

OFFICIAL DOCUMENT PACKAGE

# Manufacturer's Manual

Amikon cover with selected official ABB technical pages

ABB AC500 / S500 I/O

## DA501

MIXED DIGITAL ANALOG MODULE

Selected official pages retain the original technical tables, ratings, notes and pagination.

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ABB 3ADR010039 rev.14, 2025-11-28, DA501 original instructions

DA501 ordering, specifications and standard system installation requirements, original pages 1-11

This technical extract does not replace the complete equipment and system manuals. Check the installed hardware and project before use.

# DA501

## Digital/analog input/output module



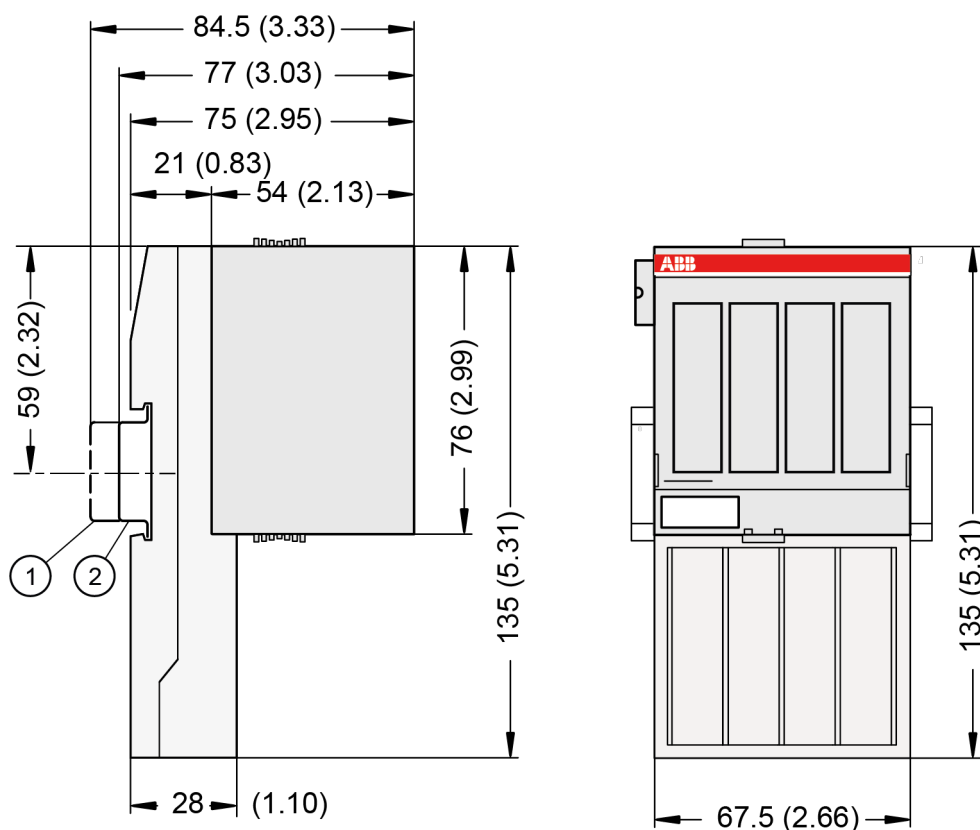
### 1 Ordering data

| Part no.           | Description                                                                       | Product life cycle phase *) |
|--------------------|-----------------------------------------------------------------------------------|-----------------------------|
| 1SAP 250 700 R0001 | DA501, digital/analog input/output module, 16 DI, 8 DC, 4 AI, 2 AO                | Active                      |
| 1SAP 450 700 R0001 | DA501-XC, digital/analog input/output module, 16 DI, 8 DC, 4 AI, 2 AO, XC version | Active                      |



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

## 2 Dimensions



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 is applicable to the standard version.

🔗 *Chapter 4 “System data AC500” on page 9*

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

🔗 *Chapter 5 “System data AC500-XC” on page 12*

Only deviating specifications are therefore described here.

The technical data is also applicable to the XC version.

| Parameter    | Value                                                       |
|--------------|-------------------------------------------------------------|
| Fast Counter | Integrated, many configurable operating modes               |
| Power supply | From the process supply voltage UP                          |
| LED displays | For system displays, signal states, errors and power supply |

| Parameter                                     | Value                                                    |
|-----------------------------------------------|----------------------------------------------------------|
| Internal supply voltage                       | Via the I/O bus interface (I/O bus)                      |
| External supply voltage                       | Via terminals UP and ZP (process supply voltage 24 V DC) |
| Effect of incorrect input terminal connection | Wrong or no signal detected, no damage up to 35 V        |
| Required terminal unit                        | TU515 or TU516                                           |

| Parameter                                                                                           | Value                                                                                                     |
|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| Process supply voltage                                                                              |                                                                                                           |
| Connections                                                                                         | Terminals 1.8, 2.8, 3.8 and 4.8 for UP (+24 V DC) and 1.9, 2.9, 3.9 and 4.9 for ZP (0 V DC)               |
| Protection against reverse voltage                                                                  | yes                                                                                                       |
| Rated protection fuse at UP                                                                         | 10 A fast                                                                                                 |
| Rated value                                                                                         | 24 V DC                                                                                                   |
| Max. ripple                                                                                         | 5 %                                                                                                       |
| Current consumption                                                                                 |                                                                                                           |
| From UP                                                                                             | 0.07 A + max. 0.5 A per output                                                                            |
| From 24 V DC power supply at the terminals UP/L+ and ZP/M of the CPU/communication interface module | ca. 2 mA                                                                                                  |
| Inrush current from UP (at power-up)                                                                | 0.04 A <sup>2</sup> s                                                                                     |
| Galvanic isolation                                                                                  |                                                                                                           |
| between the channels                                                                                | No                                                                                                        |
| between the channels and I/O bus                                                                    | Yes                                                                                                       |
| between the channels and process supply voltage (UP, ZP)                                            | No                                                                                                        |
| Max. power dissipation within the module                                                            | 6 W (outputs unloaded)                                                                                    |
| Weight (without terminal unit)                                                                      | ca. 125 g                                                                                                 |
| Mounting position                                                                                   | Horizontal mounting or<br>Vertical mounting with derating (output load reduced to 50 % at +40 °C)         |
| 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.

**Multiple overloads**

*With multi-channel modules, there are no effects of multiple overloads as each digital output channel is individually protected by an internal intelligent high-side switch.*

### 3.2 Technical data of the digital inputs

| Parameter                                | Value                                                                            |
|------------------------------------------|----------------------------------------------------------------------------------|
| Number of channels per module            | 16                                                                               |
| Distribution of the channels into groups | 2 groups of 8 channels                                                           |
| Terminals of the channels DI0 ... DI7    | Terminals 1.0 ... 1.7                                                            |
| Terminals of the channels DI8 ... DI15   | Terminals 2.0 ... 2.7                                                            |
| Reference potential for all inputs       | Terminals 1.9 ... 3.9 (negative pole of the supply voltage, signal name ZP)      |
| Indication of the input signals          | 1 yellow LED per channel, the LED is ON when the input signal is high (signal 1) |
| Monitoring point of input indicator      | LED is part of the input circuitry                                               |
| Input type (according EN 61131-2)        | Type 1                                                                           |
| Input delay (0->1 or 1->0)               | Typ. 0.1 ms, configurable from 0.1...32 ms                                       |
| Input signal voltage                     | 24 V DC                                                                          |
| 0-Signal                                 | -3 V ... +5 V                                                                    |
| Undefined Signal                         | > +5 V ... < +15 V                                                               |
| 1-Signal                                 | +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                                                                            |

### 3.3 Technical data of the configurable digital inputs/outputs

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

| Parameter                                | Value                                                                                   |
|------------------------------------------|-----------------------------------------------------------------------------------------|
| Number of channels per module            | 8 inputs/outputs (with transistors)                                                     |
| Distribution of the channels into groups | 1 group for 8 channels                                                                  |
| If the channels are used as inputs       |                                                                                         |
| Channels DC16 ... DC23                   | Terminals 4.0 ... 4.7                                                                   |
| If the channels are used as outputs      |                                                                                         |
| Channels DC16 ... DC23                   | Terminals 4.0 ... 4.7                                                                   |
| Indication of the input/output signals   | 1 yellow LED per channel, the LED is ON when the input/output signal is high (signal 1) |

| Parameter                                  | Value                              |
|--------------------------------------------|------------------------------------|
| Monitoring point of input/output indicator | LED is part of the input circuitry |
| Galvanic isolation                         | Yes, per module                    |

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

| Parameter                                  | Value                                                                            |
|--------------------------------------------|----------------------------------------------------------------------------------|
| Number of channels per module              | 8                                                                                |
| Distribution of the channels into groups   | 1 group of 8 channels                                                            |
| Terminals of the channels DC16 ... DC23    | Terminals 4.0 ... 4.7                                                            |
| Reference potential for all inputs         | Terminals 1.9 ... 4.9 (negative pole of the supply voltage, signal name ZP)      |
| Indication of the input signals            | 1 yellow LED per channel, the LED is ON when the input signal is high (signal 1) |
| Monitoring point of input/output indicator | LED is part of the input circuitry                                               |
| Input type (according EN 61131-2)          | Type 1                                                                           |
| Input delay (0->1 or 1->0)                 | Typ. 0.1 ms, configurable 0.1 ... 32 ms                                          |
| Input signal voltage                       | 24 V DC                                                                          |
| 0-Signal                                   | -3 V ... +5 V                                                                    |
| Undefined Signal                           | > +5 V ... < +15 V                                                               |
| 1-Signal                                   | +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                                                                            |

\* 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 must not exceed the clamp voltage of the varistor. The varistor limits the clamp voltage to approx. 36 V. Consequently the input voltage must be within the following range.

- If UPx = 24 V, the input voltage must range from -12 V ... +30 V.
- If UPx = 30 V, the input voltage must range from -6 V ... +30 V.

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

| Parameter                                | Value                 |
|------------------------------------------|-----------------------|
| Number of channels per module            | 8                     |
| Distribution of the channels into groups | 1 group of 8 channels |

| Parameter                                   | Value                                                                                                 |
|---------------------------------------------|-------------------------------------------------------------------------------------------------------|
| Terminals of the channels DC16 ...DC23      | Terminals 4.0 ... 4.7                                                                                 |
| Reference potential for all outputs         | Terminals 1.9 ... 4.9 (negative pole of the supply voltage, signal name ZP)                           |
| Common power supply voltage                 | For all outputs terminals 1.8, 2.8, 3.8 and 4.8 (positive pole of the 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                                                                                   |
| max. value (all channels together)          | 4 A                                                                                                   |
| Leakage current with signal 0               | < 0.5 mA                                                                                              |
| Fuse for UP                                 | 10 A fast                                                                                             |
| Demagnetization with inductive DC load      | Via internal varistors (see figure below this table)                                                  |
| Output switching frequency                  |                                                                                                       |
| With resistive load                         | On request                                                                                            |
| With inductive loads                        | Max. 0.5 Hz                                                                                           |
| With lamp loads                             | 11 Hz max. at 5 W max.                                                                                |
| Short-circuit-proof / overload-proof        | Yes                                                                                                   |
| Overload message ( $I > 0.7 \text{ A}$ )    | Yes, after ca. 100 ms                                                                                 |
| Output current limitation                   | Yes, automatic reactivation after short circuit/overload                                              |
| Resistance to feedback against 24 V signals | Yes (software-controlled supervision)                                                                 |
| Max. cable length                           |                                                                                                       |
| Shielded                                    | 1000 m                                                                                                |
| Unshielded                                  | 600 m                                                                                                 |

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

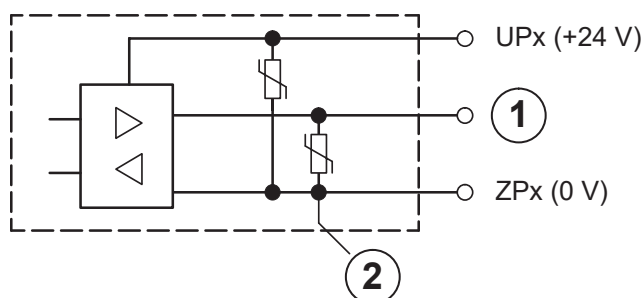


Fig. 1: Digital input/output (circuit diagram)

- 1 Digital input/output
- 2 For demagnetization when inductive loads are turned off

### 3.4 Technical data of the fast counter



*The fast counter of the module does not work if the module is connected to an FBP interface module or CS31 bus module.*

| Parameter          | Value       |
|--------------------|-------------|
| Used inputs        | DC16 / DC17 |
| Used outputs       | DC18        |
| Counting frequency | Max. 50 kHz |

### 3.5 Technical data of the analog inputs

| Parameter                             | Value                                                                                                                                                                                       |
|---------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Number of channels per module         | 4                                                                                                                                                                                           |
| Distribution of channels into groups  | 1 group with 4 channels                                                                                                                                                                     |
| Connection if channels AI0+ ... AI3+  | Terminals 3.0 ... 3.3                                                                                                                                                                       |
| Reference potential for AI0+ ... AI3+ | Terminal 3.4 (AI-) for voltage and RTD measurement<br>Terminal 1.9, 2.9, 3.9 and 4.9 for current measurement                                                                                |
| Input type                            |                                                                                                                                                                                             |
| Unipolar                              | Voltage 0 V ... 10 V, current or Pt100/Pt1000/Ni1000                                                                                                                                        |
| Bipolar                               | Voltage -10 V ... +10 V                                                                                                                                                                     |
| 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<br>Current: ca. 330 Ω                                                                                                                                                     |
| Time constant of the input filter     | Voltage: 100 μs<br>Current: 100 μs                                                                                                                                                          |
| Indication of the input signals       | 1 LED per channel (brightness depends on the value of the analog signal)                                                                                                                    |
| Conversion cycle                      | 1 ms (for 4 inputs + 2 outputs); with RTDs Pt/Ni... 1 s                                                                                                                                     |
| Resolution                            | Range 0 V ... 10 V: 12 bits<br>Range -10 V ... +10 V: 12 bits including sign<br>Range 0 mA ... 20 mA: 12 bits<br>Range 4 mA ... 20 mA: 12 bits<br>Range RTD (Pt100, Pt1000, Ni1000): 0.1 °C |

| Parameter                                                                                                                         | Value                                                                          |
|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| 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 %<br>For XC version below 0 °C and above +60 °C: on request |
| Relationship between input signal and hex code                                                                                    |                                                                                |
| Unused inputs                                                                                                                     | Are configured as "unused" (default value)                                     |
| Overvoltage protection                                                                                                            | Yes                                                                            |

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

| Parameter                                 | Value                                |
|-------------------------------------------|--------------------------------------|
| Number of channels per module             | Max. 4                               |
| Distribution of channels into groups      | 1 group of 4 channels                |
| Connections of the channels AI0+ ... AI3+ | Terminals 3.0 ... 3.3                |
| Reference potential for the inputs        | Terminals 1.9, 2.9, 3.9 and 4.9 (ZP) |
| 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. 3.7 mA                          |
| Input voltage +30 V                       | < 9 mA                               |
| Input resistance                          | ca. 3.5 kΩ                           |

### 3.7 Technical data of the analog outputs

| Parameter                                | Value                                                                                           |
|------------------------------------------|-------------------------------------------------------------------------------------------------|
| Number of channels per module            | 2                                                                                               |
| Distribution of channels into groups     | 1 group for 2 channels                                                                          |
| Connection of the channels AO0+ ... AO1+ | Terminals 3.5 and 3.6                                                                           |
| Reference potential for AO0+ ... AO1+    | Terminal 3.7 (AO-) for voltage output<br>Terminals 1.9, 2.9, 3.9 and 4.9 for current output     |
| Output type                              |                                                                                                 |
| Unipolar                                 | Current                                                                                         |
| Bipolar                                  | Voltage                                                                                         |
| Galvanic isolation                       | Against internal supply and other modules                                                       |
| Configurability                          | -10 V ... +10 V, 0 mA ... 20 mA, 4 mA ... 20 mA<br>(each output can be configured individually) |

| Parameter                                                                                                                         | Value                                                                     |
|-----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Output resistance (load) as current output                                                                                        | 0 $\Omega$ ... 500 $\Omega$                                               |
| Output loadability as voltage output                                                                                              | $\pm$ 10 mA max.                                                          |
| Indication of the output signals                                                                                                  | 1 LED per channel (brightness depends on the value of the analog signal)  |
| 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. 0.5 %, max. 1 %                                                      |
| Relationship between input signal and hex code                                                                                    |                                                                           |
| Unused outputs                                                                                                                    | Are configured as "unused" (default value) and 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 9 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.<br>0 °C ... +40 °C: Vertical mounting of modules.<br>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.<br>IEC 61131-2, zone B<br> Chapter 4.6 “Approvals and certifications” on page 12 |                                                                                                                                                                                                                                                                                                                  |
| Radiated emission according to<br>IEC 61000-6-4 CISPR11, class A                                                                                                                                                                                                                | Yes                                                                                                                                                                                                                                                                                                              |
| Conducted emission according to<br>IEC 61000-6-4 CISPR11, class A                                                                                                                                                                                                               | Yes                                                                                                                                                                                                                                                                                                              |
| Electrostatic discharge (ESD) according to<br>IEC 61000-4-2, criterion B                                                                                                                                                                                                        | Air discharge: 8 kV<br>Contact discharge: 6 kV                                                                                                                                                                                                                                                                   |
| Fast transient interference voltages (burst)<br>according to<br>IEC 61000-4-4, criterion B                                                                                                                                                                                      | Power supply (DC): 2 kV<br>Digital inputs/outputs (24 V DC): 1 kV<br>Digital inputs/outputs (240 V AC): 2 kV<br>Analog inputs/outputs: 1 kV<br>Communication lines shielded: 1 kV                                                                                                                                |
| High energy transient interference voltages<br>(surge) according to<br>IEC 61000-4-5, criterion B                                                                                                                                                                               | Power supply (DC):<br>- Line to ground: 1 kV<br>- Line to line: 0,5 kV<br>Digital inputs/outputs/relay:<br>(24 V DC):<br>- Line to ground: 1 kV<br>(AC):<br>- Line to ground: 2 kV<br>- Line to line: 1 kV<br>Analog inputs/outputs:<br>- Line to ground: 1 kV<br>Communication lines:<br>- Line to ground: 1 kV |