


# AX522

## Analog Input/Output Module



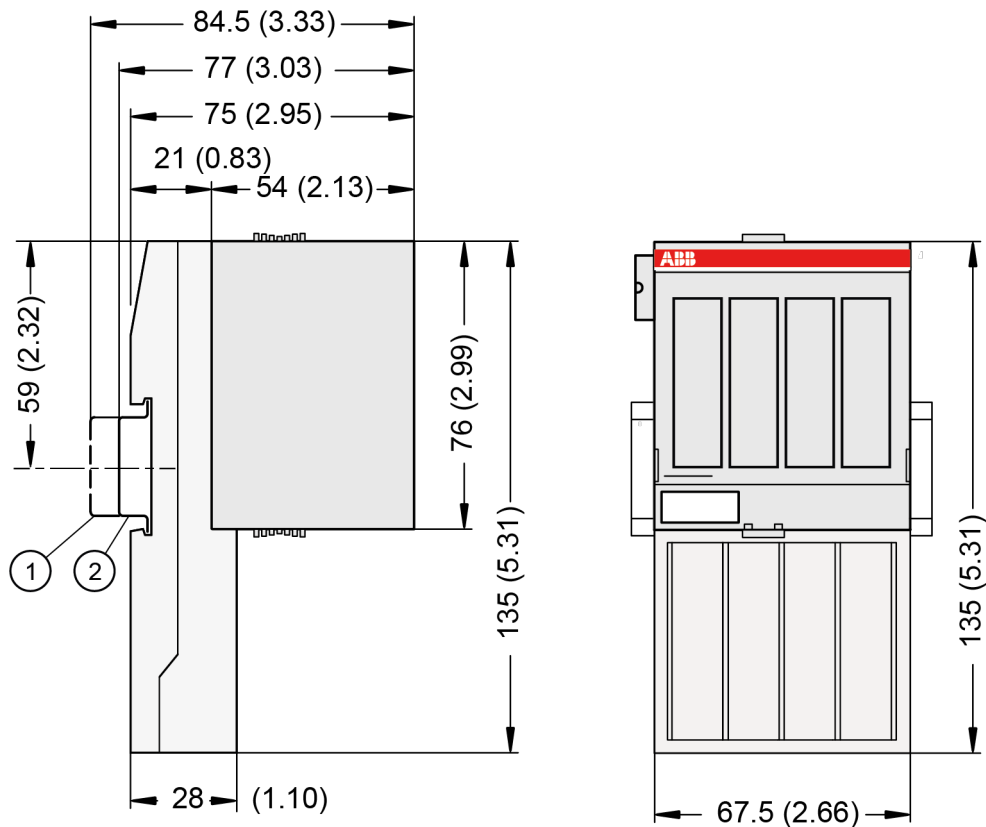
### 1 Ordering data

Part no.	Description	Product life cycle phase *)
1SAP 250 000 R0001	AX522, analog input/output module, 8 AI, 8 AO, U/I/Pt100, 12 bits including sign, 2-wires	Active
1SAP 450 000 R0001	AX522-XC, analog input/output module, 8 AI, 8 AO, U/I/Pt100, 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.

2 Dimensions



- 1 Din rail 15 mm
- 2 Din rail 7.5 mm



The dimensions are in mm and in brackets in inch.

3 Technical data

3.1 Technical data of the module

The system data of AC500 and S500 are applicable to the standard version ↗ *Chapter 4 “System data AC500” on page 5.*

The system data of AC500-XC are applicable to the XC version ↗ *Chapter 5 “System data AC500-XC” on page 9.*

Only additional details are therefore documented below.

The technical data are also applicable to the XC version.

Parameter		Value
Process voltage		
	Connections	Terminals 1.8, 2.8, 3.8 and 4.8 for +24 V (UP) as well as 1.9, 2.9, 3.9 and 4.9 for 0 V (ZP)
	Rated value	24 V DC

Parameter		Value
	Max. ripple	5 %
	Protection against reversed voltage	Yes
	Rated protection fuse on UP	10 A fast
	Galvanic isolation	Yes, per module
Current consumption		
	From 24 V DC power supply at the terminals UP/L+ and ZP/M of the CPU/communication interface module	Ca. 2 mA
	From UP at normal operation	0.15 A + output loads
Inrush current from UP (at power up)		0.020 A <sup>2</sup> s
Max. length of analog cables, conductor cross section > 0.14 mm <sup>2</sup>		100 m
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 control cabinet.

**NOTICE!**

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

### 3.2 Technical data of the analog inputs

Parameter	Value
Number of channels per module	8
Distribution of channels into groups	1 group of 8 channels
Connections of the channels I0- ... I7-	Terminals 1.0 ... 1.7
Connections of the channels I0+ ... I7+	Terminals 2.0 ... 2.3
Input type	Bipolar (not with current or Pt100/Pt1000/Ni1000)
Galvanic isolation	Against internal supply and other modules
Configurability	0 V ... 10 V, -10 V ... +10 V, 0 mA ... 20 mA, 4 mA ... 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

Parameter	Value
Resolution	Range 0 V ... 10 V: 12 bits Range -10 V ... +10 V: 12 bits including sign Range 0 mA ... 20 mA: 12 bits Range 4 mA ... 20 mA: 12 bits
Conversion error of the analog values caused by non-linearity, adjustment error at factory and resolution within the normal range	Typ. $\pm 0.5\%$ of full scale at 25 °C
	Max. $\pm 1\%$ of full scale (all ranges) at 0 °C ... 60 °C or EMC disturbance
Unused voltage inputs	Are configured as "unused"
Unused current inputs	Have a low resistance, can be left open-circuited
Overvoltage protection	Yes

### 3.3 Technical data of the analog inputs, if used as digital Inputs

Parameter	Value
Number of channels per module	Max. 8
Distribution of channels into groups	1 group of 8 channels
Connections of the channels I0+ ... I7+	Terminals 2.0 ... 2.7
Reference potential for the inputs	Terminals 1.9, 2.9, 3.9 and 4.9 (ZP)
Input signal delay	Typ. 8 ms, configurable from 0.1 ms ... 32 ms
Indication of the input signals	1 LED per channel
Input signal voltage	24 V DC
Signal 0	-30 V ... +5 V
Undefined signal	+5 V ... +13 V
Signal 1	+13 V ... +30 V
Input current per channel	
Input voltage +24 V	Typ. 7 mA
Input voltage +5 V	Typ. 1.4 mA
Input voltage +15 V	Typ. 4.3 mA
Input voltage +30 V	< 9 mA
Input resistance	Ca. 3.5 k $\Omega$

### 3.4 Technical data of the analog outputs

Parameter	Value
Number of channels per module	8, all channels for voltage, the first 4 channels also for current
Distribution of channels into groups	1 group of 8 channels
Channels O0- ... O7-	Terminals 3.0 ... 3.7
Channels O0+ ... O7+	Terminals 4.0 ... 4.7

Parameter	Value
Output type	Bipolar with voltage, unipolar with current
Galvanic isolation	Against internal supply and other modules
Configurability	-10 V ... +10 V, 0 mA ... 20 mA, 4 mA ... 20 mA (each output can be configured individually), current outputs only channels 0 ... 3
Output resistance (load), as current output	0 $\Omega$ ... 500 $\Omega$
Output loadability, as voltage output	Max. $\pm$ 10 mA
Indication of the output signals	One LED per channel
Resolution	12 bits including sign
Settling time for full range change (resistive load, output signal within specified tolerance)	Typ. 5 ms
Conversion error of the analog values caused by non-linearity, adjustment error at factory and resolution within the normal range	Typ. $\pm$ 0.5 % of full scale at 25 °C
	Max. $\pm$ 1 % of full scale (all ranges) at 0 °C ... 60 °C or EMC disturbance
Relationship between output signal and hex code	
Unused outputs	Can be left open-circuited

## 4 System data AC500

### 4.1 Environmental conditions


Table 1: Process and supply voltages

Parameter	Value
24 V DC	
Voltage	24 V (-15 %, +20 %)
Protection against reverse polarity	Yes
100 V AC...240 V AC wide-range supply	
Voltage	100 V ... 240 V (-15 %, +10 %)
Frequency	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



#### NOTICE!

##### Risk of damaging the PLC due to improper voltage levels!

- Never exceed the maximum tolerance values for process and supply voltages.
- Never fall below the minimum tolerance values for process and supply voltages. Observe the **system data**  Chapter 4 "System data AC500" on page 5 and the **technical data** of the module used.



**NOTICE!**  
Improper voltage level or frequency range which cause damage of AC inputs:

- AC voltage above 264 V
- Frequency below 47 Hz or above 62.4 Hz



**NOTICE!**  
Improper connection leads cause overtemperature on terminals.  
PLC modules may be destroyed by using wrong cable type, wire size and cable temperature classification.

Parameter		Value
Temperature		
	Operating	0 °C ... +60 °C: Horizontal mounting of modules. 0 °C ... +40 °C: Vertical mounting of modules. Output load reduced to 50 % per group.
	Storage	-40 °C ... +70 °C
	Transport	-40 °C ... +70 °C
Humidity		Max. 95 %, without condensation
Air pressure		
	Operating	> 800 hPa / < 2000 m
	Storage	> 660 hPa / < 3500 m

4.2 Creepage distances and clearances

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

4.3 Power supply units



*AC500 and AC500-eCo PLC devices are Class II/Class III devices and do not require a Protective Earth (PE) connection.*

*For proper EMC performance, all metal parts, DIN rails, mounting screws, and cable shield connection terminals are connected to a common ground and provide Functional Earth (FE). This is typically connected to a common reference potential, such as equipotential bonding rails.*

*Signal Grounds (SGND or GND) are used for signal reference and must not be connected to cable shields, FE or other signals unless otherwise specified in the specific device description.*

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


**Safety Extra Low Voltage (SELV) and Protective Extra Low Voltage (PELV)**

To ensure electrical safety of AC500/AC500-eCo extra low voltage circuits, 24 V DC supply, communication interfaces, I/O circuits, and all connected devices must be powered from sources meeting requirements of SELV, PELV, class 2, limited voltage or limited power according to applicable standards.


**WARNING!**
**Improper installation can lead to death by touching hazardous voltages!**

To avoid personal injury, safe separation, double or reinforced insulation and separation of the primary and secondary circuit must be observed and implemented during installation.

- Only use power converters for safety extra-low voltages (SELV) with safe galvanic separation of the primary and secondary circuit.
- Safe separation means that the primary circuit of mains transformers must be separated from the secondary circuit by double or reinforced insulation. The protective extra-low voltage (PELV) offers protection against electric shock.

## 4.4 Electromagnetic compatibility

Table 2: Electromagnetic compatibility

Parameter	Value
Device suitable only as <i>Control Equipment for Industrial Applications</i> , including marine applications. IEC 61131-2, zone B 🔗 Chapter 4.6 “Approvals and certifications” on page 9	
Radiated emission according to IEC 61000-6-4 CISPR11, class A	Yes
Conducted emission according to IEC 61000-6-4 CISPR11, class A	Yes
Electrostatic discharge (ESD) according to IEC 61000-4-2, criterion B	Air discharge: 8 kV Contact discharge: 6 kV
Fast transient interference voltages (burst) according to IEC 61000-4-4, criterion B	Power supply (DC): 2 kV Digital inputs/outputs (24 V DC): 1 kV Digital inputs/outputs (240 V AC): 2 kV Analog inputs/outputs: 1 kV Communication lines shielded: 1 kV

Parameter	Value
High energy transient interference voltages (surge) according to IEC 61000-4-5, criterion B	Power supply (DC): - Line to ground: 1 kV - Line to line: 0,5 kV Digital inputs/outputs/relay: (24 V DC): - Line to ground: 1 kV (AC): - Line to ground: 2 kV - Line to line: 1 kV Analog inputs/outputs: - Line to ground: 1 kV Communication lines: - Line to ground: 1 kV
Influence of radiated disturbances IEC 61000-4-3, criterion A	Test field strength: 10 V/m
Influence of line-conducted interferences IEC 61000-4-6, criterion A	Test voltage: 10 V
Power frequency magnetic fields IEC 61000-4-8, criterion A	30 A/m 50 Hz 30 A/m 60 Hz

## 4.5 Mechanical data

Parameter	Value
Mounting	Horizontal/Vertical
Wiring method	Spring/screw terminals
Degree of protection	PLC system: IP 20 <ul style="list-style-type: none"> <li>with all modules or option boards plugged in</li> <li>with all terminals plugged in</li> <li>with all covers closed</li> </ul>
Housing	Classification V-2 according to UL 94
Vibration resistance (sinusoidal) acc. to IEC 60068-2-6	All three axes 2 Hz ... 8.4 Hz, 3.5 mm peak, 8.4 Hz ... 150 Hz, 1 g
Shock test acc. to IEC 60068-2-27	All three axes 15 g, 11 ms, half-sinusoidal
<b>Mounting of the modules:</b>	
Mounting Rail Top Hat according to IEC 60715	35 mm, depth 7.5 mm or 15 mm
Mounting with screws	M4
Fastening torque	1.2 Nm



## 4.6 Approvals and certifications

The PLC Automation catalog contains an [overview of the available approvals and certifications](#).

# 5 System data AC500-XC

## 5.1 Environmental conditions

Table 3: Process and supply voltages

Parameter		Value
24 V DC		
	Voltage	24 V (-15 %, +20 %)
	Protection against reverse polarity	Yes
100 V AC...240 V AC wide-range supply		
	Voltage	100 V ... 240 V (-15 %, +10 %)
	Frequency	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



### NOTICE!

#### Risk of damaging the PLC due to improper voltage levels!

- Never exceed the maximum tolerance values for process and supply voltages.
  - Never fall below the minimum tolerance values for process and supply voltages.
- Observe the **system data** ↗ Chapter 4 “System data AC500” on page 5 and the **technical data** of the module used.



### NOTICE!

Improper voltage level or frequency range which cause damage of AC inputs:

- AC voltage above 264 V
- Frequency below 47 Hz or above 62.4 Hz



### NOTICE!

Improper connection leads cause overtemperature on terminals.

PLC modules may be destroyed by using wrong cable type, wire size and cable temperature classification.

Parameter		Value
Temperature		
	Operating	<p>-40 °C ... +70 °C</p> <p>-40 °C ... 0 °C: Due to the LCD technology, the display might respond very slowly.</p> <p>-40 °C ... +40 °C: Vertical mounting of modules possible, output load limited to 50 % per group</p> <p>+60 °C ... +70 °C with the following deratings:</p> <ul style="list-style-type: none"> <li>• System is limited to max. 2 communication modules per terminal base</li> <li>• Digital inputs: maximum number of simultaneously switched on input channels limited to 75 % per group (e.g. 8 channels =&gt; 6 channels)</li> <li>• Digital outputs: output current maximum value (all channels together) limited to 75 % per group (e.g. 8 A =&gt; 6 A)</li> <li>• Analog outputs only if configured as voltage output: maximum total output current per group is limited to 75 % (e.g. 40 mA =&gt; 30 mA)</li> <li>• Analog outputs only if configured as current output: maximum number of simultaneously used output channels limited to 75 % per group (e.g. 4 channels =&gt; 3 channels)</li> </ul>
	Storage / Transport	-40 °C ... +85 °C
Humidity		Operating / Storage: 100 % r. H. with condensation
Air pressure		<p>Operating:</p> <p>-1000 m .... 5000 m (1080 hPa ... 620 hPa)</p> <p>&gt; 2000 m (&lt; 795 hPa):</p> <ul style="list-style-type: none"> <li>• Max. operating temperature must be reduced by 10 K for each 1000 m exceeding 2000 m</li> <li>• I/O module relay contacts must be operated with 24 V nominal only</li> </ul>
Immunity to corrosive gases		<p>Yes, according to:</p> <p>ISA S71.04.1985 Harsh group A, G3/GX</p> <p>IEC60068-2-60</p> <p>Method 4 with following concentrations:</p> <ul style="list-style-type: none"> <li>• H2S 100 ± 10ppb</li> <li>• NO2 1250 ± 20ppb</li> <li>• CL2 100 ± 10ppb</li> <li>• SO2 300 ± 20ppb</li> </ul>
Immunity to salt mist		Yes, horizontal mounting only, according to IEC 60068-2-52 severity level: 1

**NOTICE!****Risk of corrosion!**

Unused connectors and slots may corrode if XC devices are used in salt-mist environments.

Protect unused connectors and slots with TA535 protective caps for XC devices.

**NOTICE!****Risk of malfunctions!**

Unused slots for communication modules are not protected against accidental physical contact.

- Unused slots for communication modules must be covered with dummy communication modules to achieve IP20 rating.
- I/O bus connectors must not be touched during operation.

## 5.2 Creepage distances and clearances

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

## 5.3 Power supply units



*AC500 and AC500-eCo PLC devices are Class II/Class III devices and do not require a Protective Earth (PE) connection.*

*For proper EMC performance, all metal parts, DIN rails, mounting screws, and cable shield connection terminals are connected to a common ground and provide Functional Earth (FE). This is typically connected to a common reference potential, such as equipotential bonding rails.*

*Signal Grounds (SGND or GND) are used for signal reference and must not be connected to cable shields, FE or other signals unless otherwise specified in the specific device description.*

**Safety Extra Low Voltage (SELV) and Protective Extra Low Voltage (PELV)**

*To ensure electrical safety of AC500/AC500-eCo extra low voltage circuits, 24 V DC supply, communication interfaces, I/O circuits, and all connected devices must be powered from sources meeting requirements of SELV, PELV, class 2, limited voltage or limited power according to applicable standards.*


**WARNING!****Improper installation can lead to death by touching hazardous voltages!**

To avoid personal injury, safe separation, double or reinforced insulation and separation of the primary and secondary circuit must be observed and implemented during installation.

- Only use power converters for safety extra-low voltages (SELV) with safe galvanic separation of the primary and secondary circuit.
- Safe separation means that the primary circuit of mains transformers must be separated from the secondary circuit by double or reinforced insulation. The protective extra-low voltage (PELV) offers protection against electric shock.

## 5.4 Electromagnetic compatibility

Table 4: Electromagnetic compatibility

Parameter	Value
Device suitable only as <i>Control Equipment for Industrial Applications</i> , including marine applications. IEC 61131-2, zone B  Chapter 5.6 “Approvals and certifications” on page 13	
Radiated emission according to IEC 61000-6-4 CISPR11, class A	Yes
Conducted emission according to IEC 61000-6-4 CISPR11, class A	Yes
Electrostatic discharge (ESD) according to IEC 61000-4-2, criterion B	Air discharge: 8 kV Contact discharge: 6 kV
Fast transient interference voltages (burst) according to IEC 61000-4-4, criterion B	Power supply (DC): 4 kV Digital inputs/outputs (24 V DC): 2 kV Digital inputs/outputs (240 V AC): 4 kV Analog inputs/outputs: 2 kV Communication lines shielded: 2 kV
High energy transient interference voltages (surge) according to IEC 61000-4-5, criterion B	Power supply (DC): - Line to ground: 1 kV - Line to line: 0,5 kV Digital inputs/outputs/relay: (24 V DC): - Line to ground: 1 kV (AC): - Line to ground: 2 kV - Line to line: 1 kV Analog inputs/outputs: - Line to ground: 1 kV Communication lines: - Line to ground: 1 kV

Parameter	Value
Influence of radiated disturbances IEC 61000-4-3, criterion A	Test field strength: 10 V/m
Influence of line-conducted interferences IEC 61000-4-6, criterion A	Test voltage: 10 V
Power frequency magnetic fields IEC 61000-4-8, criterion A	30 A/m 50 Hz 30 A/m 60 Hz

## 5.5 Mechanical data

Parameter	Value
Mounting	Horizontal/vertical (no application in salt mist environment)
Wiring method	Spring terminals
Degree of protection	PLC system: IP 20 <ul style="list-style-type: none"> <li>with all modules or option boards plugged in</li> <li>with all terminals plugged in</li> <li>with all covers closed</li> </ul>
Housing	Classification V-2 according to UL 94
Vibration resistance (sinusoidal) acc. to IEC 60068-2-6	2 Hz ... 8.4 Hz, 3.5 mm peak, 8.4 Hz ... 500 Hz, 2 g
Vibration resistance (broadband random) acc. to IEC 60068-2-64	5 Hz ... 500 Hz, 1.9 g rms (operational) 5 Hz ... 500 Hz, 4 g rms (non operational)
Shock resistance	All three axes 15 g, 11 ms, half-sinusoidal
<b>Mounting of the modules:</b>	
Mounting Rail Top Hat according to IEC 60715	35 mm, depth 7.5 mm or 15 mm
Mounting with screws	M4
Fastening torque	1.2 Nm

## 5.6 Approvals and certifications

The PLC Automation catalog contains an [overview of the available approvals and certifications](#).