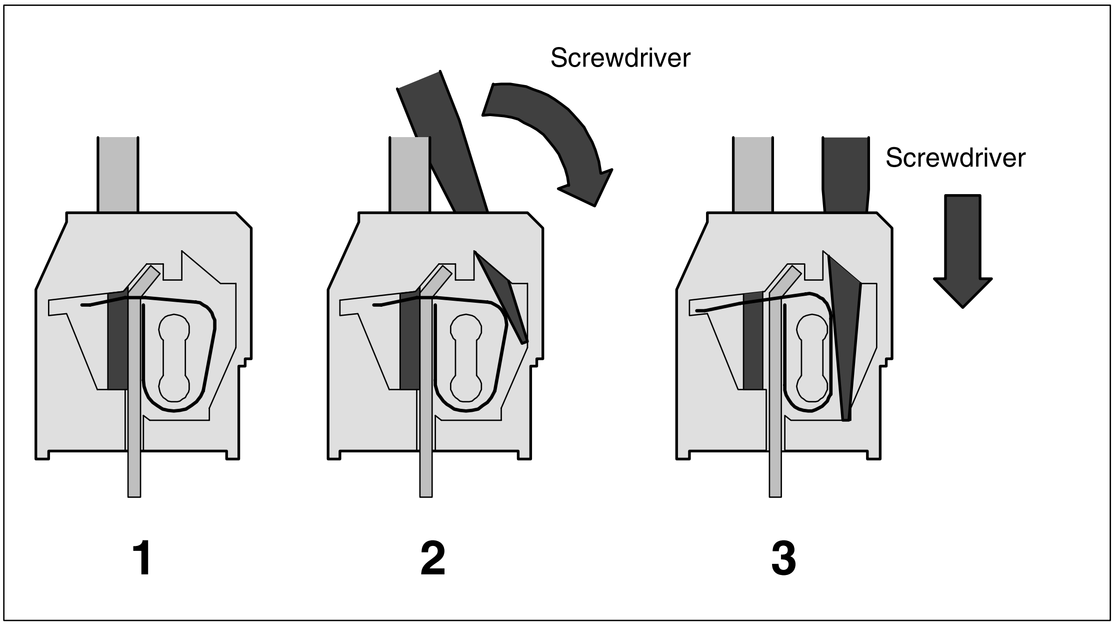


Figure: Disconnect wire from the spring terminal (steps 1 to 3)

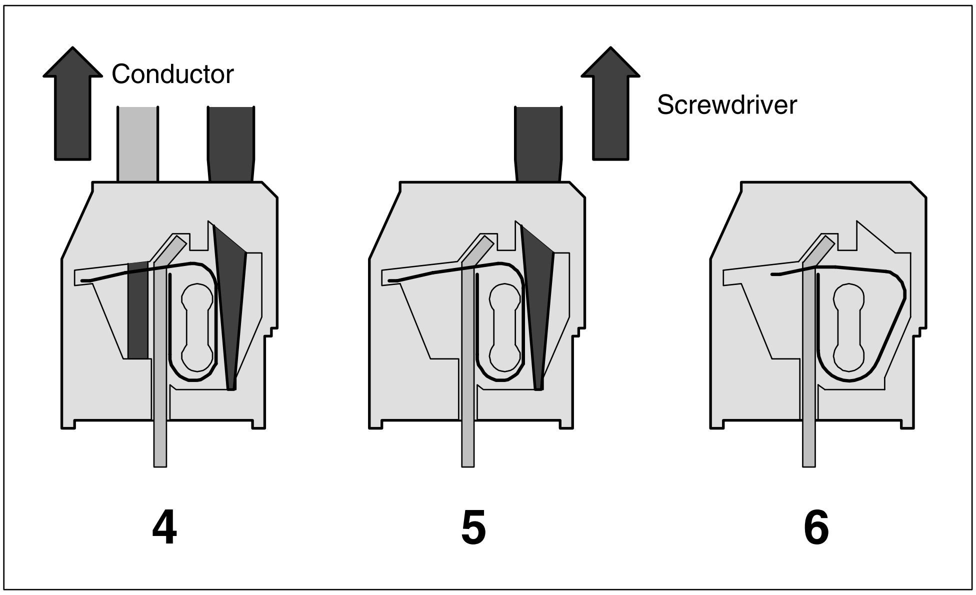


Figure: Disconnect wire from the spring terminal (steps 4 to 6)

1	Terminal with wire connected
2	Insert screwdriver (2.5 x 0.4 to 3.5 x 0.5 mm) at an angle, screwdriver must be at least 15 mm free of insulation at the tip
3	While erecting the screwdriver, insert it until the stop (requires a little strength), terminal is now open
4	Remove wire from the open terminal
5	Remove the screwdriver
6	Done

Mechanical encoding

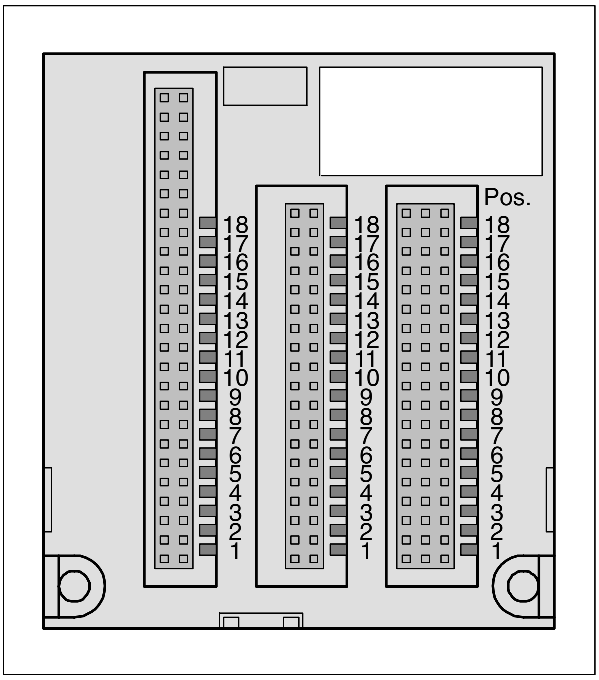


Figure: Possible positions for mechanical encoding (1 to 18)

Terminal Units (S500) and CPU Terminal Bases (AC500) have an mechanical coding which prevents that modules are inserted to wrong places. Otherwise

- dangerous parasitic voltages could occur or
- modules could be destroyed.

The coding either makes it impossible to insert the module to the wrong place or blocks its electrical function (outputs are not activated).

The following figure shows the possible codings.

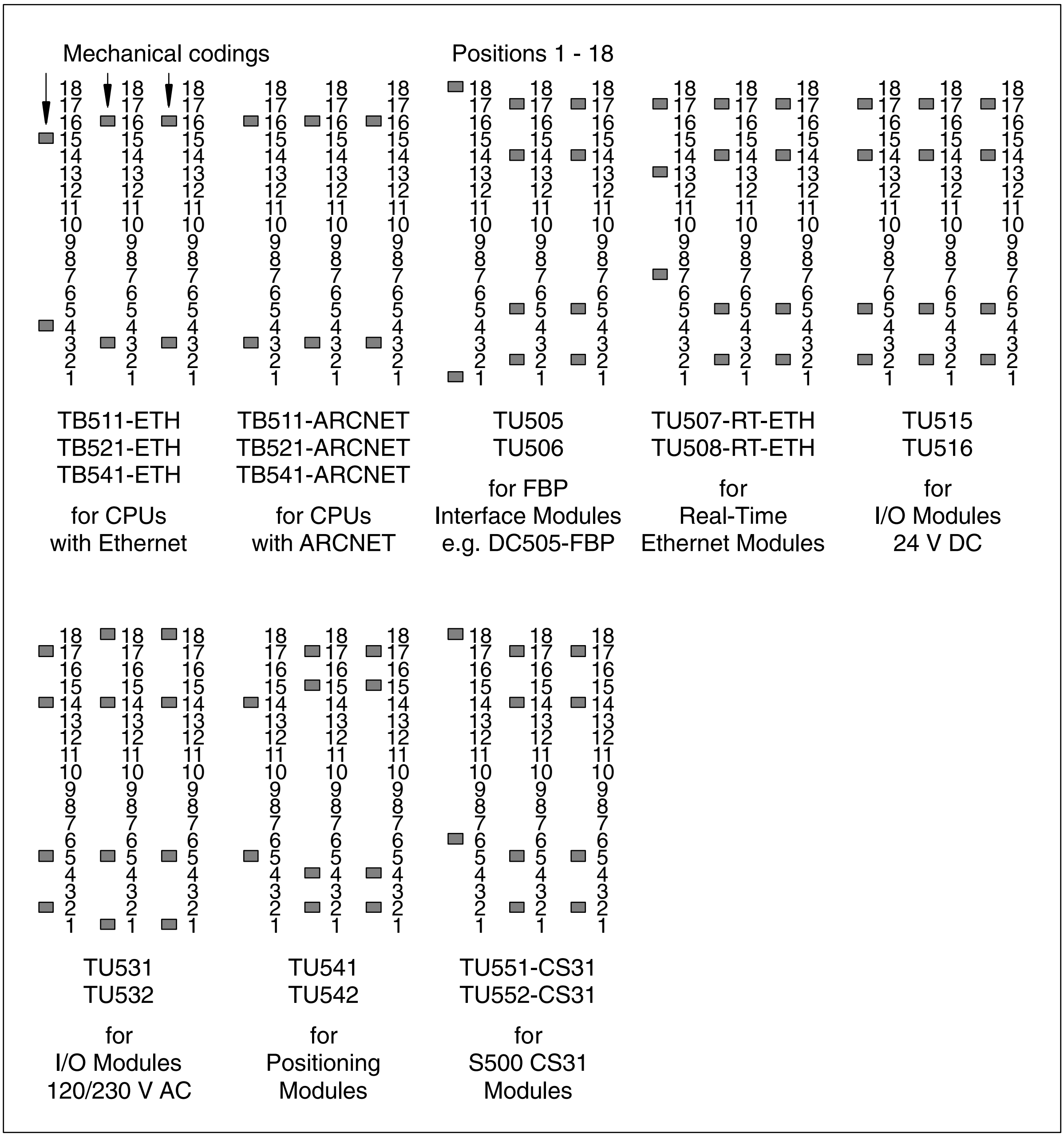


Figure: Mechanical coding

General wiring recommendations

Bad wiring on power supply terminals

⚠ **Attention:** The product should be installed by trained people who have the knowledge of wiring electronic devices. In case of bad wiring, although the modules are protected against various errors (reverse polarity, short circuit, etc.), some problems could always happen:

- On the CPU Terminal Base, the terminals L+ and M are doubled. If the power supply is badly connected, a short circuit could happen and lead to a destruction of the power supply or its fuse. If no suitable fuse exists, the Terminal Base itself could be destroyed.

- The CPUs (Terminal Bases) and all electronic modules (and Terminal Units) are protected against reverse polarity.

- All necessary measures should be carried out to avoid damages to modules and wiring. Notice the wiring plans and connection examples.

Bad wiring on I/O terminals

⚠ **Attention:** All I/O channels (digital and analog) are protected against reverse polarity, reverse supply, short circuit and continuous overvoltage up to 30 V DC.

Behaviour of the system in case of power supply interruptions and power recovering

AC500 system supply (terminals L+, M)

As soon as the CPU power supply is higher than 19.2 V DC, the power supply detection is activated and the CPU is started. When during operation the power supply is going down to lower than 19.2 V DC for more than 10 ms, the CPU is switched to safety mode (see System Technology of the CPUs).

A warm restart of the CPU only occurs by switching the power supply off and on again (see also the description of the function modes of the CPU in the "AC500 System Technology" chapters.

S500 system supply (is provided through the FBP plug)

AC500 or S500 process power supply (terminals UP and ZP)

Block diagrams, earthing concept

Block diagram DC505-FBP, earthing concept

The S500-FBP modules have to be included into the global earthing concept of the system. The following schematics will help you to understand the internal conception of the device.

The electrical isolation of the device is realized as follow:

- The isolation between the fieldbus and the internal device circuitry is realized by the FBP plug itself.
- Isolation between the I/O terminals and the I/O-Bus: The I/O-Bus and the processors are powered by the FBP plug, the process inputs and outputs need their own process supply voltage. There is an electrical isolation between these two parts within the modules.

- If it is necessary to have an electrical isolation between the I/O terminals of different I/O modules, several power supply units must be used.
- There is no electrical isolation between the I/O channels of an I/O module.

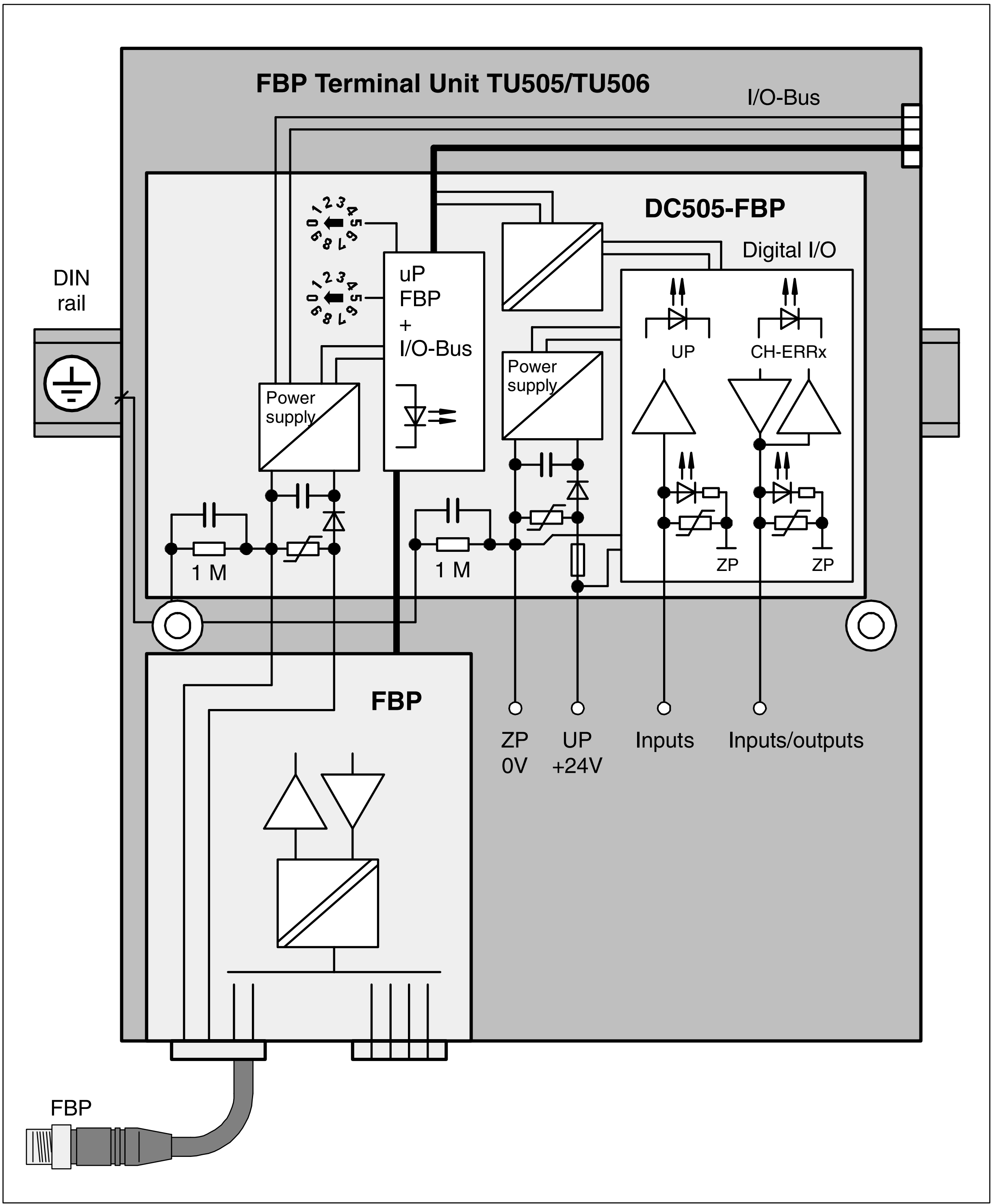


Figure: Blocks diagram DC505-FBP with FBP, earthing concept

Block diagram of the digital I/O modules, earthing concept

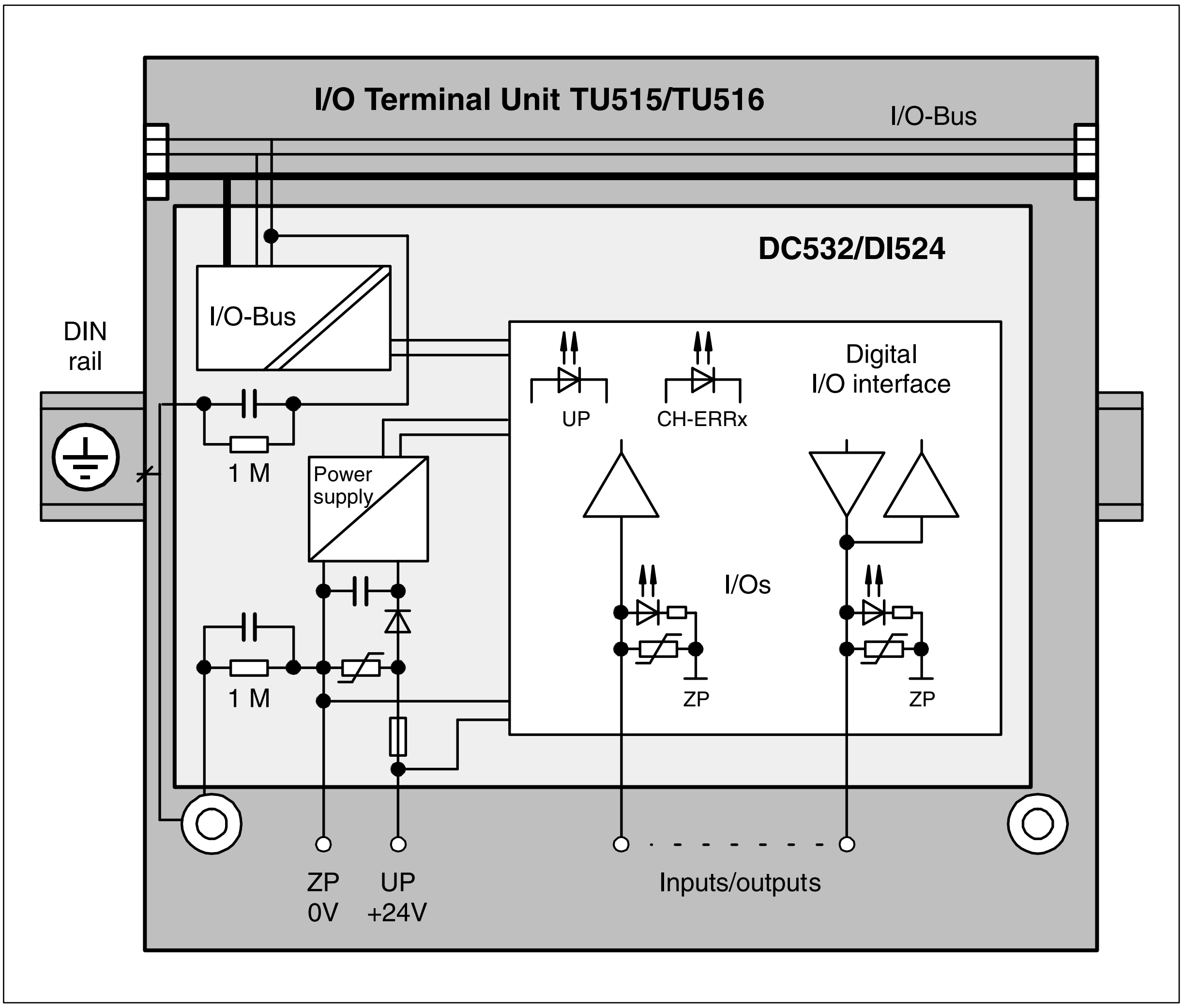


Figure: Block diagram of the digital I/O modules, earthing concept

Block diagram of the analog I/O modules, earthing concept

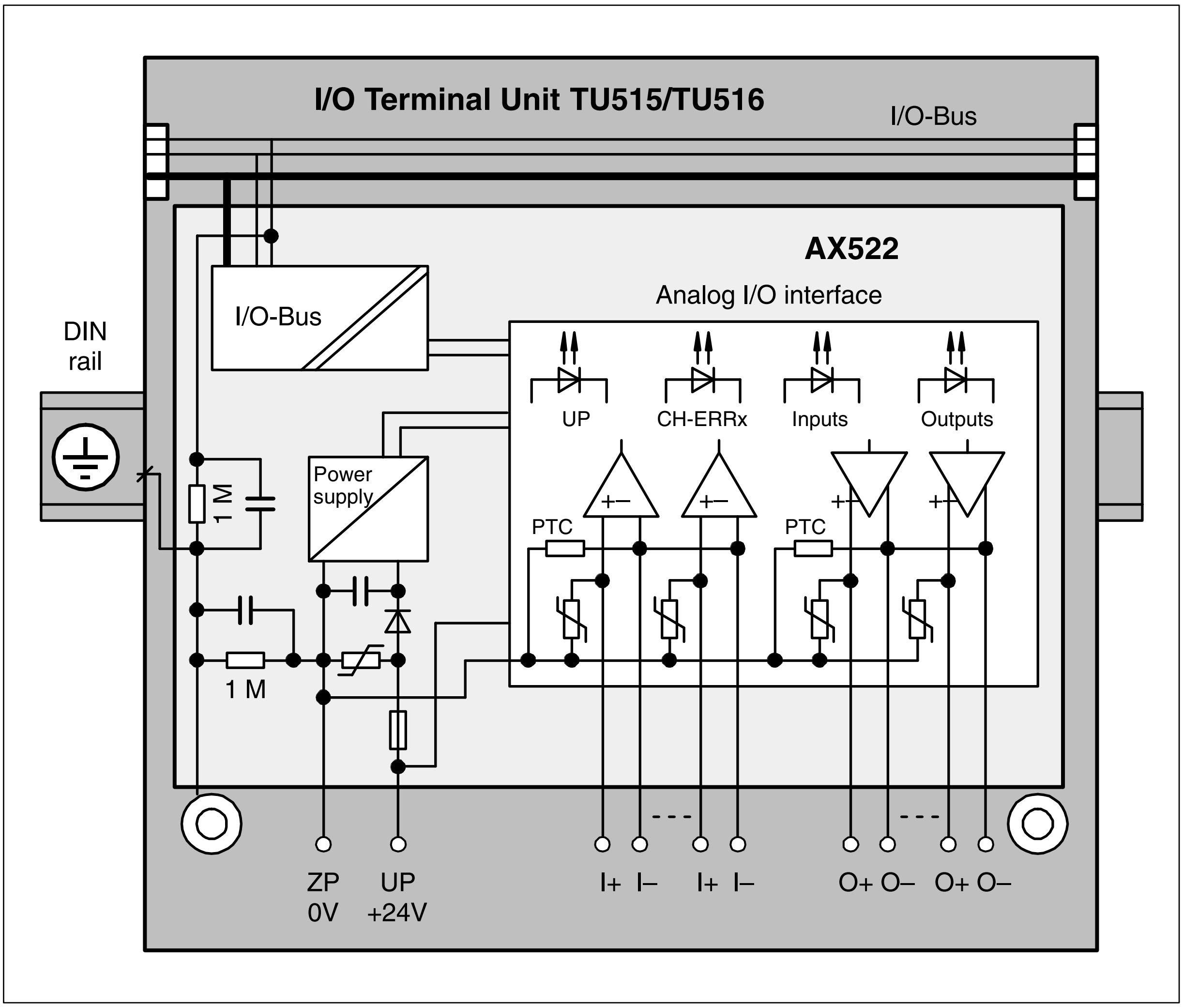
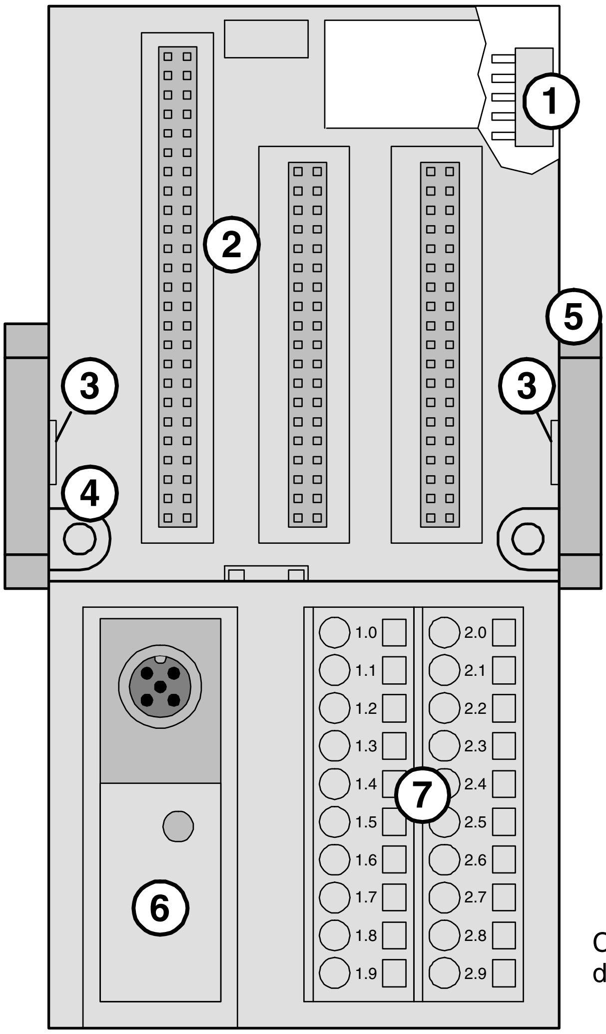


Figure: Block diagram of the analog I/O modules, earthing concept

S500 Terminal Units, Overview

FBP Terminal Units TU505 and TU506 for FBP Interface Modules
- TU505, FBP Terminal Unit, Screw-type Terminals
- TU506, FBP Terminal Unit, Spring Terminals



Elements of the FBP Terminal Unit

1 I/O-Bus (10-pole, female) to electrically connect the first I/O Terminal Unit
2 Plug (1 x 50-pole, 2 x 38-pole) to electrically connect the FBP Interface Module inserted
3 With a screwdriver, inserted in this place, the FBP Terminal Unit and the adjacent I/O Terminal Unit can be shoved from each other
4 Two holes for wall mounting
5 DIN rail
6 Neutral FieldBusPlug interface
7 20 screw-type or spring terminals, for signals and process voltage

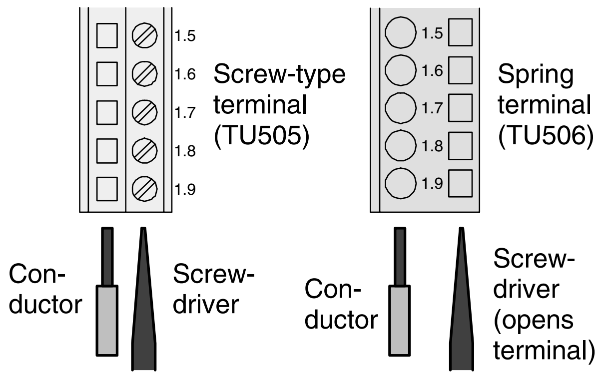


Figure: FBP Terminal Unit TU 506, for FBP Interface Modules

The FBP Terminal Units TU505 (with screw-type terminals) and TU506 (with spring terminals) are specifically designed for use with AC500/S500 FBP Interface Modules (e.g. DC505-FBP).

The FBP Interface Modules plug into the FBP Terminal Unit. When properly seated, they are secured with two mechanical locks. All the electrical connections are made through the FBP Terminal Unit, which allows removal and replacement of the FBP Interface Modules without disturbing the wiring at the FBP Terminal Unit.

Note: Mounting, disassembling and electrical connection for the Terminal Units and the FBP Interface Modules are described in detail in the S500 system data chapters.

The terminals 1.8 to 2.8 and 1.9 to 2.9 are electrically interconnected within the FBP Terminal Unit and have always the same assignment, independent of the inserted module:

Terminals 1.8 to 2.8: Process voltage UP = +24 V DC
Terminals 1.9 to 2.9: Process voltage ZP = 0 V

The assignment of the other terminals is dependent on the inserted FBP Interface Module (see the description of the FBP Interface Module).

The supply voltage 24 V DC for the module's electronic circuitry comes from the FieldBusPlug. If the FieldBusPlug is removed, the FBP Interface Module has no supply voltage. Also, all I/O expansion modules connected through the I/O-Bus have no supply for their electronic parts then.

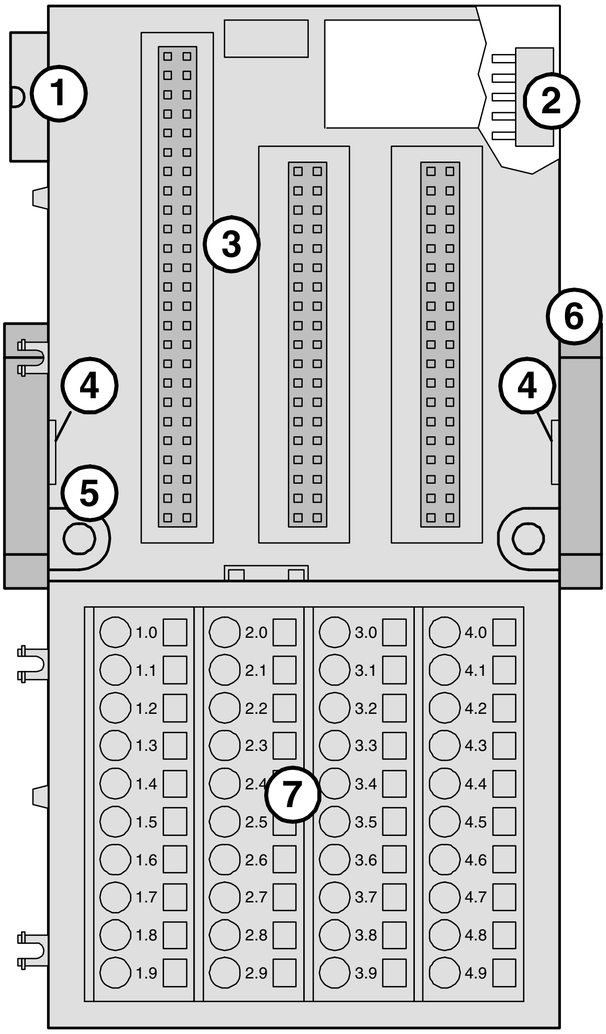
Technical data

Number of I/O channels per module	16
Distribution of the channels into groups	2 groups of 8 channels each (1.0...1.7, 2.0...2.7), the allocation of the channels is given by the inserted FBP Interface Module
FieldBusPlug	M12, 5-pole
Rated voltage	24 V DC
Max. permitted total current	10 A (between the terminals 1.8...2.8 and 1.9...2.9)
Earthing	direct connection to the earthed DIN rail or via the screws with wall mounting
Screw-type terminals	
Type	Front terminal, conductor connection vertically with respect to the printed circuit board
Conductor cross section	
- solid	0.08 mm² to 2.5 mm²
- flexible	0.08 mm² to 2.5 mm²
- with wire-end ferrule	0.25 mm² to 1.5 mm²
Stripped conductor end	8 mm
Width of the screwdriver	3.5 mm
Fastening torque	0.6 Nm
Degree of protection	IP 20
For details	see system data / Connection system
Spring terminals	
Type	Front terminal, conductor connection vertically with respect to the printed circuit board
Conductor cross section	
- solid	0.08 mm² to 2.5 mm²
- flexible	0.08 mm² to 2.5 mm²
- with wire-end ferrule	0.25 mm² to 1.5 mm²
Stripped conductor end	7 mm, min. 5 mm
Degree of protection	IP 20
For details	see system data / Connection system
Dimensions	
Width x height x depth	67.5 x 135 x 30 mm
Weight	200 g
Mounting position	horizontal or vertical

Ordering data

Order No.	**Scope of delivery**
1SAP 210 200 R0001	TU505, FBP Terminal Unit, screw-type terminals
1SAP 210 000 R0001	TU506, FBP Terminal Unit, spring terminals

I/O Terminal Units TU515 and TU516 for I/O expansion modules
- TU515, I/O Terminal Unit, 24 V DC, Screw-type Terminals
- TU516, I/O Terminal Unit, 24 V DC, Spring Terminals



Elements of the I/O Terminal Unit

1 I/O-Bus (10-pole, male) to electrically connect the previous I/O Terminal Unit or the FBP Terminal Unit or the CPU Terminal Base

2 I/O-Bus (10-pole, female) to electrically connect the next I/O Terminal Unit

3 Plug (1 x 50-pole, 2 x 38-pole) to electrically connect the expansion I/O Module inserted

4 With a screwdriver, inserted in this place, adjacent Terminal Units can be shoved from each other

5 Two holes for wall mounting

6 DIN rail

7 40 screw-type or spring terminals, for signals and process voltage, the terminal assignment depends on the module type inserted

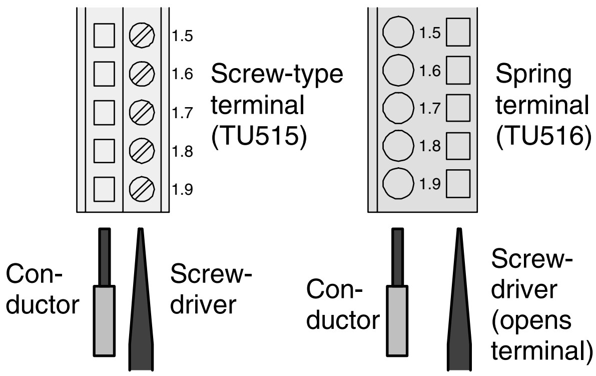


Figure: I/O Terminal Unit TU 516, for I/O expansion modules

The I/O Terminal Units TU515 (with screw-type terminals) and TU516 (with spring terminals) are specifically designed for use with AC500/S500 I/O modules that incorporate only 24 V DC or analog inputs/outputs.

The input/output modules (I/O expansion modules) plug into the I/O terminal Unit. When properly seated, they are secured with two mechanical locks. All the electrical connections are made through the Terminal Unit, which allows removal and replacement of the I/O modules without disturbing the wiring at the Terminal Unit.

Note: Mounting, disassembling and electrical connection for the Terminal Units and the expansion modules are described in detail in the S500 system data chapters.

The terminals 1.8 to 4.8 and 1.9 to 4.9 are electrically interconnected within the I/O Terminal Unit and have always the same assignment, independent of the inserted module:

Terminals 1.8 to 4.8: Process voltage UP = +24 V DC
Terminals 1.9 to 4.9: Process voltage ZP = 0 V

The assignment of the other terminals is dependent on the inserted expansion module (see the description of the used expansion module).

The supply voltage 24 V DC for the module's electronic circuitry comes from the I/O expansion bus (I/O-Bus) or from the FieldBusPlug or from the AC500 CPU.

Technical data

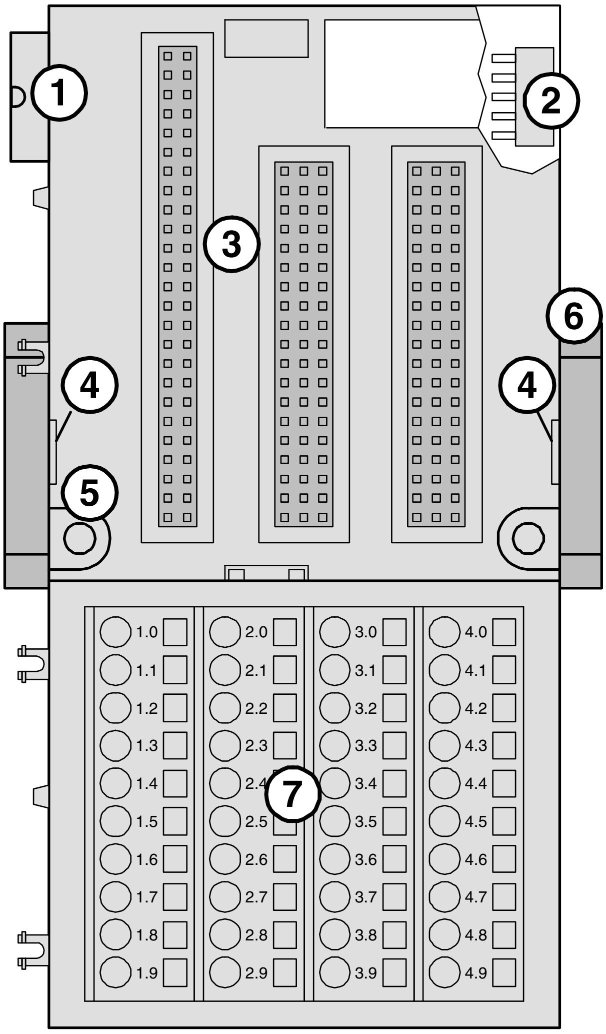
Number of channels per module	32
Distribution of the channels into groups	4 groups of 8 channels each (1.0...1.7, 2.0...2.7, 3.0...3.7, 4.0...4.7), the allocation of the channels is given by the inserted I/O expansion module
Rated voltage	24 V DC
Max. permitted total current	10 A (between the terminals 1.8...4.8 and 1.9...4.9)
Earthing	direct connection to the earthed DIN rail or via the screws with wall mounting
Screw-type terminals	
Type	Front terminal, conductor connection vertically with respect to the printed circuit board
Conductor cross section	
- solid	0.08 mm² to 2.5 mm²
- flexible	0.08 mm² to 2.5 mm²
- with wire-end ferrule	0.25 mm² to 1.5 mm²
Stripped conductor end	8 mm
Width of the screwdriver	3.5 mm
Fastening torque	0.6 Nm
Degree of protection	IP 20
For details	see system data / Connection system
Spring terminals	
Type	Front terminal, conductor connection vertically with respect to the printed circuit board
Conductor cross section	
- solid	0.08 mm² to 2.5 mm²
- flexible	0.08 mm² to 2.5 mm²
- with wire-end ferrule	0.25 mm² to 1.5 mm²
Stripped conductor end	7 mm, min. 5 mm
Degree of protection	IP 20
For details	see system data / Connection system
Dimensions	
Width x height x depth	67.5 x 135 x 30 mm
Weight	200 g
Mounting position	horizontal or vertical

Ordering data

Order No.	**Scope of delivery**
1SAP 212 200 R0001	TU515, I/O Terminal Unit, 24 V DC, screw-type terminals
1SAP 212 000 R0001	TU516, I/O Terminal Unit, 24 V DC, spring terminals

I/O Terminal Units TU531 and TU532 for I/O expansion modules

- TU531, I/O Terminal Unit, 230 V AC, Screw-type Terminals
- TU532, I/O Terminal Unit, 230 V AC, Spring Terminals



Elements of the I/O Terminal Unit

1 I/O-Bus (10-pole, male) to electrically connect the previous I/O Terminal Unit or the FBP Terminal Unit or the CPU Terminal Base

2 I/O-Bus (10-pole, female) to electrically connect the next I/O Terminal Unit

3 Plug (1 x 50-pole, 2 x 38-pole) to electrically connect the expansion I/O Module inserted

4 With a screwdriver, inserted in this place, adjacent Terminal Units can be shoved from each other

5 Two holes for wall mounting

6 DIN rail

7 40 screw-type or spring terminals, for signals and process voltage, the terminal assignment depends on the module type inserted

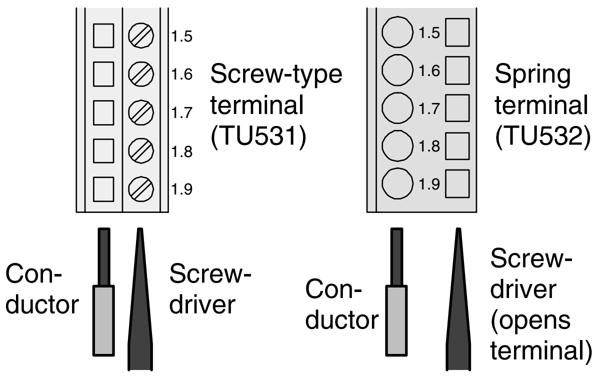


Figure: I/O Terminal Unit TU 532, for I/O expansion modules

The I/O Terminal Units TU531 (with screw-type terminals) and TU532 (with spring terminals) are specifically designed for use with AC500/S500 I/O modules that incorporate 115-230 V AC inputs and/or 230 V AC relay outputs.

The input/output modules (I/O expansion modules) plug into the I/O terminal Unit. When properly seated, they are secured with two mechanical locks. All the electrical connections are made through the Terminal Unit, which allows removal and replacement of the I/O modules without disturbing the wiring at the Terminal Unit.

Note: Mounting, disassembling and electrical connection for the Terminal Units and the expansion modules are described in detail in the S500 system data chapters.

The terminals 1.8 to 4.8 and 1.9 to 4.9 are electrically interconnected within the I/O Terminal Unit and have always the same assignment, independent of the inserted module:

Terminals 1.8 to 4.8: Process voltage UP = +24 V DC
Terminals 1.9 to 4.9: Process voltage ZP = 0 V

The assignment of the other terminals is dependent on the inserted expansion module (see the description of the used expansion module).

The supply voltage 24 V DC for the module's electronic circuitry comes from the I/O expansion bus (I/O-Bus) or from the FieldBusPlug or from the AC500 CPU.

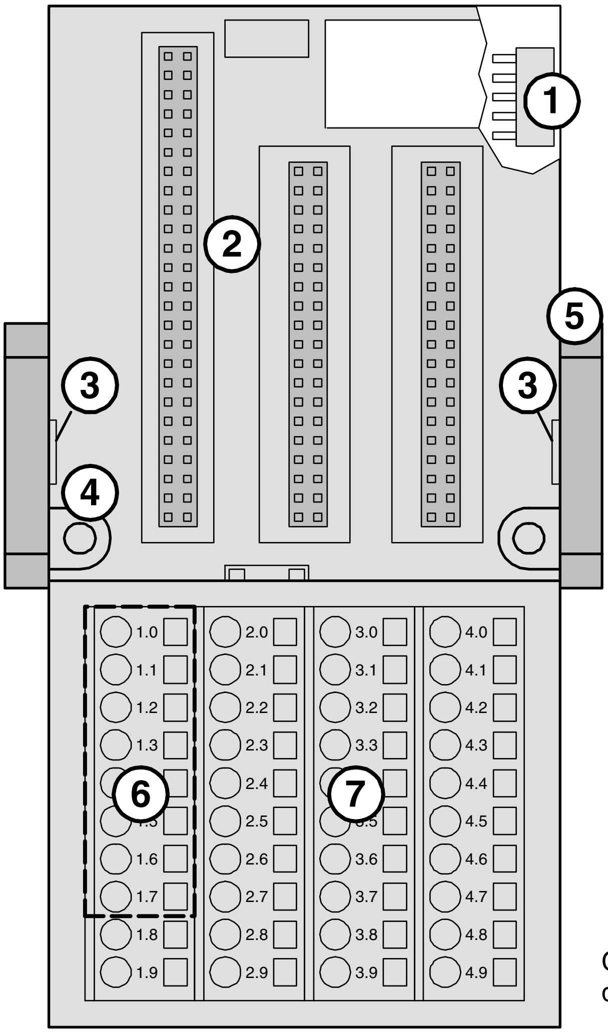
Technical data

Number of channels per module	32
Distribution of the channels into groups	4 groups of 8 channels each (1.0...1.7, 2.0...2.7, 3.0...3.7, 4.0...4.7), the allocation of the channels is given by the inserted I/O expansion module
Rated voltage	230 V AC
Max. permitted total current	10 A (between the terminals 1.8...4.8 and 1.9...4.9)
Earthing	direct connection to the earthed DIN rail or via the screws with wall mounting
Screw-type terminals	
Type	Front terminal, conductor connection vertically with respect to the printed circuit board
Conductor cross section	
- solid	0.08 mm² to 2.5 mm²
- flexible	0.08 mm² to 2.5 mm²
- with wire-end ferrule	0.25 mm² to 1.5 mm²
Stripped conductor end	8 mm
Width of the screwdriver	3.5 mm
Fastening torque	0.6 Nm
Degree of protection	IP 20
For details	see system data / Connection system
Spring terminals	
Type	Front terminal, conductor connection vertically with respect to the printed circuit board
Conductor cross section	
- solid	0.08 mm² to 2.5 mm²
- flexible	0.08 mm² to 2.5 mm²
- with wire-end ferrule	0.25 mm² to 1.5 mm²
Stripped conductor end	7 mm, min. 5 mm
Degree of protection	IP 20
For details	see system data / Connection system
Dimensions	
Width x height x depth	67.5 x 135 x 30 mm
Weight	200 g
Mounting position	horizontal or vertical

Ordering data

Order No.	Scope of delivery
1SAP 217 200 R0001	TU531, I/O Terminal Unit, 230 V AC, relays, screw-type terminals
1SAP 217 000 R0001	TU532, I/O Terminal Unit, 230 V AC, relays, spring terminals

Terminal Units TU551-CS31 and TU552-CS31 for CS31 Bus Modules
- TU551-CS31, CS31 Bus Terminal Unit, 24 V DC, Screw-type Terminals
- TU552-CS31, CS31 Bus Terminal Unit, 24 V DC, Spring Terminals



Elements of the Terminal Unit

1 I/O-Bus (10-pole, female) to electrically connect the first I/O Terminal Unit

2 Plug (1 x 50-pole, 2 x 38-pole) to electrically connect the CS31 Bus Module inserted

3 With a screwdriver, inserted in this place, adjacent Terminal Units can be shoved from each other

4 Two holes for wall mounting

5 DIN rail

6 CS31 bus interface

7 30 screw-type or spring terminals, for signals and process voltage, the terminal assignment depends on the module type inserted

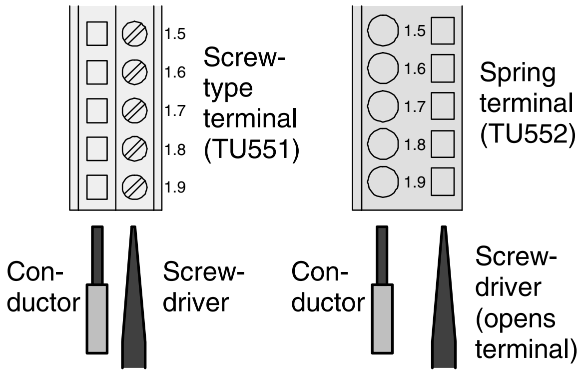


Figure: Terminal Unit TU 552-CS31, for CS31 Bus Modules (e.g. DC551-CS31)

The Terminal Units TU551-CS31 (with screw-type terminals) and TU552-CS31 (with spring terminals) are specifically designed for use with S500 CS31 Bus Modules that incorporate only 24 V DC inputs/outputs or interface signals.

The CS31 Bus Modules plug into the Terminal Unit. When properly seated, they are secured with two mechanical locks. All the electrical connections are made through the Terminal Unit, which allows removal and replacement of the CS31 Bus Modules without disturbing the wiring at the Terminal Unit.

Note: Mounting, disassembling and electrical connection for the Terminal Units and the expansion modules are described in detail in the S500 system data chapters.

The terminals 1.8 to 4.8 and 1.9 to 4.9 are electrically interconnected within the Terminal Unit and have always the same assignment, independent of the inserted module:

Terminals 1.8 to 4.8: Process voltage UP = +24 V DC
Terminals 1.9 to 4.9: Process voltage ZP = 0 V

The assignment of the other terminals is dependent on the inserted CS31 Bus Module (see the description of the used CS31 Bus Module).

The supply voltage 24 V DC for the module's electronic circuitry comes from ZP and UP.

Technical data

Number of channels per module	24
Distribution of the channels into groups	3 groups of 8 channels each (2.0...2.7, 3.0...3.7, 4.0...4.7), the allocation of the channels is given by the inserted CS31 Bus Module
CS31 field bus connector	terminals 1.0 to 1.7
Rated voltage	24 V DC
Max. permitted total current	10 A (between the terminals 1.8...4.8 and 1.9...4.9)
Earthing	direct connection to the earthed DIN rail or via the screws with wall mounting
Screw-type terminals	
Type	Front terminal, conductor connection vertically with respect to the printed circuit board
Conductor cross section	
- solid	0.08 mm² to 2.5 mm²
- flexible	0.08 mm² to 2.5 mm²
- with wire-end ferrule	0.25 mm² to 1.5 mm²
Stripped conductor end	8 mm
Width of the screwdriver	3.5 mm
Fastening torque	0.6 Nm
Degree of protection	IP 20
For details	see system data / Connection system
Spring terminals	
Type	Front terminal, conductor connection vertically with respect to the printed circuit board
Conductor cross section	
- solid	0.08 mm² to 2.5 mm²
- flexible	0.08 mm² to 2.5 mm²
- with wire-end ferrule	0.25 mm² to 1.5 mm²
Stripped conductor end	7 mm, min. 5 mm
Degree of protection	IP 20
For details	see system data / Connection system
Dimensions	
Width x height x depth	67.5 x 135 x 30 mm
Weight	200 g
Mounting position	horizontal or vertical

Ordering data

Order No.	Scope of delivery
1SAP 210 600 R0001	TU551-CS31, CS31 Bus Terminal Unit, 24 V DC, screw-type terminals
1SAP 210 400 R0001	TU552-CS31, CS31 Bus Terminal Unit, 24 V DC, spring terminals

FBP Interface Modules S500, Overview

PROFIBUS DP built with PDP21 and PDP22 FieldBusPlugs

Contents

Slaves with FieldBusPlugs

The main feature of the FieldBusPlug system is that all device types with the neutral FBP interface can be connected to several field buses using the appropriate FieldBusPlug type.

This means that a PROFIBUS DP-V0 slave (or DeviceNet, ... slave) is built up of a device with the neutral interface and the PROFIBUS DP-V0 FieldBusPlug PDP21-FBP.

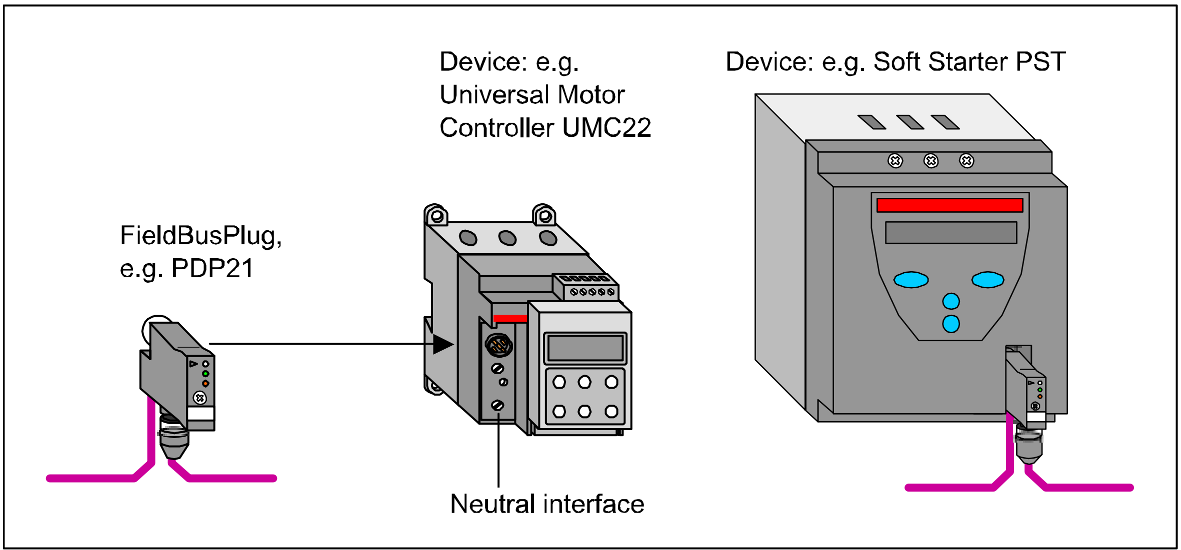
There are two types of FieldBusPlug devices for PROFIBUS:

- the DP-V0 version (PDP21) for simple devices with fixed I/O types and data size
- the DP-V1 version (PDP22) which can be used on a lot of different slaves acc. to the GSD Data files used.

The DP-V1 FBP PDP22 can be used on all the FBP slaves (from simple manual motor starter to an AC500 CPU as slave). The PDP22 is also called modular FBP because it can be used on products with modular structure like S500-FBP remote I/Os, for example. The modular FBP, due to it internal structure and appropriate GSD Data can be configured to exchange data from a modular system (mixed I/O types number of I/Os), the PDP21 can only be used with products with fixed configuration.

> ⚠ **Important:** The AC500 CPU as slave or a S500-FBP remote I/O can only be used together with FBP V1 (also called modular FBP) and their dedicated GSD Data.

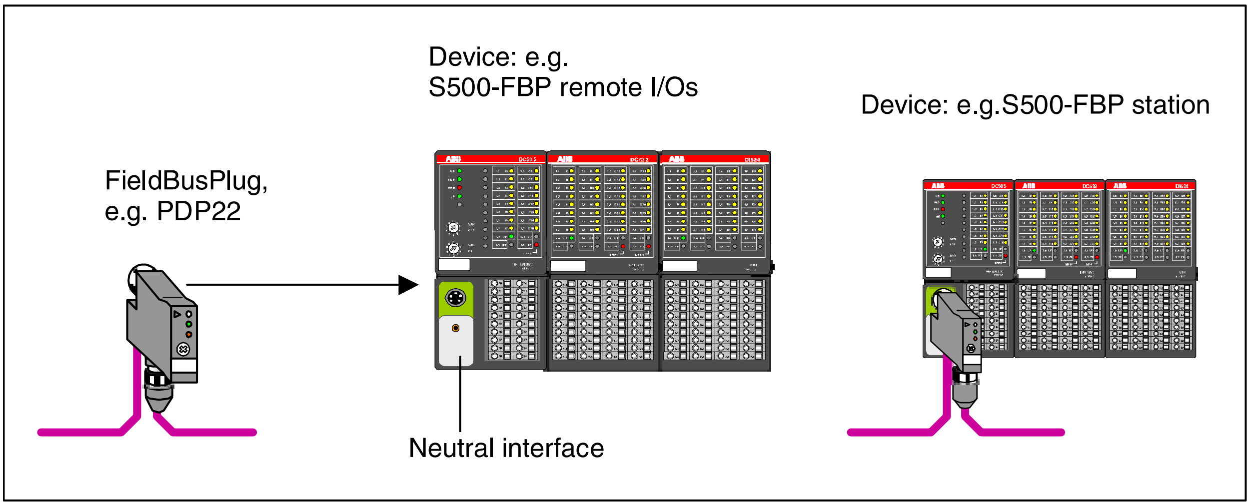
Example of use of a PDP21 FBP with simple slave (fixed configuration type):



In a PROFIBUS DP network, built with FBPs slaves, it is possible to mix the FBP types according to the devices used. It is only very important to notice that the GSD files used together with the device should support the device features.

The FBP itself performs only the PROFIBUS DP communication from the device to the master, the behaviour of the device using FBP is configured by the used GSD Data.

Example for use of a PDP22 FBP "modular" with complex slave (e.g. S500-FBP remote I/Os):



One of the most important tasks during commissioning is to adjust the correct slave address carefully. Commands sent to the wrong slave can cause severe problems. For more details see the appropriate chapter in this document.

Important Features of bus lines created with PDP21/PDP22

1. The PDP21 / PDP22 represents a tee unit.

This means: If the bus node built in the PDP21 / PDP22 fails all remaining FieldBusPlugs are still connected with the bus master.

2. All PDP21 / PDP22 connected to a bus line are supplied via the bus cable.

This means: To supply the FieldBusPlugs, a power supply unit is necessary that is situated best near the bus master.

This is not a disadvantage, because without a bus master the data transmission is not possible.

The advantage is that - under some circumstances - it is possible to supply the devices via the bus cable with 24 V DC saving local supply units.

For more infomation see chapter "Supply" and the description of the devices.

3. A bus line built with PDP21 / PDP22 is a real party line without branches or drops.

This means: The max. baud rate of 12 Mbit/s is possible, provided that the termination on both ends is done correctly and the max. bus length is not exceeded.

4. The contacts - pins and jacks - are gold plated.

This means: Concerning the contacts, the PDP21 / PDP22 avoid that faults caused by loose or bad contacts.

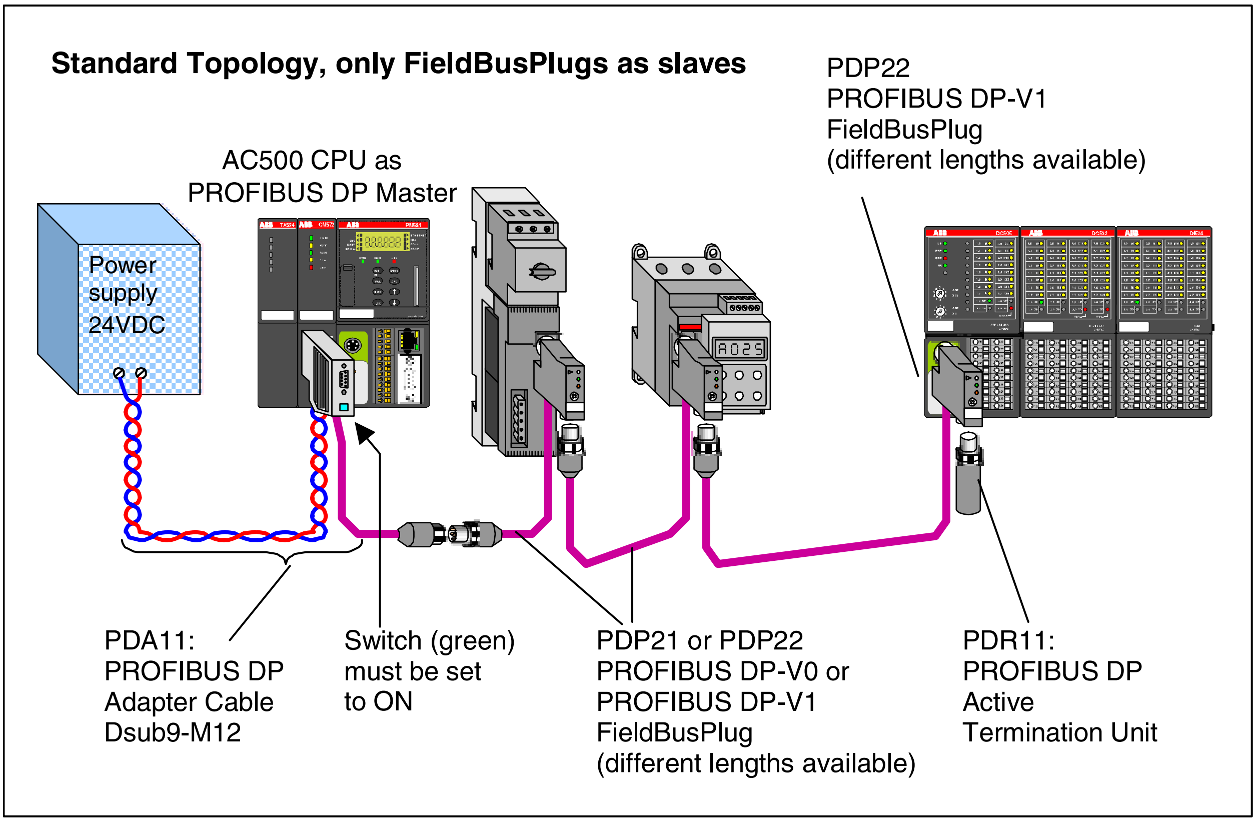
5. Only at the ends of the bus line, termination resistors are possible and necessary.

This means: In the standard topology, as shown below, only at the ends of the line terminations are possible and necessary.

At the Dsub9 connector, mounted on the bus master, the termination resistor set has to be switched ON and at the other end of the bus line the termination unit must be mounted.

Regarding the situation that 80 - 90% of the problems in conventional wired PROFIBUS lines are caused by loose contacts or wrong termination, the FieldBus Plug system guarantees a faultless data transmission line between the master and the slaves.

Building a PROFIBUS DP line with FieldBusPlugs



⚠ **Important:** When an AC500 CPU is used as Fieldbus master, the power supply of the CPU and those of the FieldbusPlug should be separated to provide a better interference immunity. The two power supplies should be integrated in the global earthing/grounding scheme of the installation.

Installation of the PROFIBUS line step by step:

- Connect PDA11 (Adapter Cable Dsub9-M12) to the bus master.
- Do not forget to set the termination switch on the PDA11 (green) to ON.
- Connect the red and blue strand of the PDA11 with a 24VDC power supply (+ red, - blue).
- Connect the first PDP21 or PDP22 to the PDA11, then the next PDP21 or PDP22 and so on. Tighten the knurled knob carefully. The roughness felt during tightening shall result in resistance to vibration.
- Do not forget to mount the PDR11 (active PROFIBUS termination unit).

A fault-free and stable data transmission urgently requests the perfect termination of the bus line on both ends and nowhere else. This has to be regarded also when repeaters or optical converters are used.

The max. number of stations per segment is 32 limited physically by the RS485 standard line drivers and receivers. This includes also repeaters and similar components.

For more than 32 stations repeaters or RS485-to-optical-fiber converters can be used.

Another limit is given by the max. number of 125 slave addresses. The available range is 1 through 125. More details see chapter "Data structure, addressing"

Topology examples

Feed-in if the bus cable is long

If the distance between the bus master and the slaves is longer, it may be necessary to feed in 24 V DC for the FieldBusPlugs on a second place. Check with: "Supply Calculation" scheme.

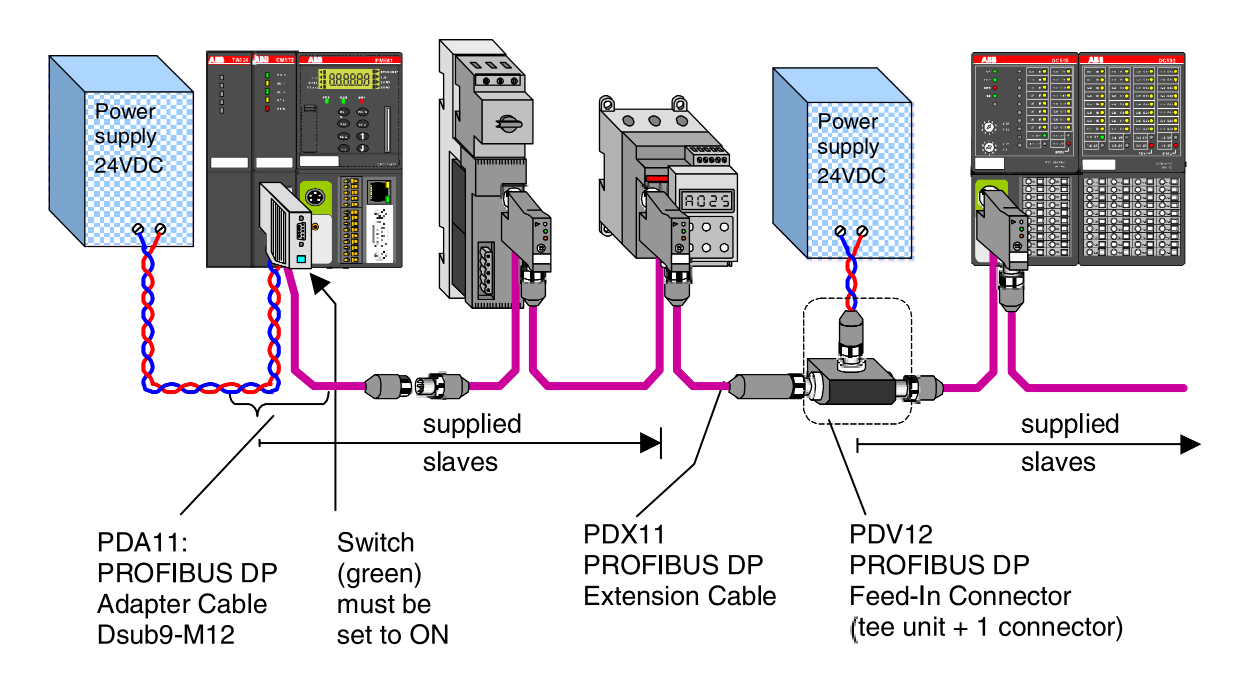
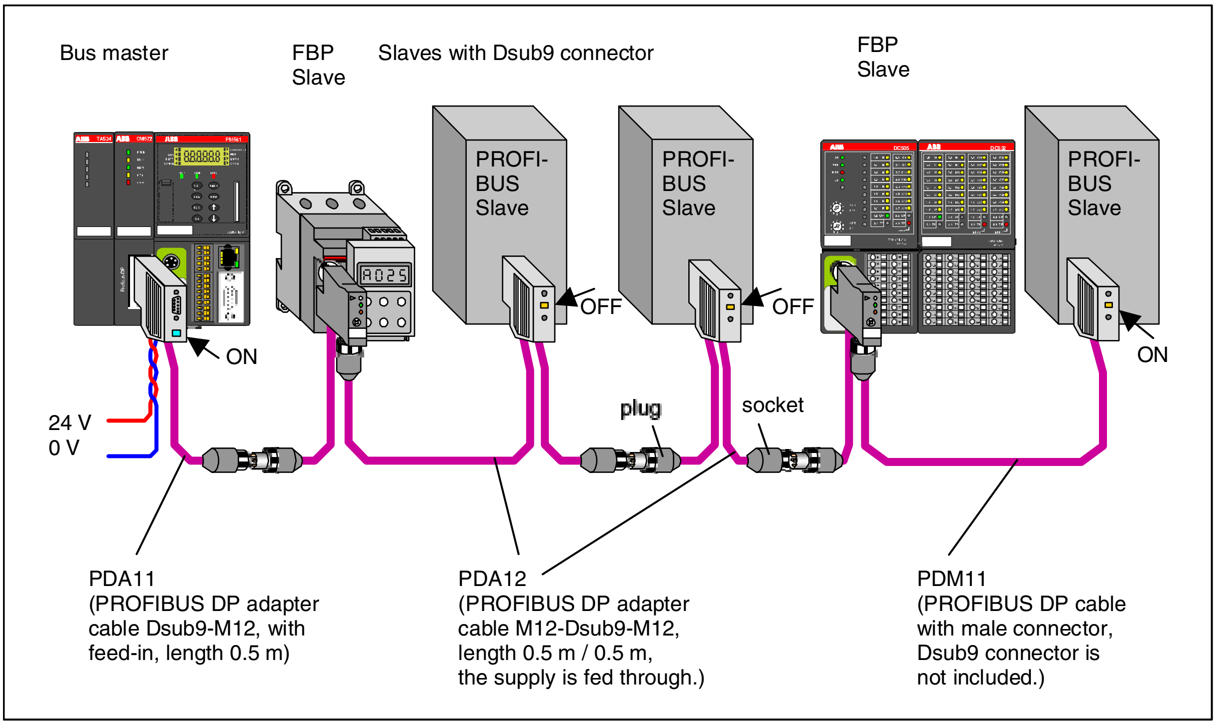


Figure: Feed-in, if the bus cable is long:

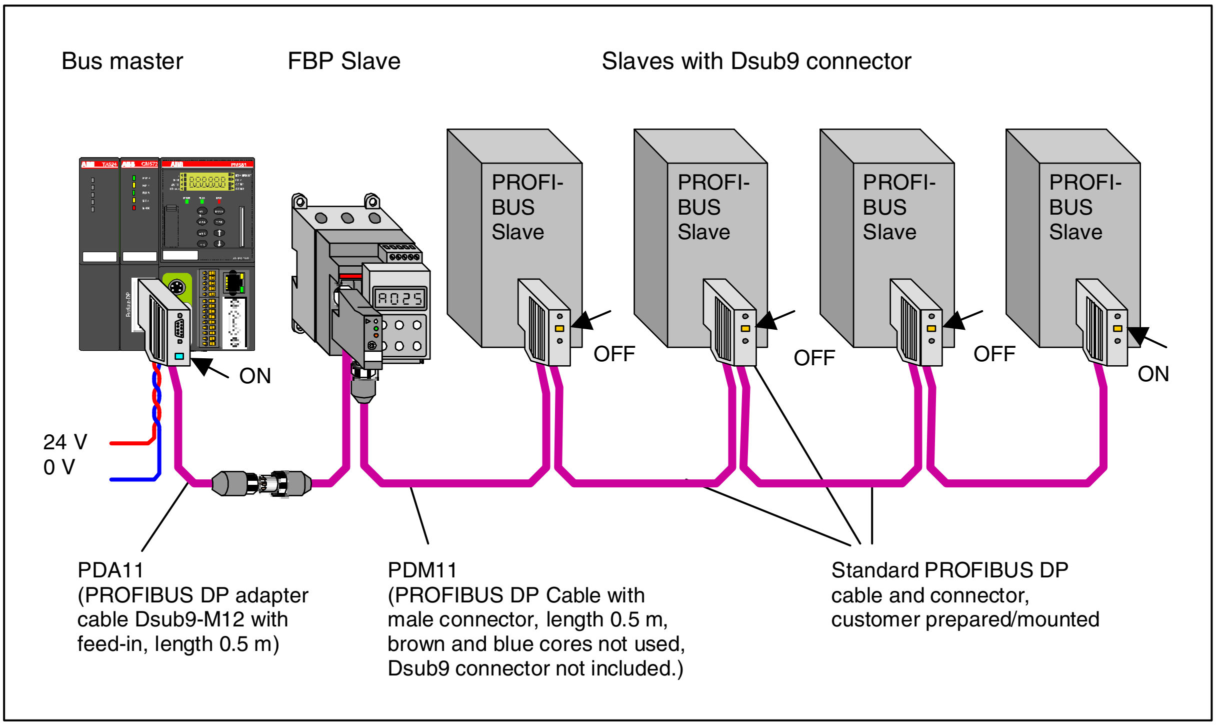
Important: As the S500-FBP remote I/Os are also powered through the FieldbusPlug, the power supply of each cabinet has to be provided locally to avoid too important power loss.

In the same way, when the distance between slaves or cabinets are quite important, it is always better to provide the power supply locally. Use the PDV12 Feed-in accessory to connect a new power supply. Also follow carefully the earthing/grounding and potential equalization rules (see the dedicated chapter further away).

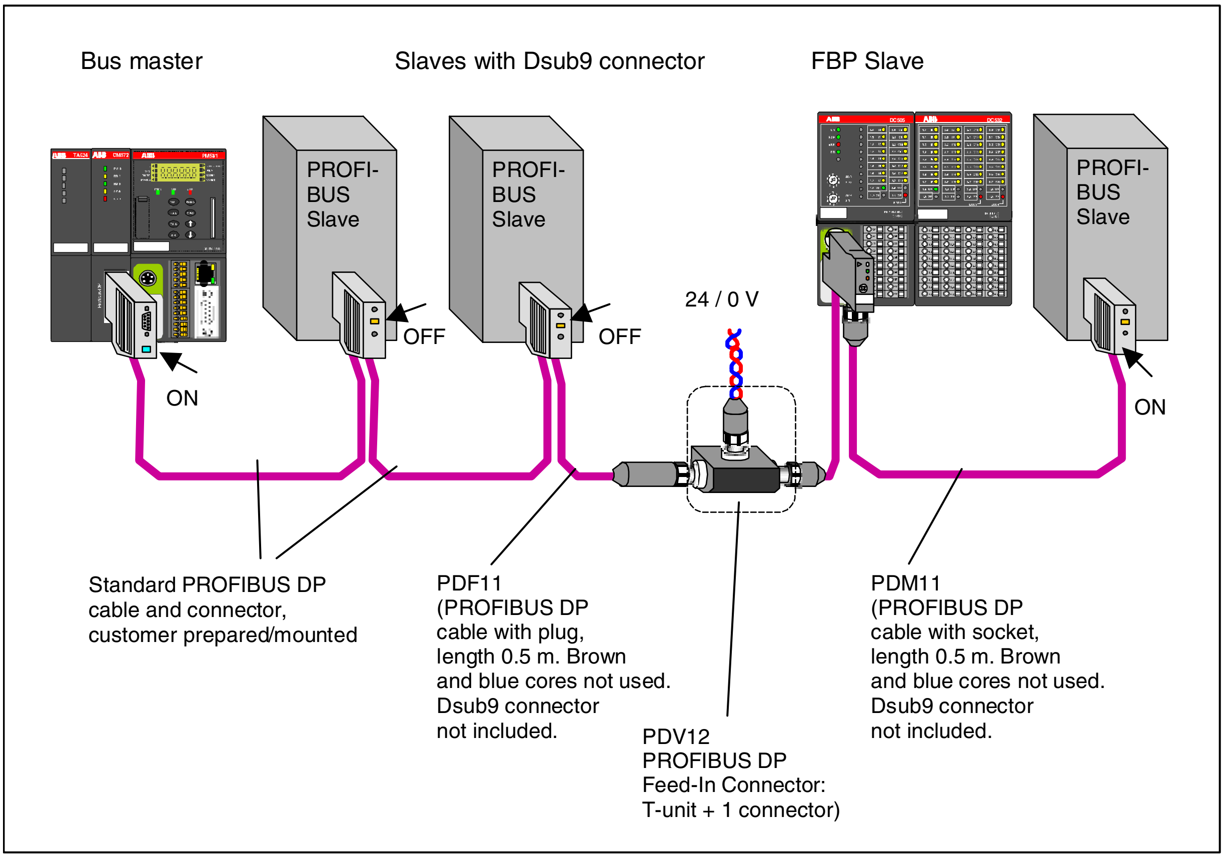
Topology, if also other PROFIBUS slaves are connected



Topology, if only one or few FBP slaves are connected

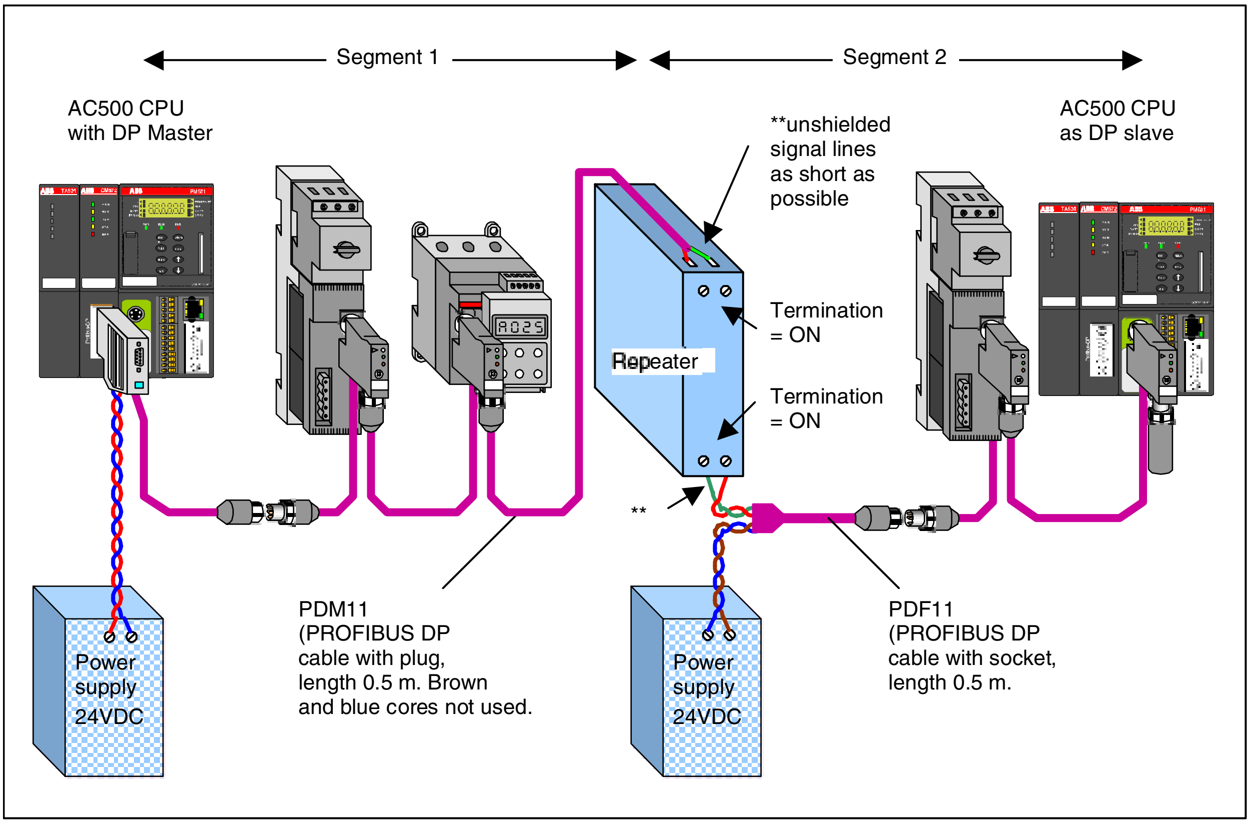


Topology, if only one FBP slave distant from the bus master is connected



Topologies with Repeater

Repeater at the end of segment 1 and at the beginning of the segment 2



Notes:

- Repeaters have to be calculated as physical stations also within the max. number 32 stations per segment. Thus only 30 slaves can be connected to a segment.
- Each segment can have the allowed bus length referring to chapter "Technical Data".
- Set baud rate on the repeater carefully according to the manufacturer's instruction.
- Most of the repeaters do not support baud rates up to 12 Mbit/s.
- Regard termination carefully. Repeaters normally have built in termination that can be switched on. Consult manufacture's instruction.
- Do not use more repeaters than necessary. Repeaters decrease the stability of the whole field bus system and make it more sensitive for electromagnetic influence.
- Keep unshielded cores as short as possible.
- Take care for perfect grounding of the shields.

Power supply considerations

The supply of the FieldBusPlug is always made via the bus cable. This enables the FieldBusPlug to monitor the actual (e.g. faulty) status to the control station even when it is removed from the device or when power down appears on the device.

Additional it is possible to supply simple components such as proximity switches or the devices MSD11 and MSR22 via the bus cable of the FieldBusPlug.

The S500-FBP remote I/Os are only powered through the bus cable. As the needed current is depending on the number and type of the I/O modules used, a total current of up to 50 mA could be necessary additionally to the current needed for the FBP itself (about 46 mA).

When the distance between master and slave or cabinet is high, the power supply of the slaves should be provided locally in each cabinet.

Notes: Prefer separate supply units or separately fused supply circuits for the FieldBusPlug line and the devices (not possible for S500-FBP which could only powered through the bus lines).

For the FBP devices with selector switch for power supply, check carefully whether the switches of the devices are set to EXT before delivering to the installation site.

Always check the supply situation using the calculation scheme in the chapter below. Do not forget to check the total bus length.

Power supply via bus cable, calculation

Supposed all devices are supplied externally, the supply has to feed the PDP21 or PDP22 connected to the bus. The supply current depends on the voltage (typical values):

Supply voltage	19.2 V	24 V	31.2 V
FBP supply current typ.	46 mA	37 mA	31 mA

To calculate the needed current per S500-FBP slave equipped with a FBP, you should add the supply current of the remote station itself to the above FBP needed current.

Module	**DC505-FBP**		**DI524, DC532, DX522, DX531, AX522**	
Supply voltage	19.2 V	24 V	19.2 V	24 V
FBP supply current typ.	18 mA	12 mA	5 mA	4 mA

Example of needed current

Station with only 1 x DC505-FBP + PDP22, total current needed with 19.2 V DC: 54 mA (46 + 18 mA)

Station with 1 x DC505-FBP + 7 x DC532 + PDP22 at 19.2 V DC supply: 99 mA (46 + 18 + 35 mA)

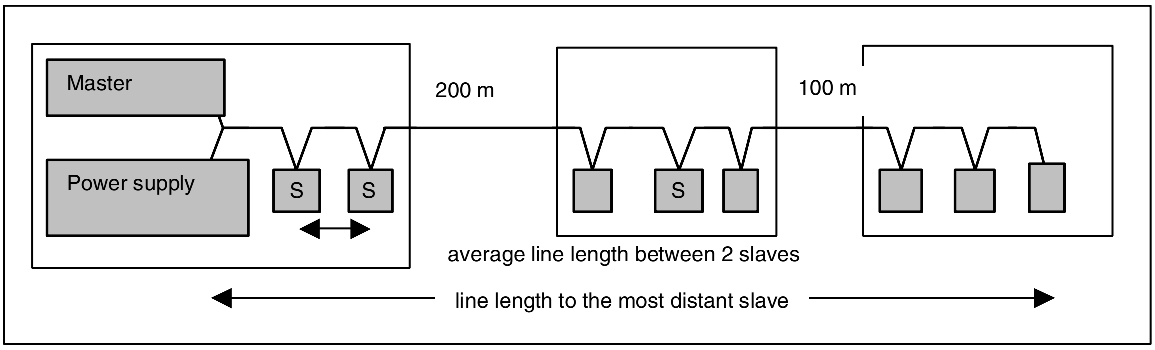
To simplify the calculation, the scheme below uses the highest values of the currents, but - on the other hand - does not regard the increased copper resistance and voltage drop for higher environment temperatures.

Note: All slaves, even the slave most distant from the supply unit, need to be supplied with min. 19.2 V DC including ripple. That means that the power supply unit at the beginning of the line has to provide a higher voltage to compensate the voltage drops due to the line resistance.

Use the Excel sheet "PROFIBUS-DP Supply via Bus Cable Calculation.xls" from the FieldBusPlug tools to estimate the size, nominal voltage and power of the needed power supply. This Excel sheet can be found on the ABB website.

Practical example

DP Network with 1 master and 8 slaves located in 3 cabinets/installations with the following splitting:



- 1st cabinet with master device (AC500 + DP coupler) located in a cabinet also containing 2 remote I/Os DC532. Distance between the slaves about 2 m.
- The distance to the following cabinet is 200 m.
- 2nd cabinet with 3 remote I/Os (1 x DC505-FBP + 2 x DC532), distance between the slaves about 2 m.
- The distance to the following cabinet is 100 m.
- 3rd cabinet with 3 remote I/Os (1 x DC505-FBP + 2 x DC532), distance between the slaves about 2 m.

With a voltage at the end of the bus of min. 19.2 V DC, the current consumption per module is as follow according to the previous table:

FBP + DC505 + 2 x DC532 = 46 + 18 + 10 = 74 mA per remote station.

Use the calculation sheet of the FBP products, adapt the values to those defined before.

The calculation sheet delivers the following result:

		Segment	Distance	Current		Total current	Voltage
Master	1 slave		312.0 m		mA	592 mA	27.82 V
		2.0 m					
8	1 slave		310.0 m	74	mA	592 mA	27.74 V
		2.0 m					
7	1 slave		308.0 m	74	mA	518 mA	27.66 V
		200.0 m					
6	1 slave		108.0 m	74	mA	444 mA	21.00 V
		2.0 m					
5	1 slave		106.0 m	74	mA	370 mA	20.94 V
		2.0 m					
4	1 slave		104.0 m	74	mA	296 mA	20.90 V
		100.0 m					
3	1 slave		4.0 m	74	mA	222 mA	19.23 V
		2.0 m					
2	1 slave		2.0 m	74	mA	148 mA	19.21 V
		2.0 m					
1	1 slave **		0.0 m	74	mA	74 mA	min. 19.20 V

Results of this example:

– The power supply unit has to deliver min. 27.82 V incl. ripple and tolerances
– The power supply unit has to deliver min. 592 mA
– The bus length is 312 m. Note: **Consider length and baud rate.**

To connect the bus line to the master the PDA11 (PROFIBUS DP Adapter Cable Dsub9-M12, 1SAJ 924 009 R0005) is recommended.
The termination resistors can be switched on at the Dsub9 connector.

** The last device needs termination: PDR11-FBP.150 (1SAJ 924 007 R0001).

The recommended power supply unit can be adjusted to 28 V DC:

Power Supply 24V / 5A adjustable, order code: 1SVR 423 416 R0100, type: CP-24/5.0

Grounding, shielding

Grounding principles

The PROFIBUS FieldBusPlug cable as well as the standard PROFIBUS cable is equipped with a perfect shield: aluminium coated foil and a braided shield.

Regarding EMC, laboratory measurements have proved that grounding is not necessary when the PROFIBUS DP is built up with PDP21 / PDP22 only, normal industrial environment supposed.

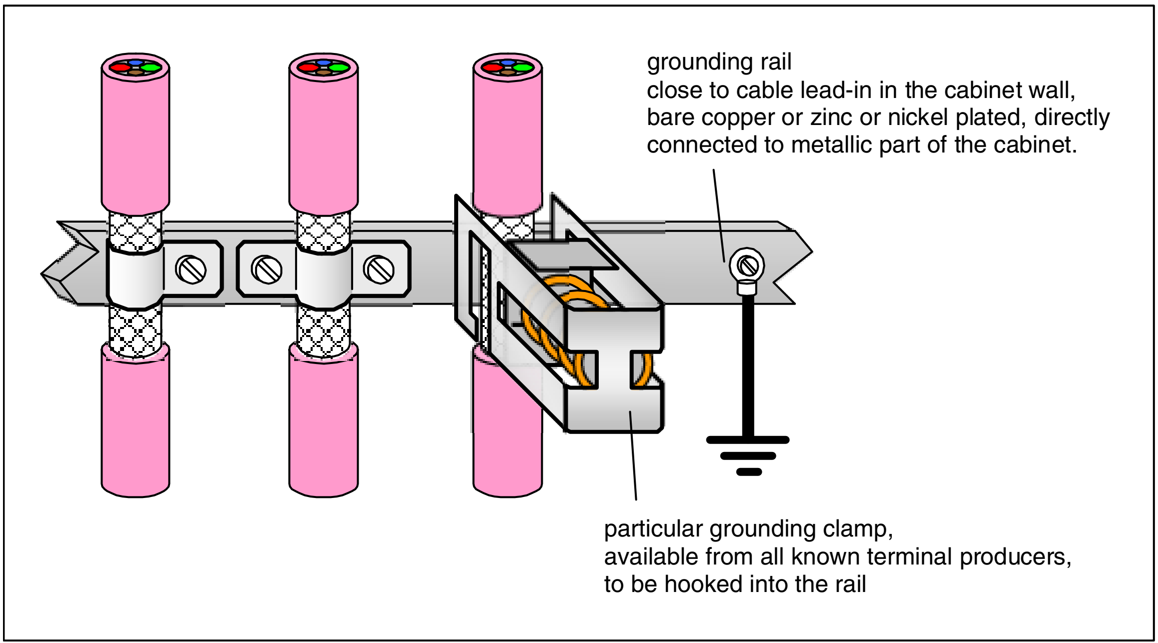
According to IEC60204 / EN60204 (chapter 6.3.3) all metallic parts must be grounded to avoid that they - in case of an insulation fault, unexpected and unobserved - are connected to a dangerous voltage.

It is highly recommended to connect the shield to ground:

- at the PROFIBUS DP master and
- when entering / leaving a cabinet and
- every third or forth FieldBusPlug and
- when connecting other - non FieldBusPlug slaves - in accordance with the manufacturer's instruction.

Efficient grounding of the shield

Best workmanship is to remove the sheath partially and to fix the shield directly onto a metallic rail or surface with a clip or a saddle:



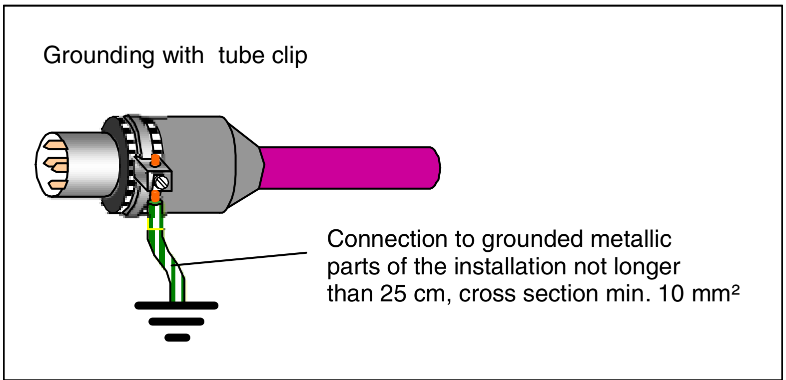
The grounding rail must be close to the cable lead-in in the cabinet wall and should be zinc or nickel plated for proper long term connection.

The rail must be mounted directly on the metallic part of the cabinet. Zinc plated parts and surfaces are preferred inside the cabinets.

Painted surfaces inside the cabinet or aluminium surfaces hinder proper connection.

Also, too long shield wires between the cable and the cabinet wall results in bad EMC data. For the shield wire with a length up to 10 cm, the flexible lead should have minimum 6 mm².

Particularly in installations outside of cabinets, where IP65 is used, the grounding with tube clips can be used:

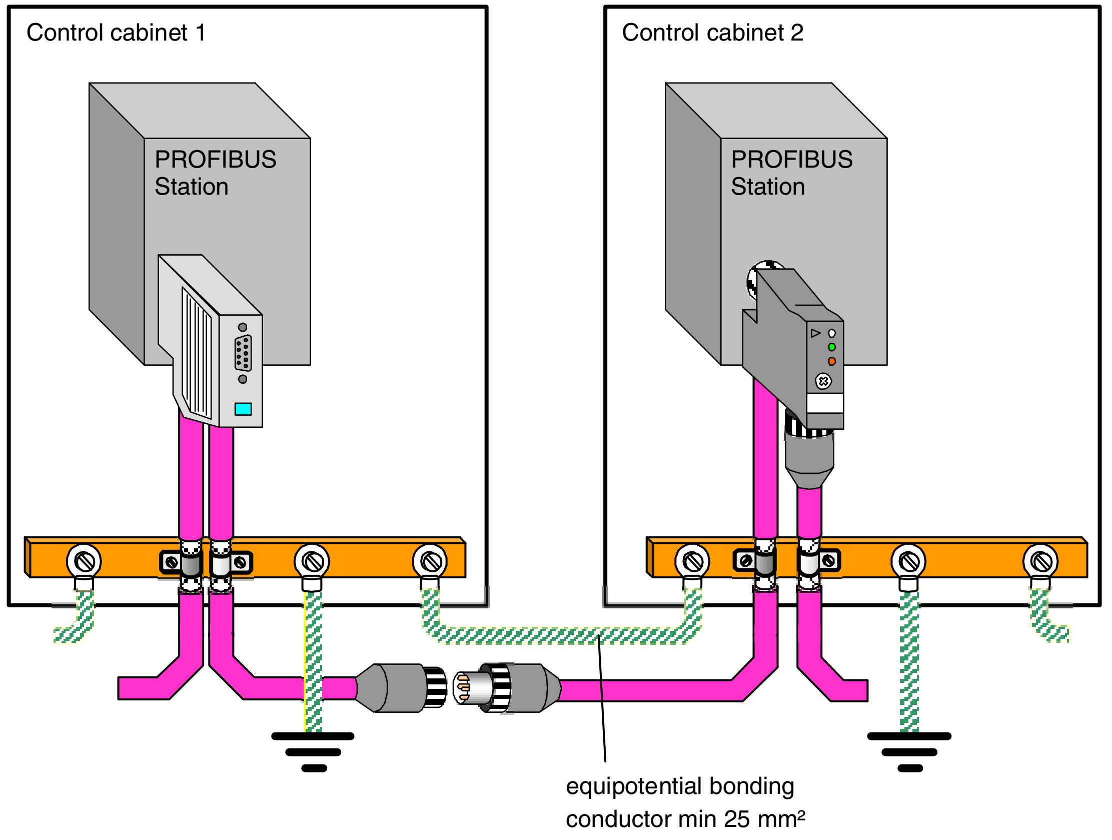


Wide spread or distant parts of an installation may have different grounding potential if there is not a good metallic connection between in. The voltage difference is low but the equalizing current can be high.

Because of the small cross section, the shield of bus cables is not able to lead large equalizing currents.

Therefore it is mandatory to add an equipotential bonding conductor in these cases with a cross section of at least 25 mm².

Equipotential bonding



Data structure / addressing / configuration of the FBP station

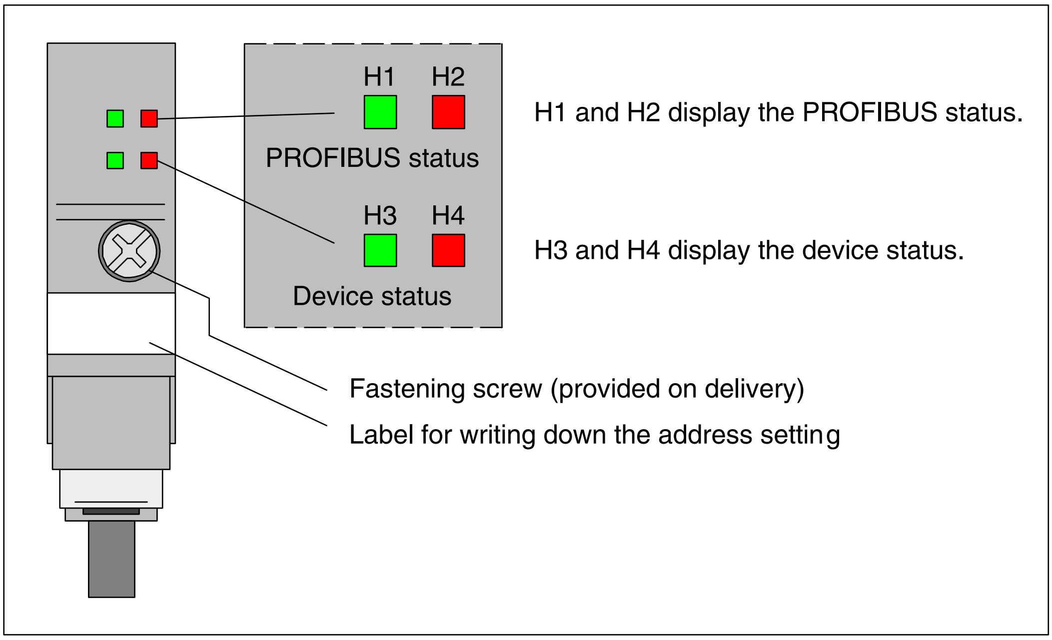
See the example in the **"Getting Started"** documentation where an application with AC500 CPU + S500-FBP remote I/Os on PROFIBUS DP is described.

Used GSD data for the different products:

PDP21:	**ABB_078F.GSD**	For use with standard devices
PDP22:	**ABB_082F.GSD**	For use with DP-V1 master and standard devices (UMC, etc.)
PDP22:	**ABB_091F.GSD**	For use with modular devices like AC500 / S500-FBP

PDP21/PDP22 - Diagnosis and display

Indicators on the front plate



Meaning of the LEDs

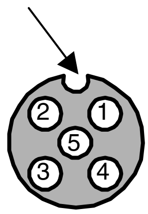
PROFIBUS status		**Device status**		**Status / cause**
LED green H1	LED red H2	LED green H3	LED red H4	
off	off	off	off	Power supply is missing
on	flashes			Possible errors: - No connection to the bus master, e.g. PROFIBUS is not operating - The PDP21/PDP22 has a slave address that is not configured in the bus master - Parameter length and slave address are correct but the I/O configuration of the slave does not meet the configuration sent by the bus master
flashes	on			The device parameters received from the bus master are formal incorrect, e.g. of other length
off	on			Connection to the bus master is interrupted longer than the timeout set by the bus master before interruption
on	**off**			Normal data exchange to the PROFIBUS DP master
		on	**off**	Normal data exchange to the terminal device
flashes	flashes	flashes	flashes	Plug is under self-test during power-up
		flashes	off	Plug is waiting for configuration data to be sent from the device (number of input/output bytes, number of parameter bytes, internal baud rate etc.) Note: If no data has been sent by the terminal device within 3 s, the plug switches to the parallel mode.
		off	flashes	Error: can be remedied, e.g. connection to the terminal device is broken
		off	on	Error: cannot be remedied, e.g. incorrect check sum in the Flash. Exchange the plug.

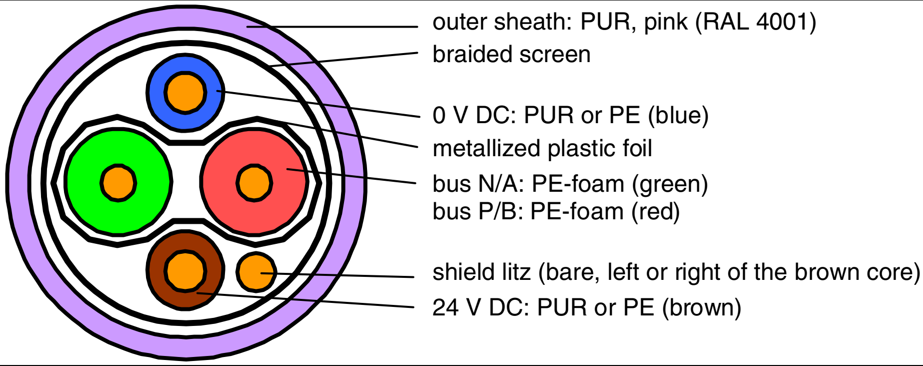
Technical data

Bus cable and bus length

Bus cable

The currently used FieldBusPlug PROFIBUS cable contains

a)	Two cores for the bus signals	**N/A = green = connector pin 2** **P/B = red = connector pin 4** (Dsub9 connector: N/A = pin 8, P/B = pin 3)	mechanical A coding  view to pins (X13 of the PDP21/22)
	Characteristic impedance	150 Ω ± 15 Ω (for 3...20 MHz)	
	Cross section	0.22 mm² = ca. AWG 24	
	Cable capacity typ.	30 nF/km	
	Insulation material	PE foam	
	Shielded with	metallized foil	
b)	Two cores to supply the plugs	**+24 V DC = brown = connector pin 1** **0 V = blue = connector pin 3**	
	Cross section	0.5 mm² = ca. AWG 20	
	Wire resistance	38.9 Ω/km	
	Insulation material	PE	
c)	Outer shield and jacket	**braided screen + metallized plastic foil + shield litz = connector pin 5,** for both signal and supply cores	
	Shield litz	0.5 mm² = ca. AWG 20	
	Jacket	PU, pink, colour ca. RAL 4001	
	Bending radius (fixed installation)	10 times jacket diameter	
	Temperature range (fixed installation)	-30°C...+80°C	



⚠ **Caution:** Exchange of bus signal lines with supply lines can cause destruction of the plug.

Bus length versus data rate

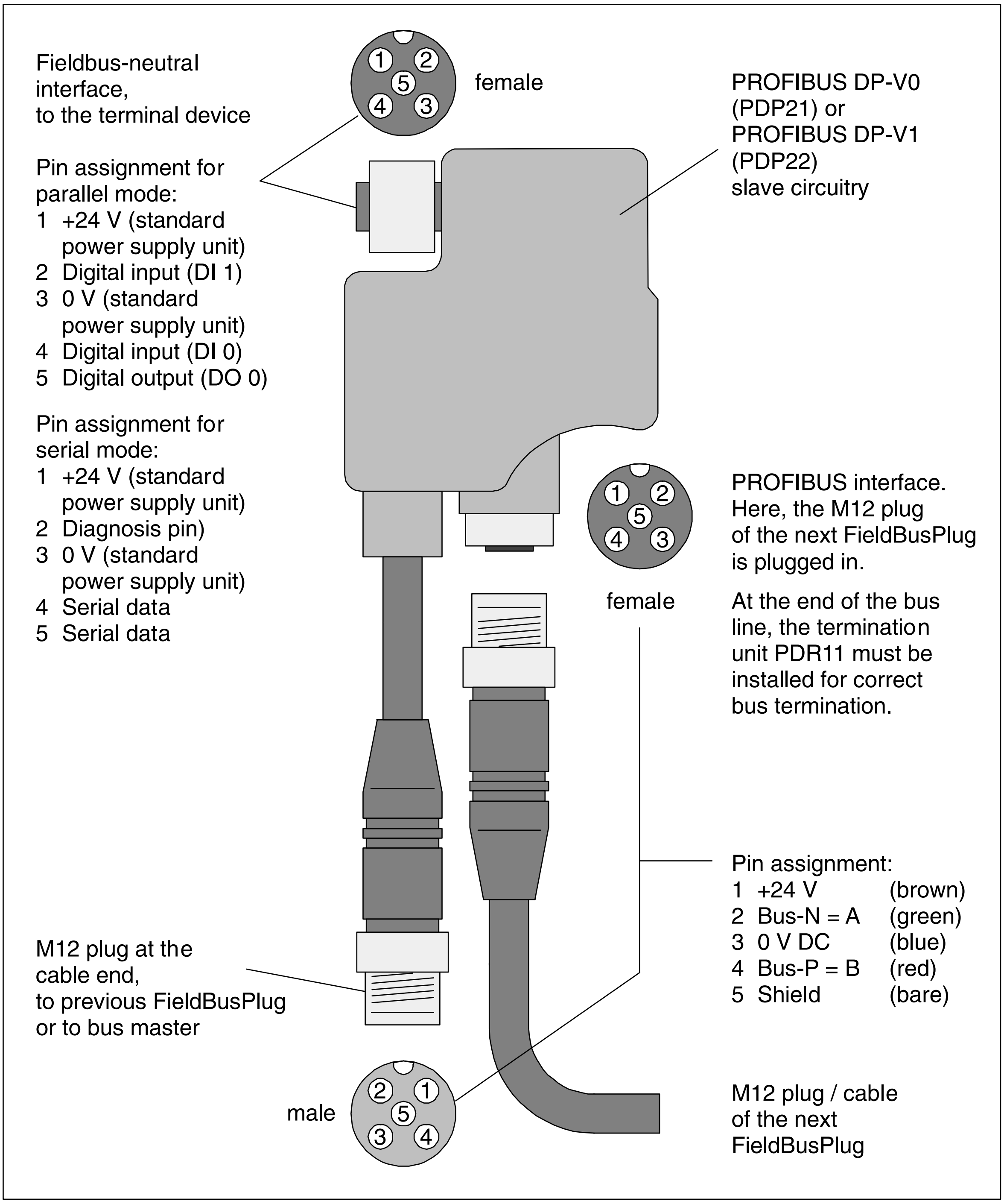
The max. data rate depends directly on the bus length:

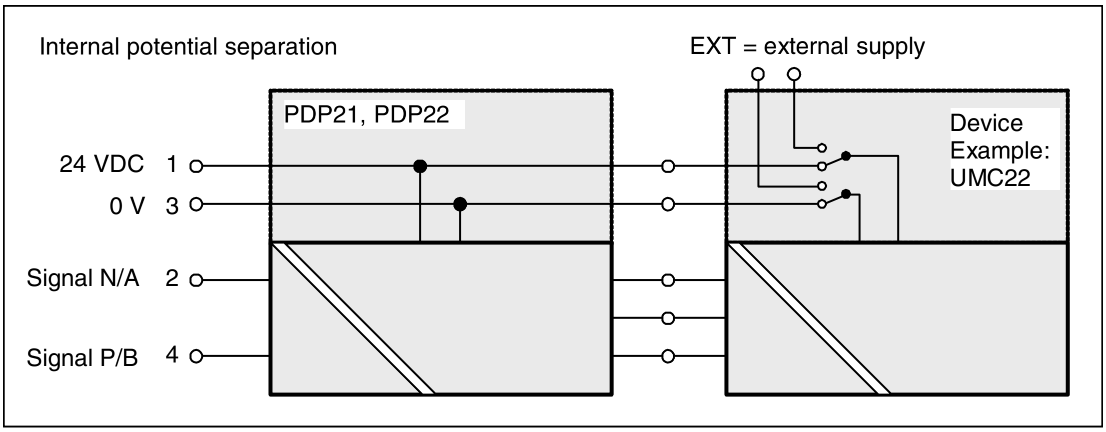
Data rate [kBit/s]	9.6 | 19.2 | 45.45 | 93.75	187.5	500	1500	3000 | 6000 | 12000
Bus length [m]	800	650	300	160	80
max. drop length* [m]	*	*	6.6	0	0

* The max drop length is defined by the standard only for 500 kBit/s, but for lower data rates higher drop lengths are possible. Higher data rates do not allow drop lines.

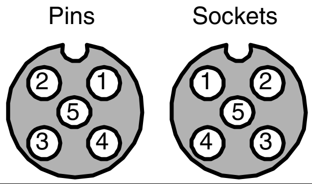
Technical data of the FBPs

PDP21, PDP22, pin assignment





Technical Data PDP21, PDP22

Supply voltage	24 V DC +30 % / -20 % (19.2...31.2 V DC)	
Safety insulation	PELV according to EN 60950	
Current consumption		
- at 19.2 V	46 mA	
- at 24.0 V	37 mA	
- at 31.2 V	31 mA	
Mounting	on the terminal device, fixed with a screw (provided on delivery) or by M12 box nut fixing	
Power line failure bridging time, to be performed by the power supply unit	min. 10 ms	
Recommended power supply unit	Type:	CP-24/5.0 adj.
	Order number:	1 SVR 423 416 R0100
	can be adjusted to max. 28 V DC	
Bus termination	active bus-line terminator 150 Ω at both ends of the bus, the bus master units (or repeaters) often offer a bus-line terminator at the beginning of the bus line	
Modes of data communication between FieldBusPlug and device	parallel and serial	
Scope of data	according to PROFIBUS DP specifications	
Construction of the FieldBusPlug cable	round cable, black, 2 x 0.34 mm² for supply voltage, 2 x 0.25 mm² for data lines, 2 connected shields	
PDP21, PDP22 pin assignment	1 +24 V DC (brown) 2 Bus-N = A (green) 3 0 V DC (blue) 4 BUS-P = B (rot) 5 Shield (bare)	
Warning:	Exchange of bus signal lines with supply lines can cause destruction of the plug.	
Load capacity of plugs and cables	max. 4 A	
Degree of protection	IP 65, if M12 box nut fixing is used at the terminal device (e.g. sensor), IP 20, if mounting is performed using the supplied fastening screw (e.g. for UMC22-FBP)	
Ambient temperature		
- storage	-20°C...+70°C	
- operation	0...+55°C	
Dimensions	see	
Total power dissipation PDP21, PDP22	max. 0.9 W	
Weight - plug with cable 0.25 m - plug with cable 0.5 m - plug with cable 1.0 m - plug with cable 5.0 m	 0.09 kg 0.10 kg 0.13 kg 0.35 kg	
Bus address setting	- with address switches or similar on the terminal device - with addressing set CAS21-FBP	
Address range	1 to 126, recommended 3 to 125, 0 to 2 and 126 to 128 are reserved for particular tasks	
Diagnosis with LEDs	see PDP21, PDP22 description "Indicators on the front panel"	

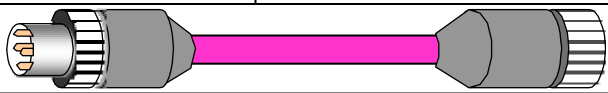
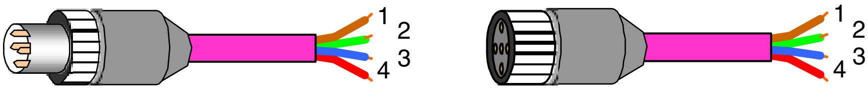
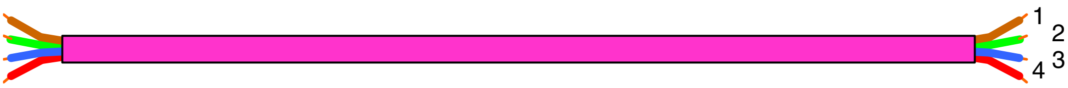
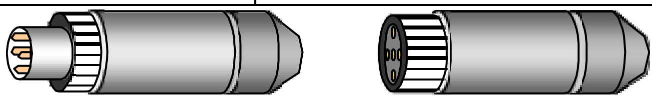
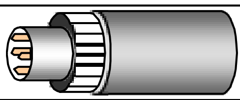
Ordering data PDP21, PDP22

PROFIBUS DP-V1 (for AC500 / S500-FBP devices)

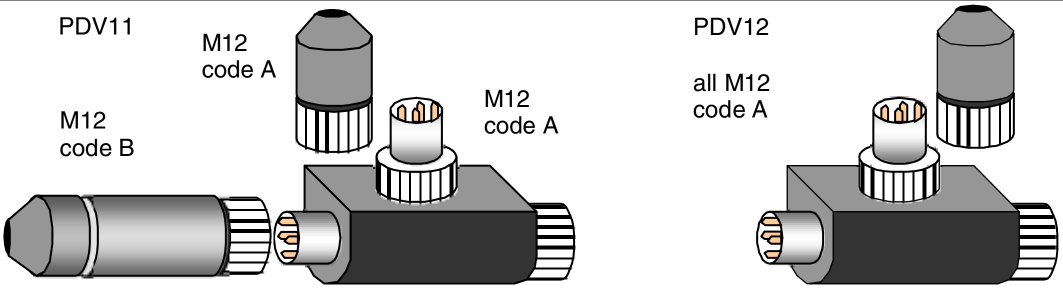
> **Note:** The PROFIBUS DP-V1 FBPs can be used with all the FBP devices which use the normal FBP-V0 plug. **The AC500 or S500-FBP absolutely need the DP-V1 FBP and cannot be used with the simple DP-V0 FBP.**

Type	Description	Order number
PDP22-FBP.025	PROFIBUS DP-V1 FieldBusPlug 0.25 m	1SAJ 240 100 R1003
PDP22-FBP.050	PROFIBUS DP-V1 FieldBusPlug 0.5 m	1SAJ 240 100 R1005
PDP22-FBP.100	PROFIBUS DP-V1 FieldBusPlug 1.0 m	1SAJ 240 100 R1010
PDP22-FBP.500	PROFIBUS DP-V1 FieldBusPlug 5.0 m	1SAJ 240 100 R1050

Accessories

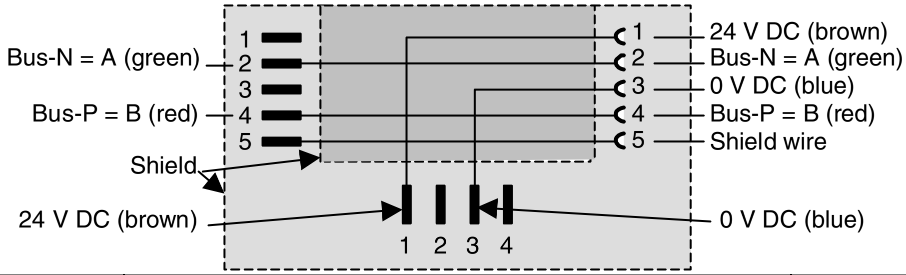
Type	Description	Order number
		
PDX11-FBP.100	PROFIBUS DP Extension Cable 1 m	1SAJ 924 001 R0010
PDX11-FBP.300	PROFIBUS DP Extension Cable 3 m	1SAJ 924 001 R0030
PDX11-FBP.500	PROFIBUS DP Extension Cable 5 m	1SAJ 924 001 R0050
		
PDF11-FBP.050	PROFIBUS DP Cable with female connector	1SAJ 924 002 R0005
PDM11-FBP.050	PROFIBUS DP Cable with male connector	1SAJ 924 003 R0005
		
PDC11-FBP.999	PROFIBUS DP Round Cable 100 m	1SAJ 924 004 R1000
		
PDM11-FBP.0	PROFIBUS DP Male Assembling Connector	1SAJ 924 005 R0001
PDF11-FBP.0	PROFIBUS DP Female Assembling Connector	1SAJ 924 006 R0001
Note: Mount carefully. Loose contacts cause communication problems.		
		
PDR11-FBP.150	PROFIBUS DP Termination Unit	1SAJ 924 007 R0001

Type	Description	Order number

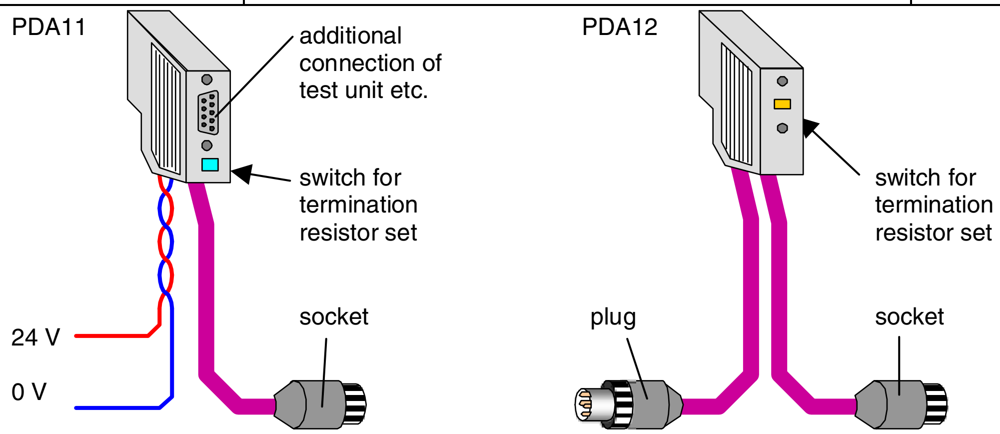


Type	Description	Order number
PDV11-FBP.0	PROFIBUS DP Feed-In Connector Code B-A	1SAJ 924 008 R0001
PDV12-FBP.0	PROFIBUS DP Feed-In Connector Code A-A	1SAJ 924 011 R1010

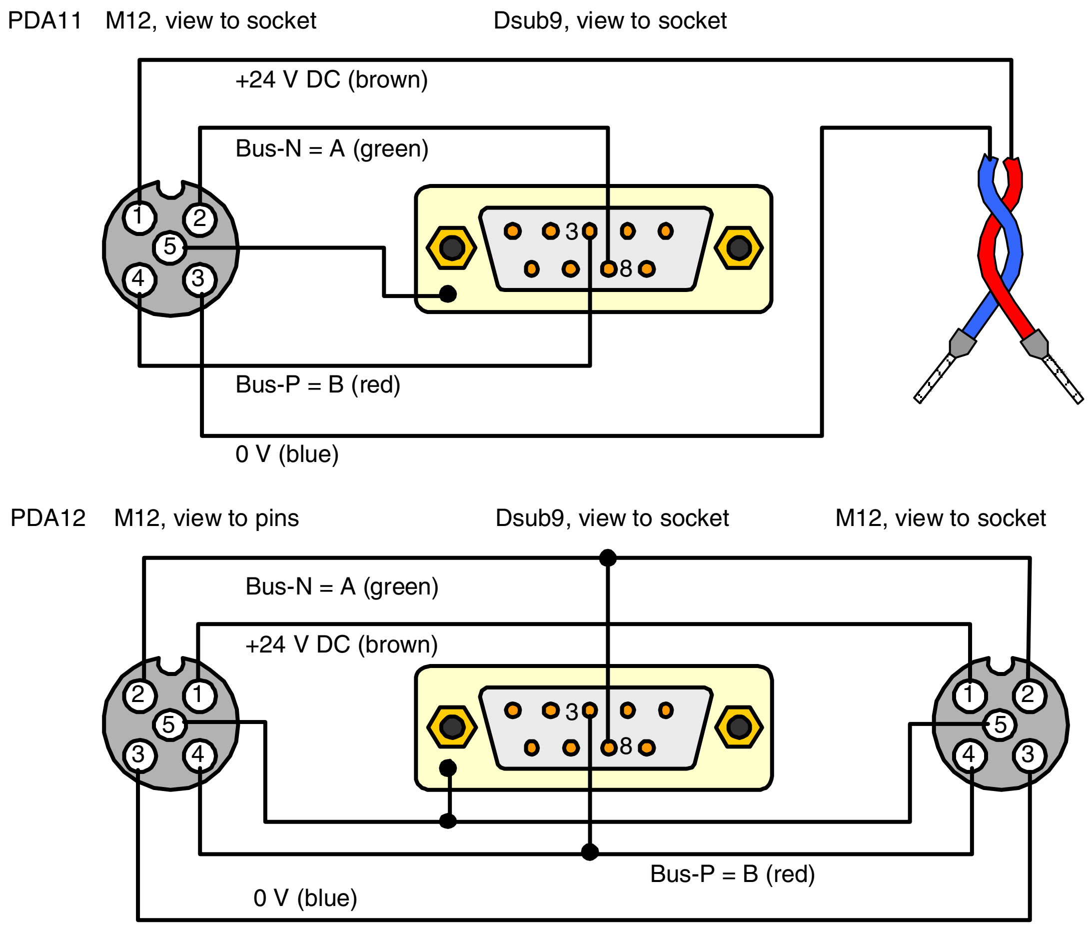
PDV11, PDV12, Circuit diagram



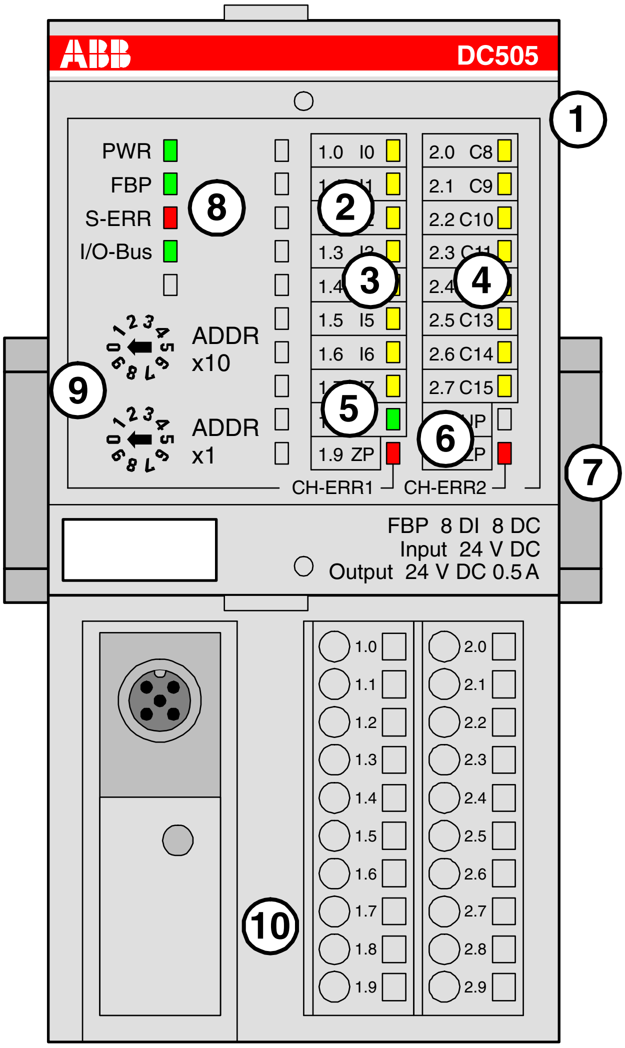
Type	Description	Order number
PDA11_FBP.050	PROFIBUS DP Adapter Cable Dsub9-M12	1SAJ 924 009 R0005
PDA12-FBP.050	PROFIBUS DP Adapter Cable M12-Dsub9-M12	1SAJ 924 010 R0005



PDA11, PDA12, Circuit Diagrams



FBP Interface Module DC505-FBP with digital inputs and outputs
- with power supply and neutral interface for the FieldBusPlug
- 8 digital inputs 24 V DC, 8 configurable digital inputs/outputs
- module-wise electrically isolated



Elements of the FBP Interface Module DC505-FBP

1 I/O-Bus (10-pole, female) to electrically connect the first expansion module

2 Allocation between terminal No. and signal name

3 8 yellow LEDs to display the signal statuses at the inputs I0 to I7

4 8 yellow LEDs to display the signal statuses at the inputs/outputs C8 to C15

5 1 green LED to display the process voltage UP

6 2 red LEDs to display errors (CH-ERR1 and CH-ERR2)

7 DIN rail

8 4 system LEDs:
PWR = Voltage (system)
FBP = FBP communication
S-ERR = Sum Error
I/O-Bus = I/O-Bus communication

9 2 rotary switches to set the module address (00 to 99)

10 FBP Terminal Unit (TU505 or TU506) with 20 terminals (screw-type or spring terminals)

Figure: FBP Interface Module DC505-FBP, plugged on a FBP Terminal Unit TU506

Contents

Intended purpose

> **Important:** Currently, the FBP Interface Module DC505-FBP con only be used together with the PROFIBUS DP "**Modular**" FBP V0/V1 (order No. 1SAJ 240 100 R10xx) and the corresponding GSD file ABB_091F.GSD.

The FBP Interface Module is used as a decentralized I/O module on several field busses. The bus connection is performed by a neutral FieldBusPlug interface, which allows the connection of all existing FieldBusPlugs. In addition, the FBP Interface Module provides 16 I/O channels with the following properties:

- 8 digital inputs 24 V DC in one group (1.0...1.7)
- 8 digital inputs/outputs in one group (2.0...2.7), of which each can be used
  - as an input,
  - as a transistor output with short-circuit and overload protection, 0.5 A rated current or
  - as a re-readable output (combined input/output) with the technical data of the digital inputs and outputs.

The inputs and output are electrically isolated from the other electronic circuitry of the module.

Functionality

Interface	neutral FieldBusPlug interface
Supply of the module's electronic circuitry	from the FieldBusPlug
Supply of the electronic circuitry of the I/O expansion modules attached	through the expansion bus interface (I/O-Bus)
Address switches	for setting the field bus address (0 to 99)
Digital inputs	8 (24 V DC)
Digital inputs/outputs	8 (24 V DC)
LED displays	for system displays, signal statuses, errors and power supply
External supply voltage	via the terminals ZP and UP (process voltage 24 V DC)

Electrical connection

The FBP Interface Module is plugged on the FBP Terminal Unit TU505 or TU506. Hereby, it clicks in with two mechanical locks. The Terminal Unit is mounted on a DIN rail or with 2 screws plus the additional accessory for wall mounting (TA526).

The electrical connection of the I/O channels is carried out using the 20 terminals of the FBP Terminal Unit. It is possible, to replace FBP Interface Modules and I/O modules without loosening the wiring.

> **Note:** Mounting, disassembling and electrical connection for the Terminal Units, the FBP Interface Modules and the I/O modules are described in detail in the S500 system data chapters.

The terminals 1.8 to 2.8 and 1.9 to 2.9 are electrically interconnected within the FBP Terminal Unit and have always the same assignment, independent of the inserted module:

Terminals 1.8 to 2.8: Process voltage UP = +24 V DC
Terminals 1.9 to 2.9: Process voltage ZP = 0 V

The assignment of the other terminals:

Terminals	Signal	Meaning
1.0 to 1.7	I0 to I7	8 digital inputs
2.0 to 2.7	C8 to C15	8 digital inputs/outputs

The supply voltage 24 V DC for the module's electronic circuitry comes from the FieldBusPlug.

The module provides several diagnosis functions (see chapter "Diagnosis and display").

Caution: Removal of energized modules is not permitted. All power sources (supply and process voltages) must be switched off while working on any AC500 system.

The following figure shows the electrical connection of the FBP Interface Module DC505-FBP.

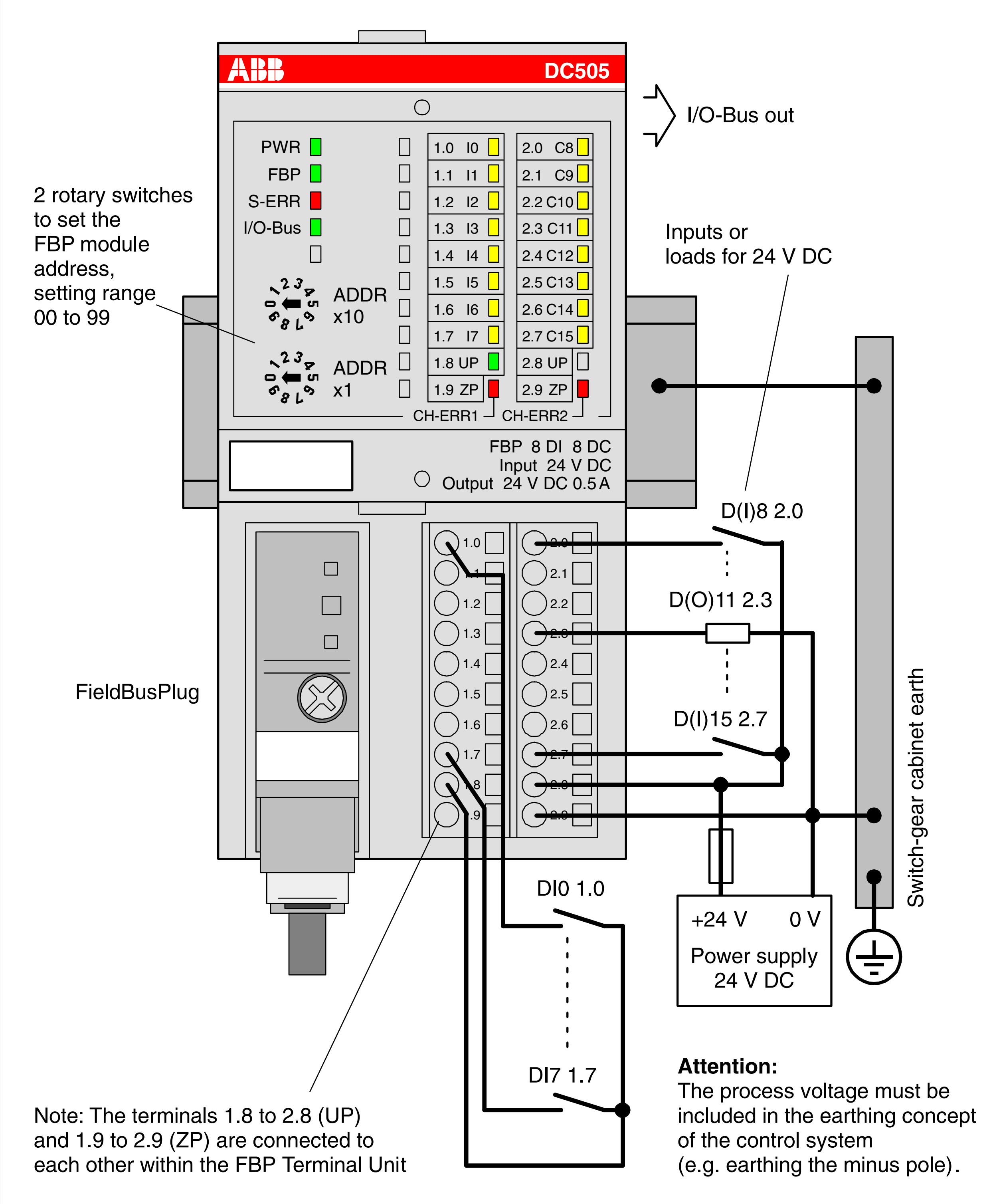


Figure: Electrical connection of the FBP Interface Module DC505-FBP

Internal data exchange

Digital inputs (bytes)	2
Digital outputs (bytes)	1
Counter input data (words)	0
Counter output data (words)	0

Addressing

An address must be set at every module so that the field bus coupler can access the specific inputs and outputs.

A detailed description concerning "addressing" can be found in the chapters "Addressing" of the CPUs and couplers.

The address (00 to 99) is set with two rotary switches on the front panel of the module.

Remark: The FBP Interface Module reads the position of the address switches only during the initialization after power ON, i.e. changes of the setting during operation remain ineffective. The set address is forwarded to the FieldBusPlug.

I/O Configuration

The DC505-FBP module does not store configuration data itself. The 8 configurable channels are defined as inputs or outputs by the user program, i.e. each of the configurable channels can used as input or output (or re-readable output) by interrogation or allocation by the user program.

Parameterization

During system start-up, the master coupler automatically sends parameter data to the slave.

The arrangement of the parameter data is performed by your master configuration software SYCON in connection with the S500 GSD files and in conjunction with the Control Builder software.

The parameter data directly influences the functionality of modules.

For non-standard applications, it is necessary to adapt the parameters into your system configuration.

Module: DC505 as master has the fixed slot number: 0x00

Nr.	Name	Value	Internal value	Internal value, type	Default	Min.	Max.	EDS Slot/ Index
	I/O-Bus master type	Internal	0 - CPU 1 - FBP	WORD	1 0x0001	0	5	0x0001
	Minimum bus cycle time [µs]	Internal	500	WORD	500 0x01f4	200	65535	0x0002
	Max. failures in succession	Internal	50	BYTE	50 0x32	0	255	0x0003
	Error LED / Failsafe function On (+16)	On Off_by_E4 Off_by_E3	0 / 16 1 / 17 2 / 18	BYTE	0 0x00			0x0004
1	I/O Module ID	Internal	1250 *1)	Word	1250 0x04e2	0	65535	0x0005
3	Parameter length	Internal	5	Byte	5-FBP 0x05	0	255	0x0006
4	Check supply	Off on	0 1	Byte	On 0x01			0x0007
5	Input delay	0.1 ms 1 ms 8 ms 32 ms	0 1 2 3	Byte	8 ms 0x02			0x0008
6	Output short-circuit detection	Off On	0 1	Byte	On 0x01			0x0009
7	Behaviour of outputs at communication errors	Off Last value Substitute value	0 1+(n*5) 2+(n*5), n <=2	Byte	Off 0x00			0x000A
8	Substitute value at outputs Bit 7 = Output 7 Bit 0 = Output 0	0...255	0... 0xff	Byte	0 0x00			0x000B

*1) With FBP, the value is increased by 1

GSD file:	Ext_User_Prm_Data_Len = Ext_User_Prm_Data_Const(0) =	14 0x00, 0x01, 0x01,0xf4, 0x32, 0x00, \ 0x04, 0xe3, 0x05, \ 0x01, 0x02, 0x01, 0x00, 0x00;

Structure of the diagnosis block via FBP with S500 DC505-FBP

If a DC505-FBP module is connected via a FieldBusPlug, then the fieldbus master receives diagnosis information by an extended diagnosis block. The following table shows the structure of this diagnosis block:

Byte number	**Description**	**Possible values**
1	Data length (header included)	18
2	FBP diagnosis byte	0 = Communication with DC505 OK 1 = Communication with DC505 failed other values according to FBP documentation
3	DC505 diagnosis byte, module number	0 = DC505 (e.g. error at the integrated 8DI/8DC) 1 = 1st attached S500 I/O module ... 7 = 7th attached S500 I/O module
4	DC505 diagnosis byte, slot	According to the I/O-Bus specification passed on by modules to the fieldbus master
5	DC505 diagnosis byte, channel	According to the I/O-Bus specification passed on by modules to the fieldbus master
6	DC505 diagnosis byte, error code	According to the I/O-Bus specification Bit 7 and bit 6, coded error class 0 = E1 1 = E2 2 = E3 3 = E4 Bit 0 to Bit 5, coded error description passed on by modules to the fieldbus master
7	DC505 diagnosis byte, flags	According to the I/O-Bus specification Bit 7: 1 = coming error Bit 6: 1 = leaving error Bit 5: 1 = Diag reset Bit 2 to Bit 4: reserved Bit 1: 1 = explicit acknowledgement Bit 0: 1 = static error passed on by modules to the fieldbus master Value = 0: static message for other systems, which do not have a coming/leaving evaluation
8ff	reserved	

Diagnosis and display

In case of overload or short-circuit, the outputs switch off automatically and try to switch on again cyclically. Therefore an acknowledgement of the outputs is not necessary. The LED error message, however, is stored.

Diagnosis:

E1..E4	d1	d2	d3	d4	Identifier 000..063	AC500 display	
Class	**Comp**	**Dev**	**Mod**	**Ch**	**Err**	**PS501 PLC browser**	**<– Display in 5)**
Byte 6 Bit 6..7	**-**	**Byte 3**	**Byte 4**	**Byte 5**	**Byte 6 Bit 0..5**	**FBP diagnosis block**	
Class	**Inter-face**	**De-vice**	**Mod-ule**	**Chan-nel**	**Error identifier**	**Error message**	**Remedy**
	1)	**2)**	**3)**	**4)**			
Module error DC505-FBP							
3	-	31	31	31	19	Checksum error in the I/O module	
3	-	31	31	31	3	Timeout in the I/O module	
3	-	31	31	31	40	Different hard-/firmware versions in the module	Replace I/O module
3	-	31	31	31	43	Internal error in the module	
3	-	31	31	31	36	Internal data exchange failure	
3	-	31	31	31	9	Overflow diagnosis buffer	New start
3	-	31	31	31	26	Parameter error	Check master
3	-	1..7	31	31	11	Process voltage too low	Check process voltage
3	-	1..7	31	31	17	No communication to the I/O module	Replace I/O module
4	-	31	31	31	45	Process voltage is switched off (ON/OFF)	Process voltage ON
4	-	31/1..7	31	31	34	No reply at initialization of the I/O module	Replace I/O module
4	-	31/1..7	31	31	32	Wrong I/O module in the slot	Replace I/O module or check configuration
4	-	1..7	31	31	31	At least one module does not support the failsafe function (can only appear with activated failsafe function).	Replace I/O module with one of version as of V1.9
Channel error DC505-FBP							
4	-	31	2	8..15	47	Short-circuit at a digital output	Check connection

Remarks:

1)	In AC500 the following interface identifier applies: 14 = I/O-Bus, 11 = COM1 (e.g. CS31 bus), 12 = COM2. The FBP diagnosis block does not contain this identifier.
2)	With "Device" the following allocation applies: 31 = Module itself, 1..7 = Expansion module 1..7
3)	With "Module" the following allocation applies: 31 = Module itself or module type (2=DO)
4)	In case of module errors, with channel "31 = Module itself" is output.
5)	Valid for the current firmware version of the AC500: Errors, which are reported by the DC505-FBP to the AC500 CPU, cannot be shown yet directly in the display of the CPU or in the PLC browser of the Control Builder PS501.

Displays:

The LEDs are on the front panels of the modules. There are two different groups:

- The 4 system LEDs (PWR, S-ERR, FBP and I/O-Bus) show the operating status of the module and indicate possible errors.
- The 19 process LEDs (UP, inputs, outputs, CH-ERR1 and CH-ERR2) display the supply voltage and signal statuses of the inputs and outputs and indicate possible errors.

All of the S500 modules have LEDs to display operating statuses and errors.

Status of the LEDs:

LED	Status	Color	LED = OFF	LED = ON	LED flashes
PWR	System voltage (supply voltage 24 V DC via FBP)	green	Missing internal system voltage or field bus supply is missing	Internal system voltage is OK	--
FBP	FBP communication	green	Communication with the field bus plug does not work correctly	Communication with the field bus plug is OK	Diagnosis mode
S-ERR	Sum error	red	No error or system voltage is missing	Internal error (storing can be parameterized)	--
I/O-Bus	Communication via the I/O-Bus	green	No expansion modules connected or data error	Expansion modules connected	Error I/O-Bus
Reserved	not defined				
I0...I7	Digital inputs	yellow	Input = OFF	Input = ON (the input voltage is even displayed if the supply voltage is OFF).	
C8...C15	Digital inputs/outputs	yellow	Input/output = OFF	Input/output = ON (the input voltage is even displayed if the supply voltage is OFF).	
UP	Process supply voltage and initialization	green	Process voltage is missing	Process voltage OK and initialization completed	Module was not initialized correctly
CH-ERR1	Channel Error, error messages in groups (digital inputs/outputs combined into the groups 1 and 2)	red	No error	Serious error within the corresponding group	Error on one channel of the corresponding group (e.g. short-circuit at an output)
CH-ERR2		red			
CH-ERR *)	Module Error	red	No error or process supply voltage is missing	Internal error	--
*) Both LEDs CH-ERR1 and CH-ERR2 light up together					

The status of the LEDs concerning the FBP Interface Module in connection with the I/O expansion modules is described in detail in the S500 system data.

Technical data

The system data of AC500 and S500 are valid here. Only additional details are therefore documented below.

Technical data of the entire module

Rated supply voltage of the module	24 V DC (through the FieldBusPlug)
Current consumption of the module	15 mA (through the FieldBusPlug)
Current consumption from the FBP (at power-up)	on request
Process voltage UP	
- rated value	24 V DC (for inputs and outputs)
- max. current loadability for the supply terminals	10 A
- Protection against reversed voltage	yes
- Rated protection fuse at UP	10 A fast
- Electrical isolation	FBP system bus interface from the rest of the module
- Inrush current from UP (at power-up)	0.008 A^2s
- Current consumption from UP at normal operation / with outputs	0.005 A + max. 0.5 A per output
- Connections	Terminals 1.8 - 2.8 for +24 V (UP) and 1.9 - 2.9 for 0 V (ZP)
Max. power dissipation within the module	6 W (outputs unloaded)
Number of digital inputs	8
Number of configurable digital inputs/outputs	8
Reference potential for all digital inputs and outputs	Minus pole of the supply voltage, signal name ZP
Address setting	with 2 rotary switches on the front panel
Diagnosis	see chapter "Diagnosis and displays"
Operating and error displays	23 LEDs altogether
Weight (without Terminal Unit)	ca. 125 g
Mounting position	horizontal or vertical with derating (output load reduced to 50 % at 40°C per group)
Cooling	The natural convection cooling must not be hindered by cable ducts or other parts in the switch-gear cabinet.

⚠ **Attention:** All I/O channels (digital and analog) are protected against reverse polarity, reverse supply, short circuit and continuous overvoltage up to 30 V DC.

Technical data of the digital inputs

Number of channels per module	8
Distribution of the channels into groups	1 group of 8 channels
Terminals of the channels I0 to I7	1.0 to 1.7
Terminals of the channels C8 to C16	2.0 to 2.7
Reference potential for all inputs	terminals 1.9...4.9 (Minus pole of the process supply voltage, signal name ZP)
Electrical isolation	from the FBP system bus
Indication of the input signals	one yellow LED per channel, the LED is ON when the input signal is high (signal 1)
Input type acc. to EN 61131-2	Type 1
Input delay (0->1 or 1-> 0)	typ. 8 ms, configurable from 0.1 to 32 ms
Input signal voltage	24 V DC
Signal 0	-3 V...+5 V
undefined signal	> +5 V...< +15 V
Signal 1	+15 V...+30 V
Ripple with signal 0	within -3 V...+5 V
Ripple with signal 1	within +15 V...+30 V
Input current per channel	
- input voltage +24 V	typ. 5 mA
- input voltage +5 V	> 1 mA
- input voltage +15 V	> 2 mA
- input voltage +30 V	< 8 mA
Max. cable length	
- shielded	1000 m
- unshielded	600 m

Technical data of the configurable digital inputs/outputs

Each of the configurable I/O channels is defined as input or output by the user program. This is done by interrogating or allocating the corresponding channel.

Number of channels per module	8 inputs/outputs (with transistors)
Distributen of the channels into groups	1 group of 8 channels
if the channels are used as inputs	
- channels I8...I15	terminals 2.0...2.7
if the channels are used as outputs	
- channels Q8...Q15	terminals 2.0...2.7
Indication of the input/output signals	one yellow LED per channel, the LED is ON when the input/output signal is high (signal 1)
Electrical isolation	from the FBP system bus

Technical data of the digital inputs/outputs if used as outputs

Number of channels per module	max. 8 transistor outputs
Reference potential for all outputs	terminals 1.9...2.9 (minus pole of the process supply voltage, signal name ZP)
Common power supply voltage	for all outputs: terminals 1.8...2.8 (plus pole of the process supply voltage, signal name UP)
Output voltage for signal 1	UP (-0.8 V)
Output delay (0->1 or 1->0)	on request
Output current	
- rated value, per channel	500 mA at UP = 24 V
- maximum value (all channels together)	10 A
Leakage current with signal 0	< 0.5 mA
Rated protection fuse	10 A fast
De-magnitization when inductive loads are switched off	with varistors integrated in the module (see figure below)
Switching frequency	
- with resistive loads	on request
- with inductive loads	max. 0.5 Hz
- with lamp loads	max. 11 Hz with max. 5 W
Short-circuit proof / overload proof	yes
Overload message (I > 0.7 A)	yes, after ca. 100 ms
Output current limitation	yes, automatic reactivation after short-circuit/overload
Resistance to feedback against 24V signals	yes
Max. cable length	
- shielded	1000 m
- unshielded	600 m

The following drawing shows the circuitry of a digital input/output with the varistors for demagnitization when inductive loads are switched off.

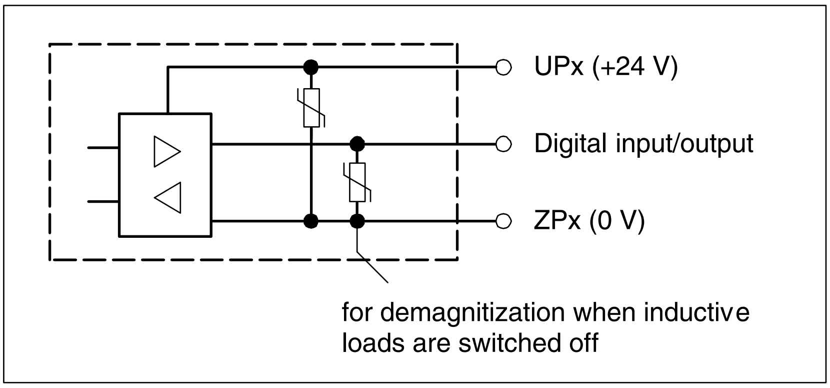


Figure: Digital input/output (circuit diagram)

Technical data of the digital inputs/outputs if used as inputs

Number of channels per module	max. 8 digital inputs
Reference potential for all inputs	terminals 1.9...2.9 (minus pole of the process supply voltage, signal name ZP)
Input current, per channel	see "Digital inputs"
Input type acc. to EN 61131-2	Type 1
Input delay (0->1 or 1->0)	typ. 8 ms, configurable from 0.1 to 32 ms
Input signal voltage	24 V DC
Signal 0	-3 V...+5 V *
undefined signal	> +5 V...< +15 V
Signal 1	+15 V...+30 V
Ripple with signal 0	within -3 V...+5 V *
Ripple with signal 1	within +15 V...+30 V
Max. cable length	
- shielded	1000 m
- unshielded	600 m

* Due to the direct connection to the output, the demagnetizing varistor is also effective at the input (see figure) above. This is why the difference between UPx and the input signal may not exceed the clamp voltage of the varistor. The varistor limits the voltage to approx. 36 V. Following this, the input voltage must range from - 12 V to + 30 V when UPx = 24 V and from - 6 V to + 30 V when UPx = 30 V.

Ordering data

Order No.	**Scope of delivery**
1SAP 220 000 R0001	DC505-FBP, FBP Interface Module, 8 DI / 8 DC
1SAP 210 200 R0001	TU505, FBP Terminal Unit, screw-type terminals
1SAP 210 000 R0001	TU506, FBP Terminal Unit, spring terminals

CS31 Bus Modules S500, Overview

High-speed counter
- integrated in digital S500 I/O modules
- integrated in the S500 CS31 Bus Module

Contents

General

Several of the S500 expansion modules have an integrated high-speed counter. If this counter is used, it uses up to 2 digital inputs and one digital output (provided that it is available). The counter can be deactivated. Is in this case, the inputs and outputs reserved for the counter are usable for other tasks. The counter only works with expansion modules which are mounted at the I/O-Bus of an AC500 CPU. An exception is the CS31 Bus Module DC551-CS31, which contains a high-speed counter that is made operationally by the address setting on the module.

The following table shows, which of the S500 modules contain a high-speed counter and which of the digital inputs and outputs are reserved for the counter.

High-speed counters integrated in S500 modules					
Module	integrated high-speed counter	assigned inputs 1)		assigned output	Remarks
		channel A	channel B	channel C 2) or (CF)	
AI523 / AO523	no	-	-	-	
AX521 / AX522	no	-	-	-	
DC505-FBP	no	-	-	-	
DC522	yes	C8	C9	C10	The counter only works with expansion modules which are mounted at the I/O-Bus of an AC500 CPU.
DC523	yes	C16	C17	C18	
DC532	yes	C24	C25	C26	
DI524	yes	I24	I25	no hardware output available	
DX522	yes	I0	I1	the counter does not activate any relay output	
DC551-CS31	yes	C16	C17	C18	Counting function is activated by the address setting on the module 3)
DX531	no	-	-	-	

1) The two hardware inputs (channels A and B) are also and always available within the normal process image, independent of the operating mode of the counter.

2) The hardware output channel C is activated by the high-speed counter only in the operating modes 1 and 2. In the other operating modes, this output can be used for other purposes.

3) The counting function of the CS31 Bus Module can only be activated, if a bus address greater than 70 is set on the module by means of the address rotary switches. In this case, the effective bus address equals the set address minus 70 and the counter is ready for operation. An example: A set bus address of 83 means that the effective bus address = (83 - 70) = 13 and that the integrated high-speed counter can be used.

Features

The counting function is performed within the expansion module. It works independently of the user program and is therefore able to response quickly to external signals. A simultaneous counting operation of several expansion modules is possible.

Each module counter can be configured for one mode out of 10 possible ones. The desired operating mode is selected in the PLC configuration using module parameters. After that, it is activated during the initialization phase (power-on, cold start, warm start).

The data exchange to and from the user program is performed using input and output operands. While integrating a module containing a high-speed counter in the PLC configuration, the necessary operands are created and reserved immediately. Thus a counter implementation carried out later on does not cause an address shift.

Features independent of the counter operating mode

- The pulses at the counters' inputs or the evaluated signals of the traces A and B in case of incremental position sensors are counted.
- The maximum counting frequency is 50 kHz. In certain operating modes, the maximum counting frequency is lower.
  If using the modules DC522, DC523, DC532 and DC551, each counting input must externally be circuited in series with a resistor of 470 Ω / 1 W, in order to safely avoid influences from the deactivated module outputs to the connected sensors.
- The positive signal edges are counted, if not noted differently.
- By setting the operating mode 0, the counting function is switched off. In this case, the reserved inputs and outputs can be used for other tasks. Simultaneous use of these terminals for the counter and other signals must be avoided.
- The counter's actual value is provided as a double word (32 bits).
- The counter can count upwards in all operating modes. It counts beginning at the start value (set value) up to the end value (max. from 0 to 4,294,967,295 or hexadecimal from 00 00 00 00 to FF FF FF FF. After reaching 4,294,967,295, the counter jumps with the next pulse to 0. When the counter reaches the programmed end value, the counter output is stored permanently as CF = TRUE (end value reached). Only when the counter is set again (set value), CF is reset to FALSE.
- The high-speed counters cannot be used with expansion modules which are mounted besides the CS31 Bus Module DC551-CS31 or the FBP Interface Module DC505-FBP.

Operands

Input information for the high-speed counter	<–	Output information of the user program
Start Value 0	<–	Output double word 0
End Value 0	<–	Output double word 1
Start Value 1	<–	Output double word 2
End Value 1	<–	Output double word 3
Control Byte 0	<–	Output byte 0
Control Byte 1	<–	Output byte 1

Meaning of the input informationen for the high-speed counter:		
Start value 0	Double word	Set values for the counters 0 and 1: Each counter can be set to a start value. Start values are loaded into the counter by the user program. Using the set signal (dependent on the operating mode either via a terminal or the bit SET within the control byte 0 or 1), the values of the double word variables are loaded into the counter 0 or 1.
Start value 1	Double word	
End value 0	Double word	End value for the counters 0 and 1: The end values for the two counters are stored as comparison values into the module by the user program. Both counters compare continuously whether or not their programmed end value is equal to their actual value. When the counter (actual value) reaches its programmed end value, the binary output CF of the status byte is set permanently.
End value 1	Double word	
Control byte 0	Byte: Bit 0 = UP/DWN Bit 1 = EN Bit 2 = SET Bit 3 to Bit 7 free	Control bytes for the counters 0 and 1: UP/DWN: In some operating modes, the counter can count downwards, too. If counting down is desired, the bit UP/DWN must be set to TRUE. When doing so, the counter starts counting downwards at the start value (set value) to the end value (max. from 4,294,967,295 to 0 or hexadecimal from FF FF FF FF to 00 00 00 00). After reaching 0 the counter jumps to 4,294,967,295. EN: The processing of the counter signals must be enabled. Depending on the operating mode, enabling is done via a terminal or by the bit EN = TRUE within the control byte. SET: The counter can be set to a start value (see the description of the set values for the counters 0 and 1 at the beginning of this table.
Control byte 1		

Output information of the high-speed counter	–>	Input information for the user program
Actual Value 0	–>	Input double word 0
Actual Value 1	–>	Input double word 1
Status Byte 0	–>	Input byte 0
Status Byte 1	–>	Input byte 1

Meaning of the output informationen of the high-speed counter:		
Actual Value 0	Double word	Actual value of the counter 0
Actual Value 1	Double word	Actual value of the counter 1
Status Byte 0 Status Byte 1	Byte: Bit 0 = CF Bit 1 to Bit 7 free	CF: When the counter reaches the programmed end value, the counter output is stored permanently as CF = TRUE (end value reached). Only when the counter is set again (set value), CF is reset to FALSE.

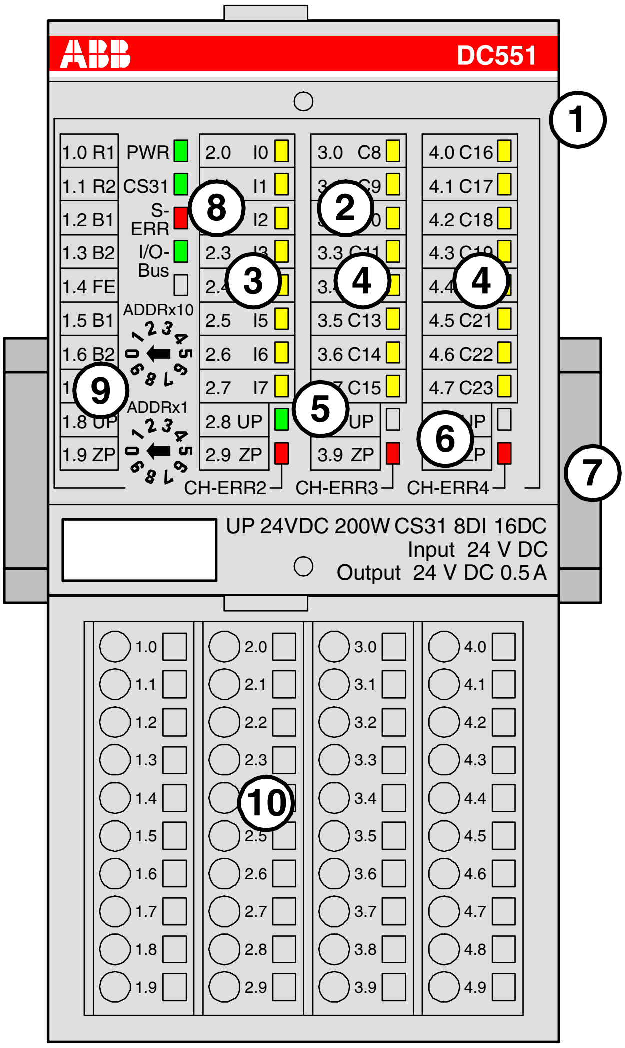
Operating modes

Inputs and outputs which are not used by the counters, are available for other tasks. In the following table, **A** means Input Channel A, **B** means Input Channel B and **C** means Output Channel C (refer also to the table in the "General" chapter.

Opera-ting mode	Function	Used inputs and outputs	Notes
0	No counter	none	This operating mode is selected, if the integrated high-speed counter is not necessary.
1	One up-counter	A = Counting input C = End value reached	The counting input and the output "End value reached) are enabled by the bit EN = TRUE within the control byte.
2	One up-counter with enable input via terminal	A = Counting input B = Enable input C = End value reached	The enable input enables the counting input and the output "end value reached" as well. The counter is only enabled, if the enable input = TRUE (signal 1) AND the bit EN = TRUE within the control byte.
3	Two up/down counters	A = Counting input 0 B = Counting input 1	With this operating mode, two counters, which are independent of each other, exist. The status "End value reached" is only readable from the two status bytes, not from output terminals. The counting direction is defined by the bit UP/DWN within the control byte.
4	Two up/down counters (1 counting input inverted)	A = Counting input 0 B = Counting input 1	This operating mode equals operating mode 3 with one exception: The counting input B (of counter 1) is inverted. It counts the TRUE/FALSE edges at input B.
5	One up/down counter with a dynamic set input via terminal	A = Counting input B = Dynamic set input	With this operating mode, one up/down counter is available which has a dynamic set input. Dynamic here means, that the set operation is performed at the FALSE/TRUE signal edge (0/1 edge) of the set input and not during the signal is TRUE. The status "End value reached" is only readable from the status byte, not from an output terminal.

6	One up/down counter with a dynamic set input via terminal	A = Counting input B = Dynamic set input	This operating mode equals operating mode 5 with one exception: The dynamic set input operates at the TRUE/FALSE edge (1-0 edge).
7	One up/down counter for position sensors	A = Trace A of the position sensor B = Trace B of the position sensor	With this operating mode, incremental position sensors can be used which give their counting signals on tracks A and B in a 90° phase sequence to each other. Dependent on the sequence of the signals at A and B, the counter counts up or down. There is no pulse multiplier function (e.g. x2 or x4). The position sensor must provide 24 V signals. Signals of 5 V sensors must be converted. A zero-trace is not processed. The status "End value reached" is only readable from the status byte 0, not from an output terminal. The bit UP/DWN within the control byte must be FALSE. Otherwise a parameter error is generated. In this operating mode, the maximum counting frequency is 35 kHz.
8	Reserved		
9	One up/down counter for position sensors (pulse multiplier x2)	A = Trace A of the position sensor B = Trace B of the position sensor	This operating mode equals operating mode 7 with one exception: There is a pulse multiplication x2 with the evaluation of the counting inputs. This means, that the counter counts both the positive edges and the negative edges of trace A. This results in the double number of counting pulses. The precision increases correspondingly. In this operating mode, the maximum counting frequency is 30 kHz.
10	One up/down counter for position sensors (pulse multiplier x4)	A = Trace A of the position sensor B = Trace B of the position sensor	This operating mode equals operating mode 7 with one exception: There is a pulse multiplication x4 with the evaluation of the counting inputs. This means, that the counter counts the positive and negative edges of the traces A and B. This results in the fourfold number of counting pulses. The precision increases correspondingly. In this operating mode, the maximum counting frequency is 15 kHz.

CS31 Bus Module DC551-CS31 with digital inputs and outputs
- 8 digital inputs 24 V DC, 16 configurable digital inputs/outputs
- module-wise electrically isolated



Elements of the CS31 Bus Module DC551-CS31

1 I/O-Bus (10-pole, female) to electrically connect the first expansion module

2 Allocation between terminal No. and signal name

3 8 yellow LEDs to display the signal statuses at the inputs I0 to I7

4 16 yellow LEDs to display the signal statuses at the inputs/outputs C8 to C23

5 1 green LED to display the process voltage UP

6 3 red LEDs to display errors (CH-ERR1, CH-ERR2 and CH-ERR3)

7 DIN rail

8 4 system LEDs:
PWR = Voltage (system)
CS31 = CS31 communication
S-ERR = Sum Error
I/O-Bus = I/O-Bus communication

9 2 rotary switches to set the module address (00 to 99)

10 CS31 Bus Terminal Unit (TU551 or TU552) with 40 terminals (screw-type or spring terminals)

Figure: CS31 Bus Module DC551-CS31, plugged on a CS31 Bus Terminal Unit TU552

Contents

Intended purpose

Important: Currently, the CS31 Bus Module DC551-CS31 can only be used together with the AC500 CPUs and dedicated PS501 Control Builder.

The CS31 Bus Module is used as a decentralized I/O module on CS31 field buses. The bus connection is performed on a RS485 serial interface, which allows the connection of this module to all existing CS31 buses. In addition, the CS31 Bus Module provides 24 I/O channels with the following properties:

- 8 digital inputs 24 V DC in one group (2.0...2.7)
- 16 digital inputs/outputs in one group (3.0...4.7), of which each can be used
  - as an input,
  - as a transistor output with short-circuit and overload protection, 0.5 A rated current or
  - as a re-readable output (combined input/output) with the technical data of the digital inputs and outputs.

The inputs and output are electrically isolated from the other electronic circuitry of the module.

Functionality

Interface	RS485, CS31 protocol
Supply of the module's electronic circuitry	from UP and ZP (power supply)
Supply of the electronic circuitry of the I/O expansion modules attached	through the expansion bus interface (I/O-Bus)
Address switches	for setting the CS31 field bus address (0 to 99)
Digital inputs	8 (24 V DC)
Digital inputs/outputs	16 (24 V DC)
High-speed counter	integrated, many configurable operating modes
LED displays	for system displays, signal statuses, errors and power supply
External supply voltage	via the terminals ZP and UP (process voltage 24 V DC)

Electrical connection

The CS31 Bus Module is plugged on the CS31 Terminal Unit TU551 or TU552. Hereby, it clicks in with two mechanical locks. The Terminal Unit is mounted on a DIN rail or with 2 screws plus the additional accessory for wall mounting (TA526).

The electrical connection of the I/O channels is carried out using the 40 terminals of the CS31 Terminal Unit. It is possible, to replace CS31 Bus Modules and I/O modules without loosening the wiring.

Note: Mounting, disassembling and electrical connection for the Terminal Units, the FBP Interface Modules and the I/O modules are described in detail in the S500 system data chapters.

The terminals 1.8 to 4.8 and 1.9 to 4.9 are electrically interconnected within the CS31 Bus Terminal Unit and have always the same assignment, independent of the inserted module:

Terminals 1.8 to 4.8: Process voltage UP = +24 V DC
Terminals 1.9 to 4.9: Process voltage ZP = 0 V

The assignment of the other terminals:

Terminals	Signal	Meaning
1.0 to 1.7	RS485	CS31 bus interface
2.0 to 2.7	I0 to I7	8 digital inputs
3.0 to 4.7	C8 to C23	16 digital inputs/outputs

The supply voltage 24 V DC for the module's electronic circuitry comes from the ZP/UP terminals.

The module provides several diagnosis functions (see chapter "Diagnosis and display").

⚠ **Caution:** Removal of energized modules is not permitted. All power sources (supply and process voltages) must be switched off while working on any AC500 system.

The following figure shows the electrical connection of the CS31 Bus Module DC551-CS31.

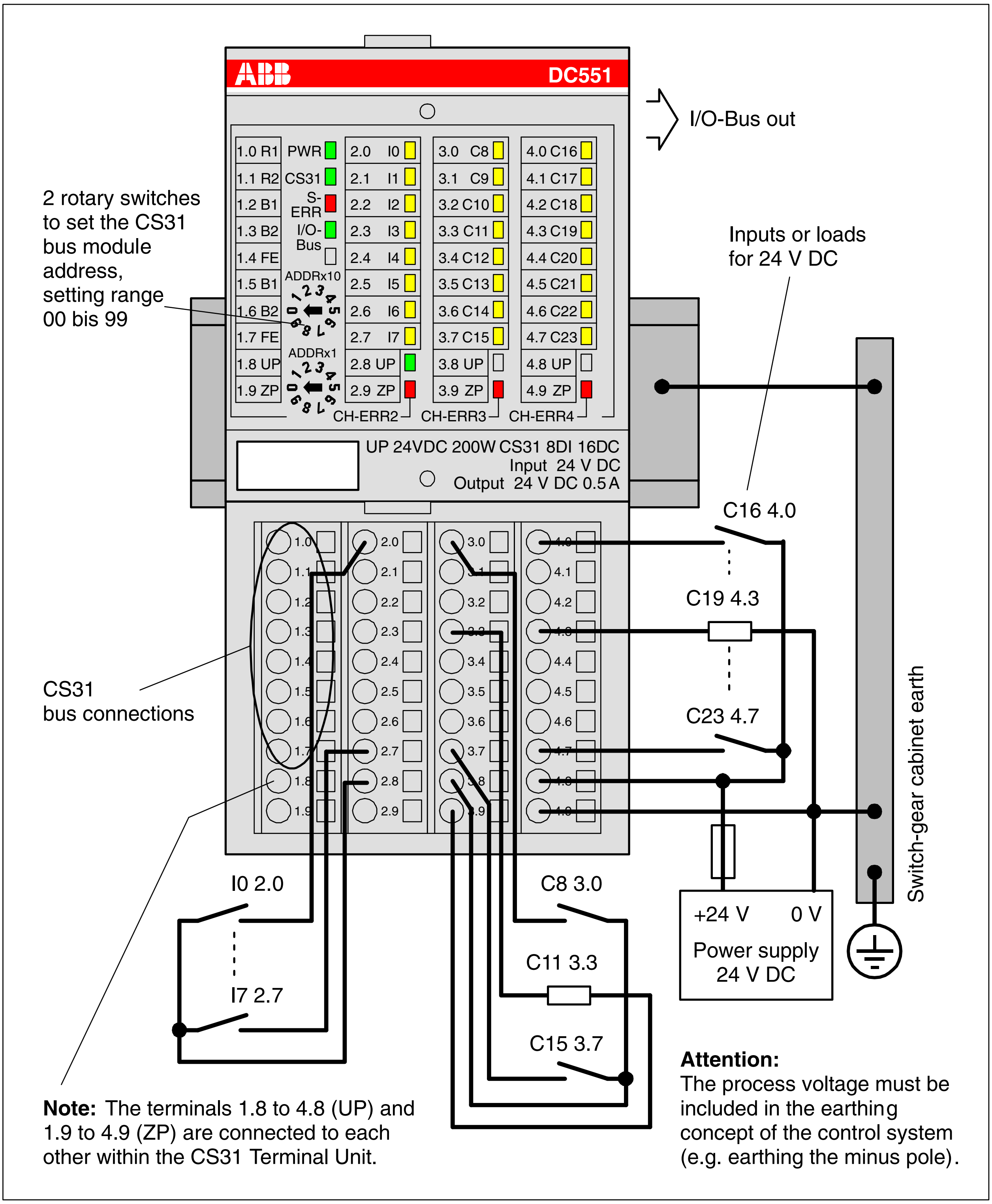


Figure: Electrical connection of the CS31 Bus Module DC551-CS31

CS31 bus connections

The CS31 bus is connected through the Terminal Unit with the terminals 1.0 to 1.7. The end-of-line resistor can also be activated by using external wire jumpers.

The following figure shows a CS31 Bus module at the end of the CS31 Bus (end-of-line resistor activated).

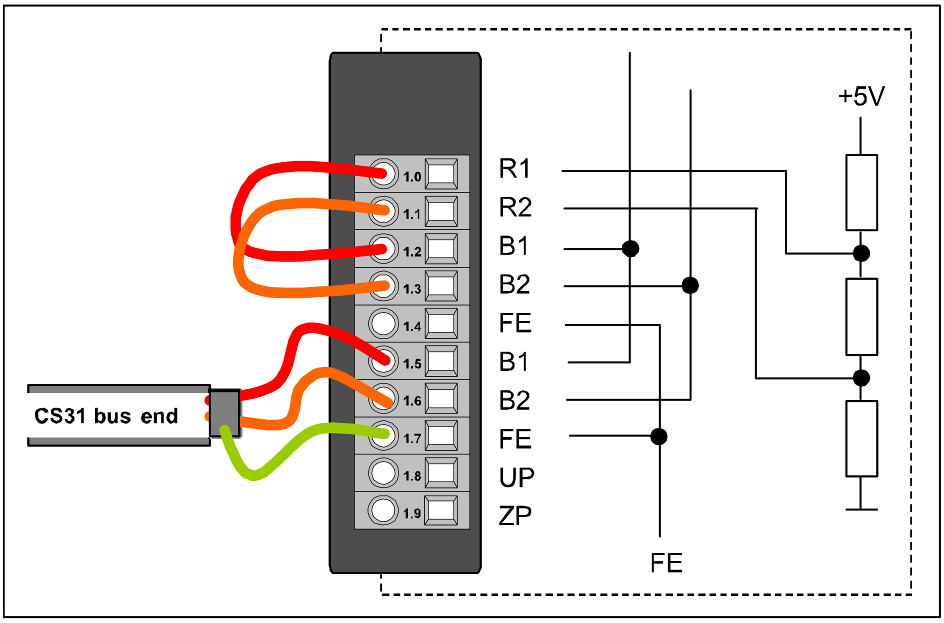


Figure: CS31 Bus module at the end of the CS31 Bus

The following figure shows a CS31 Bus module in the middle of a CS31 Bus (end-of-line resistor not activated).

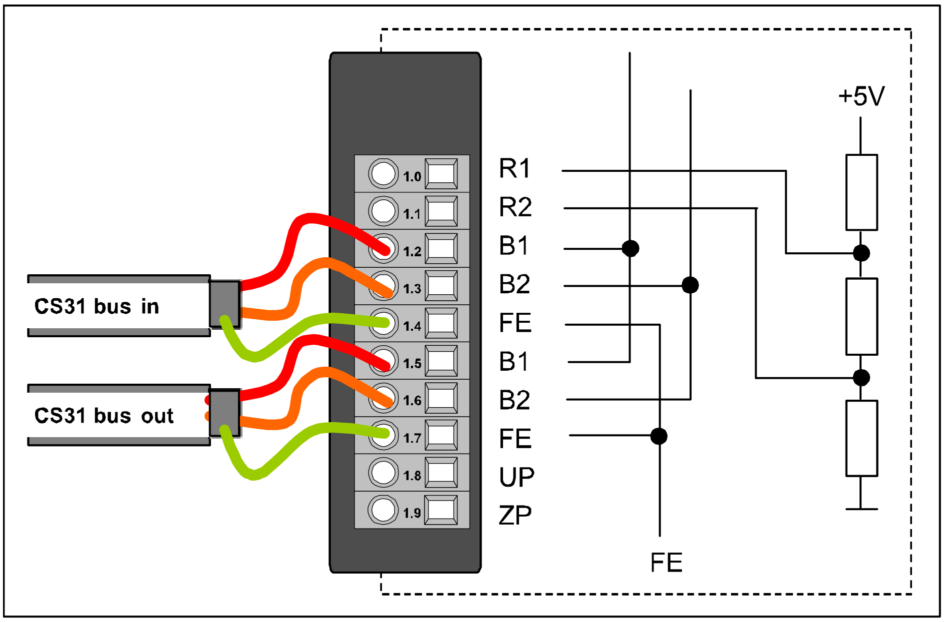


Figure: CS31 Bus module in the middle of the CS31 Bus

Internal data exchange

	without the high-speed counter	with the high-speed counter (only with AC500)
Digital inputs (bytes)	3 + expansion modules (see obove)	5 + expansion modules (see obove)
Digital outputs (bytes)	2 + expansion modules (see obove)	4 + expansion modules (see obove)
Counter input data (words)	0	5 (16 DI + 4 AI)
Counter output data (words)	0	9 (16 DO + 8 AO)

Addressing

An address must be set at every module so that the field bus coupler can access the specific inputs and outputs.

A detailed description concerning "addressing" can be found in the chapters "Addressing" of the CPUs and couplers.

The address (00 to 99) is set with two rotary switches on the front panel of the module.

Remark: The CS31 Bus Module reads the position of the address switches only during the initialization after power ON, i.e. changes of the setting during operation remain ineffective.

DC551 limitations

Digital I/O:

DC551 is able to manage **up to 240 digital I/O channels.** It uses **2 digital bus addresses** in this case.

The physical address to identify the I/O is	**address n (switch address) for the 1st module (120 I/O)**
	address n + 7 + bit 8/15 = 1 for the 2nd module

To be compatible with old CPU and EC500 using this physical address, to address I/O in user programm: **Use only 6 expansions with 32 DI.**

Analog I/O:

Analog limitation to 32AI/AO with 4 bus addresses used.

Case of DC551 with high-speed counter:

An additional bus address is used for "double word" values of the high-speed counter.
The **maximum configuration** is shown in the following table.

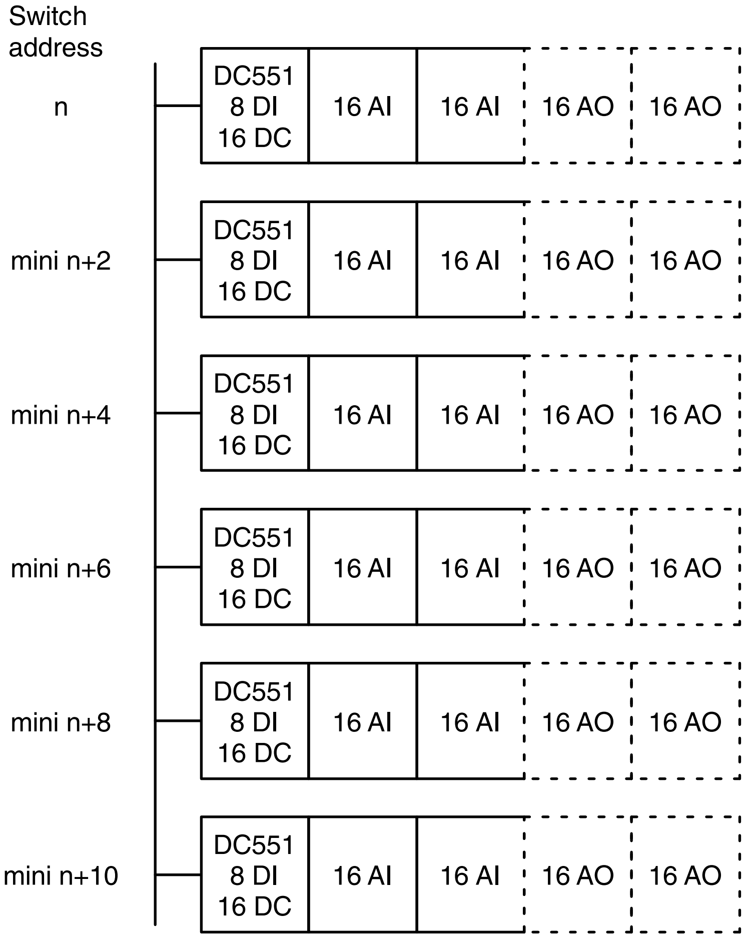
DC551 8DI + 16 DC + counter	16 AI	16 AI	DC532	DC532	DC532	DC532	DC532

The following configuration uses 7 bus addresses (the high-speed counter needs 16 DI + 16 DO + 4 AI + 8 AO):

2 bus addresses for digital I/O (24 + 16 + 5x32)DI + (16 + 16 + 5x16)DO = 200 DI (>120) + 112 DO
5 bus addresses for analog I/O (4 + 2x16)AI + 8 AO = 36 AI + 8 AO

Small overview of the addressing possibilities

Configuration example with 32 analog inputs with or without 32 analog outputs (high-speed counter not used) = 5 bus addresses by the bus module



If the number of analog outputs is less than the number of analog inputs, no additional address is necessary. Change the type from "analog in" to "analog I/O".

30 bus addresses used, 1 bus address free
192 analog inputs (+ 192 analog outputs)
48DI / 96DC (144 DI / 96 DO for CS31 and user program)

Switch address incremented to avoid control overlap.
In CPU table module switch address n will be seen as **(idem for AC500 or old CPU):**

Address n, type digital I/O, 8 DI/16DC
Address n, type analog I or I/O, 8 AI (+ 8 AO)
Address n + bit 8/15=1, type analog I or I/O, 8 AI (+ 8 AO)
Address n+1, type analog I or I/O, 8 AI (+ 8 AO)
Address n+1 + bit 8/15=1, type analog I or I/O, 8 AI (+ 8 AO)

Only difference in old CPU I/O channels are stored/updated according to the switch address.
In AC500 according to Codesys configuration table.

I/O Configuration

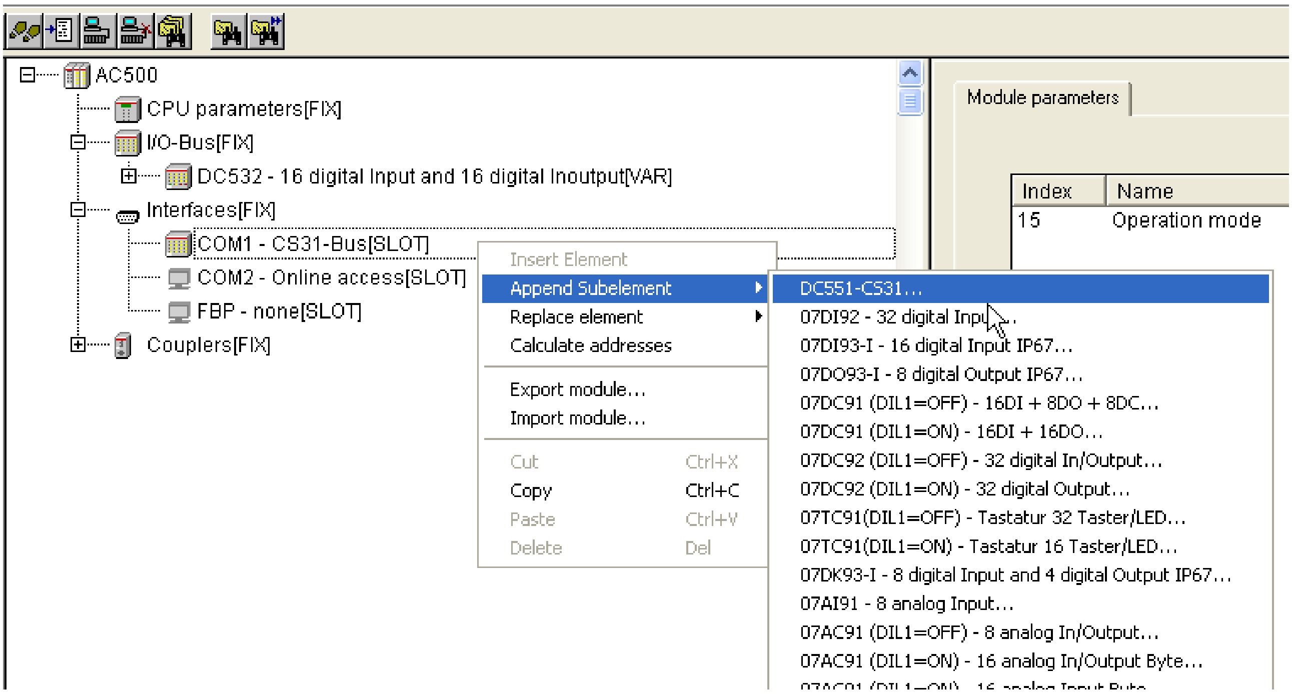
The DC551-CS31 module does not store configuration data itself. The 16 configurable channels are defined as inputs or outputs by the user program, i.e. each of the configurable channels can be used as input or output (or re-readable output) by interrogation or allocation by the user program.

Parameterization

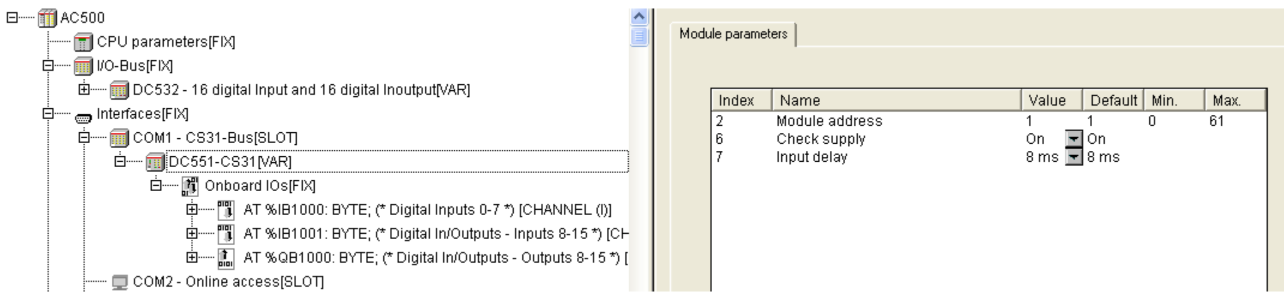
During system start-up, the master coupler automatically sends parameter data to the slave.

When the module is defined in Codesys:
Parameters are in Codesys and can be adapted to application before transfer in PLC. Then parameters will be sent to DC551 when the module connects or re-connects the bus.

By using the PLC Configurator:
Definition of CS31 Master communication on COM1, append of the 1st DC551-CS31 slave module:



The DC551-CS31 is now attached to the COM1:

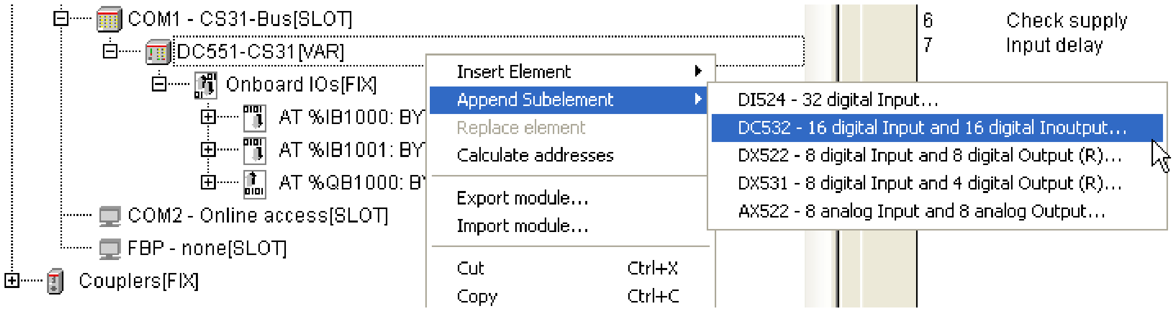


The on-board I/Os are displayed and automatically known by the AC500 Control Builder. The I/O addressing is automatically performed as for any other modules.

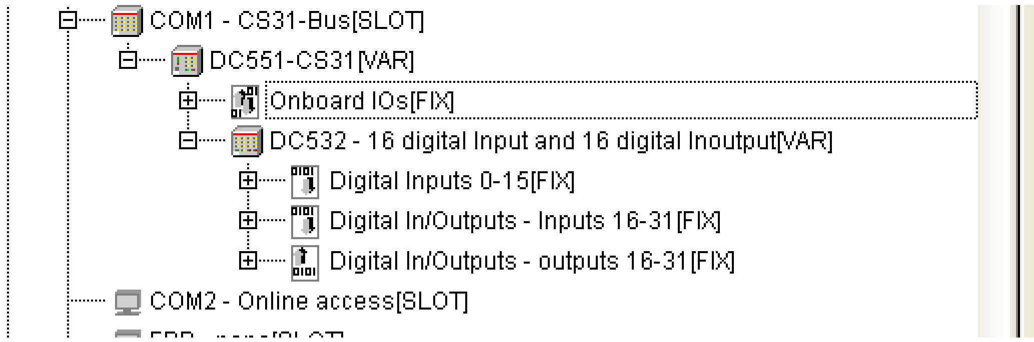
The bus address of the module, used after that by AC500 Master CS31, can be adapted to those set on the module rotary switches.

⚠ **Attention:** The AC500 PS501 Control Builder does not control the validity/integrity of the entered CS31 Bus address value during the configuration! The control is done during project compilation, then downloaded into the CPU and after starting the CPU.

The attached expansions modules of the DC551-CS31 are performed as local expansions by clicking with the right mouse button onto the DC551-CS31 bus module and using Append Subelement. See above:

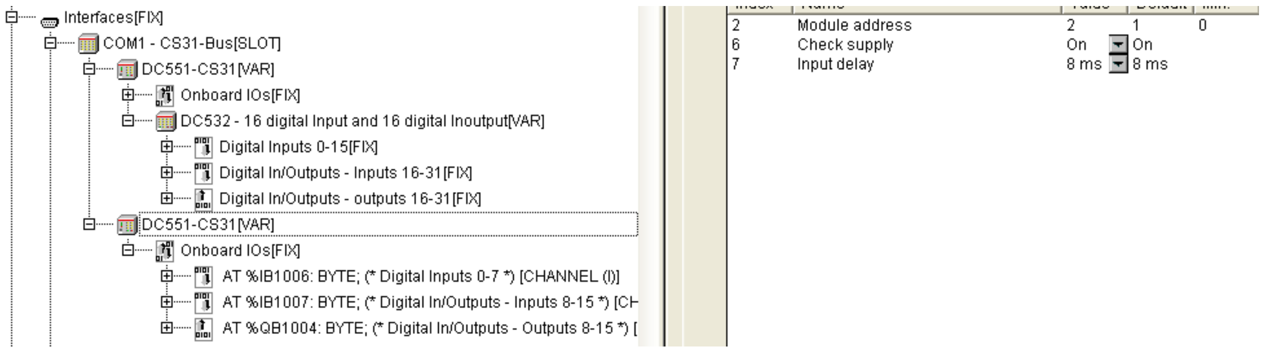


The DC532 is added as a local expansion to the DC551-CS31 Bus module:



Attention: Be careful, the AC500 PS501 Control Builder does not control the validity/integrity of amount of expansions configured (acc. to I/O limitations) during the configuration! The control is done during project compilation, then downloaded into the CPU and after starting the CPU.

Example of a CS31 bus configuration with 2 DC551-CS31 slaves:



- for EC500: Special functions must be added in the user program
- for Series 90: => use old CS31CO (write 4 bytes) or terminal command MAIL (write 4 bytes).
- (for old CPU 1 time configuration have been loaded => a command restore config from EEPROM by CS31CO can be used to avoid resend complete table)

The arrangement of the parameter data is performed by the Control Builder software.

The parameter data directly influences the functionality of modules.

For non-standard applications, it is necessary to adapt the parameters into your system configuration.

Module:

Nr.	Name	Value	Internal value	Internal value, type	Default	Min.	Max.
1	Module ID	Internal	2715 *1)	Word	2715 0x0a9b	0	65535
2	Ignore module	No Yes	0 1	Byte	No 0x00		
14	Parameter length	Internal	8 (7 * 4)	Byte	8 (7 * 4)	0	255
16	Check supply	Off on	0 1	Byte	On 0x01		
17	Input delay	0.1 ms 1 ms 8 ms 32 ms	0 1 2 3	Byte	8 ms 0x02		
18	High-speed counter	0 : 10 *3)	0 : 10	Byte	Mode 0 0x00		
Nr.+1	Detection short-circuit at outputs	off on	0 1	Byte	on 0x01		
Nr.+1	Behaviour outputs at communication errors	Off Last value Substitute value	0 1 2	Byte	off 0x00		
Nr.+1	Substitute value outputs Bit 15 = Output 15 Bit 0 = Output 0	0...65535	0...0xffff	Word	0		

*1) With CS31 and addresses less than 70, the value is increased by 1

*3) Counter operating modes, see description of the high-speed counter

*4) With CS31 and addresses less than 70, without the parameter "High-speed counter"

Structure of the diagnosis block of the DC551-CS31

If a DC551-CS31 module is connected via a CS31 bus, then the field bus master receives diagnosis information by an extended diagnosis block. The following table shows the structure of this diagnosis block:

Byte number	Description	Possible values
1	Data length (header included)	18
2	Diagnosis byte	0 = Communication with DC551 OK 1 = Communication with DC551 failed
3	DC551 diagnosis byte, module number	0 = DC551 (e.g. error at the integrated 8DI/16DC) 1 = 1st attached S500 I/O module ... 7 = 7th attached S500 I/O module
4	DC551 diagnosis byte, slot	According to the I/O-Bus specification passed on by modules to the fieldbus master
5	DC551 diagnosis byte, channel	According to the I/O-Bus specification passed on by modules to the fieldbus master
6	DC551 diagnosis byte, error code	According to the I/O-Bus specification Bit 7 and bit 6, coded error class 0 = E1 1 = E2 2 = E3 3 = E4 Bit 0 to Bit 5, coded error description passed on by modules to the fieldbus master
7	DC551 diagnosis byte, flags	According to the I/O-Bus specification Bit 7: 1 = coming error Bit 6: 1 = leaving error Bit 5: 1 = Diag reset Bit 2 to Bit 4: reserved Bit 1: 1 = explicit acknowledgement Bit 0: 1 = static error passed on by modules to the fieldbus master Value = 0: static message for other systems, which do not have a coming/leaving evaluation
8ff	reserved	

Diagnosis and display

In case of overload or short-circuit, the outputs switch off automatically and try to switch on again cyclically. Therefore an acknowledgement of the outputs is not necessary. The LED error message, however, is stored.

Diagnosis:

E1..E4	**d1**	**d2**	**d3**	**d4**	**Identifier 000..063**	**AC500 display**	**<– Display in**
Class	**Comp**	**Dev**	**Mod**	**Ch**	**Err**	**PS501 PLC browser**	
Byte 6 Bit 6..7	**-**	**Byte 3**	**Byte 4**	**Byte 5**	**Byte 6 Bit 0..5**	**FBP diagnosis block**	
Class	**Inter-face**	**De-vice**	**Mod-ule**	**Chan-nel**	**Error identifier**	**Error message**	**Remedy**
	1)	**2)**	**3)**	**4)**			
Module error DC551-CS31							
3	11	ADR	31	31	19	Checksum error in the I/O module	Replace I/O module
3	11	ADR	31	31	3	Timeout in the I/O module	
3	11	ADR	31	31	40	Different hard-/firmware versions in the module	
3	11	ADR	31	31	43	Internal error in the module	
3	11	ADR	31	31	36	Internal data exchange failure	
3	11	ADR	31	31	9	Overflow diagnosis buffer	New start
3	11	ADR	31	31	26	Parameter error	Check master
3	11	ADR	31	31	11	Process voltage too low	Check process voltage
3	11	ADR	1...7	31	17	No communication to the I/O module	Replace I/O module
4	11	ADR	31	31	45	Process voltage ON/OFF	Process voltage ON
4	11	ADR	31/1..7	31	34	No reply at initialization of the I/O module	Replace I/O module
4	11	ADR	31/1.7	31	32	Wrong I/O module in the slot	Replace I/O module or check configuration
Channel error DC551-CS31							
4	11	ADR	31/1..7	8..23	47	Short-circuit at a digital output	Check connection

Remarks:

1)	In AC500the following interface identifier applies: 11 = COM1 (protocol CS31 bus only possible with COM1)
2)	With "Device" and CS31 bus master, the hardware address of the DC551 (0...69) is output.
3)	With "Module" the following allocation applies: 31 = Module itself, 1...7 = Expansion 1...7
4)	In case of module errors, with channel "31 = Module itself" is output.

Displays:

The LEDs are on the front panels of the modules. There are two different groups:

- The 4 system LEDs (PWR, S-ERR, CS31 and I/O-Bus) show the operating status of the module and indicate possible errors.
- The 28 process LEDs (UP, inputs, outputs, CH-ERR2 to CH-ERR4) display the supply voltage and signal statuses of the inputs and outputs and indicate possible errors.

All of the S500 modules have LEDs to display operating statuses and errors.

Status of the LEDs:

LED	Status	Color	LED = OFF	LED = ON	LED flashes
PWR	System voltage	green	Missing internal system voltage or field bus supply is missing	Internal system voltage is OK	--
CS31	CS31 communication	green	No communication at the CS31 bus module	Communication at the CS31 bus OK	Diagnosis mode
S-ERR	Sum Error	red	No error or system voltage is missing	Internal error (storing can be parameterized)	--
I/O-Bus	Communication via the I/O-Bus	green	No expansion modules connected or data error	Expansion modules connected	Error I/O-Bus
Reserved	Not defined				
I0...I7	Digital inputs	yellow	Input = OFF	Input = ON (the input voltage is even displayed if the supply voltage is OFF)	
C8...C23	Digital inputs/outputs	yellow	Input/output = OFF	Input/output = ON (the input voltage is even displayed if the supply voltage is OFF)	
UP	Process supply voltage and initialization	green	Process voltage is missing	Process voltage OK and initialization completed	Module was not initialized correctly
CH-ERR2	Channel Error, error messages in groups (digital inputs/outputs combined into the groups 2 to 4)	red	No error	Serious error within the corresponding group	Error on one channel of the corresponding group (e.g. short-circuit at an output)
CH-ERR3		red			
CH-ERR4		red			
CH-ERR *)	Module Error	red	No error or process voltage is missing	Internal error	--
*) All LEDs CH-ERR2 to CH-ERR4 light up together					

The status of the LEDs concerning the CS31 Bus Module in connection with the I/O expansion modules is described in detail in the S500 system data.

Technical data

The system data of AC500 and S500 are valid here. Only additional details are therefore documented below.

Technical data of the entire module

Rated supply voltage of the module	24 V DC (UP/ZP)
Current consumption of the module (UP)	15 mA
Process voltage UP	
- rated value	24 V DC (for inputs and outputs)
- max. current loadability for the supply terminals	10 A
- Protection against reversed voltage	yes
- Rated protection fuse at UP	10 A fast
- Electrical isolation	CS31 bus interface from the rest of the module
- Inrush current from UP (at power-up)	0.040 A²s
- Current consumption from UP at normal operation / with outputs	0.1 A + max. 0.008 A per input + max. 0.5 A per output
- Connections	Terminals 1.8 - 4.8 for +24 V (UP) and 1.9 - 4.9 for 0 V (ZP)
Max. power dissipation within the module	6 W (outputs unloaded)
Number of digital inputs	8
Number of configurable digital inputs/outputs	16
Reference potential for all digital inputs and outputs	Minus pole of the supply voltage, signal name ZP
Address setting	with 2 rotary switches on the front panel
Diagnosis	see chapter "Diagnosis and displays"
Operating and error displays	32 LEDs altogether
Weight (without Terminal Unit)	ca. 125 g
Mounting position	horizontal or vertical with derating (output load reduced to 50 % at 40°C per group)
Cooling	The natural convection cooling must not be hindered by cable ducts or other parts in the switch-gear cabinet.

Attention: All I/O channels (digital and analog) are protected against reverse polarity, reverse supply, short circuit and continuous overvoltage up to 30 V DC.

Technical data of the digital inputs

Number of channels per module	8
Distribution of the channels into groups	1 group of 8 channels
Terminals of the channels I0 to I7	2.0 to 2.7
Terminals of the channels C8 to C23	3.0 to 4.7
Reference potential for all inputs	terminals 1.9...4.9 (Minus pole of the process supply voltage, signal name ZP)
Electrical isolation	from the CS31 system bus
Indication of the input signals	one yellow LED per channel, the LED is ON when the input signal is high (signal 1)
Input type acc. to EN 61131-2	Type 1
Input delay (0->1 or 1-> 0)	typ. 8 ms, configurable from 0.1 to 32 ms
Input signal voltage	24 V DC
Signal 0	-3 V...+5 V
undefined signal	> +5 V...< +15 V
Signal 1	+15 V...+30 V
Ripple with signal 0	within -3 V...+5 V
Ripple with signal 1	within +15 V...+30 V
Input current per channel	
- input voltage +24 V	typ. 5 mA
- input voltage +5 V	> 1 mA
- input voltage +15 V	> 2 mA
- input voltage +30 V	< 8 mA
Max. cable length	
- shielded	1000 m
- unshielded	600 m

Technical data of the configurable digital inputs/outputs

Each of the configurable I/O channels is defined as input or output by the user program. This is done by interrogating or allocating the corresponding channel.

Number of channels per module	16 inputs/outputs (with transistors)
Distributen of the channels into groups	1 group of 16 channels
if the channels are used as inputs	
- channels I8...I23	terminals 3.0...4.7
if the channels are used as outputs	
- channels Q8...Q23	terminals 3.0...4.7
Indication of the input/output signals	one yellow LED per channel, the LED is ON when the input/output signal is high (signal 1)
Electrical isolation	from the CS31 system bus

Technical data of the digital inputs/outputs if used as outputs

Number of channels per module	max. 16 transistor outputs
Reference potential for all outputs	terminals 1.9...4.9 (minus pole of the process supply voltage, signal name ZP)
Common power supply voltage	for all outputs: terminals 1.8...4.8 (plus pole of the process supply voltage, signal name UP)
Output voltage for signal 1	UP (-0.8 V)
Output delay (0->1 or 1->0)	on request
Output current	
- rated value, per channel	500 mA at UP = 24 V
- maximum value (all channels together)	10 A
Leakage current with signal 0	< 0.5 mA
Rated protection fuse on UP	10 A fast
De-magnitization when inductive loads are switched off	with varistors integrated in the module (see figure below)
Switching frequency	
- with resistive loads	on request
- with inductive loads	max. 0.5 Hz
- with lamp loads	max. 11 Hz with max. 5 W
Short-circuit proof / overload proof	yes
Overload message (I > 0.7 A)	yes, after ca. 100 ms
Output current limitation	yes, automatic reactivation after short-circuit/overload
Resistance to feedback against 24V signals	yes
Max. cable length	
- shielded	1000 m
- unshielded	600 m

The following drawing shows the circuitry of a digital input/output with the varistors for demagnitization when inductive loads are switched off.

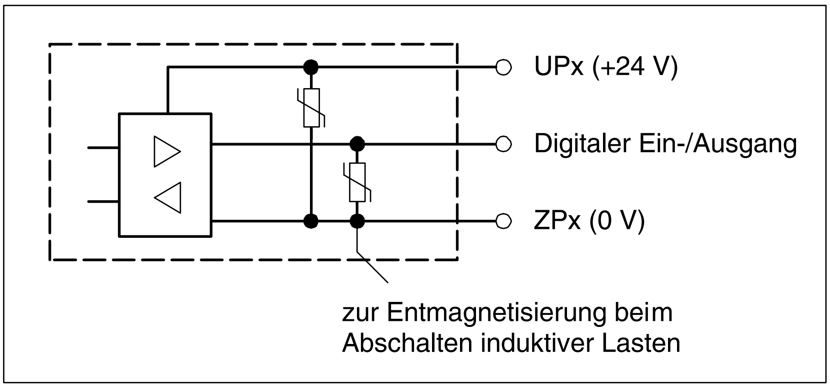


Figure: Digital input/output (circuit diagram)

Technical data of the digital inputs/outputs if used as inputs

Number of channels per module	max. 16 digital inputs
Reference potential for all inputs	terminals 1.9...4.9 (minus pole of the process supply voltage, signal name ZP)
Input current, per channel	see "Digital inputs"
Input type acc. to EN 61131-2	Type 1
Input delay (0->1 or 1->0)	typ. 8 ms, configurable from 0.1 to 32 ms
Input signal voltage	24 V DC
Signal 0	-3 V...+5 V *
undefined signal	> +5 V...< +15 V
Signal 1	+15 V...+30 V
Ripple with signal 0	within -3 V...+5 V *
Ripple with signal 1	within +15 V...+30 V
Max. cable length	
- shielded	1000 m
- unshielded	600 m

* Due to the direct connection to the output, the demagnetizing varistor is also effective at the input (see figure) above. This is why the difference between UPx and the input signal may not exceed the clamp voltage of the varistor. The varistor limits the voltage to approx. 36 V. Following this, the input voltage must range from - 12 V to + 30 V when UPx = 24 V and from - 6 V to + 30 V when UPx = 30 V.

Technical data of the high-speed counter

Used inputs	C16 / C17
Used outputs	C18
Counting frequency	max. 50 kHz
Detailed description	see chapter "High-speed counter"
Operating modes	see chapter "High-speed counter, Operating modes"

Ordering data

Order No.	Scope of delivery
1SAP 220 500 R0001	DC551-CS31, CS31 Bus Module, 8 DI / 16 DC
1SAP 210 600 R0001	TU551-CS31, CS31 Bus I/O Terminal Unit, screw-type terminals
1SAP 210 400 R0001	TU552-CS31, CS31 Bus I/O Terminal Unit, spring-type terminals

Digital I/O Modules S500, Overview

High-speed counter
- integrated in digital S500 I/O modules
- integrated in the S500 CS31 Bus Module

Contents

General

Several of the S500 expansion modules have an integrated high-speed counter. If this counter is used, it uses up to 2 digital inputs and one digital output (provided that it is available). The counter can be deactivated. Is in this case, the inputs and outputs reserved for the counter are usable for other tasks. The counter only works with expansion modules which are mounted at the I/O-Bus of an AC500 CPU. An exception is the CS31 Bus Module DC551-CS31, which contains a high-speed counter that is made operationally by the address setting on the module.

The following table shows, which of the S500 modules contain a high-speed counter and which of the digital inputs and outputs are reserved for the counter.

High-speed counters integrated in S500 modules					
Module	integrated high-speed counter	assigned inputs 1)		assigned output	Remarks
		channel A	channel B	channel C 2) or (CF)	
AI523 / AO523	no	-	-	-	
AX521 / AX522	no	-	-	-	
DC505-FBP	no	-	-	-	
DC522	yes	C8	C9	C10	The counter only works with expansion modules which are mounted at the I/O-Bus of an AC500 CPU.
DC523	yes	C16	C17	C18	
DC532	yes	C24	C25	C26	
DI524	yes	I24	I25	no hardware output available	
DX522	yes	I0	I1	the counter does not activate any relay output	
DC551-CS31	yes	C16	C17	C18	Counting function is activated by the address setting on the module 3)
DX531	no	-	-	-	

1) The two hardware inputs (channels A and B) are also and always available within the normal process image, independent of the operating mode of the counter.

2) The hardware output channel C is activated by the high-speed counter only in the operating modes 1 and 2. In the other operating modes, this output can be used for other purposes.

3) The counting function of the CS31 Bus Module can only be activated, if a bus address greater than 70 is set on the module by means of the address rotary switches. In this case, the effective bus address equals the set address minus 70 and the counter is ready for operation. An example: A set bus address of 83 means that the effective bus address = (83 - 70) = 13 and that the integrated high-speed counter can be used.

Features

The counting function is performed within the expansion module. It works independently of the user program and is therefore able to response quickly to external signals. A simultaneous counting operation of several expansion modules is possible.

Each module counter can be configured for one mode out of 10 possible ones. The desired operating mode is selected in the PLC configuration using module parameters. After that, it is activated during the initialization phase (power-on, cold start, warm start).

The data exchange to and from the user program is performed using input and output operands. While integrating a module containing a high-speed counter in the PLC configuration, the necessary operands are created and reserved immediately. Thus a counter implementation carried out later on does not cause an address shift.

Features independent of the counter operating mode

- The pulses at the counters' inputs or the evaluated signals of the traces A and B in case of incremental position sensors are counted.
- The maximum counting frequency is 50 kHz. In certain operating modes, the maximum counting frequency is lower.
  If using the modules DC522, DC523, DC532 and DC551, each counting input must externally be circuited in series with a resistor of 470 Ω / 1 W, in order to safely avoid influences from the deactivated module outputs to the connected sensors.
- The positive signal edges are counted, if not noted differently.
- By setting the operating mode 0, the counting function is switched off. In this case, the reserved inputs and outputs can be used for other tasks. Simultaneous use of these terminals for the counter and other signals must be avoided.
- The counter's actual value is provided as a double word (32 bits).
- The counter can count upwards in all operating modes. It counts beginning at the start value (set value) up to the end value (max. from 0 to 4,294,967,295 or hexadecimal from 00 00 00 00 to FF FF FF FF. After reaching 4,294,967,295, the counter jumps with the next pulse to 0. When the counter reaches the programmed end value, the counter output is stored permanently as CF = TRUE (end value reached). Only when the counter is set again (set value), CF is reset to FALSE.
- The high-speed counters cannot be used with expansion modules which are mounted besides the CS31 Bus Module DC551-CS31 or the FBP Interface Module DC505-FBP.

Operands

Input information for the high-speed counter	<–	Output information of the user program
Start Value 0	<–	Output double word 0
End Value 0	<–	Output double word 1
Start Value 1	<–	Output double word 2
End Value 1	<–	Output double word 3
Control Byte 0	<–	Output byte 0
Control Byte 1	<–	Output byte 1

Meaning of the input informationen for the high-speed counter:		
Start value 0	Double word	Set values for the counters 0 and 1: Each counter can be set to a start value. Start values are loaded into the counter by the user program. Using the set signal (dependent on the operating mode either via a terminal or the bit SET within the control byte 0 or 1), the values of the double word variables are loaded into the counter 0 or 1.
Start value 1	Double word	
End value 0	Double word	End value for the counters 0 and 1: The end values for the two counters are stored as comparison values into the module by the user program. Both counters compare continuously whether or not their programmed end value is equal to their actual value. When the counter (actual value) reaches its programmed end value, the binary output CF of the status byte is set permanently.
End value 1	Double word	
Control byte 0	Byte: Bit 0 = UP/DWN Bit 1 = EN Bit 2 = SET Bit 3 to Bit 7 free	Control bytes for the counters 0 and 1: UP/DWN: In some operating modes, the counter can count downwards, too. If counting down is desired, the bit UP/DWN must be set to TRUE. When doing so, the counter starts counting downwards at the start value (set value) to the end value (max. from 4,294,967,295 to 0 or hexadecimal from FF FF FF FF to 00 00 00 00). After reaching 0 the counter jumps to 4,294,967,295. EN: The processing of the counter signals must be enabled. Depending on the operating mode, enabling is done via a terminal or by the bit EN = TRUE within the control byte. SET: The counter can be set to a start value (see the description of the set values for the counters 0 and 1 at the beginning of this table.
Control byte 1		

Output information of the high-speed counter	–>	Input information for the user program
Actual Value 0	–>	Input double word 0
Actual Value 1	–>	Input double word 1
Status Byte 0	–>	Input byte 0
Status Byte 1	–>	Input byte 1

Meaning of the output informationen of the high-speed counter:		
Actual Value 0	Double word	Actual value of the counter 0
Actual Value 1	Double word	Actual value of the counter 1
Status Byte 0 Status Byte 1	Byte: Bit 0 = CF Bit 1 to Bit 7 free	CF: When the counter reaches the programmed end value, the counter output is stored permanently as CF = TRUE (end value reached). Only when the counter is set again (set value), CF is reset to FALSE.

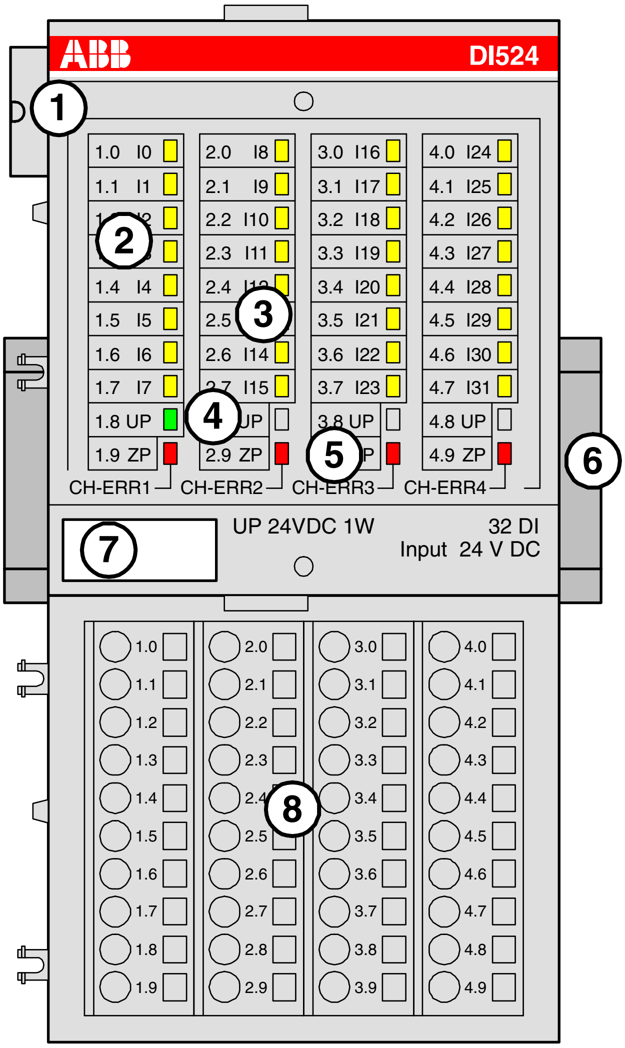
Operating modes

Inputs and outputs which are not used by the counters, are available for other tasks. In the following table, **A** means Input Channel A, **B** means Input Channel B and **C** means Output Channel C (refer also to the table in the "General" chapter.

Opera-ting mode	Function	Used inputs and outputs	Notes
0	No counter	none	This operating mode is selected, if the integrated high-speed counter is not necessary.
1	One up-counter	A = Counting input C = End value reached	The counting input and the output "End value reached) are enabled by the bit EN = TRUE within the control byte.
2	One up-counter with enable input via terminal	A = Counting input B = Enable input C = End value reached	The enable input enables the counting input and the output "end value reached" as well. The counter is only enabled, if the enable input = TRUE (signal 1) AND the bit EN = TRUE within the control byte.
3	Two up/down counters	A = Counting input 0 B = Counting input 1	With this operating mode, two counters, which are independent of each other, exist. The status "End value reached" is only readable from the two status bytes, not from output terminals. The counting direction is defined by the bit UP/DWN within the control byte.
4	Two up/down counters (1 counting input inverted)	A = Counting input 0 B = Counting input 1	This operating mode equals operating mode 3 with one exception: The counting input B (of counter 1) is inverted. It counts the TRUE/FALSE edges at input B.
5	One up/down counter with a dynamic set input via terminal	A = Counting input B = Dynamic set input	With this operating mode, one up/down counter is available which has a dynamic set input. Dynamic here means, that the set operation is performed at the FALSE/TRUE signal edge (0/1 edge) of the set input and not during the signal is TRUE. The status "End value reached" is only readable from the status byte, not from an output terminal.

6	One up/down counter with a dynamic set input via terminal	A = Counting input B = Dynamic set input	This operating mode equals operating mode 5 with one exception: The dynamic set input operates at the TRUE/FALSE edge (1-0 edge).
7	One up/down counter for position sensors	A = Trace A of the position sensor B = Trace B of the position sensor	With this operating mode, incremental position sensors can be used which give their counting signals on tracks A and B in a 90° phase sequence to each other. Dependent on the sequence of the signals at A and B, the counter counts up or down. There is no pulse multiplier function (e.g. x2 or x4). The position sensor must provide 24 V signals. Signals of 5 V sensors must be converted. A zero-trace is not processed. The status "End value reached" is only readable from the status byte 0, not from an output terminal. The bit UP/DWN within the control byte must be FALSE. Otherwise a parameter error is generated. In this operating mode, the maximum counting frequency is 35 kHz.
8	Reserved		
9	One up/down counter for position sensors (pulse multiplier x2)	A = Trace A of the position sensor B = Trace B of the position sensor	This operating mode equals operating mode 7 with one exception: There is a pulse multiplication x2 with the evaluation of the counting inputs. This means, that the counter counts both the positive edges and the negative edges of trace A. This results in the double number of counting pulses. The precision increases correspondingly. In this operating mode, the maximum counting frequency is 30 kHz.
10	One up/down counter for position sensors (pulse multiplier x4)	A = Trace A of the position sensor B = Trace B of the position sensor	This operating mode equals operating mode 7 with one exception: There is a pulse multiplication x4 with the evaluation of the counting inputs. This means, that the counter counts the positive and negative edges of the traces A and B. This results in the fourfold number of counting pulses. The precision increases correspondingly. In this operating mode, the maximum counting frequency is 15 kHz.

Digital Input Module DI524
- 32 digital inputs 24 V DC,
- module-wise electrically isolated



Elements of the digital input module DI524

1 I/O-Bus

2 Allocation between terminal No. and signal name

3 32 yellow LEDs to display the signal statuses at the inputs I0 to I31

4 1 green LED to display the process voltage UP

5 4 red LEDs to display errors (CH-ERR1...CH-ERR4)

6 DIN rail

7 Label

8 I/O Terminal Unit (TU515 or TU516) with 40 terminals (screw-type or spring terminals)

Figure: Digital input module DI524, plugged on a Terminal Unit TU516

Contents

Intended purpose

The digital input module DI524 can be used as a remote expansion module at the FBP Interface Module DC505-FBP, at the CS31 Bus Module DC551-CS31 or locally at an AC500 CPU. It contains 32 channels with the following features:

- 32 digital inputs 24 V DC in four groups (1.0...4.7), with no potential separation between the channels

The inputs are electrically isolated from the other electronic circuitry of the module.

Functionality

Digital inputs	32 (24 V DC)
High-speed counter	integrated, many configurable operating modes (only with AC500)
LED displays	for signal statuses, errors and supply voltage
Internal power supply	through the expansion bus interface (I/O-Bus)
External power supply	via the terminals ZP and UP (process voltage 24 V DC)

Electrical connection

The input module is plugged on the I/O Terminal Unit TU515 or TU516. Properly seat the module and press until it locks in place. The Terminal Unit is mounted on a DIN rail or with 2 screws plus the additional accessory for wall mounting (TA526).

The electrical connection of the I/O channels is carried out using the 40 terminals of the I/O Terminal Unit. I/O modules can be replaced without re-wiring the Terminal Units.

Note: Mounting, disassembling and electrical connection for the Terminal Units and the I/O modules are described in detail in the S500 system data chapters.

The terminals 1.8 to 4.8 and 1.9 to 4.9 are electrically interconnected within the I/O Terminal Unit and have always the same assignment, independent of the inserted module:

Terminals 1.8 to 4.8: Process voltage UP = +24 V DC
Terminals 1.9 to 4.9: Process voltage ZP = 0 V

The assignment of the other terminals:

Terminals	Signal	Meaning
1.0 to 1.7	I0 to I7	8 digital inputs
2.0 to 2.7	I8 to I15	8 digital inputs
3.0 to 3.7	I16 to I23	8 digital inputs
4.0 to 4.7	I24 to I31	8 digital inputs

The supply voltage 24 V DC for the module's electronic circuitry comes from the I/O-Bus of the FieldBusPlug or the CPU.

Caution: Removal of energized modules is not permitted. All power sources (supply and process voltages) must be switched off while working on any AC500 system.

The module provides several diagnosis functions (see chapter "Diagnosis and display").

The following figure shows the electrical connection of the digital input module DI524.

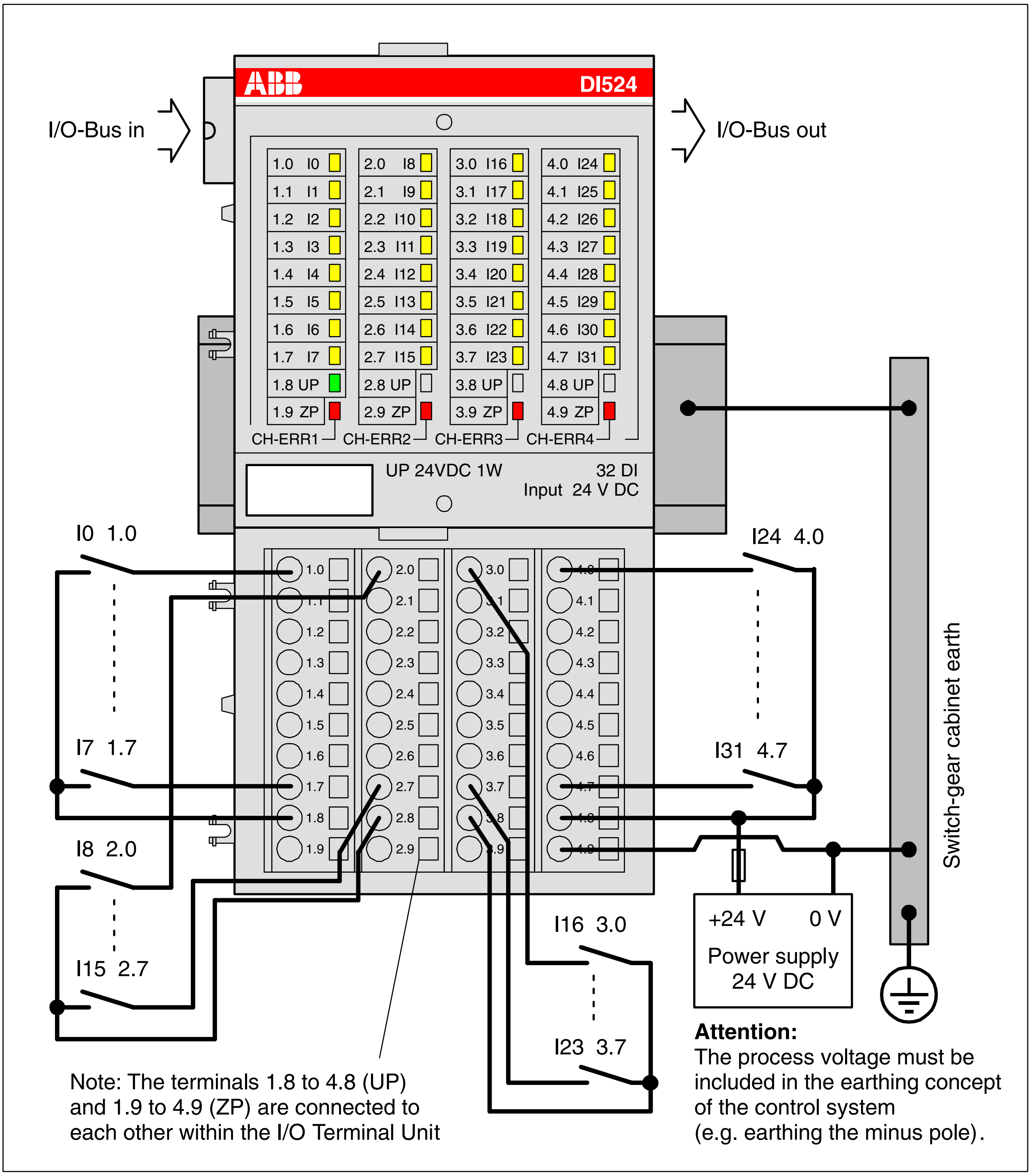


Figure: Electrical connection of the digital input module DI524

Internal data exchange

	without the high-speed counter	with the high-speed counter (only with AC500)
Digital inputs (bytes)	4	6
Digital outputs (bytes)	0	2
Counter input data (words)	0	4
Counter output data (words)	0	8

I/O configuration

The digital input module DI524 does not store configuration data itself.

Parameterization

The arrangement of the parameter data is performed by your master configuration software SYCON in connection with the S500 GSD files and in conjunction with the Control Builder software.

The parameter data directly influences the functionality of modules.

For non-standard applications, it is necessary to adapt the parameters to your system configuration.

Module: Module slot address: Y = 1...7

Nr.	Name	Value	Internal value	Internal value, type	Default	Min.	Max.	EDS Slot/Index
1	Module ID	Internal	1000 *1)	Word	1000 0x03E8	0	65535	0x0Y01
2 *2)	Ignore module	No Yes	0 1	Byte	No 0x00			not for FBP
3	Parameter length	Internal	3-CPU 2-FBP	Byte	3 2	0	255	0x0Y02
4	Check supply	Off on	0 1	Byte	On 0x01	0	1	0x0Y03
5	Input delay	0.1 ms 1 ms 8 ms 32 ms	0 1 2 3	Byte	8 ms 0x02	0	3	0x0Y04
6 *4)	High-speed counter	0 : 10 *3)	0 : 10	Byte	Mode 0 0x00			not for FBP

*1) With CS31 and addresses less than 70 and FBP, the value is increased by 1

*2) Not with FBP

*3) Counter operating modes, see description of the high-speed counter

*4) With FBP or CS31 without the parameter "High-speed counter"

Attention: The high-speed counter of the module can only be used together with the AC500 CPU. The counter does not work, if the module is attached to an FBP Interface Module or to a CS31 Bus Module.

GSD file:	Ext_User_Prm_Data_Len = Ext_User_Prm_Data_Const(0) =	5 0x03, 0xe9, 0x02, \ 0x01, 0x02;

Diagnosis and display

Diagnosis:

E1..E4	d1	d2	d3	d4	Identifier 000..063	AC500 display	
Class	**Comp**	**Dev**	**Mod**	**Ch**	**Err**	**PS501 PLC browser**	**<– Display in**
Byte 6 Bit 6..7	**-**	**Byte 3**	**Byte 4**	**Byte 5**	**Byte 6 Bit 0..5**	**FBP diagnosis block**	
Class	**Inter-face**	**De-vice**	**Mod-ule**	**Chan-nel**	**Error identifier**	**Error message**	**Remedy**
	1)	**2)**	**3)**	**4)**			
Module error DI524							
3	14	1..7	31	31	19	Checksum error in the I/O module	Replace I/O module
	11 / 12	ADR	1..7				
3	14	1..7	31	31	3	Timeout in the I/O module	Replace I/O module
	11 / 12	ADR	1..7				
3	14	1..7	31	31	40	Different hard-/firmware versions in the module	Replace I/O module
	11 / 12	ADR	1..7				
3	14	1..7	31	31	43	Internal error in the module	Replace I/O module
	11 / 12	ADR	1..7				
3	14	1..7	31	31	36	Internal data exchange failure	Replace I/O module
	11 / 12	ADR	1..7				
3	14	1..7	31	31	9	Overflow diagnosis buffer	New start
	11 / 12	ADR	1..7				
3	14	1..7	31	31	26	Parameter error	Check master
	11 / 12	ADR	1..7				
3	14	1..7	31	31	11	Process voltage too low	Check process voltage
	11 / 12	ADR	1..7				
4	14	1..7	31	31	45	Process voltage is switched off (ON –> OFF)	Process voltage ON
	11 / 12	ADR	1..7				

Remarks:

1)	In AC500 the following interface identifier applies: 14 = I/O-Bus, 11 = COM1 (e.g. CS31 bus), 12 = COM2. The FBP diagnosis block does not contain this identifier.
2)	With "Device" the following allocation applies: 31 = Module itself, 1..7 = Expansion module 1..7, ADR = Hardware address (e.g. of the DC551)
3)	With "Module" the following allocation applies dependent of the master: Module error: I/O-Bus or FBP: 31 = Module itself; COM1/COM2: 1..7 = Expansion 1..7
4)	In case of module errors, with channel "31 = Module itself" is output.

Displays:

During the power ON procedure, the module initializes automatically. All LEDs (accept the channel LEDs) are ON during this time.

Status of the LEDs (see also section "Diagnosis LEDs" in the S500 system data)

LED	Status	Color	LED = OFF	LED = ON	LED flashes
Inputs 00...31	digital input	yellow	Input = OFF	Input = ON (the input voltage is even displayed if the supply voltage is OFF).	--
UP	Process supply voltage 24 V DC via terminal	green	Process supply voltage is missing	Process supply voltage OK and initialization terminated	Module is not initialized correctly
CH-ERR1	Channel Error, error messages in groups (digital inputs combined into the groups 1, 2, 3, 4)	red	No error or process supply voltage is missing	Serious error within the corresponding group	Error on one channel of the corresponding group
CH-ERR2		red			
CH-ERR3		red			
CH-ERR4		red			
CH-ERR *)	Module Error	red	--	Internal error	--
*) All of the LEDs CH-ERR1 to CH-ERR4 light up together					

Technical data

The system data of AC500 and S500 are valid here. Only additional details are therefore documented below.

Process supply voltage UP	
- Connections	Terminals 1.8 - 4.8 for +24 V (UP) and 1.9 - 4.9 for 0 V (ZP)
- Rated value	24 V DC
- max. ripple	5 %
- Protection against reversed voltage	yes
Rated protection fuse on UP	10 A fast
- Electrical isolation	yes, per module
Current consumption	
- internal (via I/O-Bus)	about 5 mA at 3.3 V DC
- current consumption from UP at normal operation	0.05 A + max. 0.008 A per input
- inrush current from UP (at power up)	0.008 A^2s
Weight (without Terminal Unit)	ca. 105 g
Mounting position	horizontal or vertical with derating (output load reduced to 50 % at 40°C per group)
Cooling	The natural convection cooling must not be hindered by cable ducts or other parts in the switch-gear cabinet.

⚠ **Attention:** All I/O channels (digital and analog) are protected against reverse polarity, reverse supply, short circuit and continuous overvoltage up to 30 V DC.

Technical data of the digital inputs

Number of channels per module	32
Distribution of the channels into groups	1 group of 32 channels
Terminals of the channels I0 to I7	1.0 to 1.7
Terminals of the channels I8 to I15	2.0 to 2.7
Terminals of the channels I16 to I23	3.0 to 3.7
Terminals of the channels I24 to I31	4.0 to 4.7
Reference potential for all inputs	terminals 1.9...4.9 (minus pole of the process supply voltage, signal name ZP)
Electrical isolation	from the rest of the module (I/O-Bus)
Indication of the input signals	one yellow LED per channel, the LED is ON when the input signal is high (signal 1)
Input type acc. to EN 61131-2	Type 1
Input delay (0->1 or 1->0)	typ. 8 ms, configurable from 0.1 to 32 ms
Input signal voltage	24 V DC
signal 0	-3 V...+5 V
undefined signal	> +5 V...< +15 V
signal 1	+15 V...+30 V
Ripple with signal 0	within -3 V...+5 V
Ripple with signal 1	within +15 V...+30 V
Input current per channel	
input voltage +24 V	typ. 5 mA
input voltage +5 V	> 1 mA
input voltage +15 V	> 5 mA
input voltage +30 V	< 8 mA
Max. cable length	
shielded	1000 m
unshielded	600 m

Technical data of the high-speed counter

Attention: The high-speed counter of the module can only be used together with the AC500 CPU. The counter does not work, if the module is attached to an FBP Interface Module or a CS31 Bus Module.

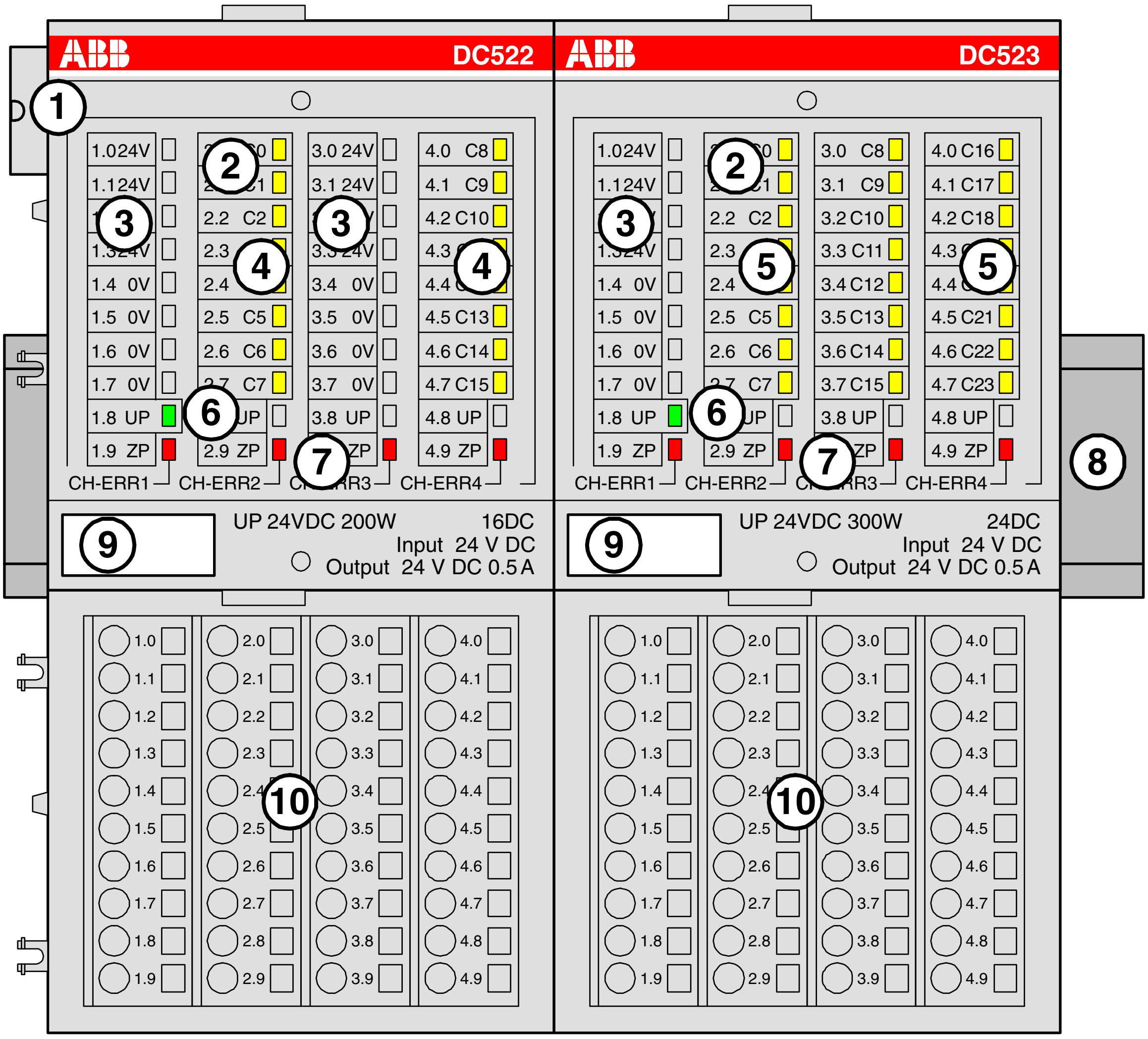
Used inputs	I24 / I25
Used outputs	none
Counting frequency	max. 50 kHz
Detailed description	see chapter "High-speed counter"
Operating modes	see "High-speed counter, Operating modes"

Ordering data

Order No.	Scope of delivery
1SAP 240 000 R0001	DI524, Digital input module, 32 DI, 24 V DC, 1-wire
1SAP 212 200 R0001	TU515, I/O Terminal Unit, 24 V DC, screw-type terminals
1SAP 212 000 R0001	TU516, I/O Terminal Unit, 24 V DC, spring terminals

Digital Input/Output Modules DC522 and DC523

- DC522: 16 configurable digital inputs/outputs
- DC523: 24 configurable digital inputs/outputs
- module-wise electrically isolated



Elements of the digital input/output modules DC522 and DC523

1 I/O-Bus
2 Allocation between terminal No. and signal name
3 Sensor power supply 24 V DC / 0.5 A
4 16 yellow LEDs to display the signal statuses at the inputs/outputs C0 to C15 (DC522)
5 24 yellow LEDs to display the signal statuses at the inputs/outputs C0 to C23 (DC523)
6 1 green LED to display the process voltage UP
7 4 red LEDs to display errors (CH-ERR1 to CH-ERR4)
8 DIN rail
9 Label
10 I/O Terminal Unit (TU515/TU516) with 40 terminals (screw-type or spring terminals)

Figure: Digital input/output modules DC522 and DC523, plugged on Terminal Units TU516

Contents

Intended purpose

The digital input/output modules DC522 and DC523 can be used as remote expansion modules at the FBP Interface Module DC505-FBP, at the CS31 Bus Module DC551-CS31 or locally at an AC500 CPU. They contain 16 or 24 channels with the following features:

DC522:

- Two 24 V DC 0.5 A sensor power supplies with short-circuit and overload protection
- 16 digital inputs/outputs 24 V DC in one group (2.0...2.7 and 4.0...4.7), of which each can be used
  - as an input,
  - as a transistor output with short-circuit and overload protection, 0.5 A rated current or
  - as a re-readable output (combined input/output) with the technical data of the digital inputs and outputs.

DC523:

- One 24 V DC 0.5 A sensor power supply with short-circuit and overload protection
- 24 digital inputs/outputs 24 V DC in one group (2.0...4.7), of which each can be used
  - as an input,
  - as a transistor output with short-circuit and overload protection, 0.5 A rated current or
  - as a re-readable output (combined input/output) with the technical data of the digital inputs and outputs.

The inputs/outputs are electrically isolated from the other electronic circuitry of the module. There is no potential separation between the channels.

Functionality

Digital inputs/outputs	DC522: 16 (24 V DC)
Digital inputs/outputs	DC523: 24 (24 V DC)
High-speed counter	integrated, many configurable operating modes (only with AC500)
LED displays	for signal statuses, errors and supply voltage
Internal power supply	through the expansion bus interface (I/O-Bus)
External power supply	via the terminals ZP and UP (process voltage 24 V DC)

Electrical connection

The input/output modules are plugged on I/O Terminal Units TU515 or TU516. Properly seat the modules and press until they lock in place. The Terminal Units are mounted on a DIN rail or with 2 screws plus the additional accessory for wall mounting (TA526).

The electrical connection of the I/O channels is carried out using the 40 terminals of the I/O Terminal Unit. I/O modules can be replaced without re-wiring the Terminal Units.

Note: Mounting, disassembling and electrical connection for the Terminal Units and the I/O modules are described in detail in the S500 system data chapters.

The terminals 1.8 to 4.8 and 1.9 to 4.9 are electrically interconnected within the I/O Terminal Unit and have always the same assignment, independent of the inserted module:

Terminals 1.8 to 4.8: Process voltage UP = +24 V DC
Terminals 1.9 to 4.9: Process voltage ZP = 0 V

The assignment of the other terminals:

DC522:

Terminals	Signal	Meaning
1.0 to 1.3	+24 V	4 x sensor power supply sources (loadable with 0.5 A in total)
1.4 to 1.7	0 V	0 V (reference potential)
2.0 to 2.7	C0 to C7	8 digital inputs/outputs
3.0 to 3.3	+24 V	4 x sensor power supply sources (loadable with 0.5 A in total)
3.4 to 3.7	0 V	0 V (reference potential)
4.0 to 4.7	C8 to C15	8 digital inputs/outputs

DC523:

Terminals	Signal	Meaning
1.0 to 1.3	+24 V	4 x sensor power supply sources (loadable with 0.5 A in total)
1.4 to 1.7	0 V	0 V (reference potential)
2.0 to 2.7	C0 to C7	8 digital inputs/outputs
3.0 to 3.7	C8 to C15	8 digital inputs/outputs
4.0 to 4.7	C16 to C23	8 digital inputs/outputs

The supply voltage 24 V DC for the module's electronic circuitry comes from the I/O-Bus of the FieldBusPlug or the CPU.

Caution: Removal of energized modules is not permitted. All power sources (supply and process voltages) must be switched off while working on any AC500 system.

The modules provide several diagnosis functions (see chapter "Diagnosis and display").

The following figure shows the electrical connection of the digital input/output module **DC522**.

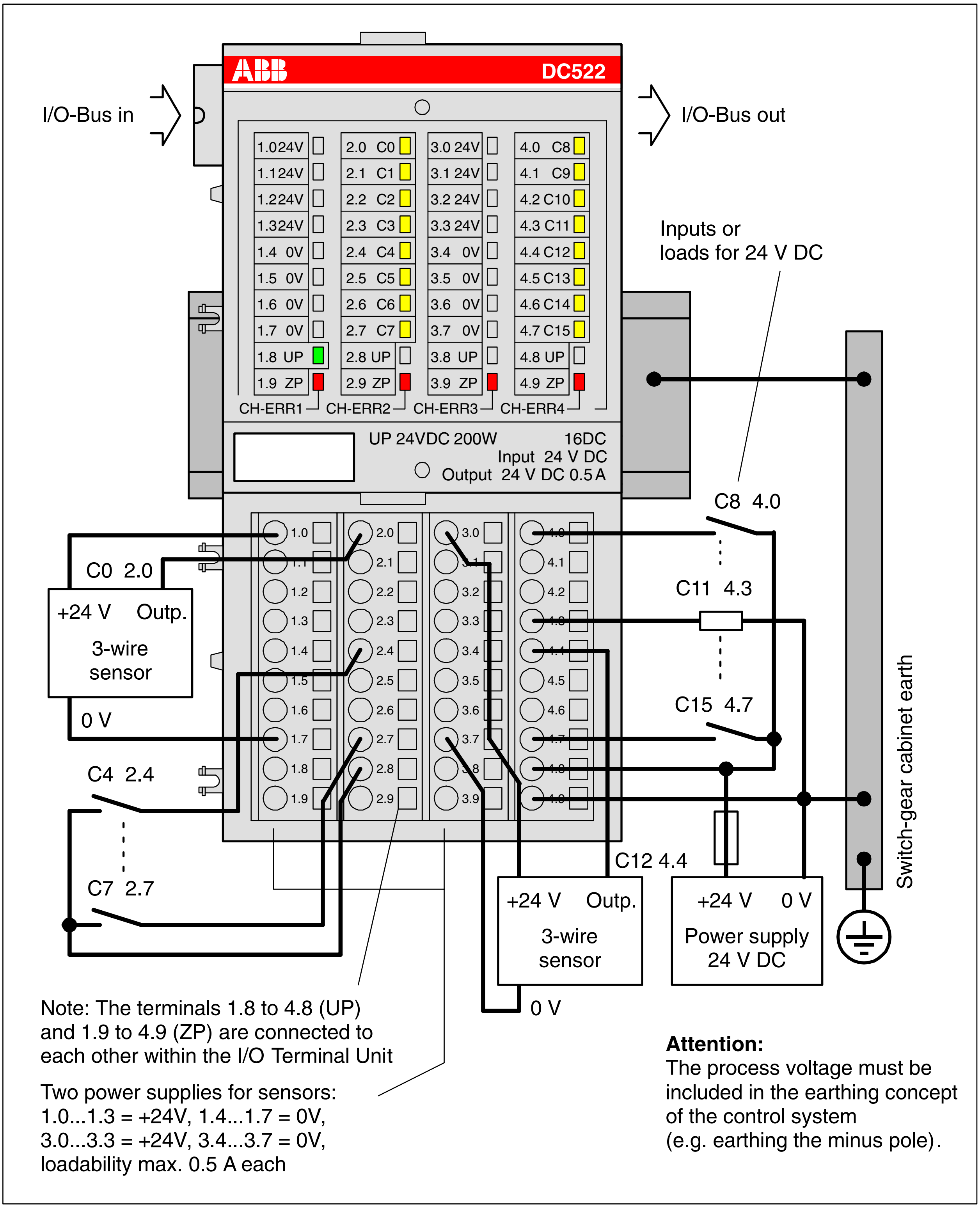


Figure: Electrical connection of the digital input/output module DC522

The following figure shows the electrical connection of the digital input/output module **DC523**.

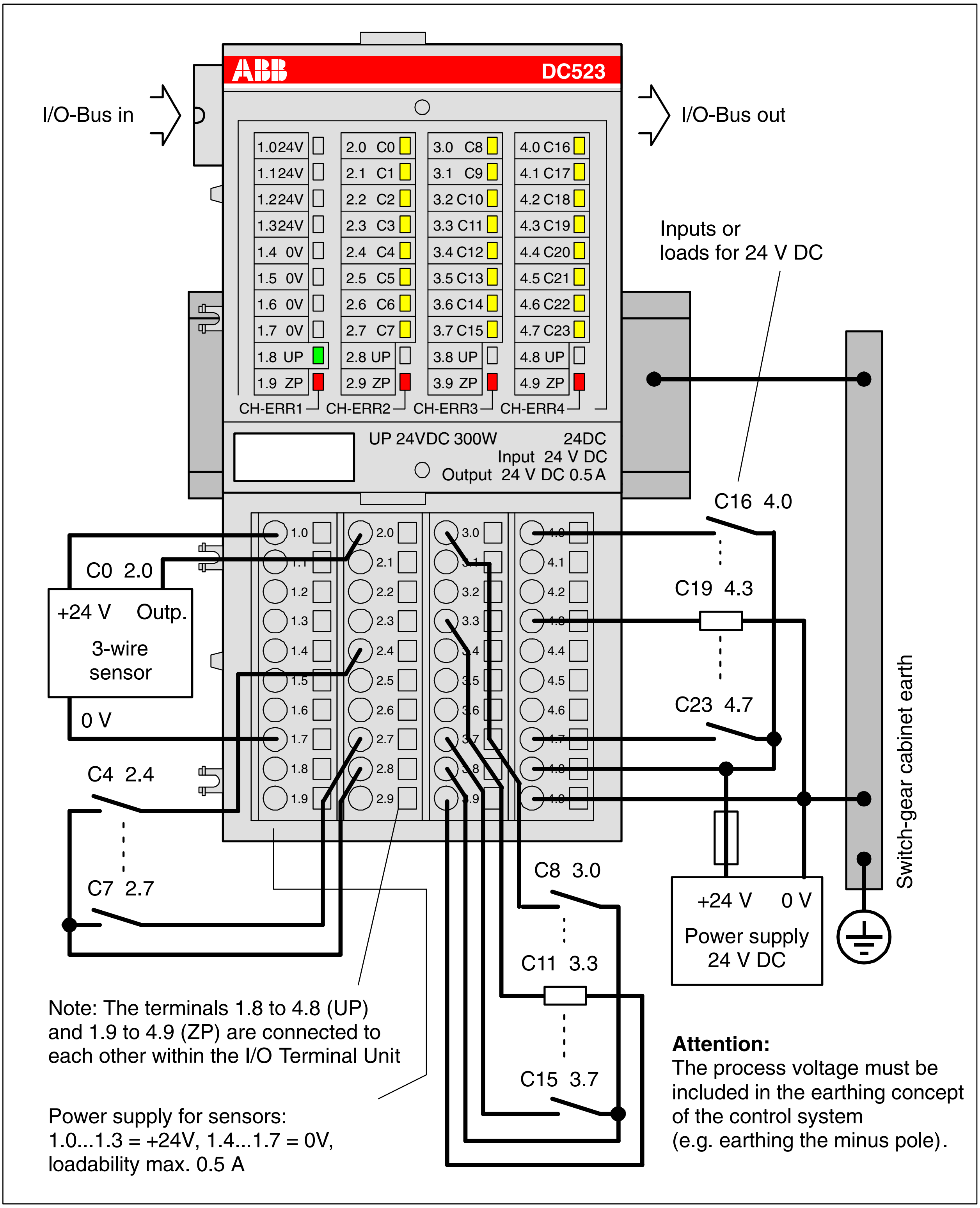


Figure: Electrical connection of the digital input/output module DC523

Internal data exchange

DC522:

	without the high-speed counter	with the high-speed counter (only with AC500)
Digital inputs (bytes)	2	4
Digital outputs (bytes)	2	4
Counter input data (words)	0	4
Counter output data (words)	0	8

DC523:

	without the high-speed counter	with the high-speed counter (only with AC500)
Digital inputs (bytes)	3	5
Digital outputs (bytes)	3	5
Counter input data (words)	0	4
Counter output data (words)	0	8

I/O configuration

The modules DC522 and DC523 do not store configuration data themselves. The configurable channels are defined as inputs or outputs by the user program, i.e. each of the configurable channels can used as input or output (or re-readable output) by interrogation or allocation by the user program.

Parameterization

The arrangement of the parameter data is performed by your master configuration software SYCON in connection with the S500 GSD files and in conjunction with the Control Builder software.

The parameter data directly influences the functionality of modules.

For non-standard applications, it is necessary to adapt the parameters to your system configuration.

Module DC522: Module slot address: Y = 1...7

Nr.	Name	Value	Internal value	Internal value, type	Default	Min.	Max.	EDS Slot/Index
1	Module ID	Internal	1220 *1)	Word	1220 0x04c4	0	65535	0x0Y01
2 *2)	Ignore module	No Yes	0 1	Byte	No 0x00			not for FBP
3	Parameter length	Internal	7	Byte	7-CPU 6-FBP	0	255	0x0Y02
4	Check supply	Off on	0 1	Byte	On 0x01	0	1	0x0Y03
5	Input delay	0.1 ms 1 ms 8 ms 32 ms	0 1 2 3	Byte	8 ms 0x02	0	3	0x0Y04
6 *4)	High-speed counter	0 : 10 *3)	0 : 10	Byte	Mode 0 0x00			not for FBP
7	Short-circuit detection of output or sensor supply	Off On	0 1	Byte	On 0x01	0	1	0x0Y05
8	Behaviour of outputs at communication errors	Off Last value Substitute value	0 1+(n*5) 2+(n*5), n <= 2	Byte	Off 0x00	0	2	0x0Y06
9	Substitute value at outputs Bit 15 = Output 15 Bit 0 = Output 0	0... 65535	0... 0xffff	Word	0 0x0000	0	65535	0x0Y07

*1) With CS31 and addresses less than 70 and FBP, the value is increased by 1

*2) Not with FBP

*3) Counter operating modes, see description of the high-speed counter

*4) With FBP or CS31 without the parameter "High-speed counter"

Module DC523: Module slot address: Y = 1...7

Nr.	Name	Value	Internal value	Internal value, type	Default	Min.	Max.	EDS Slot/Index
1	Module ID	Internal	1215 *1)	Word	1215 0x04bf	0	65535	0x0Y01
2 *2)	Ignore module	No Yes	0 1	Byte	No 0x00			not for FBP
3	Parameter length	Internal	9	Byte	9-CPU 8-FBP	0	255	0x0Y02
4	Check supply	Off on	0 1	Byte	On 0x01	0	1	0x=Y03
5	Input delay	0.1 ms 1 ms 8 ms 32 ms	0 1 2 3	Byte	8 ms 0x02	0	3	0x0Y04
6 *4)	High-speed counter	0 : 10 *3)	0 : 10	Byte	Mode 0 0x00			not for FBP
7	Short-circuit detection of output or sensor supply	Off On	0 1	Byte	On 0x01	0	1	0x0Y05
8	Behaviour of outputs at communication errors	Off Last value Substitute value	0 1+(n*5) 2+(n*5), n <= 2	Byte	Off 0x00	0	2	0x0Y06
9	Substitute value at outputs B23 = Output 23 Bit 0 = Output 0	0... 16777215	0... 0x00ff-ffff	DWord	0 0x0000 -0000	0	$2^{24}-1$	0x0Y07

*1) With CS31 and addresses less than 70 and FBP, the value is increased by 1

*2) Not with FBP

*3) Counter operating modes, see description of the high-speed counter

*4) With FBP or CS31 without the parameter "High-speed counter"

Attention: The high-speed counter of the module can only be used together with the AC500 CPU. The counter does not work, if the module is attached to an FBP Interface Module or to a CS31 Bus Module.

GSD file:		
DC522:	Ext_User_Prm_Data_Len = Ext_User_Prm_Data_Const(0) =	9 0x04, 0xc5, 0x06, \ 0x01, 0x02, 0x01, 0x00, 0x00, 0x00;
DC523:	Ext_User_Prm_Data_Len = Ext_User_Prm_Data_Const(0) =	11 0x04, 0xc0, 0x08, \ 0x01, 0x02, 0x01, 0x00, 0x00, 0x00, 0x00, 0x00;

Diagnosis and display

In case of overload or short-circuit, the outputs switch off automatically and try to switch on again cyclically. Therefore an acknowledgement of the outputs is not necessary. The LED error message, however, is stored.

Diagnosis:

E1..E4	d1	d2	d3	d4	Identifier 000..063	AC500 display	<– Display in
Class	Comp	Dev	Mod	Ch	Err	PS501 PLC browser	
Byte 6 Bit 6..7	-	Byte 3	Byte 4	Byte 5	Byte 6 Bit 0..5	FBP diagnosis block	
Class	**Inter-face**	**De-vice**	**Mod-ule**	**Chan-nel**	**Error identifier**	**Error message**	**Remedy**
	1)	**2)**	**3)**	**4)**			
Module error DC522 and DC523							
3	14 11 / 12	1..7 ADR	31 1..7	31	19	Checksum error in the I/O module	Replace I/O module
3	14 11 / 12	1..7 ADR	31 1..7	31	3	Timeout in the I/O module	Replace I/O module
3	14 11 / 12	1..7 ADR	31 1..7	31	40	Different hard-/firmware versions in the module	Replace I/O module
3	14 11 / 12	1..7 ADR	31 1..7	31	43	Internal error in the module	Replace I/O module
3	14 11 / 12	1..7 ADR	31 1..7	31	36	Internal data exchange failure	Replace I/O module
3	14 11 / 12	1..7 ADR	31 1..7	31	9	Overflow diagnosis buffer	New start
3	14 11 / 12	1..7 ADR	31 1..7	31	26	Parameter error	Check master
3	14 11 / 12	1..7 ADR	31 1..7	31	11	Process voltage too low	Check process voltage
4	14 11 / 12	1..7 ADR	31 1..7	31	45	Process voltage is switched off (ON –> OFF)	Process voltage ON
Channel error DC522							
4	14 11 / 12	1..7 ADR	2 1..7	0..15	47	Short-circuit at an output	Check connection
Channel error DC523							
4	14 11 / 12	1..7 ADR	2 1..7	0..23	47	Short-circuit at an output	Check connection

Remarks:

1)	In AC500 the following interface identifier applies: 14 = I/O-Bus, 11 = COM1 (e.g. CS31 bus), 12 = COM2. The FBP diagnosis block does not contain this identifier.
2)	With "Device" the following allocation applies: 31 = Module itself, 1..7 = Expansion module 1..7, ADR = Hardware address (e.g. of the DC551)
3)	With "Module" the following allocation applies dependent of the master: Module error: I/O-Bus or FBP: 31 = Module itself; COM1/COM2: 1..7 = Expansion 1..7 Channel error: I/O-Bus or FBP = Module type (2 = DO); COM1/COM2: 1..7 = Expansion 1..7
4)	In case of module errors, with channel "31 = Module itself" is output.

Displays:

During the power ON procedure, the module initializes automatically. All LEDs (accept the channel LEDs) are ON during this time.

Status of the LEDs (see also section "Diagnosis LEDs" in the S500 system data)

LED	Status	Color	LED = OFF	LED = ON	LED flashes
Inputs/ outputs DC522: 00...15 DC523: 00...23	digital input or digital output	yellow	Input/output = OFF	Input/output = ON (the input voltage is even displayed if the supply voltage is OFF).	--
UP	Process supply voltage 24 V DC via terminal	green	Process supply voltage is missing	Process supply voltage OK and initialization terminated	Module is not initialized correctly
CH-ERR1	Channel Error, error messages in groups (digital inputs/outputs combined into the groups 1, 2, 3, 4)	red	No error or process supply voltage is missing	Serious error within the corresponding group	Error on one channel of the corresponding group (e.g. short-circuit at an output)
CH-ERR2		red			
CH-ERR3		red			
CH-ERR4		red			
CH-ERR *)	Module Error	red	--	Internal error	--
*) All of the LEDs CH-ERR1 to CH-ERR4 light up together					

Technical data

The system data of AC500 and S500 are valid here. Only additional details are therefore documented below.

Process supply voltage UP	
- Connections	Terminals 1.8 - 4.8 for +24 V (UP) and 1.9 - 4.9 for 0 V (ZP)
- Rated value	24 V DC
- max. ripple	5 %
- Protection against reversed voltage	yes
- Rated protection fuse on UP	10 A fast
- Electrical isolation	yes, per module
Current consumption	
- internal (via I/O-Bus)	ca. 5 mA at 3.3 V DC
- current consumption from UP at normal operation / with outputs	0.05 A + max. 0.008 A per input + max. 0.5 A per output
- inrush current from UP (at power up)	0.008 A^2s
Max. power dissipation within the module	6 W (outputs unloaded)
Sensor power supply	
- Connections DC522	terminals 1.0...1.3 = +24 V, 1.4...1.7 = 0 V terminals 3.0...3.3 = +24 V, 3.4...3.7 = 0 V
- Connections DC523	terminals 1.0...1.3 = +24 V, 1.4...1.7 = 0 V
- Voltage	24 V DC with short-circuit and overload protection
- Loadability	terminals 1.0...1.3, in total max. 0.5 A terminals 3.0...3.3, in total max. 0.5 A (only DC522)
Weight (without Terminal Unit)	ca. 125 g
Mounting position	horizontal or vertical with derating (output load reduced to 50 % at 40°C per group)
Cooling	The natural convection cooling must not be hindered by cable ducts or other parts in the switch-gear cabinet.

⚠ **Attention:** All I/O channels (digital and analog) are protected against reverse polarity, reverse supply, short circuit and continuous overvoltage up to 30 V DC.

Technical data of the configurable digital inputs/outputs

Each of the configurable I/O channels is defined as input or output by the user program. This is done by interrogating or allocating the corresponding channel.

Number of channels per module	DC522: 16 inputs/outputs (with transistors) DC523: 24 inputs/outputs (with transistors)
Distribution of the channels into groups	DC522: 1 group of 16 channels DC523: 1 group of 24 channels
if the channels are used as inputs	
- channels C0...C7	DC522: terminals 2.0...2.7 DC523: terminals 2.0...2.7
- channels C8...C15	DC522: terminals 4.0...4.7 DC523: terminals 3.0...3.7
- channels C16...C23	DC523: terminals 4.0...4.7
if the channels are used as outputs	
- channels C0...C7	DC522: terminals 2.0...2.7 DC523: terminals 2.0...2.7
- channels C8 C15	DC522: terminals 4.0...4.7 DC523: terminals 3.0...3.7
- channels C16...C23	DC523: terminals 4.0...4.7
Indication of the input/output signals	one yellow LED per channel, the LED is ON when the input/output signal is high (signal 1)
Electrical isolation	from the rest of the module

Technical data of the digital inputs/outputs if used as inputs

Number of channels per module	DC522: max. 16 digital inputs DC523: max. 24 digital inputs
Reference potential for all inputs	terminals 1.9...4.9 (minus pole of the process supply voltage, signal name ZP)
Electrical isolation	from the rest of the module
Indication of the input signals	one yellow LED per channel, the LED is ON when the input signal is high (signal 1)
Input type acc. to EN 61131-2	Type 1
Input delay (0->1 or 1->0)	typ. 8 ms, configurable from 0.1 to 32 ms
Input signal voltage	24 V DC
- signal 0	-3 V...+5 V *
- undefined signal	> +5 V...< +15 V
- signal 1	+15 V...+30 V
Ripple with signal 0	within -3 V...+5 V *
Ripple with signal 1	within +15 V...+30 V
Input current per channel	
- input voltage +24 V	typ. 5 mA
- input voltage +5 V	> 1 mA
- input voltage +15 V	> 5 mA
- input voltage +30 V	< 8 mA
Max. cable length	
shielded	1000 m
unshielded	600 m

* Due to the direct connection to the output, the demagnetizing varistor is also effective at the input (see figure) above. This is why the difference between UPx and the input signal may not exceed the clamp voltage of the varistor. The varistor limits the voltage to approx. 36 V. Following this, the input voltage must range from - 12 V to + 30 V when UPx = 24 V and from - 6 V to + 30 V when UPx = 30 V.

Technical data of the digital inputs/outputs if used as outputs

Number of channels per module	DC522: max. 16 transistor outputs DC523: max. 24 transistor outputs
Reference potential for all outputs	terminals 1.9...4.9 (minus pole of the process supply voltage, signal name ZP)
Common power supply voltage	for all outputs: terminals 1.8...4.8 (plus pole of the process supply voltage, signal name UP)
Output voltage for signal 1	UP (-0.8 V)
Output delay (0->1 or 1->0)	on request
Output current	
rated value, per channel	500 mA at UP = 24 V
maximum value (all channels together)	8 A
Leakage current with signal 0	< 0.5 mA
Rated protection fuse on UP	10 A fast
De-magnitization when inductive loads are switched off	with varistors integrated in the module (see figure below)
Switching frequency	
with resistive load	on request
with inductive loads	max. 0.5 Hz
with lamp loads	max. 11 Hz with max. 5 W
Short-circuit proof / overload proof	yes
Overload message (I > 0.7 A)	yes, after ca. 100 ms
Output current limitation	yes, automatic reactivation after short-circuit/overload
Resistance to feedback against 24V signals	yes
Max. cable length	
shielded	1000 m
unshielded	600 m

The following drawing shows the circuitry of a digital input/output with the varistors for demagnitization when inductive loads are switched off.

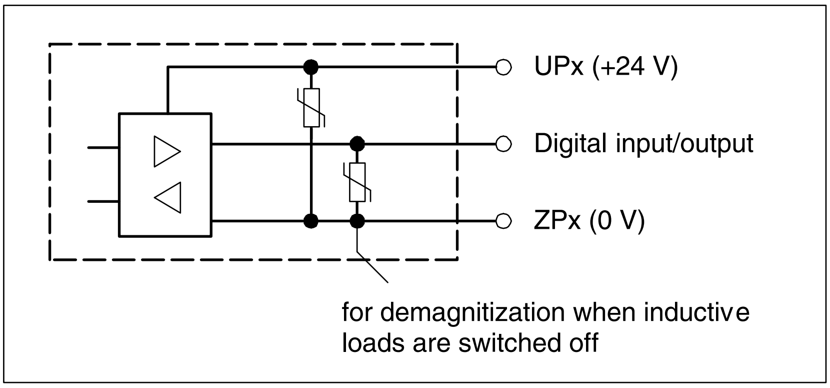


Figure: Digital input/output (circuit diagram)

Technical data of the high-speed counter

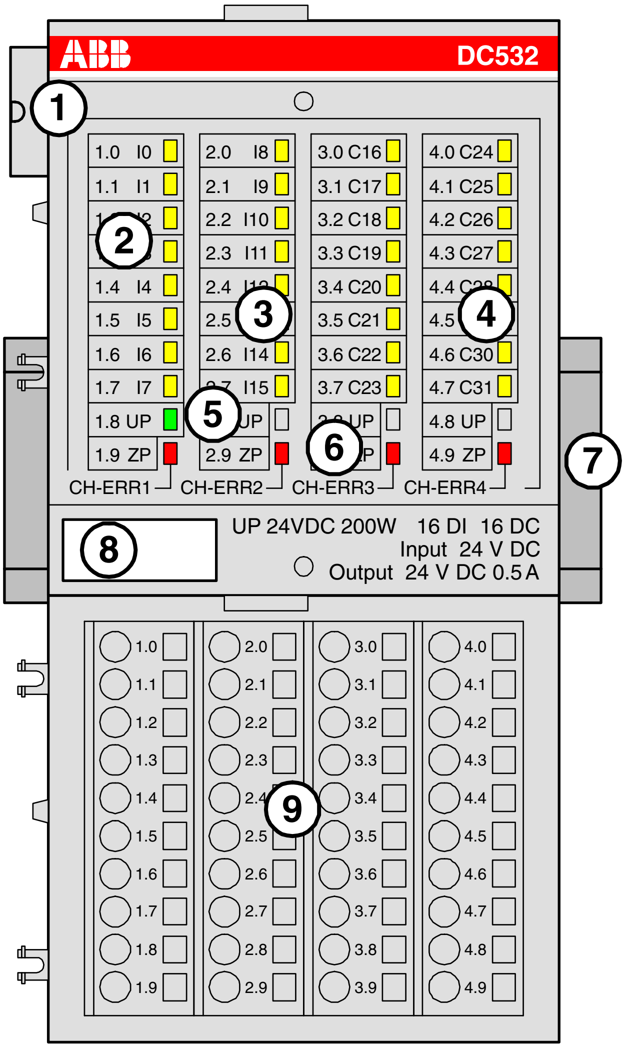
⚠ **Attention:** The high-speed counter of the module can only be used together with the AC500 CPU. The counter does not work, if the module is attached to an FBP Interface Module or a CS31 Bus Module.

Used inputs	DC522: C8 / C9 DC523: C16 / C17
Used outputs	DC522: C10 DC523: C18
Counting frequency	max. 50 kHz
Detailed description	see chapter "High-speed counter"
Operating modes	see chapter "High-speed counter, Operating modes"

Ordering data

Order No.	Scope of delivery
1SAP 240 600 R0001	DC522, Digital input/output module, 16 DC, 24 V DC / 0.5 A, 2-wire
1SAP 240 500 R0001	DC523, Digital input/output module, 24 DC, 24 V DC / 0.5 A, 1-wire
1SAP 212 200 R0001	TU515, I/O Terminal Unit, 24 V DC, screw-type terminals
1SAP 212 000 R0001	TU516, I/O Terminal Unit, 24 V DC, spring terminals

Digital Input/Output Module DC532
- 16 digital inputs 24 V DC, 16 configurable digital inputs/outputs
- module-wise electrically isolated



Elements of the digital input/output module DC532

1 I/O-Bus

2 Allocation between terminal No. and signal name

3 16 yellow LEDs to display the signal statuses at the inputs I0 to I15

4 16 yellow LEDs to display the signal statuses at the inputs/outputs C16 to C31

5 1 green LED to display the process voltage UP

6 4 red LEDs to display errors (CH-ERR1...CH-ERR4)

7 DIN rail

8 Label

9 I/O Terminal Unit (TU515 or TU516) with 40 terminals (screw-type or spring terminals)

Figure: Digital input/output module DC532, plugged on a Terminal Unit TU516

Contents

Intended purpose

The digital input/output module DC532 can be used as a remote expansion module at the FBP Interface Module DC505-FBP, at the CS31 Bus Module DC551-CS31 or locally at an AC500 CPU. It contains 32 channels with the following features:

- 16 digital inputs 24 V DC in two groups (1.0...2.7), with no potential separation between the channels
- and 16 digital inputs/outputs 24 V DC in two groups (3.0...4.7), of which each can be used
  - as an input,
  - as a transistor output with short-circuit and overload protection, 0.5 A rated current or
  - as a re-readable output (combined input/output) with the technical data of the digital inputs and outputs.

The inputs/outputs are electrically isolated from the other electronic circuitry of the module. There is no potential separation between the channels.

Functionality

Digital inputs	16 (24 V DC)
Digital inputs/outputs	16 (24 V DC)
High-speed counter	integrated, many configurable operating modes (only with AC500)
LED displays	for signal statuses, errors and supply voltage
Internal power supply	through the expansion bus interface (I/O-Bus)
External power supply	via the terminals ZP and UP (process voltage 24 V DC)

Electrical connection

The input/output module is plugged on the I/O Terminal Unit TU515 or TU516. Properly seat the module and press until it locks in place. The Terminal Unit is mounted on a DIN rail or with 2 screws plus the additional accessory for wall mounting (TA526).

The electrical connection of the I/O channels is carried out using the 40 terminals of the I/O Terminal Unit. I/O modules can be replaced without re-wiring the Terminal Units.

Note: Mounting, disassembling and electrical connection for the Terminal Units and the I/O modules are described in detail in the S500 system data chapters.

The terminals 1.8 to 4.8 and 1.9 to 4.9 are electrically interconnected within the I/O Terminal Unit and have always the same assignment, independent of the inserted module:

Terminals 1.8 to 4.8: Process voltage UP = +24 V DC
Terminals 1.9 to 4.9: Process voltage ZP = 0 V

The assignment of the other terminals:

Terminals	Signal	Meaning
1.0 to 1.7	I0 to I7	8 digital inputs
2.0 to 2.7	I8 to I15	8 digital inputs
3.0 to 3.7	C16 to C23	8 digital inputs/outputs
4.0 to 4.7	C24 to C31	8 digital inputs/outputs

The supply voltage 24 V DC for the module's electronic circuitry comes from the I/O-Bus of the FieldBusPlug or the CPU.

Caution: Removal of energized modules is not permitted. All power sources (supply and process voltages) must be switched off while working on any AC500 system.

The module provides several diagnosis functions (see chapter "Diagnosis and display").

The following figure shows the electrical connection of the digital input/output module DC532.

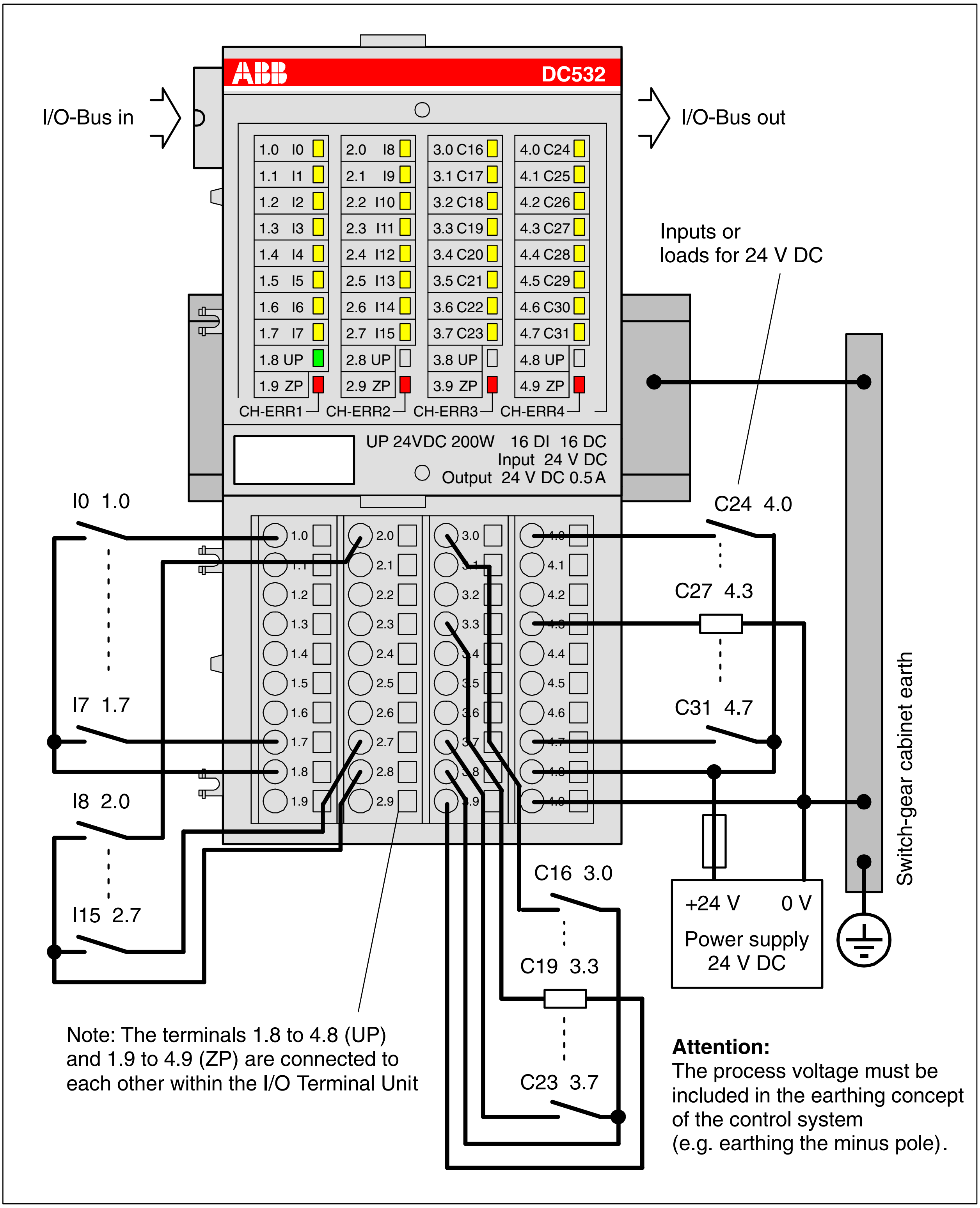


Figure: Electrical connection of the digital input/output module DC532

Internal data exchange

	without the high-speed counter	with the high-speed counter (only with AC500)
Digital inputs (bytes)	4	6
Digital outputs (bytes)	2	4
Counter input data (words)	0	4
Counter output data (words)	0	8

I/O configuration

The DC532 module does not store configuration data itself. The 16 configurable channels are defined as inputs or outputs by the user program, i.e. each of the configurable channels can used as input or output (or re-readable output) by interrogation or allocation by the user program.

Parameterization

The arrangement of the parameter data is performed by your master configuration software SYCON in connection with the S500 GSD files and in conjunction with the Control Builder software.

The parameter data directly influences the functionality of modules.

For non-standard applications, it is necessary to adapt the parameters to your system configuration.

Module: Module slot address: Y = 1...7

Nr.	Name	Value	Internal value	Internal value, type	Default	Min.	Max.	Max.
1	Module ID	Internal	1200 *1)	Word	1200 0x04b0	0	65535	0x0Y01
2 *2)	Ignore module	No Yes	0 1	Byte	No 0x00			not for FBP
3	Parameter length	Internal	7	Byte	7-CPU 6-FBP	0	255	0x0Y02
4	Check supply	Off on	0 1	Byte	On 0x01	0	1	0x0Y03
5	Input delay	0.1 ms 1 ms 8 ms 32 ms	0 1 2 3	Byte	8 ms 0x02	0	3	0x0Y04
6 *4)	High-speed counter	0 : 10 *3)	0 : 10	Byte	Mode 0 0x00			not for FBP
7	Output short-circuit detection	Off On	0 1	Byte	On 0x01	0	1	0x0Y05
8	Behaviour of outputs at communication errors	Off Last value Substitute value	0 1+(n*5) 2+(n*5), n <= 2	Byte	Off 0x00	0	2	0x0Y06
9	Substitute value at outputs Bit 15 = Output 15 Bit 0 = Output 0	0... 65535	0... 0xffff	Word	0 0x0000	0	65535	0x0Y07

*1) With CS31 and addresses less than 70 and FBP, the value is increased by 1

*2) Not with FBP

*3) Counter operating modes, see description of the high-speed counter

*4) With FBP or CS31 without the parameter "High-speed counter"

⚠ **Attention:** The high-speed counter of the module can only be used together with the AC500 CPU. The counter does not work, if the module is attached to an FBP Interface Module or to a CS31 Bus Module.

GSD file:	Ext_User_Prm_Data_Len = Ext_User_Prm_Data_Const(0) =	9 0x04, 0xb1, 0x06, \ 0x01, 0x02, 0x01, 0x00, 0x00, 0x00;

Diagnosis and display

In case of overload or short-circuit, the outputs switch off automatically and try to switch on again cyclically. Therefore an acknowledgement of the outputs is not necessary. The LED error message, however, is stored.

Diagnosis:

E1..E4	d1	d2	d3	d4	Identifier 000..063	AC500 display	<– Display in
Class	Comp	Dev	Mod	Ch	Err	PS501 PLC browser	
Byte 6 Bit 6..7	-	Byte 3	Byte 4	Byte 5	Byte 6 Bit 0..5	FBP diagnosis block	
Class	**Inter-face**	**De-vice**	**Mod-ule**	**Chan-nel**	**Error-Identifier**	**Error message**	**Remedy**
	1)	**2)**	**3)**	**4)**			
Module error DC532							
3	14 11 / 12	1..7 ADR	31 1..7	31	19	Checksum error in the I/O module	Replace I/O module
3	14 11 / 12	1..7 ADR	31 1..7	31	3	Timeout in the I/O module	Replace I/O module
3	14 11 / 12	1..7 ADR	31 1..7	31	40	Different hard-/firmware versions in the module	Replace I/O module
3	14 11 / 12	1..7 ADR	31 1..7	31	43	Internal error in the module	Replace I/O module
3	14 11 / 12	1..7 ADR	31 1..7	31	36	Internal data exchange failure	Replace I/O module
3	14 11 / 12	1..7 ADR	31 1..7	31	9	Overflow diagnosis buffer	New start
3	14 11 / 12	1..7 ADR	31 1..7	31	26	Parameter error	Check master
3	14 11 / 12	1..7 ADR	31 1..7	31	11	Process voltage too low	Check process voltage
4	14 11 / 12	1..7 ADR	31 1..7	31	45	Process voltage is switched off (ON –> OFF)	Process voltage ON
Channel error DC532							
4	14 11 / 12	1..7 ADR	2 1..7	16..31	47	Short-circuit at a digital output	Check connection

Remarks:

1)	In AC500 the following interface identifier applies: 14 = I/O-Bus, 11 = COM1 (e.g. CS31 bus), 12 = COM2. The FBP diagnosis block does not contain this identifier.
2)	With "Device" the following allocation applies: 31 = Module itself, 1..7 = Expansion module 1..7, ADR = Hardware address (e.g. of the DC551)
3)	With "Module" the following allocation applies dependent of the master: Module error: I/O-Bus or FBP: 31 = Module itself; COM1/COM2: 1..7 = Expansion 1..7 Channel error: I/O-Bus or FBP = Module type (2 = DO); COM1/COM2: 1..7 = Expansion 1..7
4)	In case of module errors, with channel "31 = Module itself" is output.

Displays:

During the power ON procedure, the module initializes automatically. All LEDs (accept the channel LEDs) are ON during this time.

Status of the LEDs (see also section "Diagnosis LEDs" in the S500 system data)

LED	Status	Color	LED = OFF	LED = ON	LED flashes
Inputs 00...15	digital input	yellow	Input = OFF	Input = ON (the input voltage is even displayed if the supply voltage is OFF).	--
Inputs/ outputs 16...31	digital input/output	yellow	Input/output = OFF	Input/output = ON (the input voltage is even displayed if the supply voltage is OFF).	--
UP	Process supply voltage 24 V DC via terminal	green	Process supply voltage is missing	Process supply voltage OK and initialization terminated	Module is not initialized correctly
CH-ERR1	Channel Error, error messages in groups (digital inputs/outputs combined into the groups 1, 2, 3, 4)	red	No error or process supply voltage is missing	Serious error within the corresponding group	Error on one channel of the corresponding group (e.g. short-circuit at an output)
CH-ERR2		red			
CH-ERR3		red			
CH-ERR4		red			
CH-ERR *)	Module Error	red	--	Internal error	--
*) All of the LEDs CH-ERR1 to CH-ERR4 light up together					

Technical data

The system data of AC500 and S500 are valid here. Only additional details are therefore documented below.

Process supply voltage UP	
- Connections	Terminals 1.8 - 4.8 for +24 V (UP) and 1.9 - 4.9 for 0 V (ZP)
- Rated value	24 V DC
- max. ripple	5 %
- Protection against reversed voltage	yes
- Rated protection fuse on UP	10 A fast
- Electrical isolation	yes, per module
Current consumption	
- internal (via I/O-Bus)	ca. 5 mA at 3.3 V DC
- current consumption from UP at normal operation / with outputs	0.05 A + max. 0.008 A per input + max. 0.5 A per output
- inrush current from UP (at power up)	0.007 A^2s
Max. power dissipation within the module	6 W (outputs unloaded)
Weight (without Terminal Unit)	ca. 125 g
Mounting position	horizontal or vertical with derating (output load reduced to 50 % at 40°C per group)
Cooling	The natural convection cooling must not be hindered by cable ducts or other parts in the switch-gear cabinet.

⚠ **Attention:** All I/O channels (digital and analog) are protected against reverse polarity, reverse supply, short circuit and continuous overvoltage up to 30 V DC.

Technical data of the digital inputs

Number of channels per module	16
Distribution of the channels into groups	1 group of 16 channels
Terminals of the channels I0 to I7	1.0 to 1.7
Terminals of the channels I8 to I15	2.0 to 2.7
Reference potential for all inputs	terminals 1.9...4.9 (minus pole of the process supply voltage, signal name ZP)
Electrical isolation	from the rest of the module (I/O-Bus)
Indication of the input signals	one yellow LED per channel, the LED is ON when the input signal is high (signal 1)
Input type acc. to EN 61131-2	Type 1
Input delay (0->1 or 1->0)	typ. 8 ms, configurable from 0.1 to 32 ms
Input signal voltage	24 V DC
signal 0	-3 V...+5 V
undefined signal	> +5 V...< +15 V
signal 1	+15 V...+30 V
Ripple with signal 0	within -3 V...+5 V
Ripple with signal 1	within +15 V...+30 V
Input current per channel	
input voltage +24 V	typ. 5 mA
input voltage +5 V	> 1 mA
input voltage +15 V	> 5 mA
input voltage +30 V	< 8 mA
Max. cable length	
shielded	1000 m
unshielded	600 m

Technical data of the configurable digital inputs/outputs

Each of the configurable I/O channels is defined as input or output by the user program. This is done by interrogating or allocating the corresponding channel.

Number of channels per module	16 inputs/outputs (with transistors)
Distribution of the channels into groups	1 group of 16 channels
if the channels are used as inputs	
- channels I16...I23	terminals 3.0...3.7
- channels I24...I31	terminals 4.0...4.7
if the channels are used as outputs	
- channels Q16...Q23	terminals 3.0...3.7
- channels Q24...Q31	terminals 4.0...4.7
Indication of the input/output signals	one yellow LED per channel, the LED is ON when the input/output signal is high (signal 1)
Electrical isolation	from the rest of the module

Technical data of the digital inputs/outputs if used as outputs

Number of channels per module	max. 16 transistor outputs
Reference potential for all outputs	terminals 1.9...4.9 (minus pole of the process supply voltage, signal name ZP)
Common power supply voltage	for all outputs: terminals 1.8...4.8 (plus pole of the process supply voltage, signal name UP)
Output voltage for signal 1	UP (-0.8 V)
Output delay (0->1 or 1->0)	on request
Output current	
rated value, per channel	500 mA at UP = 24 V
maximum value (all channels together)	8 A
Leakage current with signal 0	< 0.5 mA
Rated protection fuse on UP	10 A fast
De-magnitization when inductive loads are switched off	with varistors integrated in the module (see figure below)
Switching frequency	
with resistive load	on request
with inductive loads	max. 0.5 Hz
with lamp loads	max. 11 Hz with max. 5 W
Short-circuit proof / overload proof	yes
Overload message (I > 0.7 A)	yes, after ca. 100 ms
Output current limitation	yes, automatic reactivation after short-circuit/overload
Resistance to feedback against 24V signals	yes
Max. cable length	
shielded	1000 m
unshielded	600 m

The following drawing shows the circuitry of a digital input/output with the varistors for demagnitization when inductive loads are switched off.

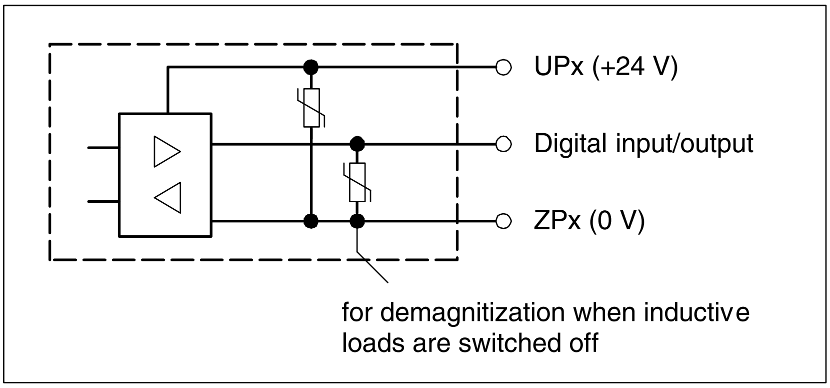


Figure: Digital input/output (circuit diagram)

Technical data of the digital inputs/outputs if used as inputs

Number of channels per module	max. 16 digital inputs
Reference potential for all inputs	terminals 1.9...4.9 (minus pole of the process supply voltage, signal name ZP)
Input current, per channel	see "Digital inputs"
Input type acc. to EN 61131-2	Type 1
Input delay (0->1 or 1->0)	typ. 8 ms, configurable from 0.1 to 32 ms
Input signal voltage	24 V DC
Signal 0	-3 V...+5 V *
undefined signal	> +5 V...< +15 V
Signal 1	+15 V...+30 V
Ripple with signal 0	within -3 V...+5 V *
Ripple with signal 1	within +15 V...+30 V
Max. cable length	
shielded	1000 m
unshielded	600 m

* Due to the direct connection to the output, the demagnetizing varistor is also effective at the input (see figure) above. This is why the difference between UPx and the input signal may not exceed the clamp voltage of the varistor. The varistor limits the voltage to approx. 36 V. Following this, the input voltage must range from - 12 V to + 30 V when UPx = 24 V and from - 6 V to + 30 V when UPx = 30 V.

Technical data of the high-speed counter

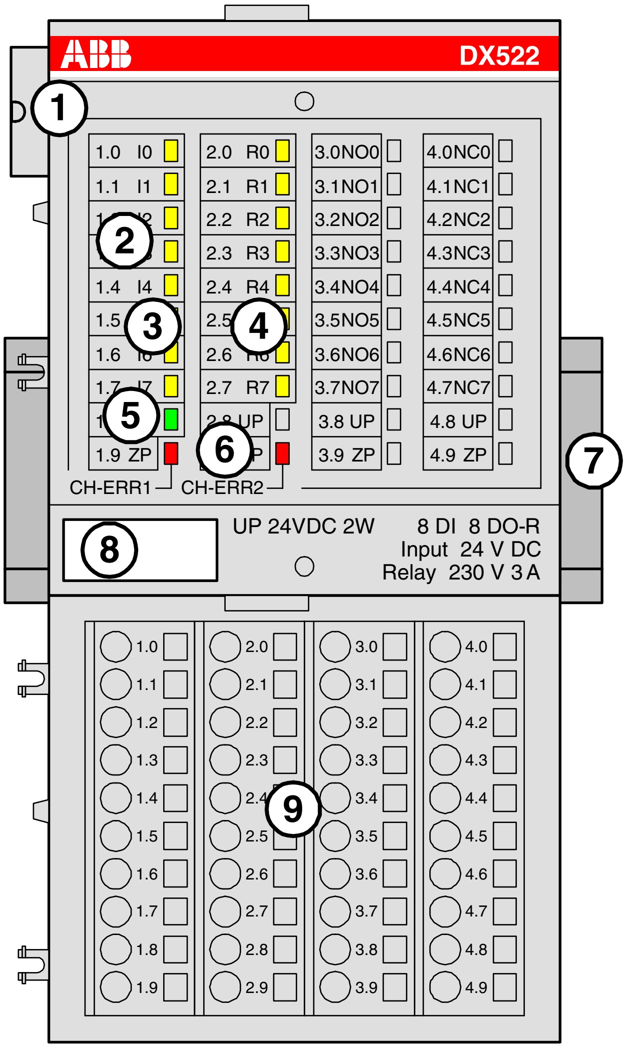
Attention: The high-speed counter of the module can only be used together with the AC500 CPU. The counter does not work, if the module is attached to an FBP Interface Module or a CS31 Bus Module.

Used inputs	C25 / C26
Used outputs	C27
Counting frequency	max. 50 kHz
Detailed description	see chapter "High-speed counter"
Operating modes	see chapter "High-speed counter, Operating modes"

Ordering data

Order No.	Scope of delivery
1SAP 240 100 R0001	DC532, Digital input/output module, 16 DI / 16 DC, 24 V DC / 0.5 A, 1-wire
1SAP 212 200 R0001	TU515, I/O Terminal Unit, 24 V DC, screw-type terminals
1SAP 212 000 R0001	TU516, I/O Terminal Unit, 24 V DC, spring terminals

Digital Input/Output Module DX522
- 8 digital inputs 24 V DC, module-wise electrically isolated
- 8 relay outputs



Elements of the digital input/output module DX522

1 I/O-Bus

2 Allocation between terminal No. and signal name

3 8 yellow LEDs to display the signal statuses at the inputs I0 to I7

4 8 yellow LEDs to display the signal statuses at the relay outputs R0 to R7

5 1 green LED to display the process voltage UP

6 2 red LEDs to display errors (CH-ERR1...CH-ERR2)

7 DIN rail

8 Label

9 I/O Terminal Unit (TU531 or TU532) with 40 terminals (screw-type or spring terminals)

Figure: Digital input/output module DX522, plugged on a Terminal Unit TU532

Contents

Intended purpose

The digital input/output module DX522 can be used as a remote expansion module at the FBP Interface Module DC505-FBP, at the CS31 Bus Module DC551-CS31 or locally at an AC500 CPU. It contains 16 channels with the following features:

- 8 digital inputs 24 V DC in one group (1.0...1.7), with no potential separation between the channels
- 8 digital relay outputs with one switch-over contact each, channels are electrically isolated from each other

The inputs/outputs are electrically isolated from the other electronic circuitry of the module. There is no potential separation between the input channels.

Functionality

Digital inputs	8 (24 V DC)
Digital outputs	8 relay outputs with one switch-over contact each
High-speed counter	integrated, many configurable operating modes (only with AC500)
LED displays	for signal statuses, errors and supply voltage
Internal power supply	through the expansion bus interface (I/O-Bus)
External power supply	via the terminals ZP and UP (process voltage 24 V DC)

Electrical connection

The input/output module is plugged on the I/O Terminal Unit TU531 or TU532. Properly seat the module and press until it locks in place. The Terminal Unit is mounted on a DIN rail or with 2 screws plus the additional accessory for wall mounting (TA526).

The electrical connection of the I/O channels is carried out using the 40 terminals of the I/O Terminal Unit. I/O modules can be replaced without re-wiring the Terminal Units.

Note: Mounting, disassembling and electrical connection for the Terminal Units and the I/O modules are described in detail in the S500 system data chapters.

The terminals 1.8 to 4.8 and 1.9 to 4.9 are electrically interconnected within the I/O Terminal Unit and have always the same assignment, independent of the inserted module:

Terminals 1.8 to 4.8: Process voltage UP = +24 V DC
Terminals 1.9 to 4.9: Process voltage ZP = 0 V

The assignment of the other terminals:

Terminals	Signal	Meaning
1.0 to 1.7	I0 to I7	Input signals of the 8 digital inputs
1.8 to 4.8	UP	Process voltage +24 V DC
1.9 to 4.9	ZP	Reference potential for the 8 digital inputs and the process voltage
2.0	R0	Common contact of the first relay output
3.0	NO 0	Normally-open contact of the first relay output
4.0	NC 0	Normally-closed contact of the first relay output
2.1	R1	Common contact of the second relay output
3.1	NO 1	Normally-open contact of the second relay output
4.1	NC 1	Normally-closed contact of the second relay output
:	:	:
2.7	R7	Common contact of the eighth relay output
3.7	NO 7	Normally-open contact of the eighth relay output
4.7	NC 7	Normally-closed contact of the eighth relay output

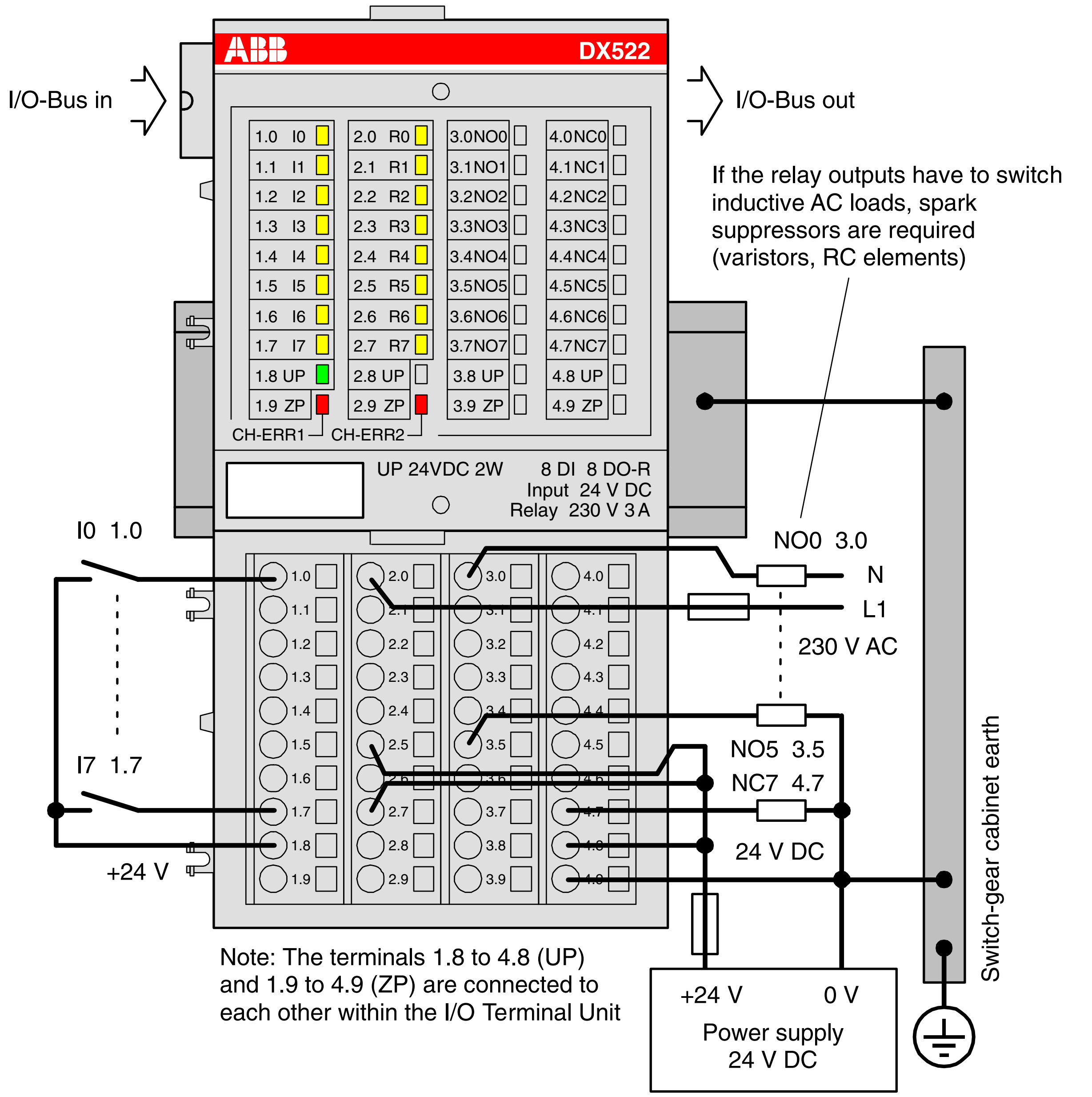
The supply voltage 24 V DC for the module's electronic circuitry comes from the I/O-Bus of the FieldBusPlug or the CPU.

⚠ **Caution:** Removal of energized modules is not permitted. All power sources (supply and process voltages) must be switched off while working on any AC500 system.

⚠ **Be aware: The module could handle 230 V AC! Make absolutely sure, that all dangerous voltages have been switched off before working at the module and its wiring.**

The module provides several diagnosis functions (see chapter "Diagnosis and display").

The following figure shows the electrical connection of the digital input/output module DX522.



If the relay outputs have to switch inductive DC loads, free-wheeling diodes must be circuited in parallel to these loads.

Attention:
The process voltage must be included in the earthing concept of the control system (e.g. earthing the minus pole).

Figure: Electrical connection of the digital input/output module DX522

Important:

The eight switch-over contacts of the relays are electrically isolated from channel to channel. This allows the user to connect loads of 24 V DC and 230 V AC to relay outputs of the same module. In such cases it is necessary that

- both supply voltages are grounded to prevent unsafe floating grounds,

- all 230 V AC feeds must be single phase from the same supply system.

It is possible to connect two or more relay contacts in series; however, voltages above 230 V AC and 3-phase loads are not allowed.

Important: The circuits of the relay contacts must be protected by back-up fuses of max. 6 A (characteristic gG/gL). Fuses can be used for single channels or module-wise, depending on the application).

Internal data exchange

	without the high-speed counter	with the high-speed counter (only with AC500)
Digital inputs (bytes)	1	3
Digital outputs (bytes)	1	3
Counter input data (words)	0	4
Counter output data (words)	0	8

I/O configuration

The digital input/output module DX522 does not store configuration data itself.

Parameterization

The arrangement of the parameter data is performed by your master configuration software SYCON in connection with the S500 GSD files and in conjunction with the Control Builder software.

The parameter data directly influences the functionality of modules.

For non-standard applications, it is necessary to adapt the parameters to your system configuration.

Module: Module slot address: Y = 1...7

Nr.	Name	Value	Internal value	Internal value, type	Default	Min.	Max.	EDS Slot/Index
1	Module ID	Internal	1210 *1)	Word	1210 0x04ba	0	65535	0x0Y01
2 *2)	Ignore module	No Yes	0 1	Byte	No 0x00			not for FBP
3	Parameter length	Internal	5	Byte	5-CPU 4-FBP	0	255	0x0Y02
4	Check supply	Off on	0 1	Byte	On 0x01	0	1	0x0Y03
5	Input delay	0.1 ms 1 ms 8 ms 32 ms	0 1 2 3	Byte	8 ms 0x02	0	3	0x0Y04
6 *4)	High-speed counter	0 : 10 *3)	0 : 10	Byte	Mode 0 0x00			not for FBP
7	Behaviour of outputs at communication errors	Off Last value Substitute value	0 1+(n*5) 2+(n*5), n <= 2	Byte	Off 0x00	0	2	0x0Y05
8	Substitute value at outputs) Bit 7 = Output 7 Bit 0 = Output 0	0... 255	0... 0xff	Byte	0 0x00	0	255	0x0Y06

*1) With CS31 and addresses less than 70 and FBP, the value is increased by 1

*2) Not with FBP

*3) Counter operating modes, see description of the high-speed counter

*4) With FBP and without the parameter "High-speed counter"

⚠ **Attention:** The high-speed counter of the module can only be used together with the AC500 CPU. The counter does not work, if the module is attached to an FBP Interface Module.

GSD file:	Ext_User_Prm_Data_Len = Ext_User_Prm_Data_Const(0) =	7 0x04, 0xbb, 0x04, \ 0x01, 0x02, 0x00, 0x00;

Diagnosis and display

Diagnosis:

E1..E4	d1	d2	d3	d4	Identifier 000..063	AC500 display	
Class	Comp	Dev	Mod	Ch	Err	PS501 PLC browser	<– Display in
Byte 6 Bit 6..7	-	Byte 3	Byte 4	Byte 5	Byte 6 Bit 0..5	FBP diagnosis block	
Class	Inter-face	De-vice	Mod-ule	Chan-nel	Error-Identifier	Error message	Remedy
	1)	2)	3)	4)			
Module error DX522							
3	14 11 / 12	1..7 ADR	31 1..7	31	19	Checksum error in the I/O module	Replace I/O module
3	14 11 / 12	1..7 ADR	31 1..7	31	3	Timeout in the I/O module	Replace I/O module
3	14 11 / 12	1..7 ADR	31 1..7	31	40	Different hard-/firmware versions in the module	Replace I/O module
3	14 11 / 12	1..7 ADR	31 1..7	31	43	Internal error in the module	Replace I/O module
3	14 11 / 12	1..7 ADR	31 1..7	31	36	Internal data exchange failure	Replace I/O module
3	14 11 / 12	1..7 ADR	31 1..7	31	9	Overflow diagnosis buffer	New start
3	14 11 / 12	1..7 ADR	31 1..7	31	26	Parameter error	Check master
3	14 11 / 12	1..7 ADR	31 1..7	31	11	Process voltage too low	Check process voltage
4	14 11 / 12	1..7 ADR	31 1..7	31	45	Process voltage is switched off (ON –> OFF)	Process voltage ON

Remarks:

1)	In AC500 the following interface identifier applies: 14 = I/O-Bus, 11 = COM1 (e.g. CS31 bus), 12 = COM2. The FBP diagnosis block does not contain this identifier.
2)	With "Device" the following allocation applies: 31 = Module itself, 1..7 = Expansion module 1..7, ADR = Hardware address (e.g. of the DC551)
3)	With "Module" the following allocation applies dependent of the master: Module error: I/O-Bus or FBP: 31 = Module itself; COM1/COM2: 1..7 = Expansion 1..7 Channel error: I/O-Bus or FBP = Module type (2 = DO); COM1/COM2: 1..7 = Expansion 1..7
4)	In case of module errors, with channel "31 = Module itself" is output.

Displays:

During the power ON procedure, the module initializes automatically. All LEDs (accept the channel LEDs) are ON during this time.

Status of the LEDs (see also section "Diagnosis LEDs" in the S500 system data)

LED	Status	Color	LED = OFF	LED = ON	LED flashes
Inputs 00...07	digital input	yellow	Input = OFF	Input = ON (the input voltage is even displayed if the supply voltage is OFF).	--
Outputs 08...15 (relays)	digital output	yellow	Relay output = OFF	Relay output = ON	--
UP	Process supply voltage 24 V DC via terminal	green	Process supply voltage is missing	Process supply voltage OK and initialization terminated	Module is not initialized correctly
CH-ERR1	Channel Error, error messages in groups (digital inputs/outputs combined into the groups 1 and 2)	red	No error or process supply voltage is missing	Serious error within the corresponding group	Error on one channel of the corresponding group
CH-ERR2		red			
CH-ERR *)	Module Error	red	--	Internal error	--
*) All of the LEDs CH-ERR1 to CH-ERR2 light up together					

Technical data

The system data of AC500 and S500 are valid here. Only additional details are therefore documented below.

Process supply voltage UP	
- Connections	Terminals 1.8 - 4.8 for +24 V (UP) and 1.9 - 4.9 for 0 V (ZP)
- Rated value	24 V DC
- max. ripple	5 %
- Protection against reversed voltage	yes
Rated protection fuse on UP	10 A fast
- Electrical isolation	yes, per module
Current consumption	
- internal (via I/O-Bus)	ca. 5 mA at 3.3 V DC
- current consumption from UP at normal operation / with outputs	0.05 A + output loads
- inrush current from UP (at power up)	0.010 A^2s
Max. power dissipation within the module	6 W (outputs OFF)
Weight (without Terminal Unit)	ca. 300 g
Mounting position	horizontal or vertical with derating (output load reduced to 50 % at 40°C per group)
Cooling	The natural convection cooling must not be hindered by cable ducts or other parts in the switch-gear cabinet.

⚠ **Attention:** All I/O channels (digital and analog) are protected against reverse polarity, reverse supply, short circuit and continuous overvoltage up to 30 V DC.

Technical data of the digital inputs

Number of channels per module	8
Distribution of the channels into groups	1 group of 8 channels
Terminals of the channels I0 to I7	1.0 to 1.7
Reference potential for all inputs	terminals 1.9...4.9 (minus pole of the process supply voltage, signal name ZP)
Electrical isolation	from the rest of the module (I/O-Bus)
Indication of the input signals	one yellow LED per channel, the LED is ON when the input signal is high (signal 1)
Input type acc. to EN 61131-2	Type 1
Input delay (0->1 or 1->0)	typ. 8 ms, configurable from 0.1 to 32 ms
Input signal voltage	24 V DC
signal 0	-3 V...+5 V
undefined signal	> +5 V...< +15 V
signal 1	+15 V...+30 V
Ripple with signal 0	within -3 V...+5 V
Ripple with signal 1	within +15 V...+30 V
Input current per channel	
input voltage +24 V	typ. 5 mA
input voltage +5 V	> 1 mA
input voltage +15 V	> 5 mA
input voltage +30 V	< 8 mA
Max. cable length	
shielded	1000 m
unshielded	600 m

Technical data of the relay outputs

Number of channels per module	8 relay outputs
Distribution of channels into groups	8 groups of 1 channel each
Connection of the channel R0	terminal 2.0 (common), 3.0 (NO) and 4.0 (NC)
Connection of the channel R1	terminal 2.1 (common), 3.1 (NO) and 4.1 (NC)
:	:
Connection of the channel R6	terminal 2.6 (common), 3.6 (NO) and 4.6 (NC)
Connection of the channel R7	terminal 2.7 (common), 3.7 (NO) and 4.7 (NC)
Electrical isolation	between the channels and from the rest of the module
Indication of the output signals	one yellow LED per channel, the LED is ON when the relay coil is energized
Output delay (0->1 or 1->0)	on request
Relay power supply	by UP process voltage
Relay outputs	
- output short-circuit protection	should be provided externally with a fuse or circuit breaker
- rated protection fuse	6 A gL/gG per channel
Output switching capacity	
- resistive load, max.	3 A; 3 A (230 V AC), 2 A (24 V DC)
- inductive load, max.	1.5 A; 1.5 A (230 V AC), 1.5 A (24 V DC)
- lamp load	60 W (230 V AC), 10 W (24 V DC)
Life time (cycles)	mechanical: 300 000; under load: 300 000 (24 V DC at 2 A), 200 000 (120 V AC at 2 A), 100 000 (230 V AC at 3 A)
Spark suppression with inductive AC load	must be performed externally according to driven load specifications
Demagnetization with inductive DC load	a free-wheeling diode must be circuited in parallel to the inductive load
Switching frequency	
- with resistive load	max. 10 Hz
- with inductive load	max. 2 Hz
- with lamp load	max. xx Hz
Max. cable length	
- shielded	1000 m
- unshielded	600 m

Technical data of the high-speed counter

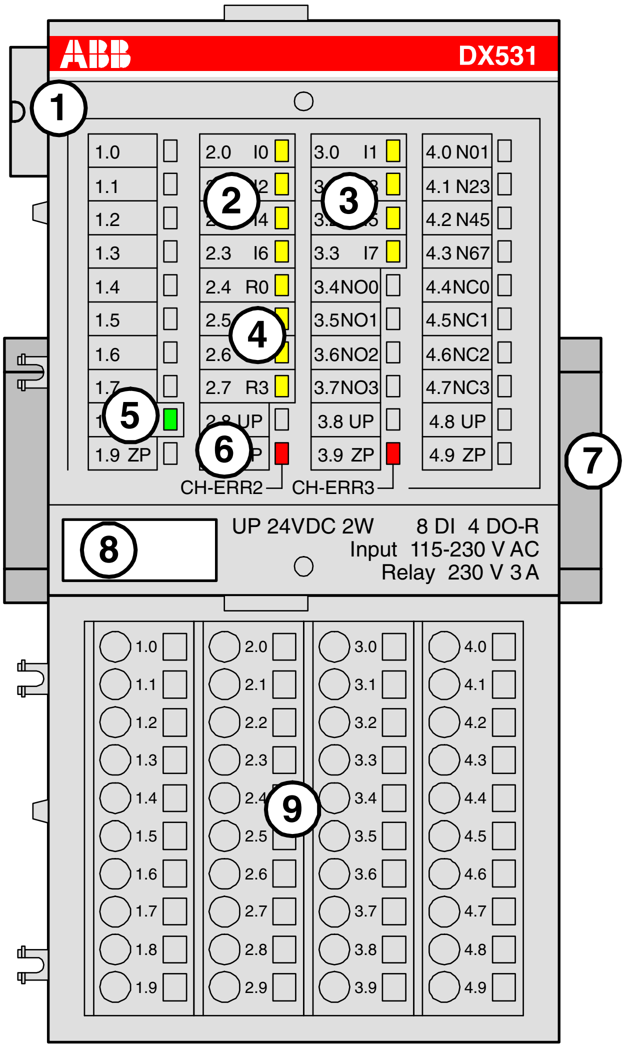
⚠ **Attention:** The high-speed counter of the module can only be used together with the AC500 CPU. The counter does not work, if the module is attached to an FBP Interface Module or a CS31 Bus Module.

Used inputs	I0 / I1
Used outputs	none
Counting frequency	50 kHz max.
Detailed description	see chapter "High-speed counter"
Operating modes	see chapter "High-speed counter, Operating modes"

Ordering data

Order No.	Scope of delivery
1SAP 245 200 R0001	DX522, Digital input/output module, 8 DI, 24 V DC, 8 DO relays
1SAP 217 200 R0001	TU531, I/O Terminal Unit, 230 V AC, relays, screw-type terminals
1SAP 217 000 R0001	TU532, I/O Terminal Unit, 230 V AC, relays, spring terminals

Digital Input/Output Module DX531
- 8 digital inputs 120/230 V AC, module-wise electrically isolated
- 4 relay outputs



Elements of the digital input/output module DX531

1 I/O-Bus

2 Allocation between terminal No. and signal name

3 8 yellow LEDs to display the signal statuses at the inputs I0 to I7

4 4 yellow LEDs to display the signal statuses at the relay outputs R0 to R3

5 1 green LED to display the process voltage UP

6 2 red LEDs to display errors (CH-ERR2 and CH-ERR3)

7 DIN rail

8 Label

9 I/O Terminal Unit (TU531 or TU532) with 40 terminals (screw-type or spring terminals)

Figure: Digital input/output module DX531, plugged on a Terminal Unit TU532

Contents

Intended purpose

The digital input/output module DX531 can be used as a remote expansion module at the FBP Interface Module DC505-FBP, at the CS31 Bus Module DC551-CS31 or locally at an AC500 CPU. It contains 12 channels with the following features:

- 8 digital inputs 120/230 V AC
- 4 digital relay outputs with one switch-over contact each, channels are electrically isolated from each other

The inputs/outputs are electrically isolated from the other electronic circuitry of the module.

Functionality

Digital inputs	8 (120 V AC / 230 V AC)
Digital outputs	4 relay outputs with one switch-over contact each
LED displays	for signal statuses, errors and supply voltage
Internal power supply	through the expansion bus interface (I/O-Bus)
External power supply	via the terminals ZP and UP (process voltage 24 V DC)

Electrical connection

The input/output module is plugged on the I/O Terminal Unit TU531 or TU532. Properly seat the module and press until it locks in place. The Terminal Unit is mounted on a DIN rail or with 2 screws plus the additional accessory for wall mounting (TA526).

The electrical connection of the I/O channels is carried out using the 40 terminals of the I/O Terminal Unit. I/O modules can be replaced without re-wiring the Terminal Units.

Note: Mounting, disassembling and electrical connection for the Terminal Units and the I/O modules are described in detail in the S500 system data chapters.

The terminals 1.8 to 4.8 and 1.9 to 4.9 are electrically interconnected within the I/O Terminal Unit and have always the same assignment, independent of the inserted module:

Terminals 1.8 to 4.8: Process voltage UP = +24 V DC
Terminals 1.9 to 4.9: Process voltage ZP = 0 V

The assignment of the other terminals:

Terminals	Signal	Meaning
1.0 to 1.7	unused	
2.0 and 3.0	I0 and I1	Input signals for the digital inputs I0 and I1
4.0	N01	Neutral conductor for the digital inputs I0 and I1
2.1 and 3.1	I2 and I3	Input signals for the digital inputs I2 and I3
4.1	N23	Neutral conductor for the digital inputs I2 and I3
2.2 and 3.2	I4 and I5	Input signals for the digital inputs I4 and I5
4.2	N45	Neutral conductor for the digital inputs I4 and I5
2.3 and 3.3	I6 and I7	Input signals for the digital inputs I6 and I7
4.3	N67	Neutral conductor for the digital inputs I6 and I7
2.4	R0	Common contact of the first relay output
3.4 and 4.4	NO0 and NC0	NO and NC contacts of the first relay output
2.5	R1	Common contact of the second relay output
3.5 and 4.5	NO1 and NC1	NO and NC contacts of the second relay output
2.6	R2	Common contact of the third relay output
3.6 and 4.6	NO2 and NC2	NO and NC contacts of the third relay output
2.7	R3	Common contact of the fourth relay output
3.7 and 4.7	NO3 and NC3	NO and NC contacts of the fourth relay output

The supply voltage 24 V DC for the module's electronic circuitry comes from the I/O-Bus of the FieldBusPlug or the CPU.

⚠ **Caution:** Removal of energized modules is not permitted. All power sources (supply and process voltages) must be switched off while working on any AC500 system.

⚠ **Be aware: The module could handle 230 V AC! Make absolutely sure, that all dangerous voltages have been switched off before working at the module and its wiring.**

The module provides several diagnosis functions (see chapter "Diagnosis and display").

The following figure shows the electrical connection of the digital input/output module DX531.

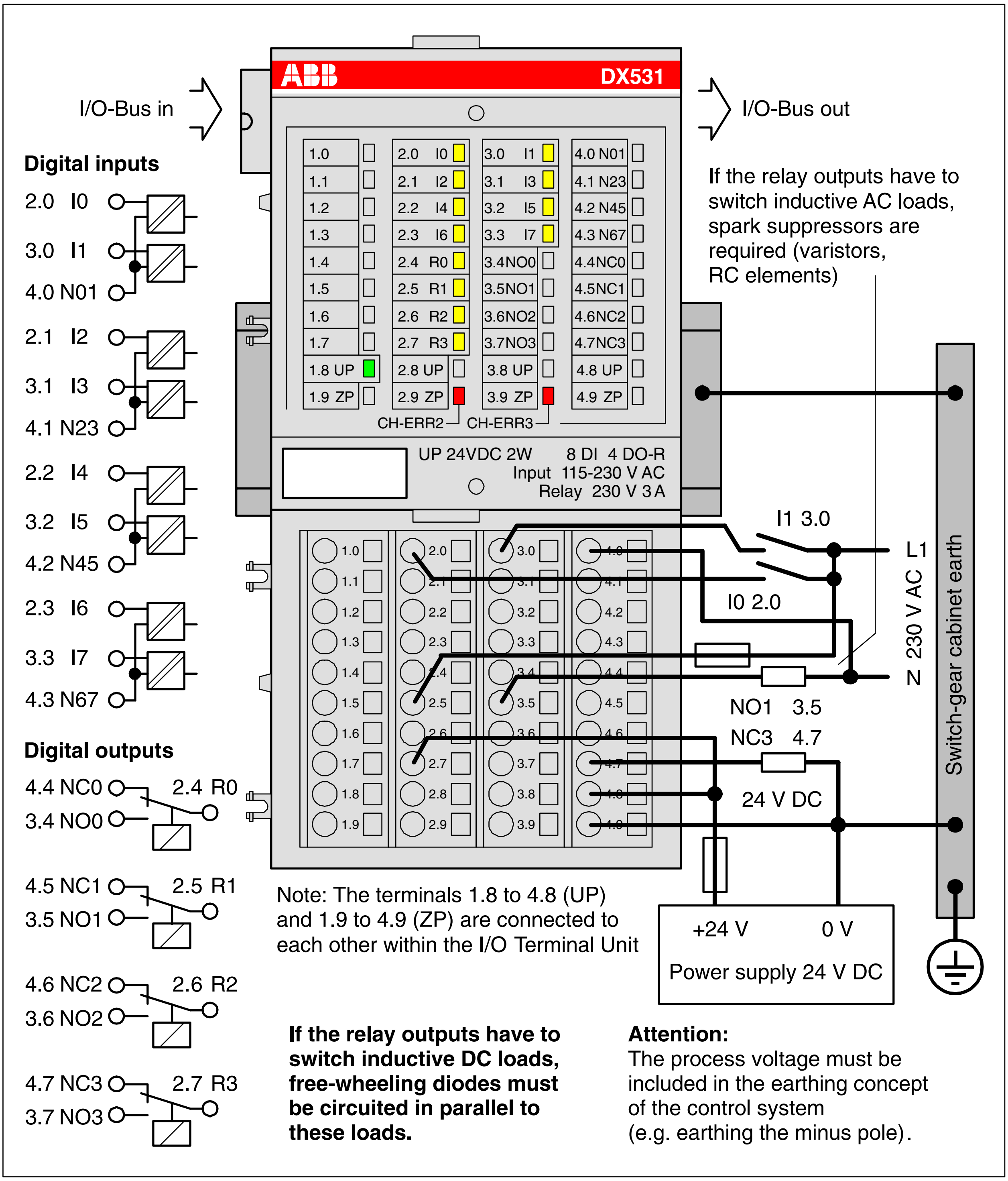


Figure: Electrical connection of the digital input/output module DX531

Important:

All neutral conductor connections must be common to the same supply system, since the terminals 4.0 to 4.3 are interconnected within the module. Otherwise, accidental energization could occur.

All input signals must come from the same phase of the same supply system (together with the used neutral conductor). The module is designed for 120/230 V AC max., not for 400 V AC, even not between two input terminals.

The four switch-over contacts of the relays are electrically isolated from channel to channel. This allows the user to connect loads of 24 V DC and 230 V AC to relay outputs of the same module. In such cases it is necessary that

- both supply voltages are grounded to prevent unsafe floating grounds,

- all 230 V AC feeds must be single phase from the same supply system.

It is possible to connect two or more relay contacts in series; however, voltages above 230 V AC and 3-phase loads are not allowed.

Important: The circuits of the relay contacts must be protected by back-up fuses of max. 6 A (characteristic gG/gL). Fuses can be used for single channels or module-wise, depending on the application).

Internal data exchange

Digital inputs (bytes)	1
Digital outputs (bytes)	1
Counter input data (words)	0
Counter output data (words)	0

I/O configuration

The digital input/output module DX531 does not store configuration data itself.

Parameterization

The arrangement of the parameter data is performed by your master configuration software SYCON in connection with the S500 GSD files and in conjunction with the Control Builder software.

The parameter data directly influences the functionality of modules.

For non-standard applications, it is necessary to adapt the parameters to your system configuration.

Module: Module slot address: Y = 1...7

Nr.	Name	Value	Internal value	Internal value, type	Default	Min.	Max.	EDS Slot/Index
1	Module ID	Internal	1205 *1)	Word	1205 0x04b5	0	65535	0x0Y01
2 *2)	Ignore module	No Yes	0 1	Byte	No 0x00			not for FBP
3	Parameter length	Internal	4	Byte	4-CPU 4-FBP	0	255	0x0Y02
4	Check supply	Off on	0 1	Byte	On 0x01	0	1	0x0Y03
5	Input delay	20 ms 100 ms	0 1	Byte	20 ms 0x00	0	1	0x0Y04
6	Behaviour of outputs at communication errors	Off Last value Substitute value	0 1+(n*5) 2+(n*5), n <= 2	Byte	Off 0x00	0	2	0x0Y05
7	Substitute value at outputs Bit 3 = Output 3 Bit 0 = Output 0	0...15	0... 0x0f	Byte	0 0x00	0	15	0x0Y06

*1) With CS31 and addresses less than 70 and FBP, the value is increased by 1

*2) Not with FBP

GSD file:	Ext_User_Prm_Data_Len = Ext_User_Prm_Data_Const(0) =	7 0x04, 0xb6, 0x04, \ 0x01, 0x00, 0x00, 0x00;

Diagnosis and display

Diagnosis:

E1..E4	d1	d2	d3	d4	Identifier 000..063	AC500 display	<– Display in
Class	**Comp**	**Dev**	**Mod**	**Ch**	**Err**	**PS501 PLC browser**	
Byte 6 Bit 6..7	**-**	**Byte 3**	**Byte 4**	**Byte 5**	**Byte 6 Bit 0..5**	**FBP diagnosis block**	
Class	**Inter-face**	**De-vice**	**Mod-ule**	**Chan-nel**	**Error-Identifier**	**Error message**	**Remedy**
	1)	**2)**	**3)**	**4)**			
Module error DX531							
3	14	1..7	31	31	19	Checksum error in the I/O module	Replace I/O module
	11 / 12	ADR	1..7				
3	14	1..7	31	31	3	Timeout in the I/O module	Replace I/O module
	11 / 12	ADR	1..7				
3	14	1..7	31	31	40	Different hard-/firmware versions in the module	Replace I/O module
	11 / 12	ADR	1..7				
3	14	1..7	31	31	43	Internal error in the module	Replace I/O module
	11 / 12	ADR	1..7				
3	14	1..7	31	31	36	Internal data exchange failure	Replace I/O module
	11 / 12	ADR	1..7				
3	14	1..7	31	31	9	Overflow diagnosis buffer	New start
	11 / 12	ADR	1..7				
3	14	1..7	31	31	26	Parameter error	Check master
	11 / 12	ADR	1..7				
3	14	1..7	31	31	11	Process voltage too low	Check process voltage
	11 / 12	ADR	1..7				
4	14	1..7	31	31	45	Process voltage is switched off (ON –> OFF)	Process voltage ON
	11 / 12	ADR	1..7				

Remarks:

1)	In AC500 the following interface identifier applies: 14 = I/O-Bus, 11 = COM1 (e.g. CS31 bus), 12 = COM2. The FBP diagnosis block does not contain this identifier.
2)	With "Device" the following allocation applies: 31 = Module itself, 1..7 = Expansion module 1..7, ADR = Hardware address (e.g. of the DC551)
3)	With "Module" the following allocation applies dependent of the master: Module error: I/O-Bus or FBP: 31 = Module itself; COM1/COM2: 1..7 = Expansion 1..7 Channel error: I/O-Bus or FBP = Module type (2 = DO); COM1/COM2: 1..7 = Expansion 1..7
4)	In case of module errors, with channel "31 = Module itself" is output.

Displays:

During the power ON procedure, the module initializes automatically. All LEDs (accept the channel LEDs) are ON during this time.

Status of the LEDs (see also section "Diagnosis LEDs" in the S500 system data)

LED	Status	Color	LED = OFF	LED = ON	LED flashes
Inputs 00...07	digital input	yellow	Input = OFF	Input = ON (the input voltage is even displayed if the supply voltage is OFF).	--
Outputs 08...11 (relays)	digital output	yellow	Relay output = OFF	Relay output = ON	--
UP	Process supply voltage 24 V DC via terminal	green	Process supply voltage is missing	Process supply voltage OK and initialization terminated	Module is not initialized correctly
CH-ERR2	Channel Error, error messages in groups (digital inputs/outputs combined into the groups 2 and 3)	red	No error or process supply voltage is missing	Serious error within the corresponding group	Error on one channel of the corresponding group
CH-ERR3		red			
CH-ERR *)	Module Error	red	--	Internal error	--
*) All of the LEDs CH-ERR2 to CH-ERR3 light up together					

Technical data

The system data of AC500 and S500 are valid here. Only additional details are therefore documented below.

Process supply voltage UP	
- Connections	Terminals 1.8 - 4.8 for +24 V (UP) and 1.9 - 4.9 for 0 V (ZP)
- Rated value	24 V DC
- max. ripple	5 %
- Protection against reversed voltage	yes
- Rated protection fuse on UP	10 A fast
- Electrical isolation	yes, per module
Current consumption	
- internal (via I/O-Bus)	ca. 5 mA at 3.3 V DC
- current consumption from UP at normal operation / with outputs	0.05 A + output loads
- inrush current from UP (at power up)	0.004 A^2s
Max. power dissipation within the module	6 W (outputs OFF)
Weight (without Terminal Unit)	ca. 300 g
Mounting position	Horizontal or vertical with derating (output load reduced to 50 % at 40°C per group)
Cooling	The natural convection cooling must not be hindered by cable ducts or other parts in the switch-gear cabinet.

Technical data of the digital inputs

Number of channels per module	8
Distribution of the channels into groups	4 groups of 2 channels each
Terminals of the channels I0 to I7	see figure "Electrical connection"
Electrical isolation	2500 V AC from the rest of the module (I/O-Bus)
Indication of the input signals	one yellow LED per channel, the LED is ON when the input signal is high (signal 1)
Input type acc. to EN 61131-2	Type 2
Input delay (0->1 or 1->0)	typ. 20 ms
Input signal voltage	230 V AC or 120 V AC
Input signal range	0...265 V AC
Input signal frequency	47...63 Hz
Input characteristic	according to EN 61132-2 Type 2
Signal 0	0...40 V AC
undefined signal	> 40 V AC...< 74 V AC
Signal 1	74...265 V AC
Input current per channel	
input voltage = 159 V AC	> 7 mA
input voltage = 40 V AC	< 5 mA
Overvoltage protection	yes
Max. cable length	
Shielded / unshielded	1000 m / 600 m

Technical data of the relay outputs

Number of channels per module	4 relay outputs
Distribution of channels into groups	4 groups of 1 channel each
Connection of the four relays	see figure "Electrical connection"
Electrical isolation	between the channels and from the rest of the module
Indication of the output signals	one yellow LED per channel, the LED is ON when the relay coil is energized
Output delay (0->1 or 1->0)	on request
Relay power supply	by UP process voltage
Relay outputs	
- output short-circuit protection	should be provided externally with a fuse or circuit breaker
- rated protection fuse	6 A gL/gG per channel
Output switching capacity	
- resistive load, max.	3 A; 3 A (230 V AC), 2 A (24 V DC)
- inductive load, max.	1.5 A; 1.5 A (230 V AC), 1.5 A (24 V DC)
- lamp load	60 W (230 V AC), 10 W (24 V DC)
Life time (cycles)	mechanical: 300 000; under load: 300 000 (24 V DC at 2 A), 200 000 (120 V AC at 2 A), 100 000 (230 V AC at 3 A)
Spark suppression with inductive AC load	must be performed externally according to driven load specifications
Demagnetization with inductive DC load	a free-wheeling diode must be circuited in parallel to the inductive load
Switching frequency	
- with resistive load	max. 10 Hz
- with inductive load	max. 2 Hz
- with lamp load	on request
Max. cable length	
- shielded	1000 m
- unshielded	600 m

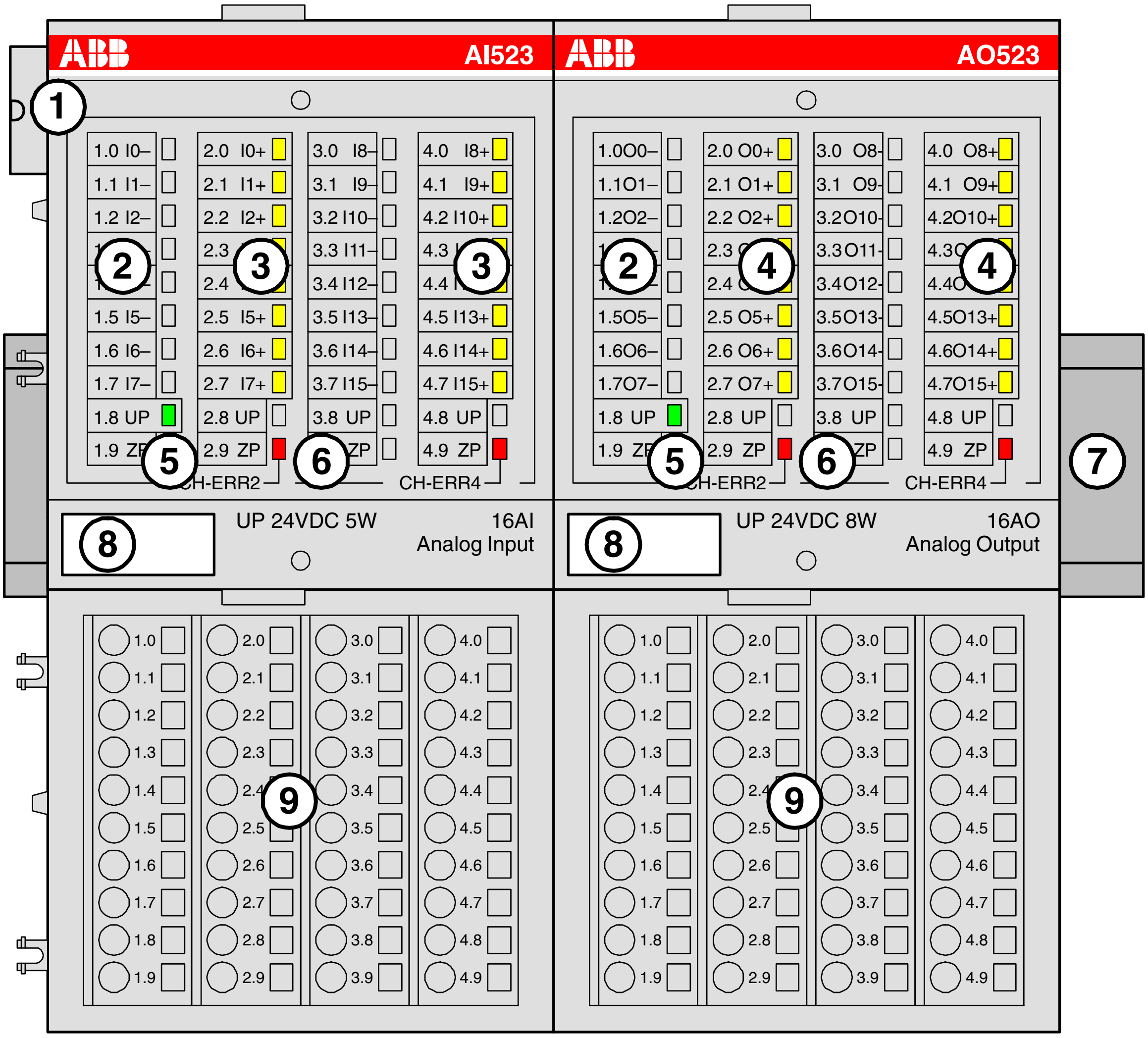
Ordering data

Order No.	**Scope of delivery**
1SAP 245 000 R0001	DX531, Digital input/output module, 8 DI, 230 V AC, 4 DO relays, 2-wire
1SAP 217 200 R0001	TU531, I/O Terminal Unit, 230 V AC, relays, screw-type terminals
1SAP 217 000 R0001	TU532, I/O Terminal Unit, 230 V AC, relays, spring terminals

S500 Analog I/O Modules, overview

Analog Input Module AI523
Analog Output Module AO523

- AI523: 16 configurable analog inputs
- AO523: 16 configurable analog outputs
- resolution 12 bits plus sign
- module-wise electrically isolated



Elements of the analog modules AI523 and AO523

1 I/O-Bus
2 Allocation between terminal No. and signal names
3 16 yellow LEDs to display the statuses at the inputs I0 to I15 (AI523)
4 16 yellow LEDs to display the statuses at the outputs O0 to O15 (AO523)
5 1 green LED to display the process voltage UP
6 2 red LEDs to display errors (CH-ERR2 and CH-ERR4)
7 DIN rail
8 Label
9 I/O Terminal Unit (TU515/TU516) with 40 terminals (screw-type or spring terminals)

Figure: Analog input module AI523 and analog output module AO523, plugged on Terminal Units TU516

Contents

Intended purpose

The analog modules AI523 and AO523 can be used as remote expansion modules at the FBP Interface Module DC505-FBP, at the CS31 Bus Module DC551-CS31 or locally at an AC500 CPU. They contain 16 channels each with the following features:

Analog input module AI523:

- 16 configurable analog inputs in two groups (1.0...2.7 and 3.0...4.7)

Analog output module AO523:

- 8 configurable analog outputs in two groups (1.0...2.7 and 3.0...4.7)

The configuration is performed by software.

The modules are supplied with a process voltage of 24 V DC. The analog inputs and outputs are electrically isolated from the rest of the modules' electronics.

Functionality

AI523: 16 analog inputs, individually configurable for	unused (default setting)
	0...10 V
	-10 V...+10 V
	0...20 mA
	4...20 mA
	Pt100, -50 °C...+400 °C (2-wire)
	Pt100, -50 °C...+400 °C (3-wire), requires 2 channels
	Pt100, -50 °C...+70 °C (2-wire)
	Pt100, -50 °C...+70 °C (3-wire), requires 2 channels
	Pt1000, -50 °C...+400 °C (2-wire)
	Pt1000, -50 °C...+400 °C (3-wire), requires 2 channels
	Ni1000, -50 °C...+150 °C (2-wire)
	Ni1000, -50 °C...+150 °C (3-wire), requires 2 channels
	0...10 V with differential inputs, requires 2 channels
	-10 V...+10 V with differential inputs, requires 2 channels
	digital signals (digital input)

AO523: 8 analog outputs, individually configurable for	unused (default setting)
	-10 V...+10 V
	0...20 mA
	4...20 mA
AO523: 8 analog outputs, individually configurable for	unused (default setting)
	-10 V...+10 V

Resolution of the analog channels	
- Voltage -10 V... +10 V	12 bits plus sign
- Voltage 0...10 V	12 bits
- Current 0...20 mA, 4...20 mA	12 bits
- Temperature	0.1 °C
LED displays	AI523: 19 LEDs for signals and error messages AO523: 19 LEDs for signals and error messages
Internal power supply	through the expansion bus interface (I/O-Bus)
External power supply	via the terminals ZP and UP (process voltage 24 V DC)

Electrical connection

The analog modules are plugged on I/O Terminal Units TU515 or TU516. Properly seat the modules and press until they lock in place. The Terminal Units are mounted on a DIN rail or with 2 screws plus the additional accessory for wall mounting (TA526).

The electrical connection of the I/O channels is carried out using the 40 terminals of the I/O Terminal Unit. I/O modules can be replaced without re-wiring the Terminal Units.

Note: Mounting, disassembling and electrical connection for the Terminal Units and the I/O modules are described in detail in the S500 system data chapters.

The terminals 1.8 to 4.8 and 1.9 to 4.9 are electrically interconnected within the I/O Terminal Units and have always the same assignment, independent of the inserted module:

Terminals 1.8 to 4.8: Process voltage UP = +24 V DC
Terminals 1.9 to 4.9: Process voltage ZP = 0 V

The assignment of the other terminals:

Analog input module AI523:

Terminals	Signal	Meaning
1.0 to 1.7	I0- to I7-	Minus poles of the first 8 analog inputs
2.0 to 2.7	I0+ to I7+	Plus poles of the first 8 analog inputs
3.0 to 3.7	I8- to I15-	Minus poles of the following 8 analog inputs
4.0 to 4.7	I8+ to I15+	Plus poles of the following 8 analog inputs

Analog output module AO523:

Terminals	Signal	Meaning
1.0 to 1.7	O0- to O7-	Minus poles of the first 8 analog outputs
2.0 to 2.7	O0+ to O7+	Plus poles of the first 8 analog outputs
3.0 to 3.7	O8- to O15-	Minus poles of the following 8 analog outputs
4.0 to 4.7	O8+ to O15+	Plus poles of the following 8 analog outputs

⚠ **Caution:** The minus poles of the analog inputs are electrically connected to each other. They form an "Analog Ground" signal for the module. The minus poles of the analog outputs are also electrically connected to each other to form an "Analog Ground" signal.

⚠ **Caution:** There is no electrical isolation between the analog circuitry and ZP/UP. Therefore, the analog sensors must be electrically isolated in order to avoid loops via the earth potential or the supply voltage.

⚠ **Caution:** Because of their common reference potential, analog current inputs cannot be circuited in series, neither within the module nor with channels of other modules.

Note: For the open-circuit detection (cut wire), each channel is pulled up to "plus" by a high-resistance resistor. If nothing is connected, the maximum voltage will be read in then.

The supply voltage 24 V DC for the modules' electronic circuitry comes from the I/O-Bus of the FieldBusPlug or the CPU.

⚠ **Caution:** Removal of energized modules is not permitted. All power sources (supply and process voltages) must be switched off while working on any AC500 system.

Analog signals are always laid in shielded cables. The cable shields are earthed at both ends of the cables. In order to avoid unacceptable potential differences between different parts of the installation, low resistance equipotential bonding conductors must be laid.

For simple applications (low disturbances, no high requirement on precision), the shielding can also be omitted.

The following figures show the electrical connection of the analog modules AI523 and AO523.

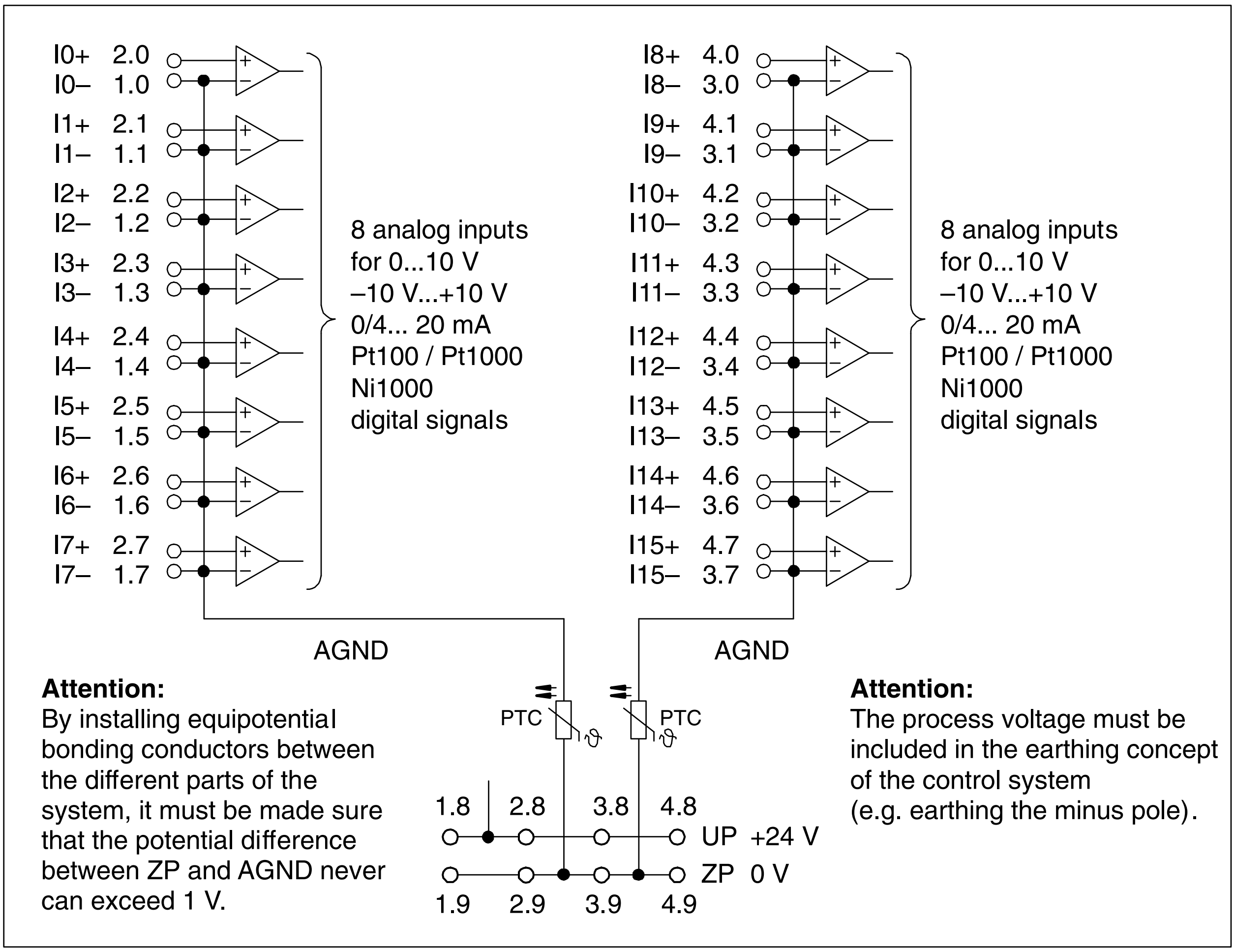


Figure: Terminal assignment of the analog input module AI523

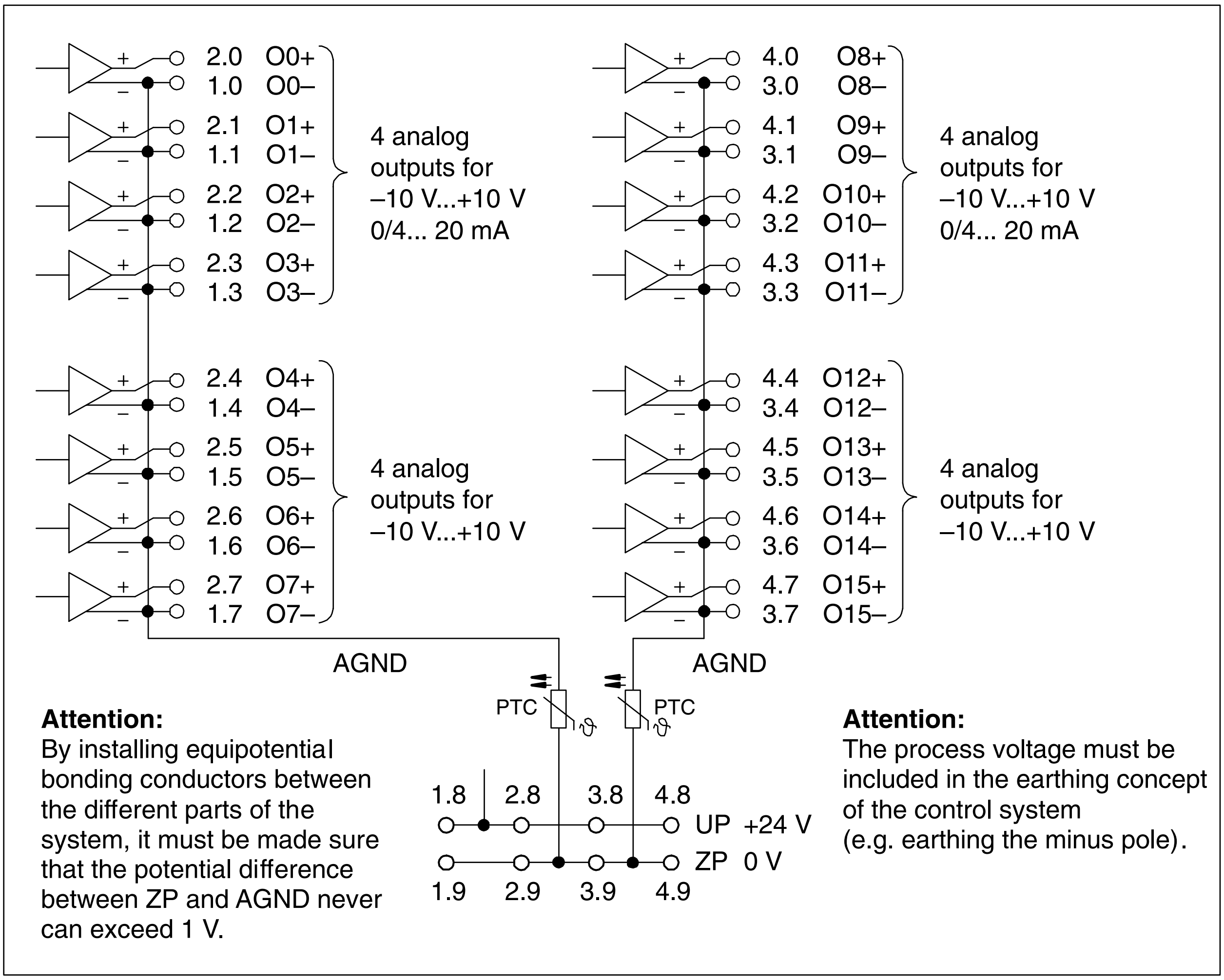


Figure: Terminal assignment of the analog output module AO523

The modules provide several diagnosis functions (see chapter "Diagnosis and display").

AI523: Connection of resistance thermometers in 2-wire configuration

When resistance thermometers (Pt100, Pt1000, Ni1000) are used, a constant current must flow through them to build the necessary voltage drop for the evaluation. For this, the module AI523 provides a constant current source which is multiplexed over the 8 analog channels.

The following figure shows the connection of resistance thermometers in **2-wire configuration.**

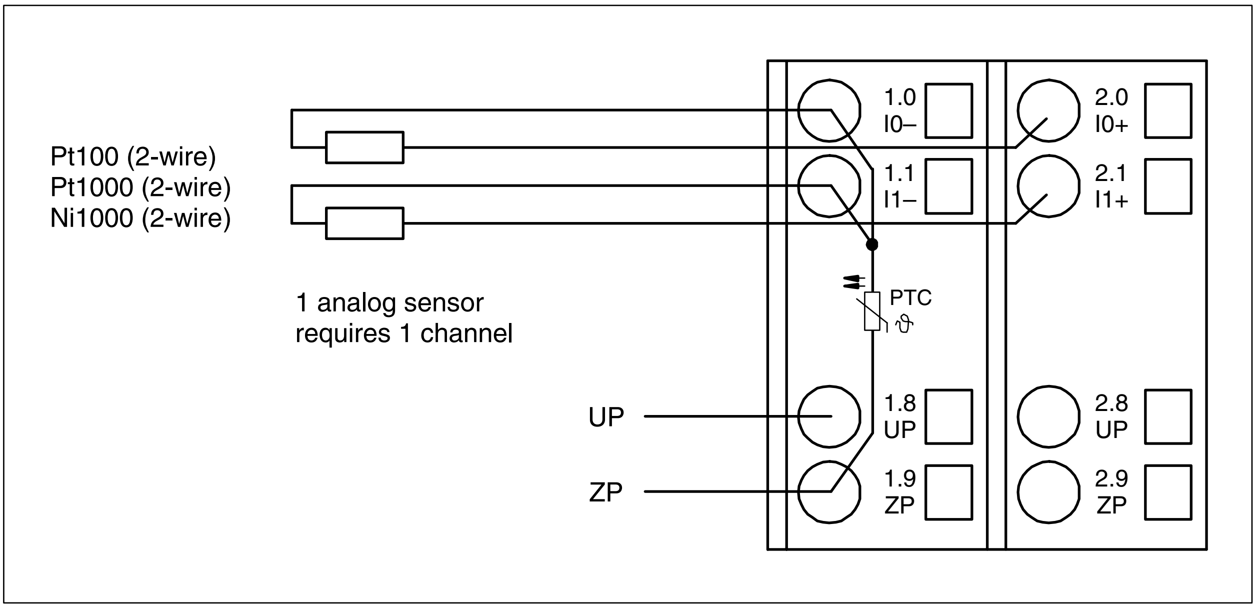


Figure: Connection of resistance thermometers in 2-wire configuration

The following measuring ranges can be configured (see also "Parameterization / Channel configuration" and "Measuring ranges / Input ranges of resistances"):

Pt100	-50 °C...+70 °C	2-wire configuration, one channel used
Pt100	-50 °C...+400 °C	2-wire configuration, one channel used
Pt1000	-50 °C...+400 °C	2-wire configuration, one channel used
Ni1000	-50 °C...+150 °C	2-wire configuration, one channel used

The function of the LEDs is described under "Diagnosis and displays / Displays".

The module AI523 performs a linearization of the resistance characteristic.

In order to avoid error messages from unused analog input channels, it is useful to configure them as "unused".

AI523: Connection of resistance thermometers in 3-wire configuration

When resistance thermometers (Pt100, Pt1000, Ni1000) are used, a constant current must flow through them to build the necessary voltage drop for the evaluation. For this, the module AI523 provides a constant current source which is multiplexed over the max. 8 (depending on the configuration) analog channels.

The following figure shows the connection of resistance thermometers in **3-wire configuration.**

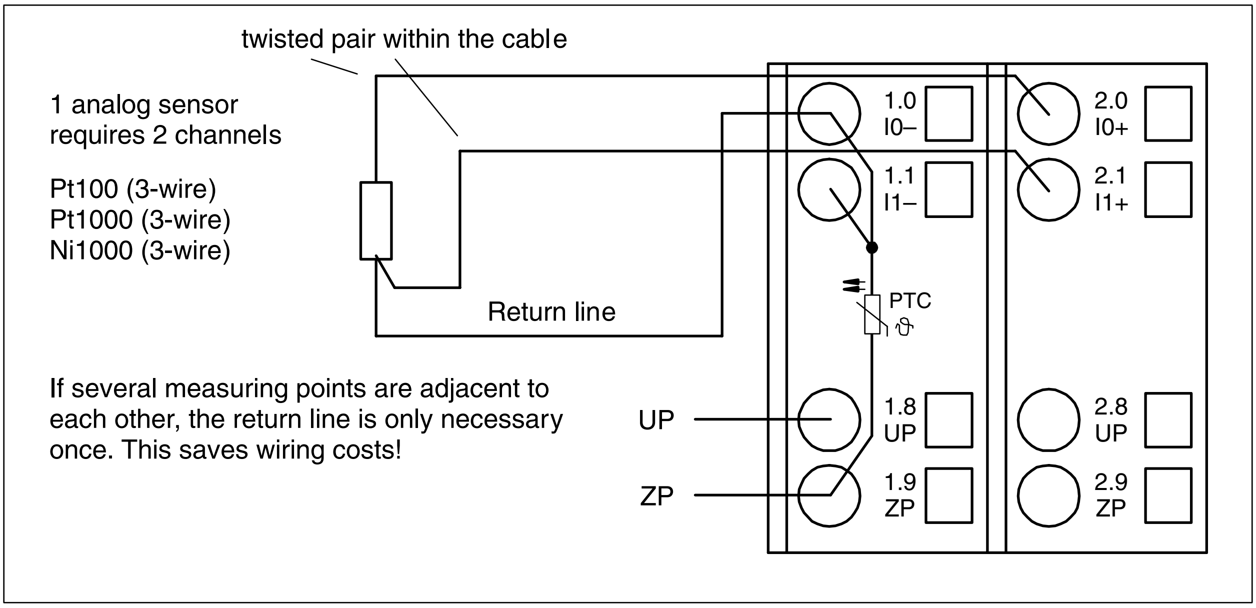


Figure: Connection of resistance thermometers in 3-wire configuration

With 3-wire configuration, two adjacent analog channels belong together (e.g. the channels 0 and 1). In this case, both channels are configured according to the desired operating mode. The lower address must be the even address (channel 0), the next higher address must be the odd address (channel 1).

The constant current of one channel flows through the resistance thermometer. The constant current of the other channel flows through one of the cores. The module calculates the measured value from the two voltage drops and stores it under the input with the higher channel number (e.g. I1).

In order to keep measuring errors as small as possible, it is necessary, to have all the involved conductors in the same cable. All the conductors must have the same cross section.

The following measuring ranges can be configured (see also "Parameterization / Channel configuration" and "Measuring ranges / Input ranges of resistances"):

Pt100	-50 °C...+70 °C	3-wire configuration, two channels used
Pt100	-50 °C...+400 °C	3-wire configuration, two channels used
Pt1000	-50 °C...+400 °C	3-wire configuration, two channels used
Ni1000	-50 °C...+150 °C	3-wire configuration, two channels used

The function of the LEDs is described under "Diagnosis and displays / Displays".

The module AI523 performs a linearization of the resistance characteristic.

In order to avoid error messages from unused analog input channels, it is useful to configure them as "unused".

AI523: Connection of active-type analog sensors (voltage) with electrically isolated power supply

The following figure shows the connection of active-type analog sensors (voltage) with electrically isolated power supply.

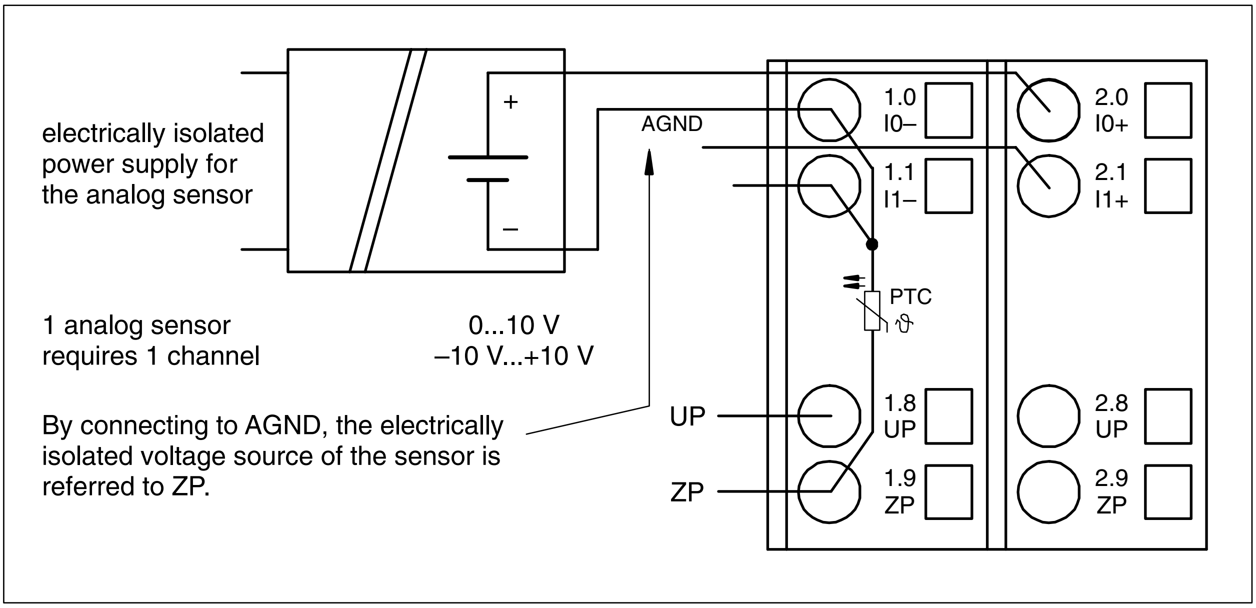


Figure: Connection of active-type analog sensors (voltage) with electrically isolated power supply

The following measuring ranges can be configured (see also "Parameterization / Channel configuration" and "Measuring ranges / Input ranges of voltage, current and digital input"):

Voltage	0...10 V	1 channel used
Voltage	-10 V...+10 V	1 channel used

The function of the LEDs is described under "Diagnosis and displays / Displays".

In order to avoid error messages or long processing times, it is useful to configure unused analog input channels as "unused".

AI523: Connection of active-type analog sensors (current) with electrically isolated power supply

The following figure shows the connection of active-type analog sensors (current) with electrically isolated power supply.

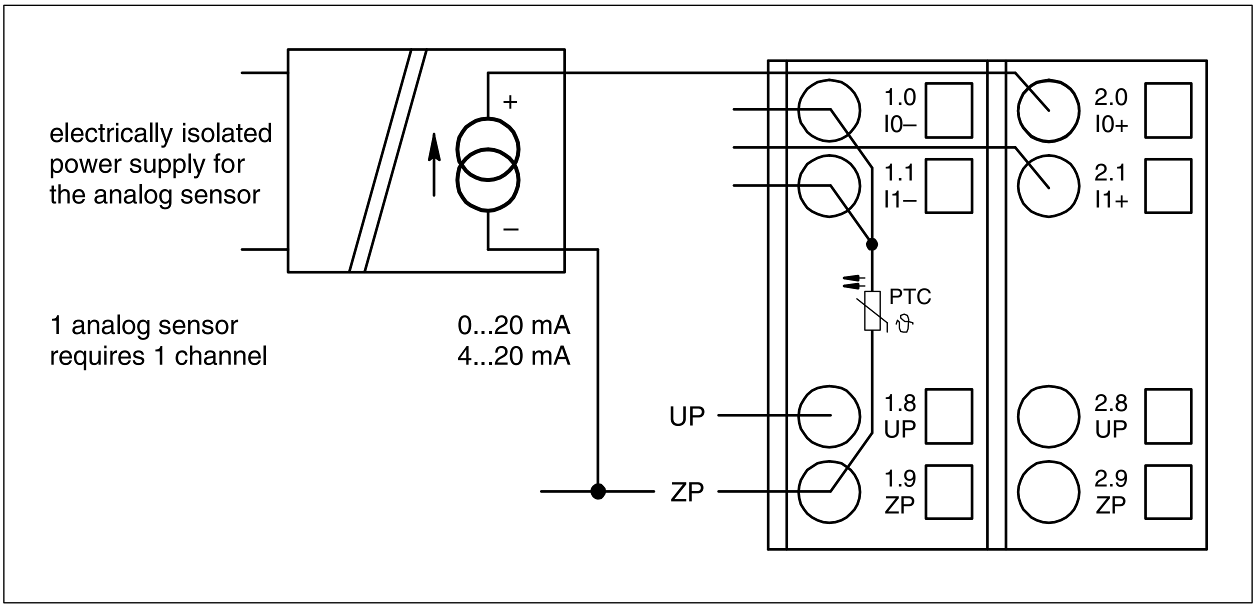


Figure: Connection of active-type analog sensors (current) with electrically isolated power supply

The following measuring ranges can be configured (see also "Parameterization / Channel configuration" and "Measuring ranges / Input ranges of voltage, current and digital input"):

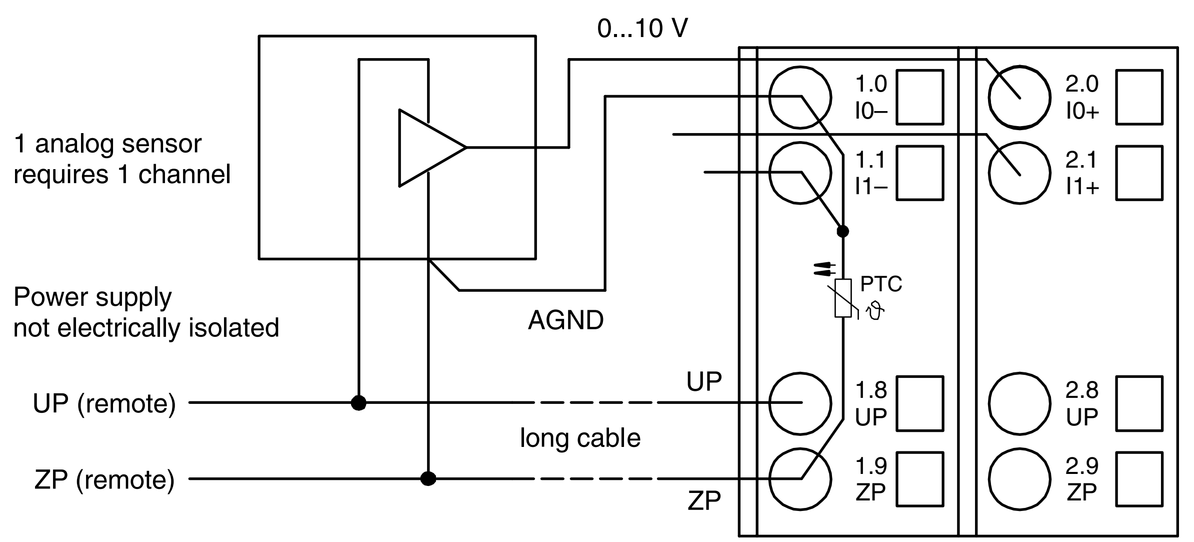
Current	0...20 mA	1 channel used
Current	4...20 mA	1 channel used

The function of the LEDs is described under "Diagnosis and displays / Displays".

Unused input channels can be left open-circuited, because they are of low resistance.

AI523: Connection of active-type analog sensors (voltage) with no electrically isolated power supply

The following figure shows the connection of active-type sensors (voltage) with no electrically isolated power supply.



Attention:
The potential difference between AGND and ZP at the AX522 module must not be greater than 1 V, not even in case of long lines (see the figure ”Terminal assignment of AX522”).

Figure: Connection of active-type sensors (voltage) with no electrically isolated power supply

Note for the picture: If AGND does not get connected to ZP, the sensor current flows to ZP via the AGND line. The measuring signal is distorted, since it flows a very little current over the voltage line. The total current through the PTC should not exceed 50 mA. This measuring method is therefore only suitable for short lines and small sensor currents. If there are bigger distances, the difference measuring method has to be preferred.

The following measuring ranges can be configured (see also "Parameterization / Channel configuration" and "Measuring ranges / Input ranges of voltage, current and digital input"):

Voltage	0...10 V	1 channel used
Voltage	-10 V...+10 V *)	1 channel used

*) if the sensor can provide this signal range

The function of the LEDs is described under "Diagnosis and displays / Displays".

In order to avoid error messages or long processing times, it is useful to configure unused analog input channels as "unused".

AI523: Connection of passive-type analog sensors (current)

The following figure shows the connection of passive-type analog sensors (current).

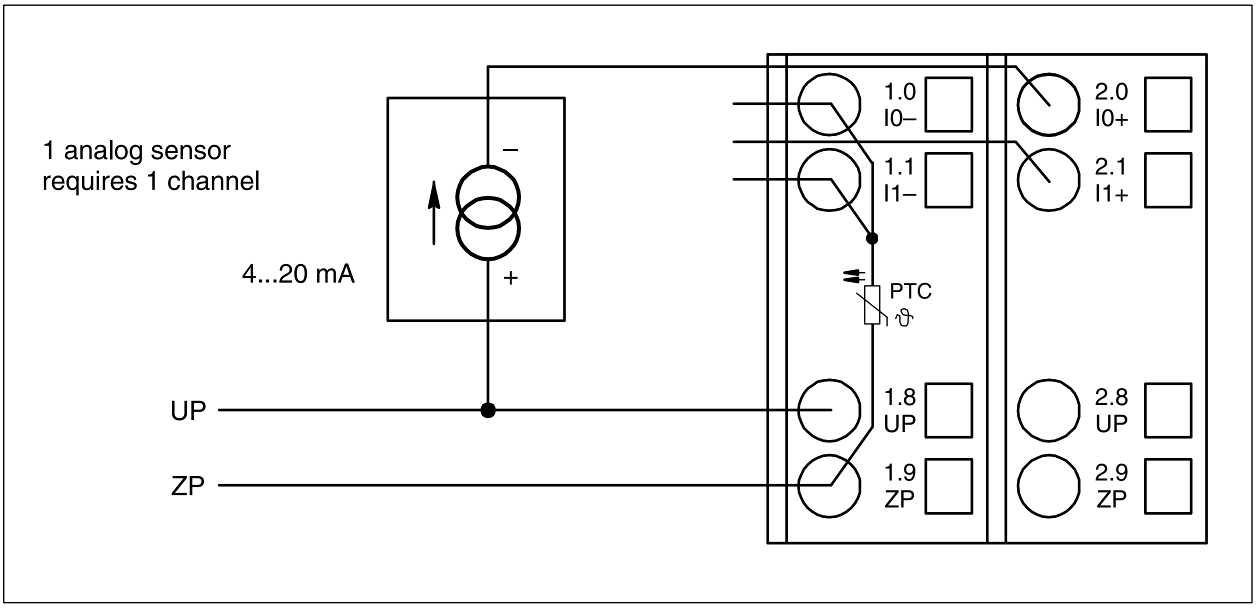


Figure: Connection of passive-type analog sensors (current)

The following measuring ranges can be configured (see also "Parameterization / Channel configuration" and "Measuring ranges / Input ranges of voltage, current and digital input"):

Current	4...20 mA	1 channel used

The function of the LEDs is described under "Diagnosis and displays / Displays".

Caution: If, during initialization, an analog current sensor supplies more than 25 mA for more than 1 second into an analog input, this input is switched off by the module (input protection). In such cases, it is recommended, to protect the analog input by a 10-volt zener diode (in parallel to I+ and I-). But, in general, it is a better solution to prefer sensors with fast initialization or without current peaks higher than 25 mA.

Unused input channels can be left open-circuited, because they are of low resistance.

AI523: Connection of active-type analog sensors (voltage) to differential inputs

Differential inputs are very useful, if analog sensors are used which are remotely non-isolated (e.g. the minus terminal is remotely earthed).

The evaluation using differential inputs helps to considerably increase the measuring accuracy and to avoid earthing loops.

With differential input configurations, two adjacent analog channels belong together (e.g. the channels 0 and 1). In this case, both channels are configured according to the desired operating mode. The lower address must be the even address (channel 0), the next higher address must be the odd address (channel 1). The converted analog value is available at the higher address (channel 1).

The analog value is calculated by subtraction of the input value with the higher address from the input value of the lower address.

The converted analog value is available at the odd channel (higher address).

> **Important:** The earthing potential at the sensors must not have a too big potential difference with respect to ZP (max. ± 1 V within the full signal range). Otherwise problems can occur concerning the common-mode input voltages of the involved analog inputs.

The following figure shows the connection of active-type analog sensors (voltage) to differential inputs.

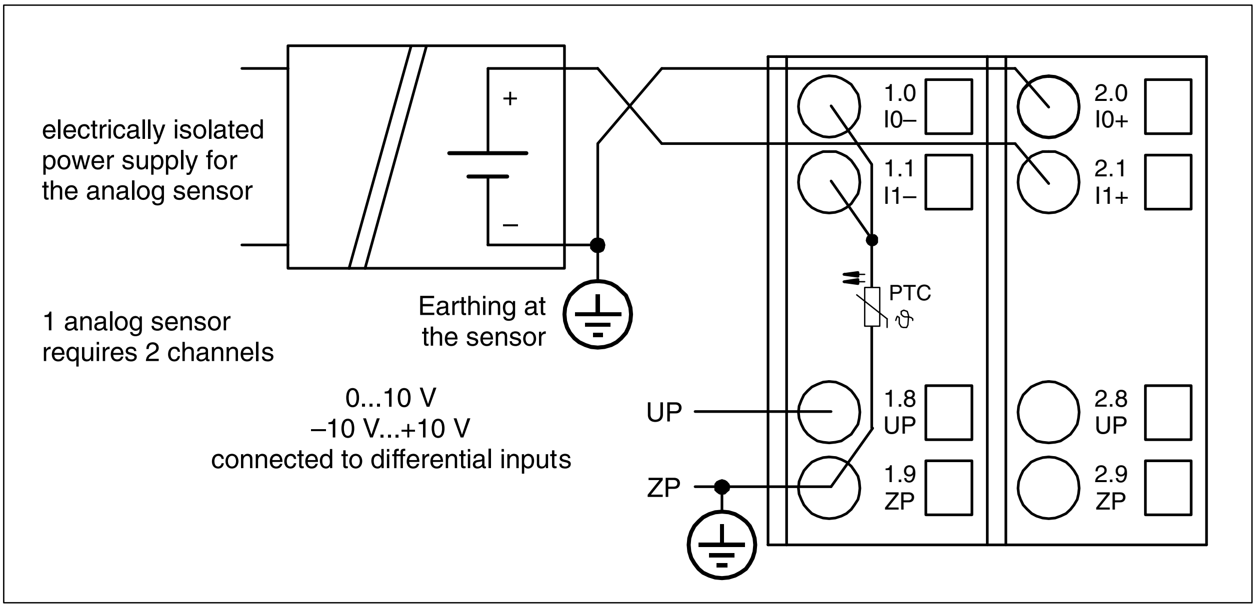


Figure: Connection of active-type analog sensors (voltage) to differential inputs

The following measuring ranges can be configured (see also "Parameterization / Channel configuration" and "Measuring ranges / Input ranges of voltage, current and digital input"):

Voltage	0...10 V	with differential inputs, 2 channels used
Voltage	-10 V...+10 V	with differential inputs, 2 channels used

The function of the LEDs is described under "Diagnosis and displays / Displays".

In order to avoid error messages or long processing times, it is useful to configure unused analog input channels as "unused".

AI523: Use of analog inputs as digital inputs

Several (or all) analog inputs can be configured as digital inputs (see also "Technical Data / Technical data of the analog inputs, if they are used as digital inputs"). The inputs are not electrically isolated against the other analog channels.

The following figure shows the use of analog inputs as digital inputs.

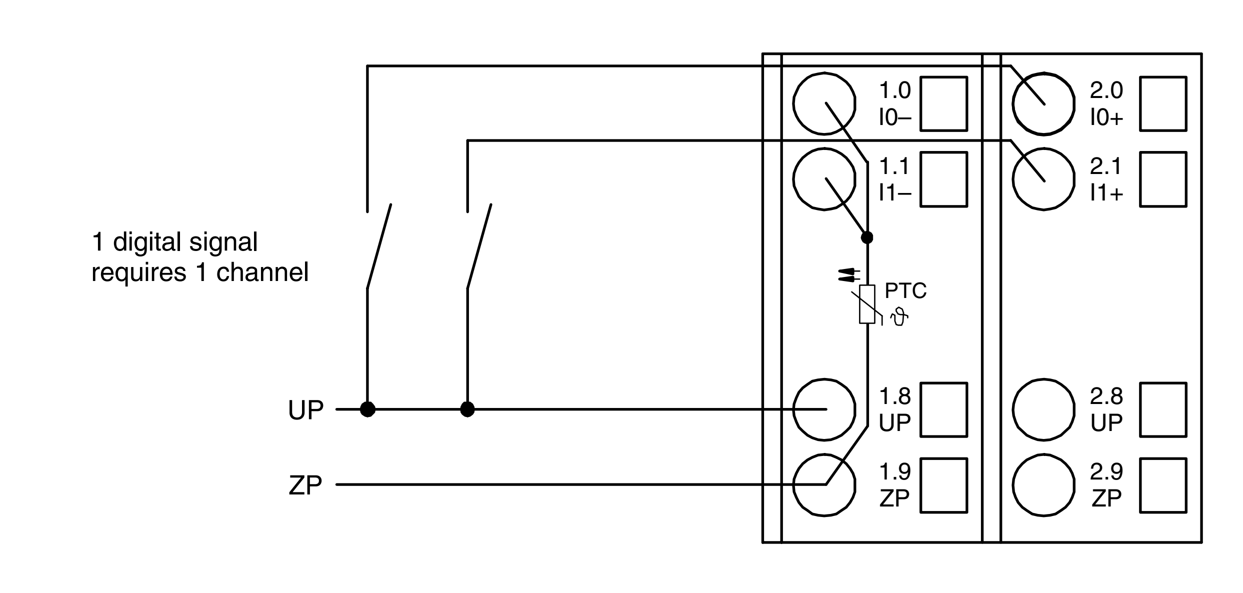


Figure: Use of analog inputs as digital inputs

The following operating mode can be configured (see also "Parameterization / Channel configuration" and "Measuring ranges / Input ranges of voltage, current and digital input"):

Digital input	24 V	1 channel used

The function of the LEDs is described under "Diagnosis and displays / Displays".

AO523: Connection of analog output loads (voltage, current)

The following figure shows the connection of analog output loads (voltage, current).

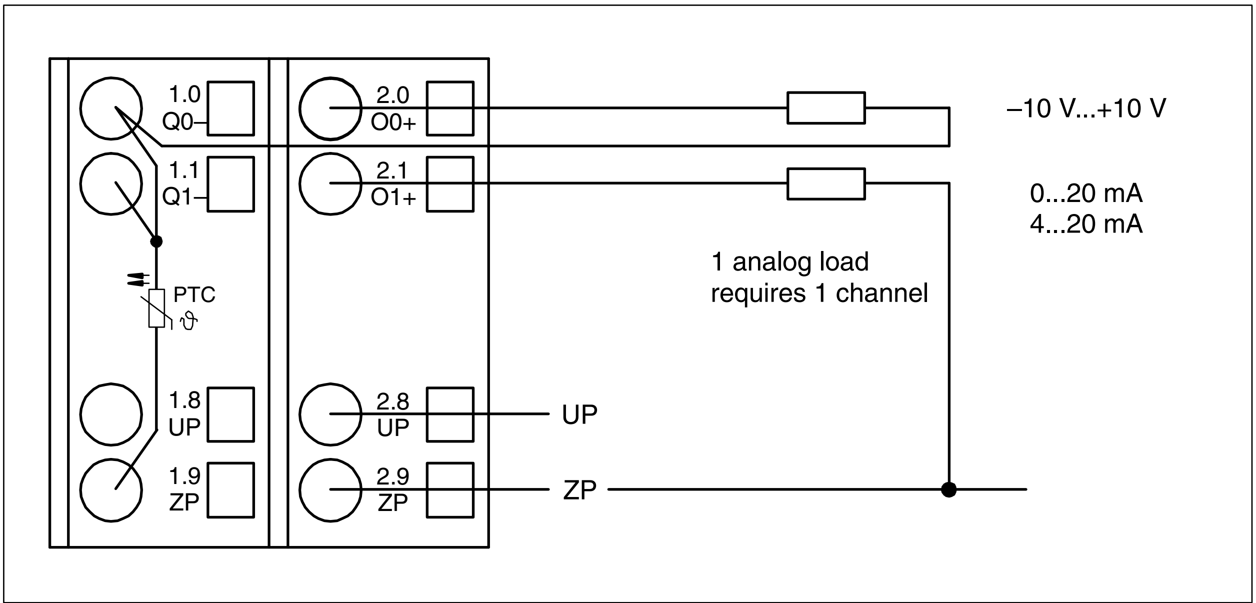


Figure: Connection of analog output loads (voltage, current)

The following measuring ranges can be configured (see also "Parameterization / Channel configuration" and "Measuring ranges / Output ranges of voltage and current"):

Voltage	-10 V...+10 V	Load max. ±10 mA	1 channel used
Current	0...20 mA	Load 0...500 Ω	1 channel used
Current	4...20 mA	Load 0...500 Ω	1 channel used

Only the channels 0...3 and 8...11 can be configured as current output (0...20 mA or 4...20 mA).

The function of the LEDs is described under "Diagnosis and displays / Displays".

Unused analog outputs can be left open-circuited.

Internal data exchange

	AI523	AO523
Digital inputs (bytes)	0	0
Digital outputs (bytes)	0	0
Counter input data (words)	16	0
Counter output data (words)	0	16

I/O configuration

The analog modules AI523 and AO523 do not store configuration data themselves.

Parameterization

The arrangement of the parameter data is performed by your master configuration software SYCON in connection with the S500 GSD files and in conjunction with the Control Builder software.

The parameter data directly influences the functionality of modules.

For non-standard applications, it is necessary to adapt the parameters to your system configuration.

Module AI523: Module slot address: Y = 1...7

No.	Name	Value	Internal value	Internal value, type	Default	Min.	Max.	EDS Slot/Index
1	Module ID	Internal	1515 *1)	Word	1515 0x05eb	0	65535	0x0Y01
2 *2)	Ignore module	No Yes	0 1	Byte	No 0x00			not for FBP
3	Parameter length in bytes	Internal	34	Byte	34-CPU 34-FBP	0	255	0x0Y02
4	Check supply	Off On	0 1	Byte	On 0x01	0	1	0x0Y03
5	Analog data format	Default	0	Byte	Default 0x00			0x0Y04
6	Channel configuration Input channel 0	see table Channel configuration		Byte	Default 0x00	0	19	0x0Y05
7	Channel monitoring Input channel 0	see table Channel monitoring		Byte	Default 0x00	0	3	0x0Y06
8 to 35	Channel configuration and channel monitoring of the input channels 1 to 14	see tables channel configuration and channel monitoring		Byte Byte	Default 0x00 0x00	0 0	19 3	0x0Y07 to 0x0Y22
36	Channel configuration Input channel 15	see table Channel configuration		Byte	Default 0x00	0	19	0x0Y23
37	Channel monitoring Input channel 15	see table Channel monitoring		Byte	Default 0x00	0	3	0x0Y24

*1) With CS31 and addresses less than 70 and FBP, the value is increased by 1

*2) Not with FBP

Module AO523: Module slot address: Y = 1...7

No.	Name	Value	Internal value	Internal value, type	Default	Min.	Max.	EDS Slot/Index
1	Module ID	Internal	1510 *1)	Word	1510 0x05e6	0	65535	0x0Y01
2 *2)	Ignore module	No Yes	0 1	Byte	No 0x00			not for FBP
3	Parameter length in bytes	Internal	39	Byte	39-CPU 39-FBP	0	255	0x0Y02
4	Check supply	Off On	0 1	Byte	On 0x01	0	1	0x0Y03
5	Analog data format	Default	0	Byte	Default 0x00			0x0Y04
6	Behaviour of outputs at communication errors	Off Last value Substitute value	0 1+(n*5) 2+(n*5), n <= 2	Byte	Off 0x00	0	2	0x0Y05
7	Channel configuration Output channel 0	see table Channel configuration		Byte	Default 0x00	0	130	0x0Y06
8	Channel monitoring Output channel 0	see table Channel monitoring		Byte	Default 0x00	0	3	0x0Y07
9	Substitute value Output channel 0	Output channel 0!	0...0xffff	Word	Default 0x0000	0	65535	0x0Y08
10 to 15	Channel configuration and channel monitoring of the output channels 1 to 3	see tables channel configuration and channel monitoring		Byte Byte	Default 0x00 0x00	0 0	130 3	0x0Y09 to 0x0Y0E
16 to 23	Channel configuration and channel monitoring of the output channels 4 to 7	see tables channel configuration and channel monitoring		Byte Byte	Default 0x00 0x00	0 0	128 3	0x0Y0F to 0x0Y16
24	Channel configuration Output channel 8	see table Channel configuration		Byte	Default 0x00	0	130	0x0Y17
25	Channel monitoring Output channel 8	see table Channel monitoring		Byte	Default 0x00	0	3	0x0Y18
26	Substitute value Output channel 8	Output channel 8!	0...0xffff	Word	Default 0x0000	0	65535	0x0Y19
27 to 32	Channel configuration and channel monitoring of the output channels 9 to 11	see tables channel configuration and channel monitoring		Byte Byte	Default 0x00 0x00	0 0	130 3	0x0Y1A to 0x0Y1F
33 to 40	Channel configuration and channel monitoring of the output channels 12 to 15	see tables channel configuration and channel monitoring		Byte Byte	Default 0x00 0x00	0 0	128 3	0x0Y20 to 0x0Y27

*1) With CS31 and addresses less than 70 and FBP, the value is increased by 1

*2) Not with FBP

GSD file:

AI523	Ext_User_Prm_Data_Len = Ext_User_Prm_Data_Const(0) =	37 0x05, 0xec, 0x22, \ 0x01, 0x00, \ 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, \ 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, \ 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, \ 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00;
AO523	Ext_User_Prm_Data_Len = Ext_User_Prm_Data_Const(0) =	42 0x05, 0xe7, 0x27, \ 0x01, 0x00, 0x00, \ 0x00, 0x00, 0x00, 0x00, \ 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, \ 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, \ 0x00, 0x00, 0x00, 0x00, \ 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, \ 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00;

Input channel (16 x with AI523):

No.	Name	Value	Internal value	Internal value, type	Default	Min.	Max.
1	Channel configuration	see below *2)	see below *2)	Byte	0 0x00 see below *3)		
2	Channel monitoring	see below *4)	see below *4)	Byte	0 0x00 see below *5)		

- Channel configuration

*2)	Internal value	Operating modes of the analog inputs, individually configurable
***3)**	0	Unused (default)
	1	Analog input 0...10 V
	2	Digital input
	3	Analog input 0...20 mA
	4	Analog input 4...20 mA
	5	Analog input -10 V...+10 V
	8	Analog input Pt100, -50 °C...+400 °C (2-wire)
	9	Analog input Pt100, -50 °C...+400 °C (3-wire), requires 2 channels *)
	10	Analog input 0...10 V via differential inputs, requires 2 channels *)
	11	Analog input -10 V...+10 V via differential inputs, requires 2 channels *)
	14	Analog input Pt100, -50 °C...+70 °C (2-wire)
	15	Analog input Pt100, -50 °C...+70 °C (3-wire), requires 2 channels *)
	16	Analog input Pt1000, -50 °C...+400 °C (2-wire)
	17	Analog input Pt1000, -50 °C...+400 °C (3-wire), requires 2 channels *)
	18	Analog input Ni1000, -50 °C...+150 °C (2-wire)
	19	Analog input Ni1000, -50 °C...+150 °C (3-wire), requires 2 channels *)
		*) In the operating modes with 3-wire configuration or with differential inputs, two adjacent analog inputs belong together (e.g. the channels 0 and 1). In these cases, both channels are configured in the desired operating mode. The lower address must be the even address (channel 0). The next higher address must be the odd address (channel 1). The converted analog value is available at the higher address (channel 1).

- Channel monitoring

*4)	Internal value	Monitoring
*5)	0	Plausibility, open-circuit (broken wire) and short-circuit
	1	Open-circuit and short-circuit
	2	Plausibility
	3	No monitoring

Output channels 0 and 8 (2 channels, AO523):

No.	Name	Value	Internal value	Internal value, type	Default	Min.	Max.
1	Channel configuration	see below *6)	see below *6)	Byte	see below *7)		
2	Channel monitoring	see below *8)	see below *8)	Byte	see below *9)		
3	Substitute value *10)	0...65535	0... 0xffff	Word	0		

Output channels 1...7 and 9...15 (14 channels, AO523):

No.	Name	Value	Internal value	Internal value, type	Default	Min.	Max.
1	Channel configuration	see below *6)	see below *6)	Byte	see below *7)		
2	Channel monitoring	see below *8)	see below *8)	Byte	see below *9)		

- Channel configuration

*6)	Internal value	Operating modes of the analog outputs, individually configurable
*7)	0	Unused (default)
	128	Analog output -10 V...+10 V
	129	Analog output 0...20 mA (not with the channels 4...7 and 12...15)
	130	Analog output 4...20 mA (not with the channels 4...7 and 12...15)

- Channel monitoring

*8)	Internal value	Monitoring
*9)	0	Plausibility, open-circuit (broken wire) and short-circuit (default)
	1	Open-circuit (broken wire) and short-circuit
	2	Plausibility
	3	No monitoring

- Substitute value

*10)	Intended behaviour of channel 0 when the control system stops:	Required setting of the module parameter "Behaviour of outputs in case of a communication error"	Required setting of the channel parameter "Substitute value"
	Output OFF	OFF	0
	Last value	Last value	0
	Substitute value	OFF or Last value	1...65535

Diagnosis and display

Diagnosis:

E1..E4	d1	d2	d3	d4	Identifier 000..063	AC500 display	<– Display in
Class	Comp	Dev	Mod	Ch	Err	PS501 PLC browser	
Byte 6 Bit 6..7	-	Byte 3	Byte 4	Byte 5	Byte 6 Bit 0..5	FBP diagnosis block	
Class	Inter-face	De-vice	Mod-ule	Chan-nel	Error identifier	Error message	Remedy
	1)	2)	3)	4)			
Module error AI523 / AO523							
3	14 11 / 12	1..7 ADR	31 1..7	31	19	Checksum error in the I/O module	Replace I/O module
3	14 11 / 12	1..7 ADR	31 1..7	31	3	Timeout in the I/O module	Replace I/O module
3	14 11 / 12	1..7 ADR	31 1..7	31	40	Different hard-/firmware versions in the module	Replace I/O module
3	14 11 / 12	1..7 ADR	31 1..7	31	43	Internal error in the module	Replace I/O module
3	14 11 / 12	1..7 ADR	31 1..7	31	36	Internal data exchange failure	Replace I/O module
3	14 11 / 12	1..7 ADR	31 1..7	31	9	Overflow diagnosis buffer	New start
3	14 11 / 12	1..7 ADR	31 1..7	31	26	Parameter error	Check master
3	14 11 / 12	1..7 ADR	31 1..7	31	11	Process voltage too low	Check process voltage
4	14 11 / 12	1..7 ADR	31 1..7	31	45	Process voltage is switched off (ON -> OFF)	Process voltage ON
Channel error AI523							
4	14 11 / 12	1...7 ADR	1 1...7	0...15	48	Analog value overflow or broken wire at an analog input	Check input value or terminal
4	14 11 / 12	1...7 ADR	1 1...7	0...15	7	Analog value underflow at an analog input	Check input value
4	14 11 / 12	1...7 ADR	1 1...7	0...15	47	Short-circuit at an analog input	Check terminal
Channel error AO523							
4	14 11 / 12	1...7 ADR	3 1...7	0...15	48	Analog value overflow at an analog output	Check output value
4	14 11 / 12	1...7 ADR	3 1...7	0...15	7	Analog value underflow at an analog output	Check output value

Remarks:

1)	In AC500 the following interface identifier applies: 14 = I/O-Bus, 11 = COM1 (e.g. CS31 bus), 12 = COM2. The FBP diagnosis block does not contain this identifier.
2)	With "Device" the following allocation applies: 31 = Module itself, 1..7 = Expansion module 1..7, ADR = Hardware address (e.g. of the DC551)
3)	With "Module" the following allocation applies dependent of the master: Module error: I/O-Bus or FBP: 31 = Module itself; COM1/COM2: 1..7 = Expansion 1..7 Channel error: I/O-Bus or FBP = Module type (2 = DO); COM1/COM2: 1..7 = Expansion 1..7
4)	In case of module errors, with channel "31 = Module itself" is output.

Displays:

During the power ON procedure, the module initializes automatically. All LEDs (accept the channel LEDs) are ON during this time.

Status of the LEDs (see also section "Diagnosis LEDs" in the S500 system data)

LED	Status	Color	LED = OFF	LED = ON	LED flashes
AI523: inputs 00...07 and 08...15	analog input	yellow	input is OFF	input is ON (brightness depends on the value of the analog signal)	--
AO523: outputs 00...07 and 08...15	analog output	yellow	output is OFF	output is ON (brightness depends on the value of the analog signal)	--
UP	process voltage 24 V DC via terminal	green	process voltage is missing	process voltage OK and initialization successful	module is not initialized correctly
CH-ERR2	Channel Error, error messages in groups (analog inputs or outputs combined into the groups 2 and 4)	red	no error or process voltage is missing	serious error within the corresponding group	error on one channel of the group
CH-ERR4		red			
CH-ERR *)	Module Error	red	--	internal error	--
*) Both LEDs (CH-ERR2 and CH-ERR4) light up together					

Measuring ranges

AI523: Input ranges of voltage, current and digital input

Range	0...10 V	-10...+10 V	0...20 mA	4...20 mA	Digital input	Digital value	
						decimal	hex.
Overflow	>11.7589	>11.7589	>23.5178	>22.8142		32767	7FFF
Measured value too high	11.7589 : 10.0004	11.7589 : 10.0004	23.5178 : 20.0007	22.8142 : 20.0006		32511 : 27649	7EFF : 6C01
Normal range	10.0000 : 0.0004	10.0000 : 0.0004	20.0000 : 0.0007	20.0000 : 4.0006	ON	27648 : 1	6C00 : 0001
	0.0000	0.0000	0	4	OFF	0	0000
Normal range or measured value too low	-0.0004 -1.7593	-0.0004 : : : -10.0000		3.9994 : 0		-1 -4864 -6912 : -27648	FFFF ED00 E500 : 9400
Measured value too low		-10.0004 : -11.7589				-27649 : -32512	93FF : 8100
Underflow	<0,0000	<-11.7589	<0.0000	<0.0000		-32768	8000

The represented resolution corresponds to 16 bits.

AI523: Input ranges resistance

Range	Pt100 / Pt 1000 -50...70 °C	Pt100 / Pt1000 -50...400 °C	Ni1000 -50...150 °C	Digital value	
				decimal	hex.
Overflow	> 80.0 °C	> 450.0 °C	> 160.0 °C	32767	7FFF
Measured value too high		450.0 °C : 400.1 °C		4500 : 4001	1194 : 0FA1
			160.0 °C : 150.1 °C	1600 : 1501	0640 : 05DD
	80.0 °C : 70.1 °C			800 : 701	0320 : 02BD
Normal range	70.0 °C : 0.1 °C	400.0 °C : : : 0.1 °C	150.0 °C : : 0.1 °C	4000 1500 700 : 1	0FA0 05DC 02BC : 0001
	0.0 °C	0.0 °C	0.0 °C	0	0000
	-0.1 °C : -50.0 °C	-0.1 °C : -50.0 °C	-0.1 °C : -50.0 °C	-1 : -500	FFFF : FE0C
Measured value too low	-50.1 °C : -60.0 °C	-50.1 °C : -60.0 °C	-50.1 °C : -60.0 °C	-501 : -600	FE0B : FDA8
Underflow	< -60.0 °C	< -60.0 °C	< -60.0 °C	-32768	8000

AO523: Output ranges voltage and current

Range	-10...+10 V	0...20 mA	4...20 mA	Digital value	
				decimal	hex.
Overflow	0 V	0 mA	0 mA	> 32511	> 7EFF
Measured value too high	11.7589 V : 10.0004 V	23.5178 mA : 20.0007 mA	22.8142 mA : 20.0006 mA	32511 : 27649	7EFF : 6C01
Normal range	10.0000 V : 0.0004 V	20.0000 mA : 0.0007 mA	20.0000 mA : 4.0006 mA	27648 : 1	6C00 : 0001
	0.0000 V	0.0000 mA	4.0000 mA	0	0000
	-0.0004 V : -10.0000 V	0 mA : 0 mA	3.9994 mA 0 mA 0 mA	-1 -6912 -27648	FFFF E500 9400
Measured value too low	-10.0004 V : -11.7589 V	0 mA : 0 mA	0 mA : 0 mA	-27649 : -32512	93FF : 8100
Underflow	0 V	0 mA	0 mA	< -32512	< 8100

The represented resolution corresponds to 16 bits.

Technical data

The system data of AC500 and S500 are valid here. Only additional details are therefore documented below.

Process voltage	
- Rated value	24 V DC
- max. ripple	5 %
- Protection against reversed voltage	yes
Rated protection fuse on UP	10 A fast
- Electrical isolation	yes, per module
- Current consumption from UP at normal operation	0.15 A + output loads (AO523)
- Inrush current from UP (at power up)	0.050 A^2s
- Connections	Terminals 1.8 - 4.8 for +24 V (UP) and 1.9 - 4.9 for 0 V (ZP)
Max. length of analog cables, conductor cross section > 0.14 mm^2	100 m
Conversion error of the analog values caused by non-linearity, adjustment error at factory and resolution within the normal range	typ. 0.5 %, max. 1 %
Weight	300 g
Mounting position	horizontal or vertical with derating (output load reduced to 50 % at 40°C per group)
Cooling	The natural convection cooling must not be hindered by cable ducts or other parts in the switch-gear cabinet.

Attention: All I/O channels (digital and analog) are protected against reverse polarity, reverse supply, short circuit and continuous overvoltage up to 30 V DC.

AI523: Technical data of the analog inputs

Number of channels per module	16
Distribution of channels into groups	2 groups of 8 channels each
Connections of the channels I0- to I7- Connections of the channels I0+ to I7+	Terminals 1.0 to 1.7 Terminals 2.0 to 2.7
Connections of the channels I8- to I15- Connections of the channels I8+ to I15+	Terminals 3.0 to 3.7 Terminals 4.0 to 4.7
Input type	bipolar (not with current or Pt100/Pt1000/Ni1000)
Electrical isolation	against internal supply and other modules
Configurability	0...10 V, -10...+10 V, 0/4...20 mA, Pt100/1000, Ni1000 (each input can be configured individually)
Channel input resistance	Voltage: > 100 kΩ, current: ca. 330 Ω
Time constant of the input filter	Voltage: 100 µs, current: 100 µs
Indication of the input signals	one LED per channel
Conversion cycle	2 ms (for 8 inputs + 8 outputs), with Pt/Ni... 1 s
Resolution	Range 0...10 V: 12 bits
	Range -10...+10 V: 12 bits + sign
	Range 0...20 mA: 12 bits
	Range 4...20 mA: 12 bits
Relationship between input signal and hex code	see tables "Input ranges voltage, current and digital input" and "Input ranges resistance"
Unused voltage inputs	are configured as "unused"
Unused current inputs	have a low resistance, can be laft open-circuited
Overvoltage protection	yes

AI523: Technical data of the analog inputs, if they are used as digital inputs

Number of channels per module	max. 16
Distribution of channels into groups	2 groups of 8 channels each
Connections of the channels I0+ to I7+ Connections of the channels I8+ to I15+	Terminals 2.0 to 2.7 Terminals 4.0 to 4.7
Reference potential for the inputs	Terminals 1.8 to 4.8 (ZP)
Input signal delay	typ. 8 ms, configurable from 0.1 to 32 ms
Indication of the input signals	one LED per channel
Input signal voltage	24 V DC
Signal 0	-30 V...+5 V
Signal 1	+13 V...+30 V

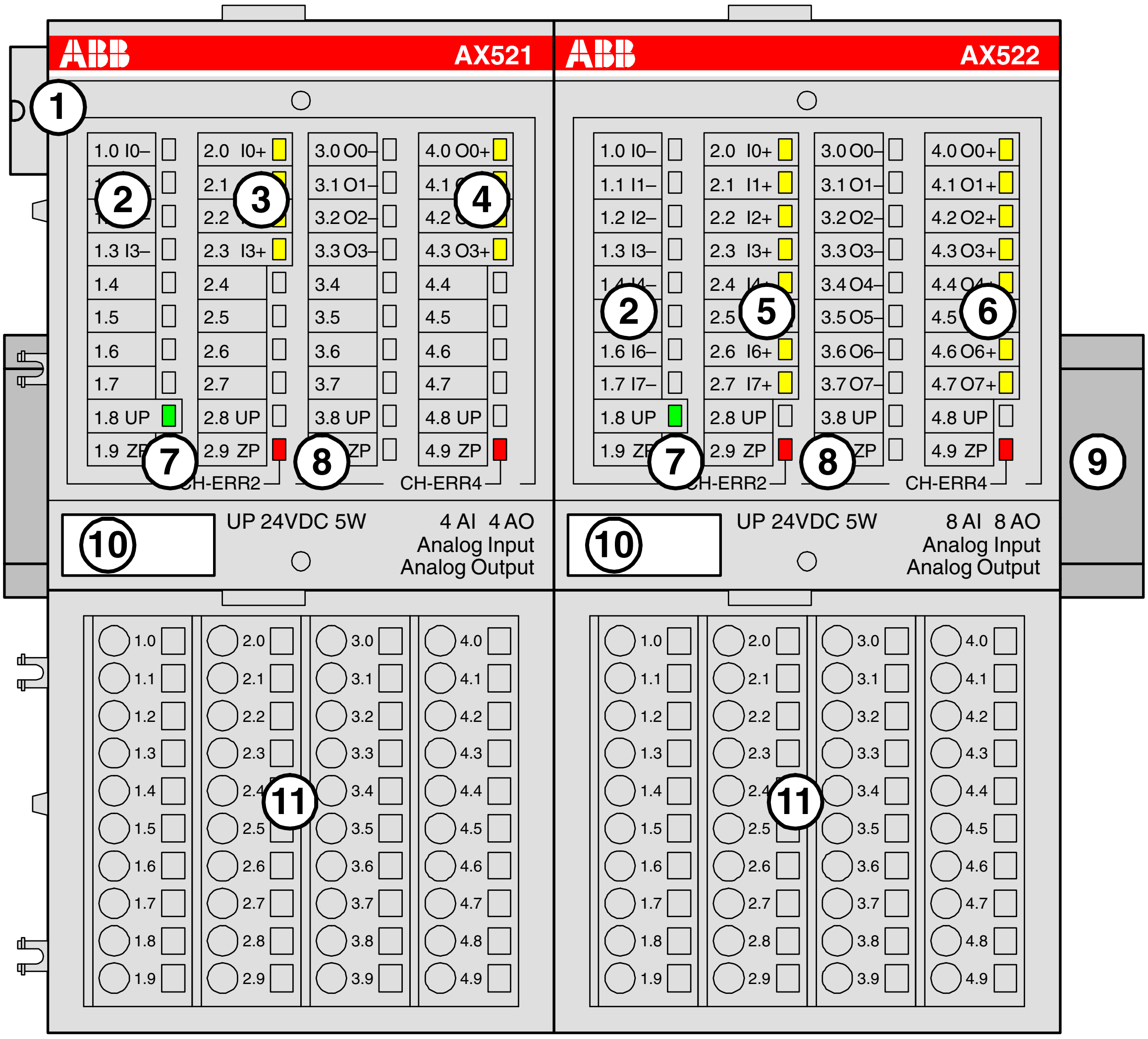
AO523: Technical data of the analog outputs

Number of channels per module	16, of which channnels O0...O3 and O8...O11 for voltage and current, and channels O4...7 and O12...15 only for voltage
Distribution of channels into groups	2 groups of 8 channels each
- Channels O0-...O7- - Channels O0+...O7+	Terminals 1.0...1.7 Terminals 2.0...2.7
- Channels O8-...O15- - Channels O8+...O15+	Terminals 3.0...3.7 Terminals 4.0...4.7
Output type	bipolar with voltage, unipolar with current
Electrical isolation	against internal supply and other modules
Configurability	-10...+10 V, 0...20 mA, 4...20 mA (each output can be configured individually), current outputs only channels 0...3
Output resistance (load), as current output	0...500 Ω
Output loadability, as voltage output	max. ±10 mA
Indication of the output signals	one LED per channel
Resolution	12 bits (+ sign)
Relationship between output signal and hex code	see table "Output ranges voltage and current"
Unused outputs	can be left open-circuited

Ordering data

Order No.	Scope of delivery
1SAP 250 300 R0001	AI523, Analog input module, 16 AI, U/I/Pt100, 12 Bit + sign, 2-wires
1SAP 250 200 R0001	AO523, Analog output module, 16 AO, U/I, 12 Bit + sign, 2-wires
1SAP 212 200 R0001	TU515, I/O Terminal Unit, 24 V DC, screw-type terminals
1SAP 212 000 R0001	TU516, I/O Terminal Unit, 24 V DC, spring terminals

Analog Input/Output Modules AX521 and AX522
- AX521: 4 configurable analog inputs, 4 configurable analog outputs
- AX522: 8 configurable analog inputs, 8 configurable analog outputs
- resolution 12 bits plus sign
- module-wise electrically isolated



Elements of the analog input/output modules AX521 and AX522

1 I/O-Bus
2 Allocation between terminal No. and signal name
3 4 yellow LEDs to display the signal statuses at the inputs I0 to I3 (AX521)
4 4 yellow LEDs to display the signal statuses at the outputs O0 to O3 (AX521)
5 8 yellow LEDs to display the signal statuses at the inputs I0 to I7 (AX522)
6 8 yellow LEDs to display the signal statuses at the outputs O0 to O7 (AX522)
7 1 green LED to display the process voltage UP
8 2 red LEDs to display errors (CH-ERR2 and CH-ERR4)
9 DIN rail
10 Label
11 I/O Terminal Unit (TU515/TU516) with 40 terminals (screw-type or spring terminals)

Figure: Analog input/output modules AX521 and AX522, plugged on Terminal Units TU516

Contents

Intended purpose

The analog input/output modules AX521 and AX522 can be used as remote expansion modules at the FBP Interface Module DC505-FBP, at the CS31 Bus Module DC551-CS31 or locally at an AC500 CPU. They contain 8 or 16 channels each with the following features:

AX521:

- 4 configurable analog inputs in one group (1.0...2.3)
- 4 configurable analog outputs in one group (3.0...4.3)

AX522:

- 8 configurable analog inputs in one group (1.0...2.7)
- 8 configurable analog outputs in one group (3.0...4.7)

The configuration is performed by software.

The modules are supplied with a process voltage of 24 V DC. The analog inputs and outputs are electrically isolated from the rest of the modules' electronics.

Functionality

AX521: 4 analog inputs, individually configurable for AX522: 8 analog inputs, individually configurable for	unused (default setting)
	0...10 V
	-10 V...+10 V
	0...20 mA
	4...20 mA
	Pt100, -50 °C...+400 °C (2-wire)
	Pt100, -50 °C...+400 °C (3-wire), requires 2 channels
	Pt100, -50 °C...+70 °C (2-wire)
	Pt100, -50 °C...+70 °C (3-wire), requires 2 channels
	Pt1000, -50 °C...+400 °C (2-wire)
	Pt1000, -50 °C...+400 °C (3-wire), requires 2 channels
	Ni1000, -50 °C...+150 °C (2-wire)
	Ni1000, -50 °C...+150 °C (3-wire), requires 2 channels
	0...10 V with differential inputs, requires 2 channels
	-10 V...+10 V with differential inputs, requires 2 channels
	digital signals (digital input)

AX521 and AX522: 4 analog outputs, individually configurable for	unused (default setting)
	-10 V...+10 V
	0...20 mA
	4...20 mA
only AX522: 4 analog outputs, individually configurable for	unused (default setting)
	-10 V...+10 V

Resolution of the analog channels	
- Voltage -10 V... +10 V	12 bits plus sign
- Voltage 0...10 V	12 bits
- Current 0...20 mA, 4...20 mA	12 bits
- Temperature	0.1 °C
LED displays	AX521: 11 LEDs for signals and error messages AX522: 19 LEDs for signals and error messages
Internal power supply	through the expansion bus interface (I/O-Bus)
External power supply	via the terminals ZP and UP (process voltage 24 V DC)

Electrical connection

The input/output modules are plugged on I/O Terminal Units TU515 or TU516. Properly seat the modules and press until they lock in place. The Terminal Units are mounted on a DIN rail or with 2 screws plus the additional accessory for wall mounting (TA526).

The electrical connection of the I/O channels is carried out using the 40 terminals of the I/O Terminal Unit. I/O modules can be replaced without re-wiring the Terminal Units.

Note: Mounting, disassembling and electrical connection for the Terminal Units and the I/O modules are described in detail in the S500 system data chapters.

The terminals 1.8 to 4.8 and 1.9 to 4.9 are electrically interconnected within the I/O Terminal Units and have always the same assignment, independent of the inserted module:

Terminals 1.8 to 4.8: Process voltage UP = +24 V DC
Terminals 1.9 to 4.9: Process voltage ZP = 0 V

The assignment of the other terminals:

AX521:

Terminals	Signal	Meaning
1.0 to 1.3	I0- to I3-	Minus poles of the 4 analog inputs
2.0 to 2.3	I0+ to I3+	Plus poles of the 4 analog inputs
3.0 to 3.3	O0- to O3-	Minus poles of the 4 analog outputs
4.0 to 4.3	O0+ to O3+	Plus poles of the 4 analog outputs

AX522:

Terminals	Signal	Meaning
1.0 to 1.7	I0- to I7-	Minus poles of the 8 analog inputs
2.0 to 2.7	I0+ to I7+	Plus poles of the 8 analog inputs
3.0 to 3.7	O0- to O7-	Minus poles of the 8 analog outputs
4.0 to 4.7	O0+ to O7+	Plus poles of the 8 analog outputs

⚠ **Caution:** The minus poles of the analog inputs are electrically connected to each other. They form an "Analog Ground" signal for the module. The minus poles of the analog outputs are also electrically connected to each other to form an "Analog Ground" signal.

⚠ **Caution:** There is no electrical isolation between the analog circuitry and ZP/UP. Therefore, the analog sensors must be electrically isolated in order to avoid loops via the earth potential or the supply voltage.

⚠ **Caution:** Because of their common reference potential, analog current inputs cannot be circuited in series, neither within the module nor with channels of other modules.

Note: For the open-circuit detection (cut wire), each channel is pulled up to "plus" by a high-resistance resistor. If nothing is connected, the maximum voltage will be read in then.

The supply voltage 24 V DC for the modules' electronic circuitry comes from the I/O-Bus of the FieldBusPlug or the CPU.

⚠ **Caution:** Removal of energized modules is not permitted. All power sources (supply and process voltages) must be switched off while working on any AC500 system.

Analog signals are always laid in shielded cables. The cable shields are earthed at both ends of the cables. In order to avoid unacceptable potential differences between different parts of the installation, low resistance equipotential bonding conductors must be laid.

For simple applications (low disturbances, no high requirement on precision), the shielding can also be omitted.

The following figure shows the electrical connection of the analog input/output modules AX521 and AX522.

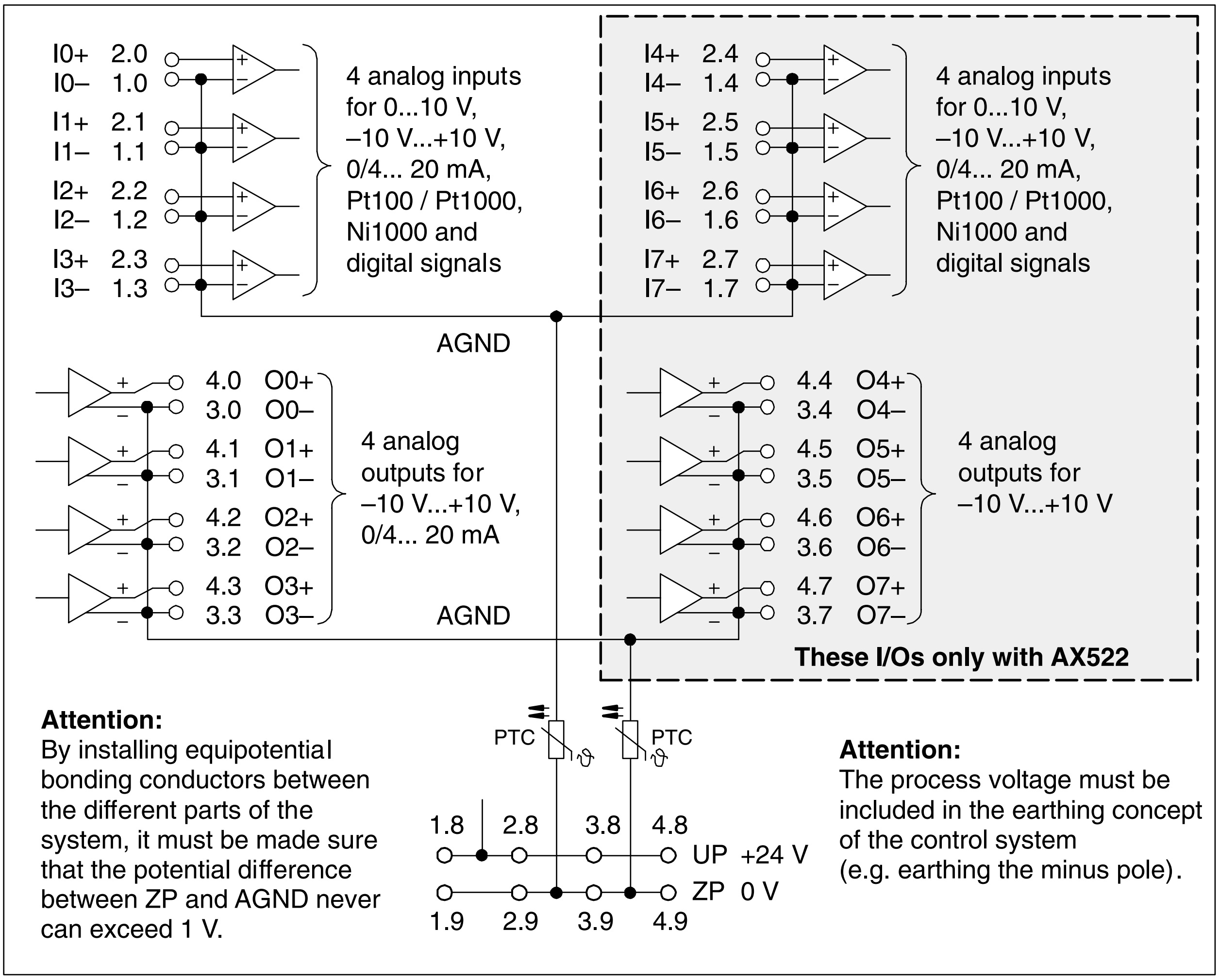


Figure: Terminal assignment of AX521 and AX522

The modules provide several diagnosis functions (see chapter "Diagnosis and display").

Connection of resistance thermometers in 2-wire configuration

When resistance thermometers (Pt100, Pt1000, Ni1000) are used, a constant current must flow through them to build the necessary voltage drop for the evaluation. For this, the module AX521/AX522 provides a constant current source which is multiplexed over the 8 analog channels.

The following figure shows the connection of resistance thermometers in **2-wire configuration.**

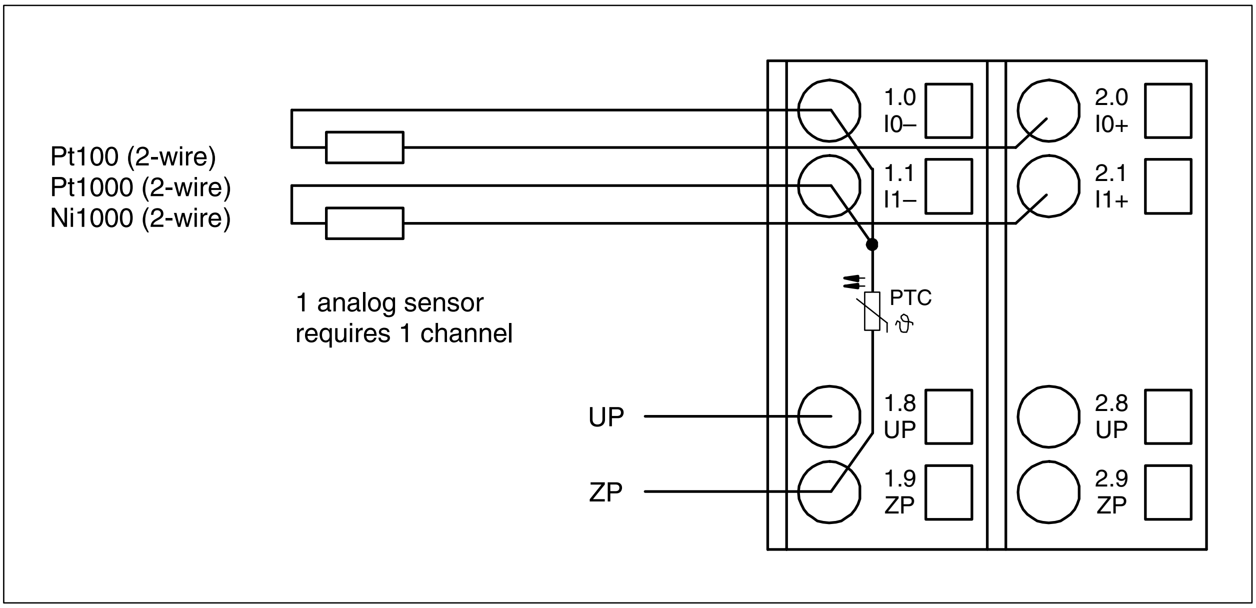


Figure: Connection of resistance thermometers in 2-wire configuration

The following measuring ranges can be configured (see also "Parameterization / Channel configuration" and "Measuring ranges / Input ranges of resistances"):

Pt100	-50 °C...+70 °C	2-wire configuration, one channel used
Pt100	-50 °C...+400 °C	2-wire configuration, one channel used
Pt1000	-50 °C...+400 °C	2-wire configuration, one channel used
Ni1000	-50 °C...+150 °C	2-wire configuration, one channel used

The function of the LEDs is described under "Diagnosis and displays / Displays".

The modules AX521 and AX522 perform a linearization of the resistance characteristic.

In order to avoid error messages from unused analog input channels, it is useful to configure them as "unused".

Connection of resistance thermometers in 3-wire configuration

When resistance thermometers (Pt100, Pt1000, Ni1000) are used, a constant current must flow through them to build the necessary voltage drop for the evaluation. For this, the module AX521/AX522 provides a constant current source which is multiplexed over the max. 8 (depending on the configuration) analog channels.

The following figure shows the connection of resistance thermometers in **3-wire configuration.**

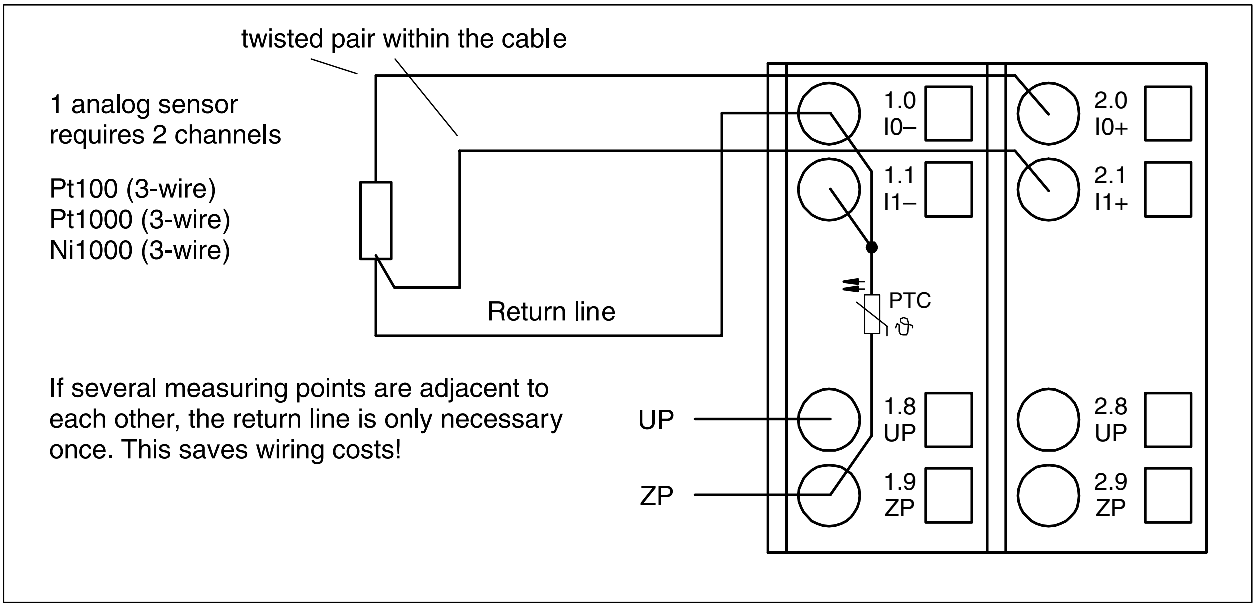


Figure: Connection of resistance thermometers in 3-wire configuration

With 3-wire configuration, two adjacent analog channels belong together (e.g. the channels 0 and 1). In this case, both channels are configured according to the desired operating mode. The lower address must be the even address (channel 0), the next higher address must be the odd address (channel 1).

The constant current of one channel flows through the resistance thermometer. The constant current of the other channel flows through one of the cores. The module calculates the measured value from the two voltage drops and stores it under the input with the higher channel number (e.g. I1).

In order to keep measuring errors as small as possible, it is necessary, to have all the involved conductors in the same cable. All the conductors must have the same cross section.

The following measuring ranges can be configured (see also "Parameterization / Channel configuration" and "Measuring ranges / Input ranges of resistances"):

Pt100	-50 °C...+70 °C	3-wire configuration, two channels used
Pt100	-50 °C...+400 °C	3-wire configuration, two channels used
Pt1000	-50 °C...+400 °C	3-wire configuration, two channels used
Ni1000	-50 °C...+150 °C	3-wire configuration, two channels used

The function of the LEDs is described under "Diagnosis and displays / Displays".

The modules AX521 and AX522 perform a linearization of the resistance characteristic.

In order to avoid error messages from unused analog input channels, it is useful to configure them as "unused".

Connection of active-type analog sensors (voltage) with electrically isolated power supply

The following figure shows the connection of active-type analog sensors (voltage) with electrically isolated power supply.

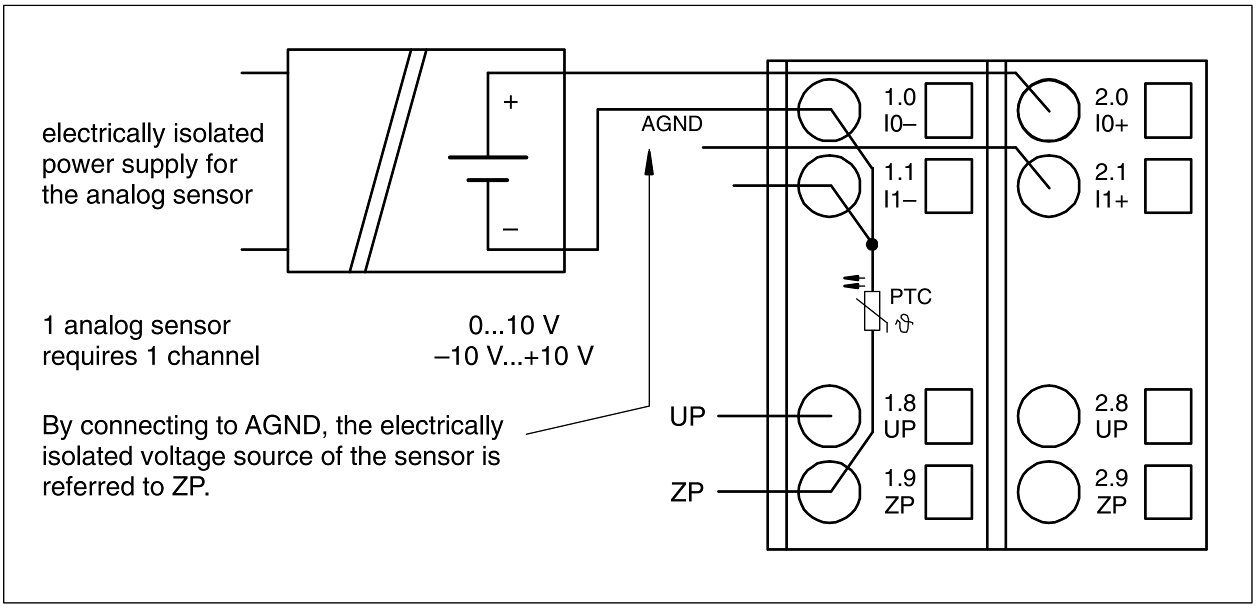


Figure: Connection of active-type analog sensors (voltage) with electrically isolated power supply

The following measuring ranges can be configured (see also "Parameterization / Channel configuration" and "Measuring ranges / Input ranges of voltage, current and digital input"):

Voltage	0...10 V	1 channel used
Voltage	-10 V...+10 V	1 channel used

The function of the LEDs is described under "Diagnosis and displays / Displays".

In order to avoid error messages or long processing times, it is useful to configure unused analog input channels as "unused".

Connection of active-type analog sensors (current) with electrically isolated power supply

The following figure shows the connection of active-type analog sensors (current) with electrically isolated power supply.

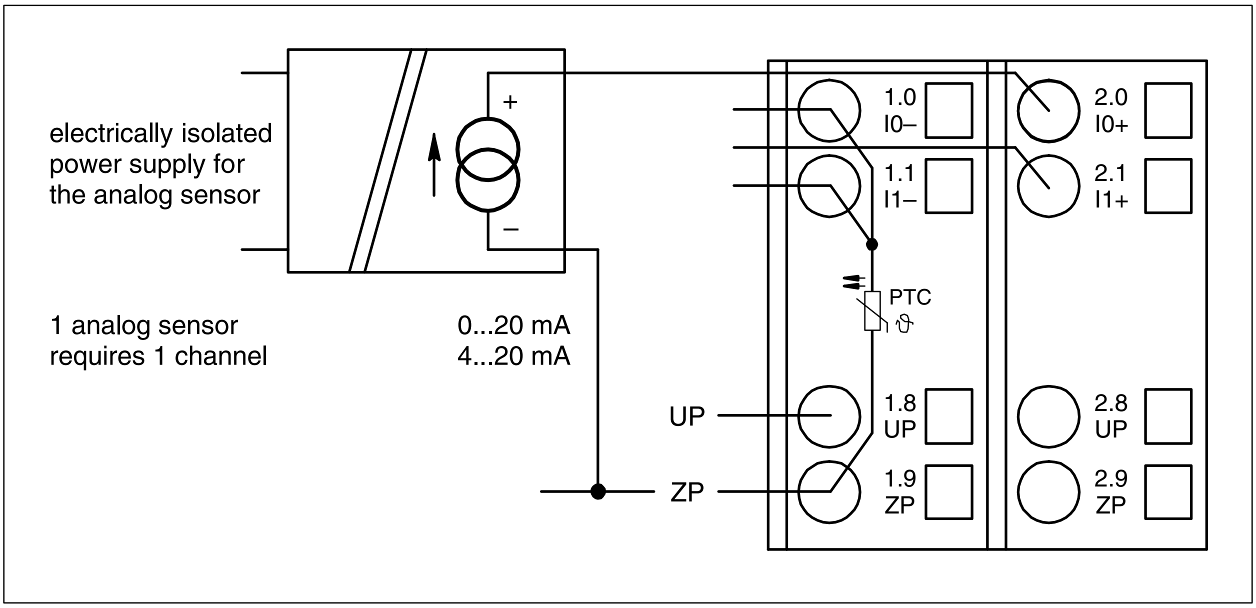


Figure: Connection of active-type analog sensors (current) with electrically isolated power supply

The following measuring ranges can be configured (see also "Parameterization / Channel configuration" and "Measuring ranges / Input ranges of voltage, current and digital input"):

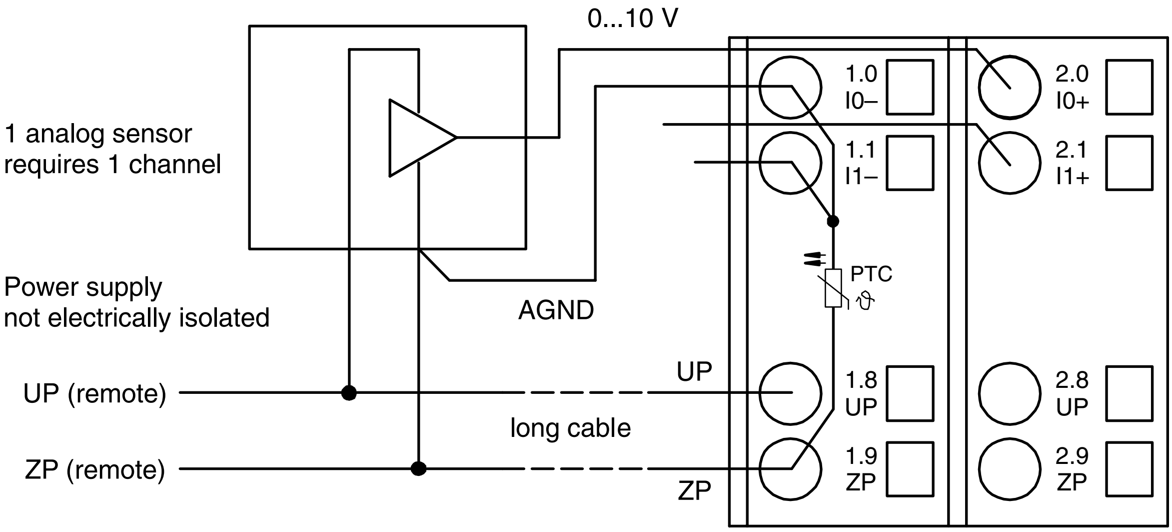
Current	0...20 mA	1 channel used
Current	4...20 mA	1 channel used

The function of the LEDs is described under "Diagnosis and displays / Displays".

Unused input channels can be left open-circuited, because they are of low resistance.

Connection of active-type analog sensors (voltage) with no electrically isolated power supply

The following figure shows the connection of active-type sensors (voltage) with no electrically isolated power supply.



Attention:
The potential difference between AGND and ZP at the AX522 module must not be greater than 1 V, not even in case of long lines (see the figure ”Terminal assignment of AX522”).

Figure: Connection of active-type sensors (voltage) with no electrically isolated power supply

Note for the picture: If AGND does not get connected to ZP, the sensor current flows to ZP via the AGND line. The measuring signal is distorted, since it flows a very little current over the voltage line. The total current through the PTC should not exceed 50 mA. This measuring method is therefore only suitable for short lines and small sensor currents. If there are bigger distances, the difference measuring method has to be preferred.

The following measuring ranges can be configured (see also "Parameterization / Channel configuration" and "Measuring ranges / Input ranges of voltage, current and digital input"):

Voltage	0...10 V	1 channel used
Voltage	-10 V...+10 V *)	1 channel used

*) if the sensor can provide this signal range

The function of the LEDs is described under "Diagnosis and displays / Displays".

In order to avoid error messages or long processing times, it is useful to configure unused analog input channels as "unused".

Connection of passive-type analog sensors (current)

The following figure shows the connection of passive-type analog sensors (current).

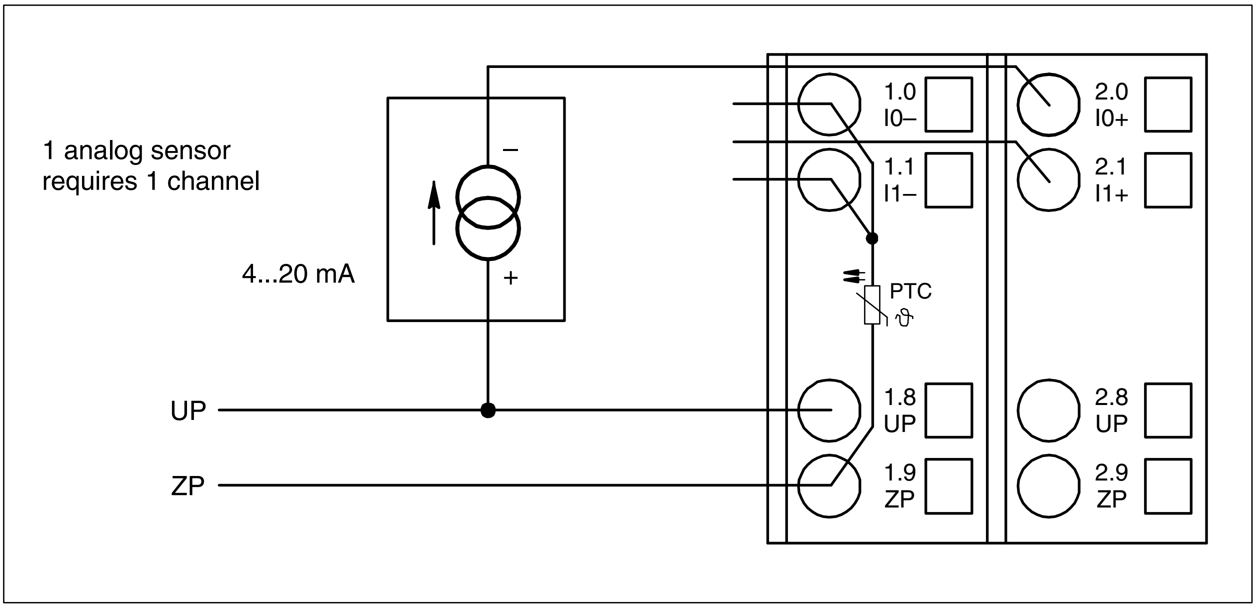


Figure: Connection of passive-type analog sensors (current)

The following measuring ranges can be configured (see also "Parameterization / Channel configuration" and "Measuring ranges / Input ranges of voltage, current and digital input"):

Current	4...20 mA	1 channel used

The function of the LEDs is described under "Diagnosis and displays / Displays".

Caution: If, during initialization, an analog current sensor supplies more than 25 mA for more than 1 second into an analog input, this input is switched off by the module (input protection). In such cases, it is recommended, to protect the analog input by a 10-volt zener diode (in parallel to I+ and I-). But, in general, it is a better solution to prefer sensors with fast initialization or without current peaks higher than 25 mA.

Unused input channels can be left open-circuited, because they are of low resistance.

Connection of active-type analog sensors (voltage) to differential inputs

Differential inputs are very useful, if analog sensors are used which are remotely non-isolated (e.g. the minus terminal is remotely earthed).

The evaluation using differential inputs helps to considerably increase the measuring accuracy and to avoid earthing loops.

With differential input configurations, two adjacent analog channels belong together (e.g. the channels 0 and 1). In this case, both channels are configured according to the desired operating mode. The lower address must be the even address (channel 0), the next higher address must be the odd address (channel 1). The converted analog value is available at the higher address (channel 1).

The analog value is calculated by subtraction of the input value with the higher address from the input value of the lower address.

The converted analog value is available at the odd channel (higher address).

> ⚠ **Important:** The earthing potential at the sensors must not have a too big potential difference with respect to ZP (max. ± 1 V within the full signal range). Otherwise problems can occur concerning the common-mode input voltages of the involved analog inputs.

The following figure shows the connection of active-type analog sensors (voltage) to differential inputs.

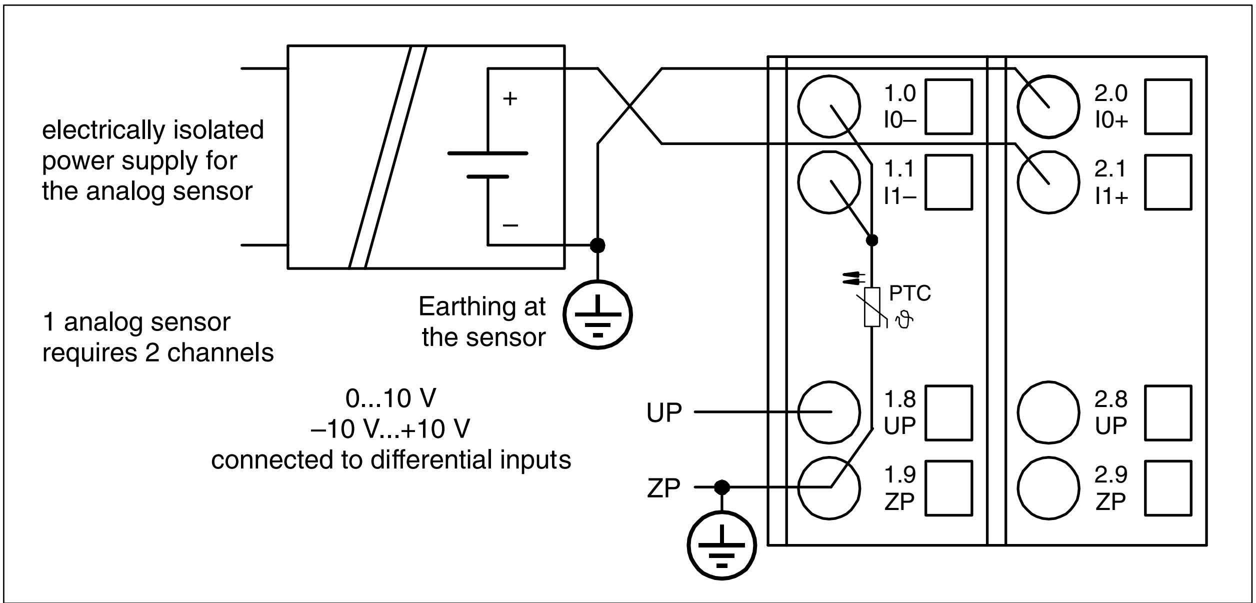


Figure: Connection of active-type analog sensors (voltage) to differential inputs

The following measuring ranges can be configured (see also "Parameterization / Channel configuration" and "Measuring ranges / Input ranges of voltage, current and digital input"):

Voltage	0...10 V	with differential inputs, 2 channels used
Voltage	-10 V...+10 V	with differential inputs, 2 channels used

The function of the LEDs is described under "Diagnosis and displays / Displays".

In order to avoid error messages or long processing times, it is useful to configure unused analog input channels as "unused".

Use of analog inputs as digital inputs

Several (or all) analog inputs can be configured as digital inputs (see also "Technical Data / Technical data of the analog inputs, if they are used as digital inputs"). The inputs are not electrically isolated against the other analog channels.

The following figure shows the use of analog inputs as digital inputs.

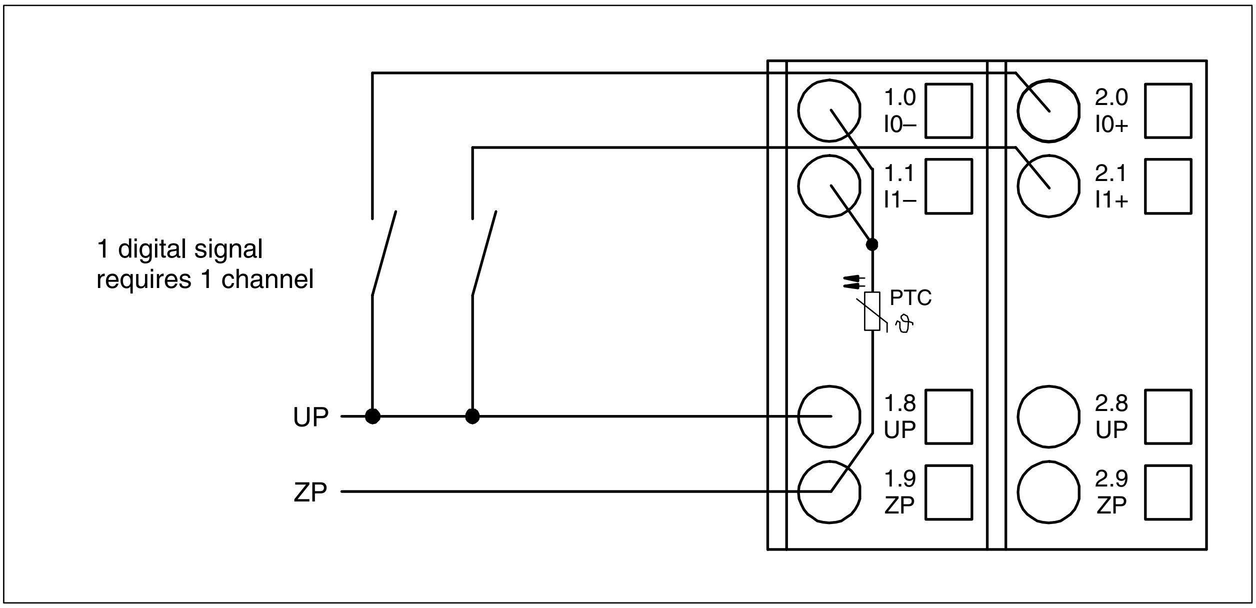


Figure: Use of analog inputs as digital inputs

The following operating mode can be configured (see also "Parameterization / Channel configuration" and "Measuring ranges / Input ranges of voltage, current and digital input"):

Digital input	24 V	1 channel used

The function of the LEDs is described under "Diagnosis and displays / Displays".

Connection of analog output loads (voltage, current)

The following figure shows the connection of analog output loads (voltage, current).

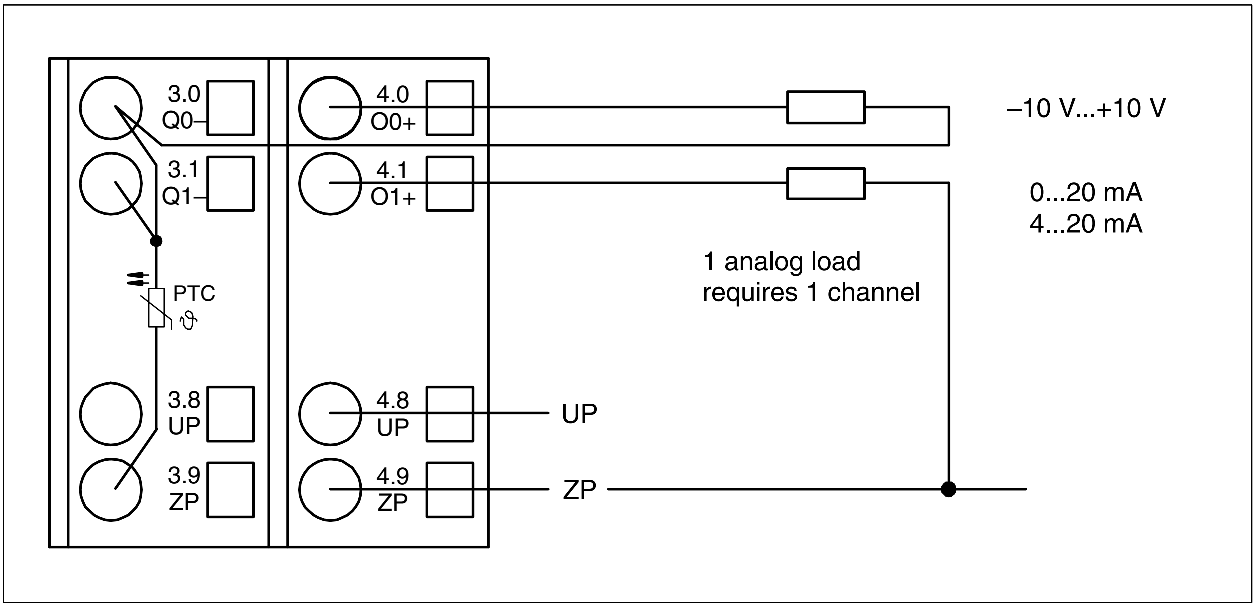


Figure: Connection of analog output loads (voltage, current)

The following measuring ranges can be configured (see also "Parameterization / Channel configuration" and "Measuring ranges / Output ranges of voltage and current"):

Voltage	-10 V...+10 V	Load max. ±10 mA	1 channel used
Current	0...20 mA	Load 0...500 Ω	1 channel used
Current	4...20 mA	Load 0...500 Ω	1 channel used

Only the channels 0...3 can be configured as current output (0...20 mA or 4...20 mA).

The function of the LEDs is described under "Diagnosis and displays / Displays".

Unused analog outputs can be left open-circuited.

Internal data exchange

	AX521	**AX522**
Digital inputs (bytes)	0	0
Digital outputs (bytes)	0	0
Counter input data (words)	4	8
Counter output data (words)	4	8

I/O configuration

The analog input/output modules AX521 and AX522 do not store configuration data themselves.

Parameterization

The arrangement of the parameter data is performed by your master configuration software SYCON in connection with the S500 GSD files and in conjunction with the Control Builder software.

The parameter data directly influences the functionality of modules.

For non-standard applications, it is necessary to adapt the parameters to your system configuration.

Module AX521: Module slot address: Y = 1...7

No.	Name	Value	Internal value	Internal value, type	Default	Min.	Max.	EDS Slot/Index
1	Module ID	Internal	1505 *1)	Word	1505 0x05dc	0	65535	0x0Y01
2 *2)	Ignore module	No Yes	0 1	Byte	No 0x00			not for FBP
3	Parameter length in bytes	Internal	21	Byte	21-CPU 21-FBP	0	255	0x0Y02
4	Check supply	Off On	0 1	Byte	On 0x01	0	1	0x0Y03
5	Analog data format	Default	0	Byte	Default 0x00			0x0Y04
6	Behaviour of outputs at communication errors	Off Last value Substitute value	0 1+(n*5) 2+(n*5), n <= 2	Byte	Off 0x00	0	2	0x0Y05
7	Channel configuration Input channel 0	see table Channel configuration		Byte	Default 0x00	0	19	0x0Y06
8	Channel monitoring Input channel 0	see table Channel monitoring		Byte	Default 0x00	0	3	0x0Y07
9 to 14	Channel configuration and channel monitoring of the input channels 1 to 3	see tables channel configuration and channel monitoring		Byte Byte	Default 0x00 0x00	0 0	19 3	0x0Y08 to 0x0Y0D
15	Channel configuration Output channel 0	see table Channel configuration		Byte	Default 0x00	0	130	0x0Y0E
16	Channel monitoring Output channel 0	see table Channel monitoring		Byte	Default 0x00	0	3	0x0Y0F
17	Substitute value Output channel 0	only valid for output channel 0	0...0xffff	Word	Default 0x0000	0	65535	0x0Y10
18 to 21	Channel configuration and channel monitoring of the output channels 1 to 2	see tables channel configuration and channel monitoring		Byte Byte	Default 0x00 0x00	0 0	130 3	0x0Y11 to 0x0Y14
22	Channel configuration Output channel 3	see table Channel configuration		Byte	Default 0x00	0	130	0x0Y15
23	Channel monitoring Output channel 3	see table Channel monitoring		Byte	Default 0x00	0	3	0x0Y16

*1) With CS31 and addresses less than 70 and FBP, the value is increased by 1

*2) Not with FBP

Module AX522: Module slot address: Y = 1...7

No.	Name	Value	Internal value	Internal value, type	Default	Min.	Max.	EDS Slot/Index
1	Module ID	Internal	1500 *1)	Word	1500 0x05dc	0	65535	0x0Y01
2 *2)	Ignore module	No Yes	0 1	Byte	No 0x00			not for FBP
3	Parameter length in bytes	Internal	37	Byte	37-CPU 37-FBP	0	255	0x0Y02
4	Check supply	Off On	0 1	Byte	On 0x01	0	1	0x0Y03
5	Analog data format	Default	0	Byte	Default 0x00			0x0Y04
6	Behaviour of outputs at communication errors	Off Last value Substitute value	0 1+(n*5) 2+(n*5), n <= 2	Byte	Off 0x00	0	2	0x0Y05
7	Channel configuration Input channel 0	see table Channel configuration		Byte	Default 0x00	0	19	0x0Y06
8	Channel monitoring Input channel 0	see table Channel monitoring		Byte	Default 0x00	0	3	0x0Y07
9 to 22	Channel configuration and channel monitoring of the input channels 1 to 7	see tables channel configuration and channel monitoring		Byte Byte	Default 0x00 0x00	0 0	19 3	0x0Y08 to 0x0Y15
23	Channel configuration Output channel 0	see table Channel configuration		Byte	Default 0x00	0	130	0x0Y16
24	Channel monitoring Output channel 0	see table Channel monitoring		Byte	Default 0x00	0	3	0x0Y17
25	Substitute value Output channel 0	only valid for output channel 0	0...0xffff	Word	Default 0x0000	0	65535	0x0Y18
26 to 31	Channel configuration and channel monitoring of the output channels 1 to 3	see tables channel configuration and channel monitoring		Byte Byte	Default 0x00 0x00	0 0	130 3	0x0Y19 to 0x0Y1E
32	Channel configuration Output channel 4	see table Channel configuration		Byte	Default 0x00	0	128	0x0Y1F
33	Channel monitoring Output channel 4	see table Channel monitoring		Byte	Default 0x00	0	3	0x0Y20
34 to 39	Channel configuration and channel monitoring of the output channels 5 to 7	see tables channel configuration and channel monitoring		Byte Byte	Default 0x00 0x00	0 0	128 3	0x0Y21 to 0x0Y26

*1) With CS31 and addresses less than 70 and FBP, the value is increased by 1

*2) Not with FBP

GSD file:

AX521	Ext_User_Prm_Data_Len = Ext_User_Prm_Data_Const(0) =	24 0x05, 0xe2, 0x15, \ 0x01, 0x00, 0x00 \ 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, \ 0x00, 0x00, 0x00, 0x00, \ 0x00, 0x00, 0x00, 0x00, 0x00, 0x00;
AX522	Ext_User_Prm_Data_Len = Ext_User_Prm_Data_Const(0) =	40 0x05, 0xdd, 0x25, \ 0x01, 0x00, 0x00, \ 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, \ 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, \ 0x00, 0x00, 0x00, 0x00, \ 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, \ 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00;

Input channel (4x with AX521):

No.	Name	Value	Internal value	Internal value, type	Default	Min.	Max.
1	Channel configuration	see below *2)	see below *2)	Byte	0 0x00 see below *3)		
2	Channel monitoring	see below *4)	see below *4)	Byte	0 0x00 see below *5)		

Input channel (8x with AX522):

No.	Name	Value	Internal value	Internal value, type	Default	Min.	Max.
1	Channel configuration	see below *2)	see below *2)	Byte	0 0x00 see below *3)		
2	Channel monitoring	see below *4)	see below *4)	Byte	0 0x00 see below *5)		

- Channel configuration

*2)	Internal value	Operating modes of the analog inputs, individually configurable
***3)**	0	Unused (default)
	1	Analog input 0...10 V
	2	Digital input
	3	Analog input 0...20 mA
	4	Analog input 4...20 mA
	5	Analog input -10 V...+10 V
	8	Analog input Pt100, -50 °C...+400 °C (2-wire)
	9	Analog input Pt100, -50 °C...+400 °C (3-wire), requires 2 channels *)
	10	Analog input 0...10 V via differential inputs, requires 2 channels *)
	11	Analog input -10 V...+10 V via differential inputs, requires 2 channels *)
	14	Analog input Pt100, -50 °C...+70 °C (2-wire)
	15	Analog input Pt100, -50 °C...+70 °C (3-wire), requires 2 channels *)
	16	Analog input Pt1000, -50 °C...+400 °C (2-wire)
	17	Analog input Pt1000, -50 °C...+400 °C (3-wire), requires 2 channels *)
	18	Analog input Ni1000, -50 °C...+150 °C (2-wire)
	19	Analog input Ni1000, -50 °C...+150 °C (3-wire), requires 2 channels *)
		*) In the operating modes with 3-wire configuration or with differential inputs, two adjacent analog inputs belong together (e.g. the channels 0 and 1). In these cases, both channels are configured in the desired operating mode. The lower address must be the even address (channel 0). The next higher address must be the odd address (channel 1). The converted analog value is available at the higher address (channel 1).

- Channel monitoring

*4)	Internal value	Monitoring
***5)**	0	Plausibility, open-circuit (broken wire) and short-circuit
	1	Open-circuit and short-circuit
	2	Plausibility
	3	No monitoring

Output channel 0 (1 channel):

No.	Name	Value	Internal value	Internal value, type	Default	Min.	Max.
1	Channel configuration	see below *6)	see below *6)	Byte	see below *7)		
2	Channel monitoring	see below *8)	see below *8)	Byte	see below *9)		
3	Substitute value *10)	0...65535	0... 0xffff	Word	0		

Output channels 1...3 (3 channels with AX521):

No.	Name	Value	Internal value	Internal value, type	Default	Min.	Max.
1	Channel configuration	see below *6)	see below *6)	Byte	see below *7)		
2	Channel monitoring	see below *8)	see below *8)	Byte	see below *9)		

Output channels 1...7 (7 channels with AX522):

No.	Name	Value	Internal value	Internal value, type	Default	Min.	Max.
1	Channel configuration	see below *6)	see below *6)	Byte	see below *7)		
2	Channel monitoring	see below *8)	see below *8)	Byte	see below *9)		

- Channel configuration

*6)	Internal value	Operating modes of the analog outputs, individually configurable
*7)	0	Unused (default)
	128	Analog output -10 V...+10 V
	129	Analog output 0...20 mA (not with the channels 4...7 and 12...15)
	130	Analog output 4...20 mA (not with the channels 4...7 and 12...15)

- Channel monitoring

*8)	Internal value	Monitoring
*9)	0	Plausibility, open-circuit (broken wire) and short-circuit (default)
	1	Open-circuit (broken wire) and short-circuit
	2	Plausibility
	3	No monitoring

- Substitute value

*10)	Intended behaviour of channel 0 when the control system stops:	Required setting of the module parameter "Behaviour of outputs in case of a communication error"	Required setting of the channel parameter "Substitute value"
	Output OFF	OFF	0
	Last value	Last value	0
	Substitute value	OFF or Last value	1...65535

Diagnosis and display

Diagnosis:

E1..E4	d1	d2	d3	d4	Identifier 000..063	AC500 display	
Class	Comp	Dev	Mod	Ch	Err	PS501 PLC browser	<– Display in
Byte 6 Bit 6..7	-	Byte 3	Byte 4	Byte 5	Byte 6 Bit 0..5	FBP diagnosis block	
Class	**Inter-face**	**De-vice**	**Mod-ule**	**Chan-nel**	**Error identifier**	**Error message**	**Remedy**
	1)	2)	3)	4)			
Module error AX521 / AX522							
3	14 11 / 12	1..7 ADR	31 1..7	31	19	Checksum error in the I/O module	Replace I/O module
3	14 11 / 12	1..7 ADR	31 1..7	31	3	Timeout in the I/O module	Replace I/O module
3	14 11 / 12	1..7 ADR	31 1..7	31	40	Different hard-/firmware versions in the module	Replace I/O module
3	14 11 / 12	1..7 ADR	31 1..7	31	43	Internal error in the module	Replace I/O module
3	14 11 / 12	1..7 ADR	31 1..7	31	36	Internal data exchange failure	Replace I/O module
3	14 11 / 12	1..7 ADR	31 1..7	31	9	Overflow diagnosis buffer	New start
3	14 11 / 12	1..7 ADR	31 1..7	31	26	Parameter error	Check master
3	14 11 / 12	1..7 ADR	31 1..7	31	11	Process voltage too low	Check process voltage
4	14 11 / 12	1..7 ADR	31 1..7	31	45	Process voltage is switched off (ON –> OFF)	Process voltage ON
Channel error AX521 / AX522							
4	14 11 / 12	1...7 ADR	1 1...7	0...3 0...7	48	Analog value overflow or broken wire at an analog input	Check input value or terminal
4	14 11 / 12	1...7 ADR	1 1...7	0...3 0...7	7	Analog value underflow at an analog input	Check input value
4	14 11 / 12	1...7 ADR	1 1...7	0...3 0...7	47	Short-circuit at an analog input	Check terminal
4	14 11 / 12	1...7 ADR	1 1...7	0...3 0...7	48	Analog value overflow at an analog output	Check output value
4	14 11 / 12	1...7 ADR	1 1...7	0...3 0...7	7	Analog value underflow at an analog output	Check output value

1)	In AC500 the following interface identifier applies: 14 = I/O-Bus, 11 = COM1 (e.g. CS31 bus), 12 = COM2. The FBP diagnosis block does not contain this identifier.
2)	With "Device" the following allocation applies: 31 = Module itself, 1..7 = Expansion module 1..7, ADR = Hardware address (e.g. of the DC551)
3)	With "Module" the following allocation applies dependent of the master: Module error: I/O-Bus or FBP: 31 = Module itself; COM1/COM2: 1..7 = Expansion 1..7 Channel error: I/O-Bus or FBP = Module type (2 = DO); COM1/COM2: 1..7 = Expansion 1..7
4)	In case of module errors, with channel "31 = Module itself" is output.

Displays:

During the power ON procedure, the module initializes automatically. All LEDs (accept the channel LEDs) are ON during this time.

Status of the LEDs (see also section "Diagnosis LEDs" in the S500 system data)

LED	**Status**	**Color**	**LED = OFF**	**LED = ON**	**LED flashes**
inputs 00...03 or 00...07	analog input	yellow	input is OFF	input is ON (brightness depends on the value of the analog signal)	--
outputs 00...03 or 00...07	analog output	yellow	output is OFF	output is ON (brightness depends on the value of the analog signal)	--
UP	process voltage 24 V DC via terminal	green	process voltage is missing	process voltage OK and initialization successful	module is not initialized correctly
CH-ERR2	Channel Error, error messages in groups (analog inputs or outputs combined into the groups 2 and 4)	red	no error or process voltage is missing	serious error within the corresponding group	error on one channel of the group
CH-ERR4		red			
CH-ERR *)	Module Error	red	--	internal error	--
*) Both LEDs (CH-ERR2 and CH-ERR4) light up together					

Measuring ranges

Input ranges of voltage, current and digital input

Range	0...10 V	-10...+10 V	0...20 mA	4...20 mA	Digital input	Digital value	
						decimal	hex.
Overflow	>11.7589	>11.7589	>23.5178	>22.8142		32767	7FFF
Measured value too high	11.7589 : 10.0004	11.7589 : 10.0004	23.5178 : 20.0007	22.8142 : 20.0006		32511 : 27649	7EFF : 6C01
Normal range	10.0000 : 0.0004	10.0000 : 0.0004	20.0000 : 0.0007	20.0000 : 4.0006	ON	27648 : 1	6C00 : 0001
	0.0000	0.0000	0	4	OFF	0	0000
Normal range or measured value too low	-0.0004 -1.7593	-0.0004 : : : -10.0000		3.9994 : 0		-1 -4864 -6912 : -27648	FFFF ED00 E500 : 9400
Measured value too low		-10.0004 : -11.7589				-27649 : -32512	93FF : 8100
Underflow	<0,0000	<-11.7589	<0.0000	<0.0000		-32768	8000

The represented resolution corresponds to 16 bits.

Input ranges resistance

Range	Pt100 / Pt 1000 -50...70 °C	Pt100 / Pt1000 -50...400 °C	Ni1000 -50...150 °C	Digital value	
				decimal	hex.
Overflow	> 80.0 °C	> 450.0 °C	> 160.0 °C	32767	7FFF
Measured value too high		450.0 °C : 400.1 °C		4500 : 4001	1194 : 0FA1
			160.0 °C : 150.1 °C	1600 : 1501	0640 : 05DD
	80.0 °C : 70.1 °C			800 : 701	0320 : 02BD
Normal range	70.0 °C : 0.1 °C	400.0 °C : : : 0.1 °C	150.0 °C : : 0.1 °C	4000 1500 700 : 1	0FA0 05DC 02BC : 0001
	0.0 °C	0.0 °C	0.0 °C	0	0000
	-0.1 °C : -50.0 °C	-0.1 °C : -50.0 °C	-0.1 °C : -50.0 °C	-1 : -500	FFFF : FE0C
Measured value too low	-50.1 °C : -60.0 °C	-50.1 °C : -60.0 °C	-50.1 °C : -60.0 °C	-501 : -600	FE0B : FDA8
Underflow	< -60.0 °C	< -60.0 °C	< -60.0 °C	-32768	8000

Output ranges voltage and current

Range	-10...+10 V	0...20 mA	4...20 mA	Digital value	
				decimal	hex.
Overflow	0 V	0 mA	0 mA	> 32511	> 7EFF
Measured value too high	11.7589 V : 10.0004 V	23.5178 mA : 20.0007 mA	22.8142 mA : 20.0006 mA	32511 : 27649	7EFF : 6C01
Normal range	10.0000 V : 0.0004 V	20.0000 mA : 0.0007 mA	20.0000 mA : 4.0006 mA	27648 : 1	6C00 : 0001
	0.0000 V	0.0000 mA	4.0000 mA	0	0000
	-0.0004 V : -10.0000 V	0 mA : 0 mA	3.9994 mA 0 mA 0 mA	-1 -6912 -27648	FFFF E500 9400
Measured value too low	-10.0004 V : -11.7589 V	0 mA : 0 mA	0 mA : 0 mA	-27649 : -32512	93FF : 8100
Underflow	0 V	0 mA	0 mA	< -32512	< 8100

The represented resolution corresponds to 16 bits.

Technical data

The system data of AC500 and S500 are valid here. Only additional details are therefore documented below.

Process voltage	
- Rated value	24 V DC
- max. ripple	5 %
- Protection against reversed voltage	yes
- Rated protection fuse on UP	10 A fast
- Electrical isolation	yes, per module
- Current consumption from UP at normal operation	0.10 A + output loads
- Inrush current from UP (at power up)	0.020 A^2s
- Connections	Terminals 1.8 - 4.8 for +24 V (UP) and 1.9 - 4.9 for 0 V (ZP)
Max. length of analog cables, conductor cross section > 0.14 mm^2	100 m
Conversion error of the analog values caused by non-linearity, adjustment error at factory and resolution within the normal range	typ. 0.5 %, max. 1 %
Weight	300 g
Mounting position	horizontal or vertical with derating (output load reduced to 50 % at 40°C per group)
Cooling	The natural convection cooling must not be hindered by cable ducts or other parts in the switch-gear cabinet.

Attention: All I/O channels (digital and analog) are protected against reverse polarity, reverse supply, short circuit and continuous overvoltage up to 30 V DC.

Technical data of the analog inputs

Number of channels per module	AX521: 4 AX522: 8
Distribution of channels into groups	AX521: 1 group of 4 channels AX522: 1 group of 8 channels
Connections of the channels I0- to I3- Connections of the channels I0- to I7-	AX521: Terminals 1.0 to 1.3 AX522: Terminals 1.0 to 1.7
Connections of the channels I0+ to I3+ Connections of the channels I0+ to I7+	AX521: Terminals 2.0 to 2.3 AX522: Terminals 2.0 to 2.7
Input type	bipolar (not with current or Pt100/Pt1000/Ni1000)
Electrical isolation	against internal supply and other modules
Configurability	0...10 V, -10...+10 V, 0/4...20 mA, Pt100/1000, Ni1000 (each input can be configured individually)
Channel input resistance	Voltage: > 100 kΩ, current: ca. 330 Ω
Time constant of the input filter	Voltage: 100 µs, current: 100 µs
Indication of the input signals	one LED per channel
Conversion cycle	2 ms (for 8 inputs + 8 outputs), with Pt/Ni... 1 s
Resolution	Range 0...10 V: 12 bits
	Range -10...+10 V: 12 bits + sign
	Range 0...20 mA: 12 bits
	Range 4...20 mA: 12 bits
Relationship between input signal and hex code	see tables "Input ranges voltage, current and digital input" and "Input ranges resistance"
Unused voltage inputs	are configured as "unused"
Unused current inputs	have a low resistance, can be laft open-circuited
Overvoltage protection	yes

Technical data of the analog inputs, if they are used as digital inputs

Number of channels per module	AX521: max. 4 AX522: max. 8
Distribution of channels into groups	AX521: 1 group of 4 channels AX522: 1 group of 8 channels
Connections of the channels I0+ to I3+ Connections of the channels I0+ to I7+	AX521: Terminals 2.0 to 2.3 AX522: Terminals 2.0 to 2.7
Reference potential for the inputs	Terminals 1.8 to 4.8 (ZP)
Input signal delay	typ. 8 ms, configurable from 0.1 to 32 ms
Indication of the input signals	one LED per channel
Input signal voltage	24 V DC
Signal 0	-30 V...+5 V
Signal 1	+13 V...+30 V

Technical data of the analog outputs

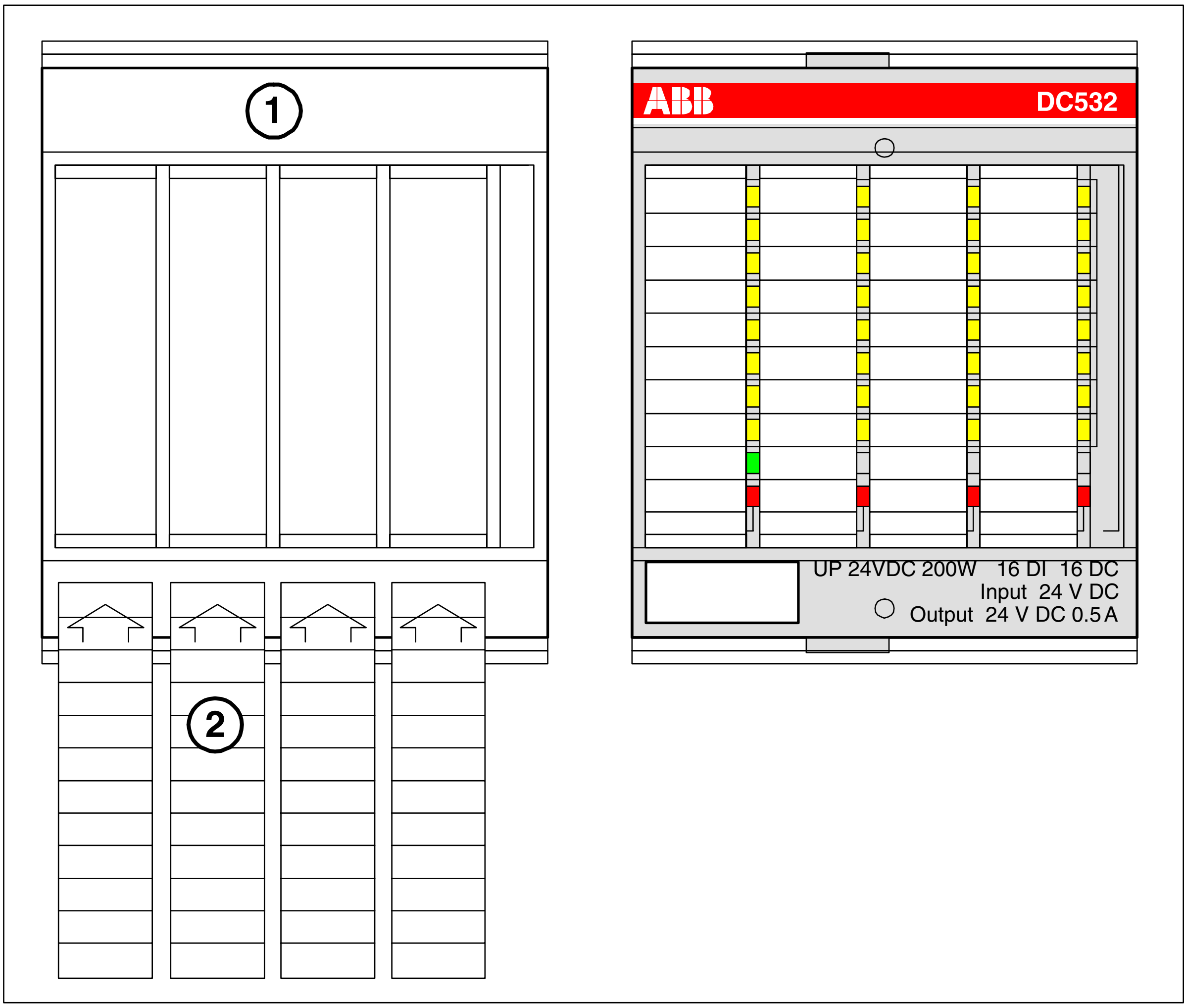
Number of channels per module	AX521: 4, all channels for voltage and current AX522: 8, all channels for voltage, the first 4 channels also for current
Distribution of channels into groups	AX521: 1 group of 4 channels AX522: 1 group of 8 channels
- Channels O0-...O3- - Channels O0-...O7-	AX521: Terminals 3.0...3.3 AX522: Terminals 3.0...3.7
- Channels O0+...O3+ - Channels O0+...O7+	AX521: Terminals 4.0...4.3 AX522: Terminals 4.0...4.7
Output type	bipolar with voltage, unipolar with current
Electrical isolation	against internal supply and other modules
Configurability	-10...+10 V, 0...20 mA, 4...20 mA (each output can be configured individually), current outputs only channels 0...3
Output resistance (load), as current output	0...500 Ω
Output loadability, as voltage output	max. ±10 mA
Indication of the output signals	one LED per channel
Resolution	12 bits (+ sign)
Relationship between output signal and hex code	see table "Output ranges voltage and current"
Unused outputs	can be left open-circuited

Ordering data

Order No.	**Scope of delivery**
1SAP 250 100 R0001	AX521, Analog input/output module, 4 AI / 4 AO, U/I/Pt100, 12 Bit + sign, 2-wires
1SAP 250 000 R0001	AX522, Analog input/output module, 8 AI / 8 AO, U/I/Pt100, 12 Bit + sign, 2-wires
1SAP 212 200 R0001	TU515, I/O Terminal Unit, 24 V DC, screw-type terminals
1SAP 212 000 R0001	TU516, I/O Terminal Unit, 24 V DC, spring terminals

Accessories S500, overview

Pluggable Marker Holder TA523
- for labelling the channels of S500 I/O modules



(1) Pluggable Marking Holder TA523

(2) Marking stripes to be inserted into the holder

(3) Pluggable Marking Holder, snapped on an I/O module

Contents

Purpose

The Pluggable Marking Holder is used to hold 4 marking stripes, on which the meaning of the I/O channels of I/O modules can be written down. The holder is transparent so that after snapping it onto the module the LEDs shine through.

Handling instructions

The marking stripes can be printed out from a Word file.

Template: ...\Documentation\2-Hardware-AC500\TA523.doc

Technical data

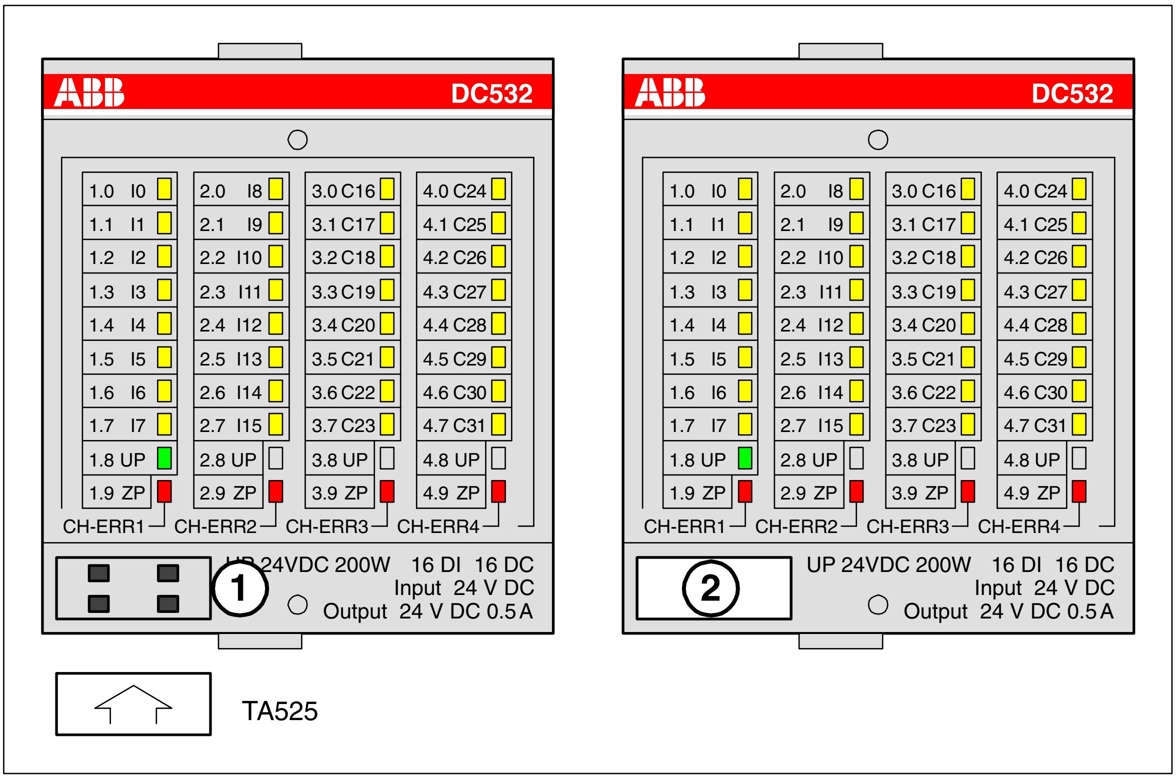
The system data of AC500 and S500 are valid here. Only additional details are therefore documented below.

Use	for labelling channels of I/O modules
Mounting	snap-on to the module
Weight	20 g
Dimensions	82 mm x 67 mm x 13 mm

Ordering data

Order No.	Scope of delivery
1SAP 180 500 R0001	TA523, Pluggable Marker Holder (10 pieces)

Set of 10 white Plastic Markers TA525
- to label AC500 and S500 modules



(1) Module without Plastic Marker TA525

(2) Module with Plastic Marker TA525

Contents

Purpose
Handling instructions
Technical data
Ordering data

Purpose

The Plastic Markers are suitable for labelling AC500 and S500 modules (CPUs, couplers and I/O modules). The small plastic parts can be written with a standard waterproof pen.

Handling instructions

The Plastic Markers are inserted under a slight pressure. For disassembly, a small screwdriver is inserted at the lower edge of the module.

Technical data

The system data of AC500 and S500 are valid here. Only additional details are therefore documented below.

Use	for labelling AC500 and S500 modules
Mounting	insertion under a slight pressure
Disassembly	with a small screwdriver
Scope of delivery	10 pieces
Weight	1 g per piece
Dimensions	8 mm x 20 mm x 5 mm

Ordering data

Order No.	**Scope of delivery**
1SAP 180 700 R0001	TA525, Set of 10 white Plastic Markers

Wall Mounting Accessory TA526
- for insertion at the rear side of Terminal Bases and Terminal Units

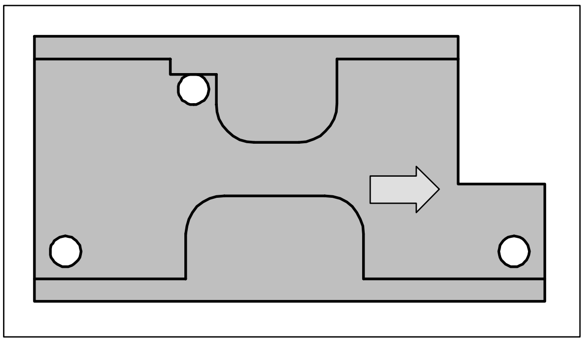


Figure: Wall mounting accessory TA526

Contents

Purpose
Handling instructions
Technical data
Ordering data

Purpose

If the Terminal Bases TB5xx or Terminal Units TU5xx should be mounted with screws, Wall Mounting Accessories TA526 must be inserted at the rear side first. This plastic parts prevent bending of Terminal Bases and Terminal Units while screwing up.

Handling instructions

The handling of the Wall Mounting Accessories is described in detail under "AC500 system data" and "S500 system data".

Technical data

The system data of AC500 and S500 are valid here. Only additional details are therefore documented below.

Use	with wall mounting of Terminal Bases and Terminal Units
Assembly	see system data of AC500 and S500
Weight	5 g
Dimensions	67 mm x 35 mm x 5,5 mm

Ordering data

Order No.	**Scope of delivery**
1SAP 180 800 R0001	TA526, Wall Mounting Accessory

24 V DC Power supplies which can be used with the system
- as system power supply or process supply

Figure: Power supply units CP24..

Contents

Features
Characteristics
Special characteristics
Ordering data

Features

- **Switching power supplies, primary switch mode**
- **High effiency**
- **Wide-range input voltage**
- **Mounting on DIN rail**
- **Compact design**
- **Tested according to EN 60950**
- **Complies with EMC directives EN 61000-6-2 and EN 61000-6-4**

Characteristics

- Versions with output voltages from 5 V DC to 48 V DC and output currents form 300 mA to 20 A are available.
- Fixed or adjustable output voltage (depending on type).
- Most of the types provide a wide input voltage range from 90 V AC to 260 V AC and a frequency range from 47 Hz to 440 Hz. No adjustment is necessary.

- Integrated input fuse.
- Almost all types can also be supplied with DC voltage from 105 V DC to 260 V DC.
- High efficiency of up to 90 %.
- Extended lifetime due to low power dissipation and low heating.
- No-load proof, overload proof, continuous short-circuit proof, automatic restart.
- Fast and easy mounting on DIN rail.
- Compact slim design.

Special characteristics

- Power factor correction (PFC) according to EN 61000-3-2 for CP-24/5.0 and CP-24/5.0 adj.
- Parallel connection possible for CP-24/10 adj. and CP-24/20 adj.
- Redundancy module available.

Ordering data

Ordering data CP Range, switching power supplies

Order No.	Type	Input	Output
1SVR 423 418 R0000	CP-24/1.0	90-260 V AC or 105-260 V DC	24 V DC, 1 A
1SVR 423 417 R0000	CP-24/2.0	90-140 V AC	24 V DC, 2 A
1SVR 423 417 R1000	CP-24/2.0	140-260 V AC	24 V DC, 2 A
1SVR 423 417 R1100	CP-24/2.0 adj.	140-260 V AC or 160-260 V DC	24 V DC, 2 A adj.
1SVR 423 416 R0000	CP-24/5.0	90-260 V AC or 127-260 V DC	24 V DC, 5 A
1SVR 423 416 R0100	CP-24/5.0 adj.	90-260 V AC or 127-260 V DC	24 V DC, 5 A adj.
1SVR 423 416 R1000	CP-24/4.2	90-260 V AC or 127-260 V DC	24 V DC, 4,2 A

Ordering data CP-S Range, switching power supplies

Order No.	Type	Input	Output
1SVR 427 014 R0000	CP-S 24/5.0	110-240 V AC	24 V DC, 5 A
1SVR 427 015 R0100	CP-S 24/10.0	110-120 V AC or 220-240 V AC (with selector switch)	24 V DC, 10 A
1SVR 427 016 R0100	CP-S 24/20.0	110-120 V AC or 220-240 V AC (with selector switch)	24 V DC, 20 A

Ordering data CP-C Range, switching power supplies

Order No.	Type	Input	Output
1SVR 427 024 R0000	CP-C 24/5.0	110-240 V AC	22-28 V DC, 5 A
1SVR 427 025 R0000	CP-C 24/10.0	110-240 V AC	22-28 V DC, 10 A
1SVR 427 026 R0000	CP-C 24/20.0	110-240 V AC	22-28 V DC, 20 A

Manual No.: 2CDC 125 017 M0201

ABB STOTZ-KONTAKT GmbH
Eppelheimer Straße 82 69123 Heidelberg, Germany
Postfach 10 16 80 69006 Heidelberg, Germany
Telephone (06221) 701-0
Telefax (06221) 701-240
Internet http://www.abb.de/stotz-kontakt
E-Mail desst.helpline@de.abb.com