DATA SHEET

CI501

PROFINET communication interface module

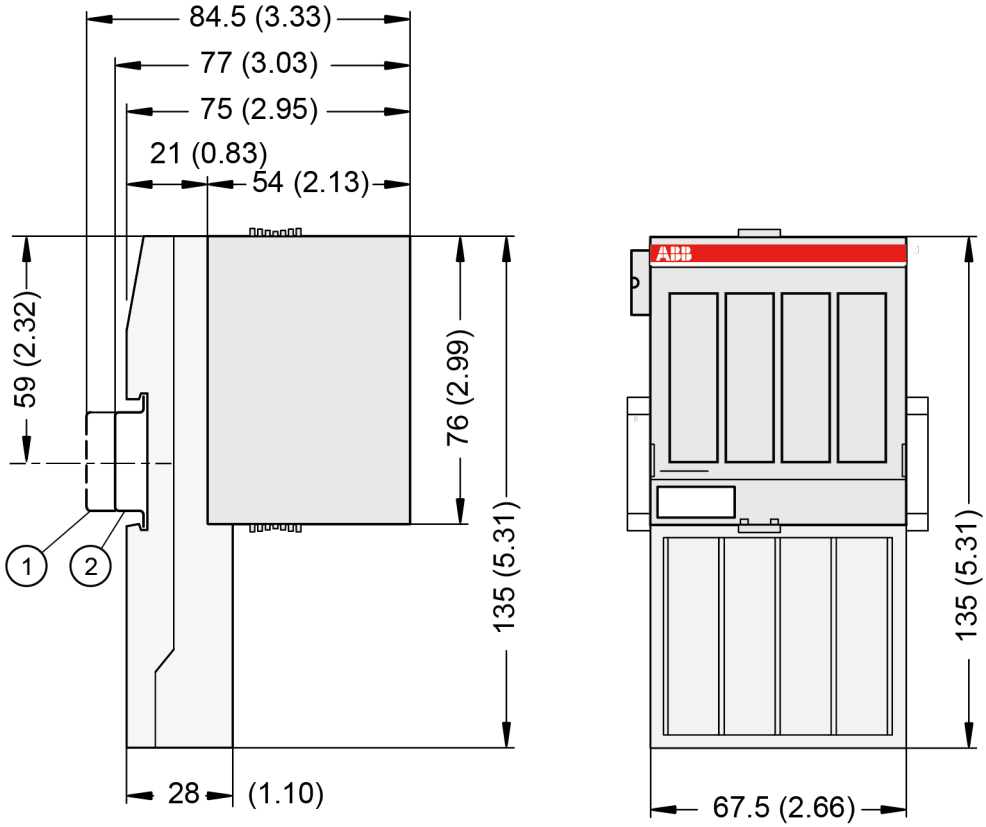


1 Ordering data

Part no.	Description	Product life cycle phase *)
1SAP 220 600 R0001	CI501-PNIO (V3), PROFINET communication interface module, 8 DI, 8 DO, 4 AI and 2 AO	Active
1SAP 420 600 R0001	CI501-PNIO-XC (V3), PROFINET communication interface module, 8 DI, 8 DO, 4 AI and 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



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 8*.

The system data of AC500-XC are applicable to the XC version *Chapter 5 “System data AC500-XC” on page 12*.

Only additional details are therefore documented below.

The technical data are also applicable to the XC version.

Parameter		Value
Process supply voltages UP/UP3		
	Rated value	24 V DC (for inputs and outputs)
	Max. load for the terminals	10 A
	Protection against reversed voltage	Yes

Parameter		Value
	Rated protection fuse on UP/UP3	10 A fast
	Galvanic isolation	Ethernet interface against the rest of the module
	Inrush current from UP (at power up)	On request
	Current consumption via UP (normal operation)	0.2 A
	Current consumption via UP3	0.06 A + 0.5 A max. per output
	Connections	Terminals 1.8 and 2.8 for +24 V (UP) Terminal 3.8 for +24 V (UP3) Terminals 1.9, 2.9 and 3.9 for 0 V (ZP)
Max. power dissipation within the module		6 W
Number of digital inputs		8
Number of digital outputs		8
Number of analog inputs		4
Number of analog outputs		2
Input data length		19 bytes
Output data length		23 bytes
Reference potential for all digital inputs and outputs		Negative terminal of the supply voltage, signal name ZP
Setting of the I/O device identifier		With 2 rotary switches at the front side of the module
Diagnose		See Diagnosis and Displays
Operation and error displays		32 LEDs (totally)
Weight (without terminal unit)		Ca. 125 g
Mounting position		Horizontal or vertical with derating (output load reduced to 50 % at +40 °C per group)
Extended ambient temperature (XC version)		>+60 °C on request
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
No effects of multiple overloads on isolated multi-channel modules occur, as every channel is protected individually by an internal smart high-side switch.

Parameter	Value
Bus connection	2 x RJ45
Switch	Integrated

Parameter	Value
Technology	Hilscher NETX 100
Transfer rate	10/100 Mbit/s (full-duplex)
Transfer method	According to Ethernet II, IEEE 802.3
Ethernet	100 base-TX, internal switch, 2x RJ45 socket
Expandability	Max. 10 S500 I/O modules
Adjusting elements	2 rotary switches for generation of an explicit name
Supported protocols	RTC - real time cyclic protocol, class 1 *) RTA - real time acyclic protocol DCP - discovery and configuration protocol CL-RPC - connectionless remote procedure Call LLDP - link layer discovery protocol MRP - MRP Client
Acyclic services	PNIO read / write sequence (max. 1024 bytes per telegram) Process-Alarm service
Supported alarm types	Process Alarm, Diagnostic Alarm, Return of Sub-Module, Plug Alarm, Pull Alarm
Min. bus cycle	1 ms
Conformance class	CC A
Protective functions (according to IEC 61131-3)	Protected against: ● short circuit ● reverse supply ● overvoltage ● reverse polarity Galvanic isolation from the rest of the module

*) Priorization with the aid of VLAN-ID including priority level

3.2 Technical data of the digital inputs

Parameter		Value
Number of channels per module		8
Distribution of the channels into groups		1 group of 8 channels
Terminals of the channels DI0 ... DI7		Terminals 2.0 ... 2.7
Reference potential for all inputs		Terminals 1.9 ... 3.9 (negative terminal 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)
Input type (according EN 61131-2)		Type 1
Input delay (0->1 or 1->0)		Typ. 0.1 ms, configurable from 0.1 ms ... 32 ms
Input signal voltage		24 V DC
	0-Signal	-3 V ... +5 V
	Undefined Signal	> +5 V ... < +15 V

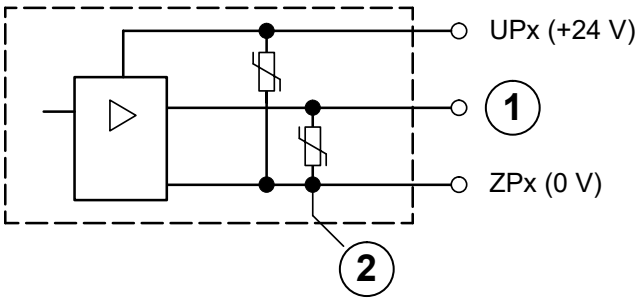
Parameter		Value
	1-Signal	+15 V ... +30 V
Ripple with signal 0		Within -3 V ... +5 V
Ripple with signal 1		Within +15 V ... +30 V
Input current per channel		
	Input voltage +24 V	Typ. 5 mA
	Input voltage +5 V	> 1 mA
	Input voltage +15 V	> 2 mA
	Input voltage +30 V	< 8 mA
Max. cable length		
	Shielded	1000 m
	Unshielded	600 m

3.3 Technical data of the digital outputs

Parameter		Value
Number of channels per module		8
Distribution of the channels into groups		1 group of 8 channels
Terminals of the channels DO0 ... DO7		Terminals 3.0 ... 3.7
Reference potential for all outputs		Terminals 1.9 ... 3.9 (negative terminal of the supply voltage, signal name ZP)
Common power supply voltage		For all outputs terminal 3.8 (positive terminal of the supply voltage, signal name UP3)
Output voltage for signal 1		UP3 (-0.8 V)
Output delay (0->1 or 1->0)		On request
Output current		
	Rated value per channel	500 mA at UP3 = 24 V
	Max. value (all channels together)	4 A
Leakage current with signal 0		< 0.5 mA
	Fuse for UP3	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 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		

Parameter		Value
	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.



1 Digital output
2 Varistors for demagnetization when inductive loads are turned off

3.4 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 1.0 ... 1.3
Reference potential for AI0+ ... AI3+		Terminal 1.4 (AI-) for voltage and RTD measurement Terminal 1.9, 2.9 and 3.9 for current measurement
Input type		
	Unipolar	Voltage 0 V ... 10 V, current or Pt100/Pt1000/ Ni1000
	Bipolar	Voltage -10 V ... +10 V
Galvanic isolation		Against Ethernet network
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		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

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 Range RTD (Pt100, PT1000, Ni1000): +0.1 °C
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 inputs	Are configured as "unused" (default value)
Overvoltage protection	Yes

3.5 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 1.0 ... 1.3
Reference potential for the inputs		Terminals 1.9, 2.9 and 3.9 (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

3.6 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 1.5 ... 1.6
Reference potential for AO0+ ... AO1+		Terminal 1.7 (AO-) for voltage output terminal 1.9, 2.9 and 3.9 for current output
Output type		
	Unipolar	Current

Parameter		Value
	Bipolar	Voltage
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)
Output resistance (load), as current output		0 Ω ... 500 Ω
Output loadability, as voltage output		± 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		Table Output ranges voltage and current
Unused outputs		Are configured as "unused" (default value) and can be left open-circuited

3.7 Technical data of the fast counter

Parameter	Value
Used inputs	Terminal 2.0 (DI0), 2.1 (DI1)
Used outputs	Terminal 3.0 (DO0)
Counting frequency	Depending on operation mode: Mode 1 - 6: max. 200 kHz Mode 7: max. 50 kHz Mode 9: max. 35 kHz Mode 10: max. 20 kHz

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		

Parameter		Value
	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 8* 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
– Frenquency 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 *Control Equipment for Industrial Applications*, including marine applications. IEC 61131-2, zone B *Chapter 4.6 “Approvals and certifications” on page 12*	
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

Parameter	Value
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
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 ● with all modules or option boards plugged in ● with all terminals plugged in ● with all covers closed
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
Mounting of the modules:	

Parameter	Value
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 8* 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
– Frenquency 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	-40 °C ... +70 °C -40 °C ... 0 °C: Due to the LCD technology, the display might respond very slowly. -40 °C ... +40 °C: Vertical mounting of modules possible, output load limited to 50 % per group +60 °C ... +70 °C with the following deratings: ● System is limited to max. 2 communication modules per terminal base ● Digital inputs: maximum number of simultaneously switched on input channels limited to 75 % per group (e.g. 8 channels => 6 channels) ● Digital outputs: output current maximum value (all channels together) limited to 75 % per group (e.g. 8 A => 6 A) ● Analog outputs only if configured as voltage output: maximum total output current per group is limited to 75 % (e.g. 40 mA => 30 mA) ● Analog outputs only if configured as current output: maximum number of simultaneously used output channels limited to 75 % per group (e.g. 4 channels => 3 channels)
	Storage / Transport	-40 °C ... +85 °C
Humidity		Operating / Storage: 100 % r. H. with condensation
Air pressure		Operating: -1000 m .... 5000 m (1080 hPa ... 620 hPa) > 2000 m (< 795 hPa): ● Max. operating temperature must be reducted by 10 K for each 1000 m exceeding 2000 m ● I/O module relay contacts must be operated with 24 V nominal only
Immunity to corrosive gases		Yes, according to: ISA S71.04.1985 Harsh group A, G3/GX IEC60068-2-60 Method 4 with following concentrations: ● H2S 100 ± 10ppb ● NO2 1250 ± 20ppb ● CL2 100 ± 10ppb ● SO2 300 ± 20ppb
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 *Control Equipment for Industrial Applications*, including marine applications. IEC 61131-2, zone B ↳ *Chapter 5.6 “Approvals and certifications” on page 16*	
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 ● with all modules or option boards plugged in ● with all terminals plugged in ● with all covers closed
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
Mounting of the modules:	
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*.

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