The dimensions are in mm and in brackets in inch.

Ordering data

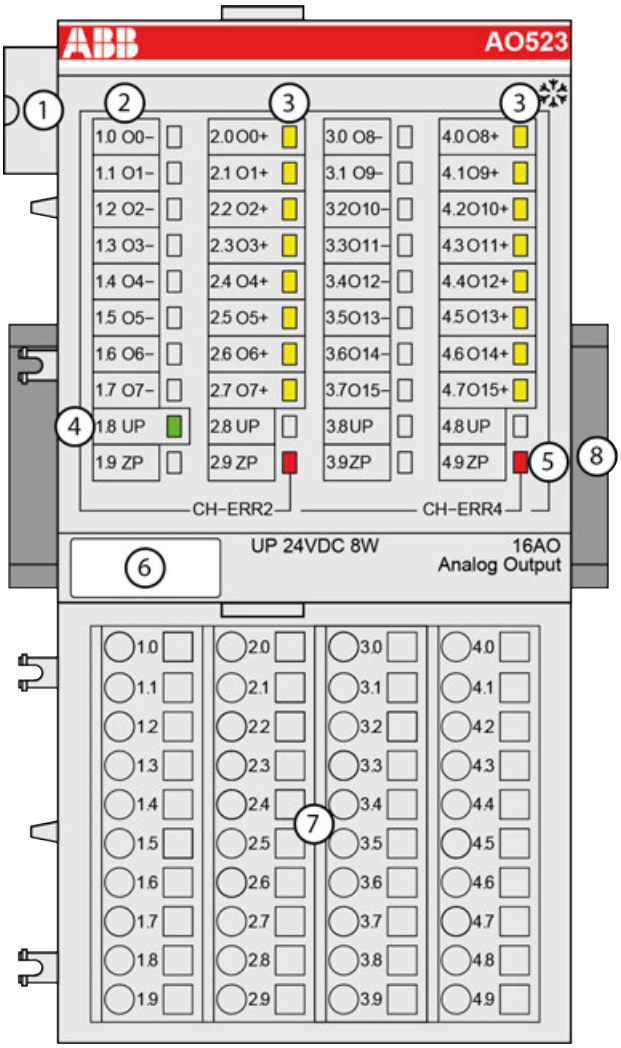
Part no.	Description	Product life cycle phase *)
1SAP 250 900 R0001	AO522: S500 analog output module, 8 AO: U/I,1-wire	Active
1SAP 450 900 R0001	AO522-XC: S500 analog output module, 8 AO: U/I,1-wire, XC version	Active

**) Modules in lifecycle Classic are available from stock but not recommended for planning and commissioning of new installations.*

1.6.2.2.5 AO523 - Analog output module

- 16 analog outputs in two groups:
  - 8 channels configurable for voltage or currrent output (O0...O3 / O8...O11)
  - 8 channels for voltage output (O4...O7 / O12...O15)

  Resolution 12 bits including sign
- Module-wise galvanically isolated
- XC version for use in extreme ambient conditions available



1 I/O bus
2 Allocation between terminal number and signal name
3 Yellow LEDs to display the signal states of the channels
4 1 green LED to display the state of the process supply voltage UP
5 2 red LEDs to display errors
6 Label
7 Terminal unit
8 DIN rail
Sign for XC version

Consider the safety instructions

In the description, special attention must be paid to designs using galvanic isolation, grounding and EMC measures for the reasons stated. Consider the safety instructions for AC500 product family.

Intended use

The module can be used both on an AC500 processor module and on a communication interface module.

Unless expressly intended for this purpose, the following applications are prohibited:

- Use in explosion-proof areas.
- Use in environments with harmful oils, acids, gases, vapors, dusts and radiation.
- Operation under water.

Not to be used as a safety module.

Connections



For a detailed description of the mounting, disassembly and connection of the module, please refer to the installation instructions.

The modules are plugged on an I/O terminal unit.

TU515, TU516

Properly position 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.

Chapter 1.9.3.5 “TA526 - Wall mounting accessory” on page 1145

The 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.

The internal logic of the module is supplied by the I/O bus.

The input/output circuits are powered by the process voltage:

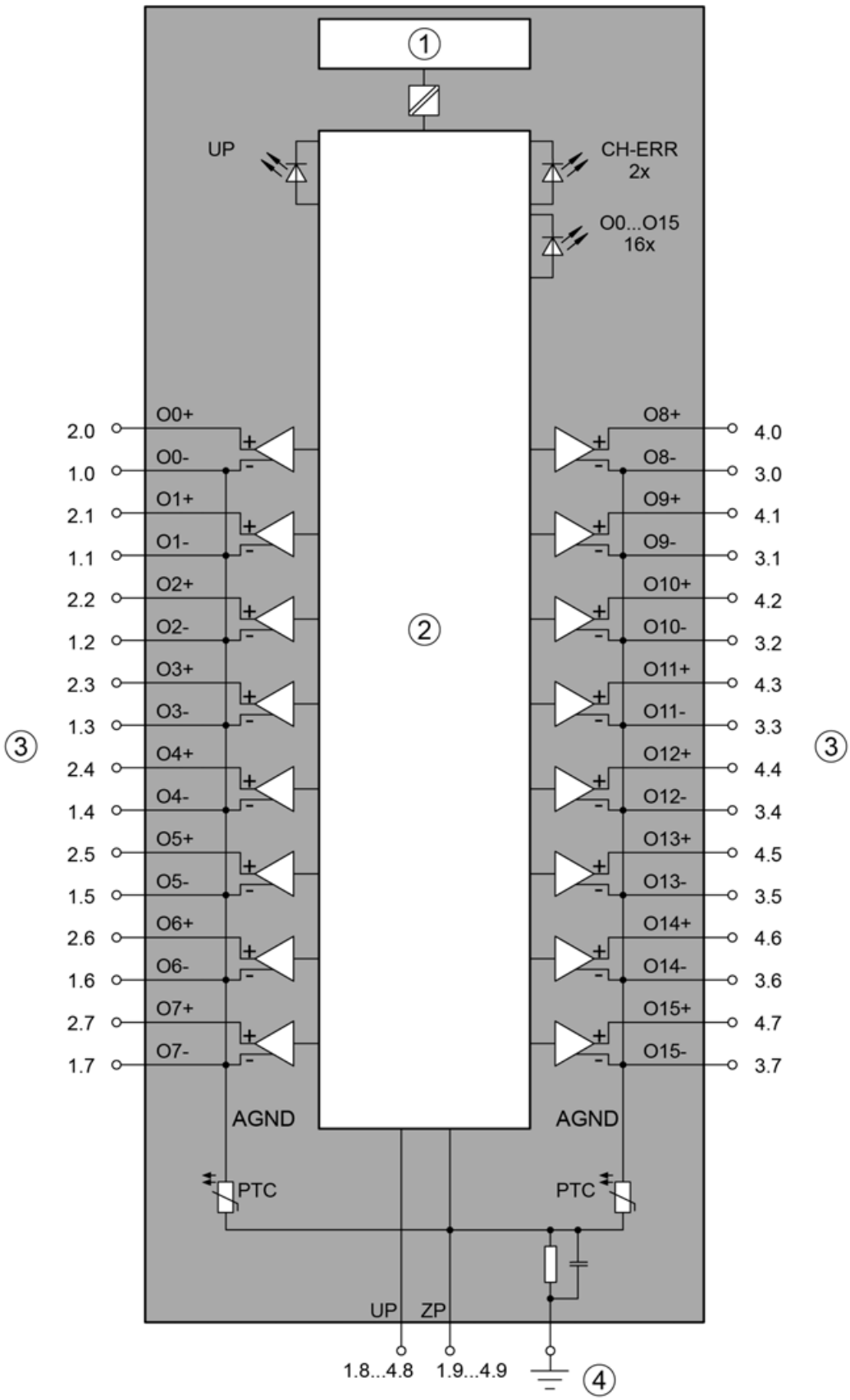
Process voltage UP = +24 V DC. Terminals 1.8 ... 4.8 are internally connected in the terminal unit.

Process voltage ZP = 0 V DC. Terminals 1.9 ... 4.9 are internally connected in the terminal unit.



The maximum current load capability of the terminals must be taken into account.

Block diagram and connections



1 I/O bus interface to the CPU or communication interface module
2 Internal logic and I/O circuits of the module
3 Analog outputs
4 Functional earth connection between terminal unit and DIN rail

WARNING!

Removal/Insertion under power

Removal or insertion under power is permissible only if all conditions for hot swapping are fullfilled.

Conditions for hot swap

“Conditions for hot swap” on page 1152

The devices are not designed for removal or insertion under power when the conditions for hot swap do not apply. Because of unforeseeable consequences, it is not allowed to plug in or unplug devices with the power being ON.

Make sure that all voltage sources (supply and process voltage) are switched off before doing any of the following actions:

– Connect or disconnect any signal or terminal block.
– Remove, mount or replace a module.

Disconnecting any powered devices while they are energized in a hazardous location could result in an electric arc, which could create an ignition source resulting in fire or explosion.

Prior to proceeding, make sure that power is disconnected and that the area has been thoroughly checked to ensure that flammable materials or ignitable concentrations are not present.

The devices must not be opened when in operation. The same applies to the network interfaces.

NOTICE!

Risk of damaging the PLC modules!

Overvoltages and short circuits might damage the PLC modules.

– Make sure that all voltage sources (supply voltage and process supply voltage) are switched off before you begin with operations on the system.
– Never connect any voltages or signals to reserved terminals (marked with ---). Reserved terminals may carry internal voltages.

Generally, analog signals must be laid in shielded cables. The cable shields must be grounded at both sides of the cables. In order to avoid unacceptable potential differences between different parts of the installation, low resistance equipotential bonding conductors must be laid.

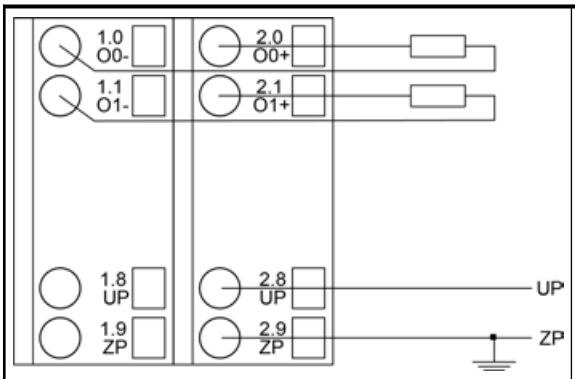
CAUTION!

By installing equipotential bonding conductors between the different parts of the system, it must be ensured that the potential difference between ZP and AGND never can exceed 1 V.

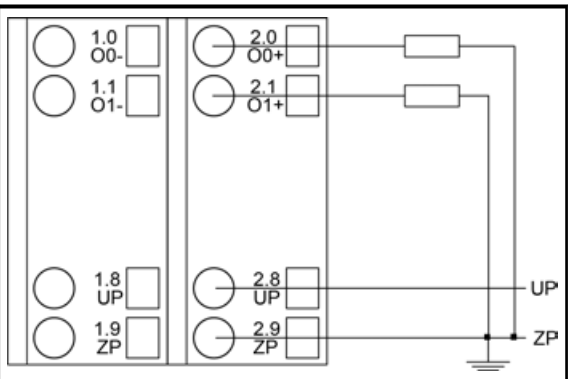
CAUTION!

The process supply voltage must be included in the grounding concept (e. g. grounding of the negative terminal).

Connection of analog output loads (Voltage, current)



Connection of analog voltage actuators



Connection of analog current actuators

Unused analog outputs can be left open-circuited.

Internal data exchange

Digital inputs (bytes)	0
Digital outputs (bytes)	0
Analog inputs (words)	0
Analog outputs (words)	16

Parameterization

The module itself does not save any configuration data. It receives all parameters from the master device of the I/O bus (CPU or communication interface module) when the system is switched on.

If the external power supply voltage via UP/ZP terminals fails, the I/O module loses its configuration data. To reconfigure the module, the entire station must be switched off and on again.

Table 94: Module parameters

No.	Name	Default value	Internal value	Values in menu
1	Ignore module	Yes	0	Yes
			1	No
4	Check supply	On	0	On
			1	Off
6	Behaviour of outputs at communication errors	Off	0	Off
			1+(n*5)	Last value
				Last value 5 s
				Last value 10 s
			2+(n*5)	Substitute value
			n ≤ 2	Substitute value 5 s
				Substitute value 10 s

Table 95: Channel parameters

No.	Name	Default value	Internal value	Values in menu
1	Channel configuration	Not used	0	Not used
			128	-10 ... +10 V
			129	0 ... 20 mA
			130	4 ... 20 mA
2	Channel monitoring	Diagnosis (Plausib, Cut wire, Short circuit)	0	Diagnosis (Plausib, Cut wire, Short circuit)
			3	Not used
3	Substitute value	0	0	0 ... 65535

Diagnosis

Table 96: Possible diagnosis of I/O channels

Output range	Condition	
	Output value in the PLC underflow	Output value in the PLC overflow
0 mA ... 20 mA	Error identifier = 7	Error identifier = 4
4 mA ... 20 mA		
-10 V ... +10 V		

Table 97: Error severity E3: Warnings

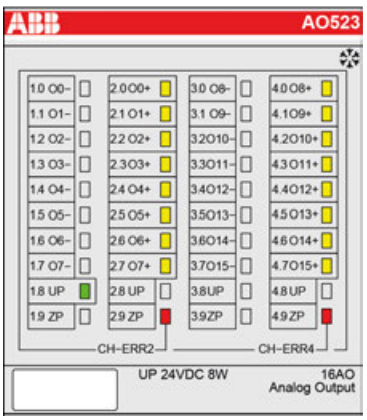
Error severity	Location	Error code	d1	d2	d3	d4	Description	Remedy
								
E3	iob (I/O bus)	3	14	1 ... 10	31	31	Timeout in the I/O module	Replace I/O module
E3	iob (I/O bus)	9	14	1 ... 10	31	31	Overflow diagnosis buffer	New start
E3	iob (I/O bus)	11	14	1 ... 10	31	31	Process voltage too low	Check process voltage
E3	iob (I/O bus)	19	14	1 ... 10	31	31	Checksum error in the I/O module	Replace I/O module
E3	iob (I/O bus)	26	14	1 ... 10	31	31	Parameter error	Check master
E3	iob (I/O bus)	36	14	1 ... 10	31	31	Internal data exchange failure	Replace I/O module
E3	iob (I/O bus)	40	14	1 ... 10	31	31	Different hard-/firmware versions in the module	Replace I/O module
E3	iob (I/O bus)	43	14	1 ... 10	31	31	Internal error in the module	Replace I/O module

Table 98: Error severity E4: Warnings

Error severity	Location	Error code	d1	d2	d3	d4	Description	Remedy
								
E4	iob (I/O bus)	4	14	1 ... 10	3	0 ... 7	Analog value > upper limit (Over-flow)	Check output value
E4	iob (I/O bus)	7	14	1 ... 10	3	0 ... 7	Analog value < lower limit (Underflow)	Check output value
E4	iob (I/O bus)	45	14	1 ... 10	31	31	Process voltage is switched off (ON -> OFF)	Process voltage ON
E4	iob (I/O bus)	48	14	1 ... 10	3	0 ... 7	Current: Current output > 0.3 mA: wire break Voltage: Voltage output with signal outside the range -2.5 … +2.5 V: short circuit	Check output value

State LEDs

During the power ON procedure, the module initializes automatically. All LEDs (except the channel LEDs) are ON during this time.

LED		State	Color	LED = OFF	LED = ON	LED flashes
	Input/output channels	Channel status	Yellow	Channel is OFF	Channel is ON (for analog input/output brightness depends on the value of the signal)	--
	UP	Process voltage 24 V DC via terminal	Green	Process voltage is missing	Process voltage OK	--
	CH-ERR4	Module/ 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	Severe error within the corresponding group	Error on one channel of the group

Representation of the signal ranges

The represented resolution corresponds to 16 bits.

Range	-10 V ... +10 V	0 mA ... 20 mA	4 mA ... 20 mA	Digital value	
				Decimal	Hex.
Overflow	0 V	0 mA	0 mA	> 32511	> 7EFF
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
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

Technical data

Technical data of the module

The AC500 and S500 system data is applicable to the standard version.

↳ *Chapter 2.6.1 “System data AC500” on page 1194*

The AC500-XC system data is applicable to the XC version.

↳ *Chapter 2.7.1 “System data AC500-XC” on page 1263*

Only deviating specifications are therefore described here.

The technical data is also applicable to the XC version.

Power supply		
Process voltage (UP)		
	Rated value	24 V DC
	No load current	typ. 0.075 A
	Inrush current (at power up)	typ. 0.06 A^2s
	Protection against reversed voltage	Yes
	Protection against improper voltage level	Up to 30 V DC
	Protection against improper lead connection	Up to ±30 V DC
	Rated protection fuse on UP	↳ *TU515, TU516*
Logic supply		

Power supply		
	Supply current at 24 V DC power supply at the terminals UP/L+ or ZP/M of the CPU or communication interface module	Ca. 2 mA
Power loss		5 W
Weight		300 g

Technical data of the analog outputs

General data		
Number of analog outputs		16
Distribution of channels into groups		2 groups
Resolution		12 bits including sign
Analog output signal ranges		-10 V ... +10 V 0 mA ... 20 mA 4 mA ... 20 mA
Cycle time (all channels)		On request
Settling time for full-range change (resistive load, output signal within specified tolerance)		typ. 5 ms
Overshoot		On request
Type of protection		All I/O channels are protected against reverse polarity, reverse supply, short circuit, and temporary overvoltage up to 30 V DC.
Voltage output		
	Output impedance in signal range	On request
	Maximum output current	±10 mA
	Short-circuit current	On request
	Type of load	On request
	Maximum capacitive load	On request
Output type		Bipolar with voltage, unipolar with current
Galvanic isolation		Yes, per module
Current output		
	Load impedance including cable resistance	0…500 Ω
	Type of load	On request
	Maximum capacitive load	On request
Indication of the output signals		One LED per channel
Type, length of cable		Shielded cable. Maximum length so that load is within maximum resistive, capacitive, and inductive load limits
Output response at power up and power down		On request
Error		
Error at 25 °C		

General data		
	Voltage output at 0 ... 60 °C	±0.5 % of full scale
Temperature coefficient		On request
Maximum error over full temperature range		
	Voltage output at 0 ... 60 °C	±1 % of full scale
Maximum temporary deviation during each specified electrical interference test		On request
Crosstalk between channels		On request
Monotonicity		On request
Repeatability at fixed temperature after specified stabilization time		On request
Output ripple		On request
Galvanic isolation		
	Between the channels	No
	Between the channels and I/O bus	Yes
	Between the channels and process supply voltage (UP, ZP)	No

Ordering data

Part no.	Description	Product life cycle phase *)
1SAP 250 200 R0001	AO523, analog output module, 16 AO, U/I, 12 bits including sign, 2-wires	Active
1SAP 450 200 R0001	AO523-XC, analog output module, 16 AO, U/I, 12 bits including sign, 2-wires, XC version	Active

**) Modules in lifecycle Classic are available from stock but not recommended for planning and commissioning of new installations.*

1.6.2.2.6 AX521 - Analog input/output module

- 4 configurable analog inputs (I0 ... I3) in 1 group (1.0 ... 2.3)
  Resolution 12 bits including sign
- 4 configurable analog outputs (O0 ... O3) in 1 group (3.0 ... 4.3)
  Resolution 12 bits including sign
- Module-wise galvanically isolated
- XC version available for use in extreme environmental conditions