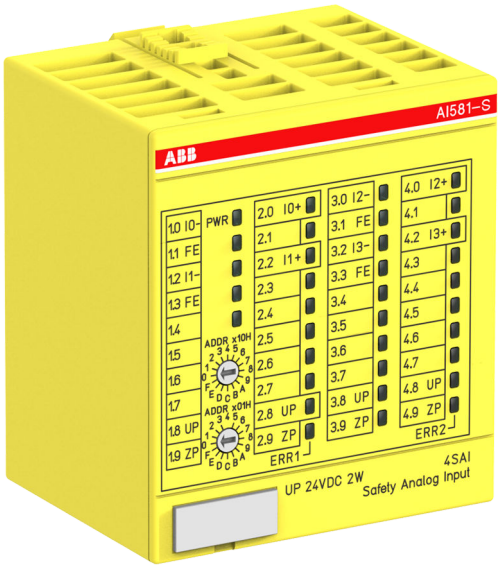
DATA SHEET

AI581-S

Safety analog input module



1 Ordering data

Type	Description	Part no.
AI581-S	Safety analog input module 4SAI	1SAP 282 000 R0001
AI581-S-XC	Safety analog input module 4SAI, extreme conditions	1SAP 482 000 R0001

2 Dimensions

Dimensions

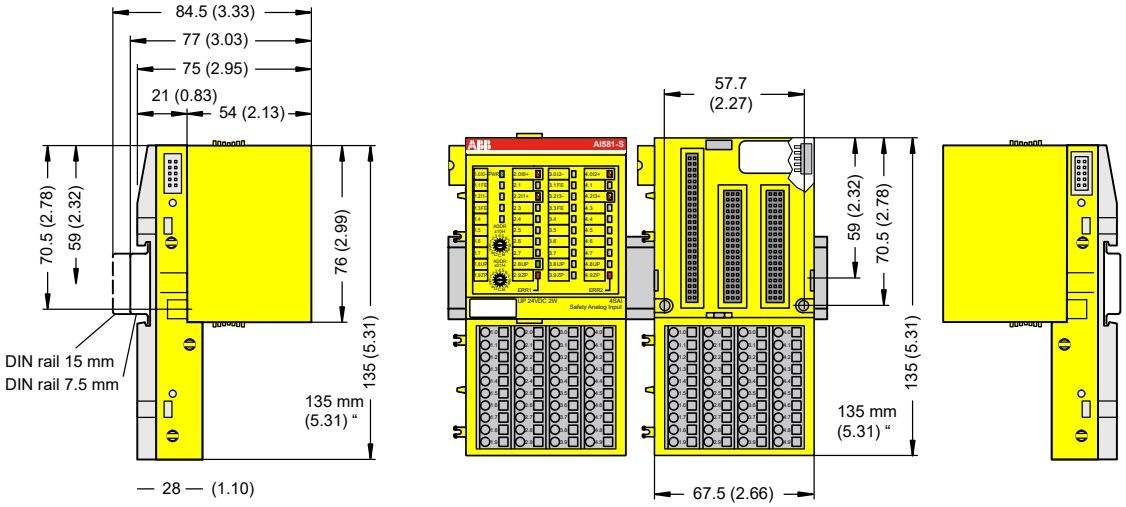


Fig. 1: Dimensions of AI581-S safety I/O module

3 Technical data

> **NOTICE!**
> AI581-S-XC version is available for usage in extreme environmental conditions
> ↪ *Appendix A “System data for AC500-S-XC” on page 7*.

Additional technical data is available in ABB PLC catalog at *www.abb.com/plc*.

Process supply voltage UP

Data	Value	Unit
Connections terminals 1.8 ... 4.8 (UP)	+24	V
Connections terminals 1.9 ... 4.9 (ZP)	0	V
Rated value (-15 %, +20 %, without ripple)	24	V DC
Max. ripple	5	%
Protection against reversed voltage	yes	
Rated protection fuse for UP (fast)	10	A
Electrical isolation	per module	
Mechanisms in which I/Os are processed	periodically refreshed	
Conversion error of the analog values caused by non-linearity, adjustment error at factory and resolution within the normal range, typically	±1	%
Conversion error of the analog values caused by non-linearity, adjustment error at factory and resolution within the normal range, max.	±1.5	%
Maximum signal frequency	70	Hz
Current consumption from UP at normal operation with + 24 V DC (for module electronics)	0.18	A
Inrush current from UP at 30 V (at power up)	0.1	A^2s

Data	Value	Unit
Inrush current from UP at 24 V (at power up)	0.06	A²s

Mounting position

Horizontal or vertical with derating (maximal operating temperature reduced to +40 °C).

Cable length

Data	Value	Unit
Conductor cross section of analog cables	> 0.14	mm²
Max. analog cable length, shielded	100	m

Cooling

The natural convection cooling must not be hindered by cable ducts or other parts in the switchgear cabinet.

Allowed interruptions of power supply, according to EN 61131-2

Data	Value	Unit
DC supply interruptions	< 10	ms
Time between 2 DC supply interruptions, PS2	> 1	s

Environmental conditions

Data	Value	Unit
Operating temperature*	0 ... +60	°C
Storage temperature	-40 ... +85	°C
Transport temperature	-40 ... +85	°C
Humidity without condensation	max. 95	%
Operating air pressure	> 800	hPa
Storage air pressure	> 660	hPa
Operating altitude	< 2000	m above sea level
Storage altitude	< 3500	m above sea level

* Extended temperature ranges (below 0 °C and above +60 °C) can be supported in special versions of AI581-S ↳ *Appendix A "System data for AC500-S-XC" on page 7*.

Creepage distances and clearances

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

Power supply units

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

Electromagnetic compatibility

For information on electromagnetic compatibility refer to the latest TÜV SÜD Report.

Mechanical properties

Data	Value	Unit
Degree of protection	IP 20	
Housing	according to UL 94	
Vibration resistance acc. to EN 61131-2 (all three axes), continuous 3.5 mm	2 ... 15	Hz

Data	Value	Unit
Vibration resistance acc. to EN 61131-2 (all three axes), continuous 1 g *	15 ...150	Hz
Shock test (all three axes), 11 ms half-sinusoidal	15	g
MTBF	102	years

* Higher values on request

Self-test and diagnostic functions

Start-up and runtime tests: Program flow control, RAM, CPU, ADC, etc.

Dimensions, weight

Data	Value	Unit
W x H x D	67.5 x 76 x 62	mm
Weight (without terminal unit)	~ 130	g

Certifications

CE, cUL (further certifications at *www.abb.com/plc*)

3.1 Technical data of safety analog inputs

DANGER!
Exceeding the permitted process or supply voltage range (< -35 V DC or > +35 V DC) could lead to unrecoverable damage of the system.

Data	Value	Unit
Number of channels per module	4	
Configurability, 1 channel mode	0 ... 20	mA
Configurability, 1 channel mode	4 ... 20	mA
Configurability, 2 channel mode	4 ... 20	mA
Channel input resistance, in active mode	~ 125	Ω
Channel input resistance, in inactive mode	~ 15	kΩ

Distribution of channels into groups

2 groups of 2 channels each.

Data	Value	Unit
Time constant of the input filter	1	ms
Conversion cycle	0.33	ms
Resolution	14	bits
Temperature coefficient ± % of full scale (0 ... 20 mA)	±0.005	%/K
Maximum error at +25 °C ± % of full scale (0 ... 20 mA)	± 0.25	%
Maximum error over full temperature range ± % of full scale (0 ... 20 mA)	± 0.25	%
Value of a LSB (least significant bit)	2.03	µA

Data	Value	Unit
Maximum permanent allowed overload (no damage) (self-protected), voltage	32	V DC
Maximum permanent allowed overload (no damage) (self-protected), current	24	mA
Non-linearity (of full scale)	±0.05	%
Sample repetition time	3.3	ms
Input filter characteristics - first order, filter time constant	1	ms
Transition frequency	160	Hz
Overvoltage protection	Yes	

Electrical isolation

Against internal supply and other modules.

Input signal indication

One LED per channel.

Maximum temporary deviation during specified electrical interference test ± % of full scale

Data	Value	Unit
Deviation during radiated and conducted disturbance	< 0.1	%
Deviation during burst test	max. 0.33	%
Deviation during surge test	up to 50	%
Deviation during electrostatic discharge	no deviation	

Analog input protection

Data	Value
Type of analog input protection	suppressor diode

Cable length

Data	Value	Unit
Max. cable length, shielded	100	m

Appendix

A System data for AC500-S-XC

A.1 Environmental conditions

Process and supply voltages

Data	Value	Unit
Process and supply voltage (-25 %, +30 % inclusive ripple)	24	V DC
Absolute limits inclusive ripple	18 ... 31.2	V
Ripple	< 10	%
Protection against reverse polarity	yes	
Allowed interruptions of DC power supply	< 10	ms
Time between 2 interruptions, PS2	> 1	s

DANGER!
Exceeding the permitted process or supply voltage range (< -35 V DC or > +35 V DC) could lead to unrecoverable damage of the system.

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

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

Temperature

Data	Value	Unit
Operating temperature*	-40 ... +70	°C
Operating temperature (vertical mounting of module output load limited to 50 % per group)	-40 ... +40	°C
Storage temperature	-40 ... +85	°C
Transport temperature	-40 ... +85	°C

* +60 ... +70 °C with the following deratings:

- Terminal bases: Maximum 2 communication modules allowed
- Digital inputs: Maximum number of simultaneously switched on input channels limited to 50 % per group (e.g. 8 channels => 4 channels)
- Digital outputs: Output current maximum value (all channels together) limited to 50 % per group (e.g. 4 A => 2 A)
- Analog inputs: No limitations

DANGER!
The average temperature (MTBF calculation base) for both the extended temperature range (-40 ... +70 °C) as well as for normal temperature range (0 ... +60 °C) is defined to +40 °C.

Ensure that average operating temperature for used AC500-S-XC modules does not exceed +40 °C.

Humidity

Data	Value	Unit
Relative humidity with condensation (operating/storage)	100	%

Air pressure

Data	Value	Unit
Operating air pressure	1080 ... 620	hPa
Operating altitude	-1000 ... 4000	m
Reduction of operating temperature at an air pressure of < 795 hPa (or > 2000 m above sea level)	10 (e.g. +70 °C to +60 °C)	K

Immunity to corrosive gases

Data	Value
Operating: according to ISA S71.04.1985 harsh group A, G3/GX IEC 60721-3-3 3C2 / 3C3	yes

Immunity to salt mist

Data	Value
Operating: horizontal mounting only, according to IEC 60068-2-52 severity level 1	yes

Electromagnetic compatibility

Data	Value
Radiated emission (radio disturbance) according to CISPR 16-2-3	yes
Conducted emission (radio disturbance) according to CISPR 16-2-1, CISPR 16-1-2	yes
Electrostatic discharge (ESD) according to IEC 61000-4-2, zone B, criterion B	yes
Fast transient interference voltages (burst) according to IEC 61000-4-4, zone B, criterion B	yes
High energy transient interference voltages (surge) according to IEC 61000-4-5, zone B, criterion B	yes
Influence of radiated disturbances according to IEC 61000-4-3, zone B, criterion A	yes
Influence of line-conducted interferences according to IEC 61000-4-6, zone B, criterion A	yes
Influence of power frequency magnetic fields according to IEC 61000-4-8, zone B, criterion A	yes

NOTICE!
In order to prevent malfunctions, it is recommended that the operating personnel discharge themselves prior to touching communication connectors or perform other suitable measures to reduce effects of electrostatic discharges.

NOTICE!
Unused sockets for communication modules on terminal bases must be covered with TA524 dummy communication module. I/O bus connectors must not be touched during operation.

Radiation

Data	Value
Radio disturbance according to IEC 55011, group 1, class A	yes

A.2 Mechanical data

Data	Value
Wiring method	spring terminals
Degree of protection	IP 20
Vibration resistance according to IEC 61131-2, IEC 60068-2-6, IEC 60068-2-64	yes
Shock resistance according to IEC 60068-2-27	yes
Horizontal assembly position	yes
Vertical assembly position (no application in salt mist environment)	yes

Assembly on DIN rail according to IEC 60715

Data	Value	Unit
DIN rail type	35	mm
DIN rail type depth	7.5 or 15	mm

Assembly with screws

Data	Value	Unit
Screw diameter	4	mm
Fastening torque	1.2	Nm

A.3 Environmental tests

Storage	IEC 60068-2-1 test Ab: cold withstand test -40 °C / 16 h IEC 60068-2-2 test Bb: dry heat withstand test +85 °C / 16 h
Humidity	IEC 60068-2-30 test Dd: Cyclic (12 h / 12 h) damp-heat test +55 °C, 93 % relative humidity / +25 °C, 95 % relative humidity, 6 cycles IEC 60068-2-78, stationary humidity test: +40 °C, 93 % relative humidity, 240 h
Insulation test	IEC 61131-2
Vibration resistance	IEC 61131-2 / IEC 60068-2-6: 5 Hz ... 500 Hz, 2 g (with SD memory card inserted in non-safety CPU) IEC 60068-2-64: 5 Hz ... 500 Hz, 4 g rms
Shock resistance	IEC 60068-2-27: all 3 axes 15 g, 11 ms, half-sinusoidal

EMC immunity

Electrostatic discharge (ESD)

Data	Value	Unit
Electrostatic voltage in case of air discharge	8	kV
Electrostatic voltage in case of contact discharge	6	kV

Fast transient interference voltages (burst)

Data	Value	Unit
Supply voltage units (DC)	4	kV
Digital inputs/outputs (24 V DC)	2	kV
Analog inputs/outputs	2	kV
Communication lines, shielded	2	kV
I/O supply (DC-out)	2	kV

High energy transient interference voltages (surge) - common mode (CM)

Data	Value	Unit
Supply voltage units (DC)	1	kV
Digital inputs/outputs (24 V DC)	1	kV
Analog inputs/outputs	1	kV
Communication lines, shielded	1	kV
I/O supply (DC-out)	0.5	kV

High energy transient interference voltages (surge) - differential mode (DM)

Data	Value	Unit
Supply voltage units (DC)	0.5	kV
Digital inputs/outputs (24 V DC)	0.5	kV
Analog inputs/outputs	0.5	kV
I/O supply (DC-out)	0.5	kV

Data	Value	Unit
Influence of radiated disturbances: test field strength	10	V/m
Influence of line-conducted interferences: test voltage	10	V

Data	Value	Unit
Power frequency magnetic fields at 30 A/m	50 and 60	Hz

NOTICE!
Extreme environmental conditions and relevant requirements for used non-safety CPUs and I/O modules from AC500-XC family shall be taken into account.

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