



Item	Item No.
SAI205	00030796-00
SAI205 CC	00032462-00

## SAI205 Safety Analog Input Module

Numerous safety-related tasks in automation applications require the acquisition of analog values. Safe compliance with limits on variables such as pressure, temperature, mechanical load, the charge state of energy storage systems, flow rate and many more determines the safety of technical processes and sequences.

The SAI205 module offers a total of 5 safety channels for recording safety-related analog variables. The standard current signal type (4 to 20 mA) enables the connection of various sensors, making the module extremely flexible. Temperatures play a critical role in safety-related processes, so the SAI205 supports 4 and 2-wire measurement with Pt100 sensors. The special voltage inputs for strain gauge measurement enable reliable acquisition of mechanical voltages.

- 4 safety inputs for 4 to 20 mA signals, forming 2 logic safety channels
- Optional encoder supply via the module
- 4 safety inputs for temperature measurement (Pt100), forming 2 logic safety channels
- 2 safety inputs for strain gauge signals, forming one logic safety channel

Connecting the inputs in pairs enables the implementation of safety applications up to SIL 2, PL d.

With a high variety of functions, outstanding signal properties and optional data preprocessing, the module can measure virtually all analog signals in safety-related applications, thus providing an inexpensive solution. Compared with analog digital converters with a threshold configuration, integrated solutions mean a significant engineering cost reduction. All signals are also available for operational control and individually-measured variables can also work co-dependently in the safety application. This makes it possible, for example, to implement status-dependent limit values. All inputted variables can also be visualized and are available for analysis via remote maintenance.

- Fast sampling of all analog signals at 1 kHz
- Availability of all signals for highly dynamic controls
- Configurable low-pass filters with a high slew rate for suppressing interference in the application
- Very high measurement accuracy and high resolution: 16-bit on all channels
- Optional data preprocessing in the module (minimum, maximum, mean)
- Configurable voting modes for each channel

SAI205 – Current inputs 4 to 20 mA			
General		Standard	ColdClimate (❄)
Number		4 inputs (not electrically isolated)	
Measuring range		4 to 20 mA	
Input impedance		Typically 230 Ω Maximum 300 Ω	
Filter setting range		0.875 to 875 Hz	
Resolution		16-bit	
Sampling rate		1 kHz	
I/O Bus Sync (mode: non-safety area)		The sampling of the measured values (1 kHz) can be synchronized with the Sync signal.	
Accuracy	T <sub>A</sub> -30 to 60 °C	±0.5 % FS (±0.1 mA)	
Cable length		< 100 m with shielded twisted pair cables	
External withstand voltage		±30 V	
Monitoring			
Wire break fault detection		Yes	
Measuring range monitoring		Yes, response below 2 mA and above +20.5 mA	
Optional +24 V Current Encoder Power Supply			
Output voltage		U <sub>ext</sub> - 1 V	
Tolerance		As U <sub>ext</sub>	
Maximum output current for all encoders together		400 mA	
Ripple (20 MHz bandwidth)		As U <sub>ext</sub>	
Short circuit capability		Yes	
Voltage monitoring		Yes, response below 16.6 V and above 37.4 V	

SAI205 – Pt100 Inputs			
General		Standard	ColdClimate (❄)
Number		4 inputs (not electrically isolated)	
Measuring range		-50 to +200 °C	
Sensor type		Pt100	
Input type		4-wire measurement	
Filter setting range		0.875 to 55 Hz	
Sensor current		1.3 mA	
Resolution		16-bit	
Sampling rate		1 kHz	
I/O Bus Sync (mode: non-safety area)		The sampling of the measured values (1 kHz) can be synchronized with the Sync signal.	
Accuracy	T <sub>A</sub> -30 to 60 °C	±0.8 °C (sensor temperature -5 to 5 °C)	
4-wire measurement		±1.75 °C (sensor temperature -50 to -5 °C and 5 to 200 °C)	
Value representation		Absolute temperature °C, resolution 0.1 K	
Cable length		< 30 m	
External withstand voltage		±24 V	
Monitoring			
Wire break fault detection		Yes	
Measuring range monitoring		Yes, response below -60 °C and above +210 °C	

SAI205 – Strain Gauge Inputs			
General		Standard	ColdClimate (❄)
Number	2 inputs (not electrically isolated)		
Measuring range	-100 to +100 mV		
Input type	Differential		
Input impedance	> 100 kΩ		
Filter setting range	0.875 to 3500 Hz		
Resolution	16-bit		
Sampling rate	1 kHz		
I/O Bus Sync (mode: non-safety area)	The sampling of the measured values (1 kHz) can be synchronized with the Sync signal.		
Accuracy	T <sub>A</sub> -30 to 60 °C	±0,25 % FS (±0,5 mV)	
Allowed common mode voltage of measurement system	-1 to +4 V		
Common mode suppression	> 60 dB		
Cable length	< 30 m		
External withstand voltage	±24 V		
Monitoring			
Wire break in bridge supply	Yes		
Wire break in measurement channel	Yes		
Measuring range monitoring	Yes, response below -102 mV and above +102 mV		
Strain Gauge Measuring Bridge Supply		Standard	ColdClimate (❄)
Output voltage	6 V		
Tolerance	±0,2 % (±0,12 mV)		
Maximum output current	20 mA		
Maximum bridge resistance	1,500 Ω		
Short circuit capability	Yes		
Voltage monitoring	Yes, response below 5.917 mV and above 6.083 mV		

SAI205 – Other Technical Data		
Measured Value Conditioning	Standard	ColdClimate (☼)
Measured value compression	Yes, optional minimum, maximum value during one safety cycle or mean value calculation over one safety cycle	
Voter in the module	Yes, optional	
External Power Supply		
Input voltage, allowable range	+18 to +34 V	
Input voltage Maximum value, $t < 1$ s/min	+40 V (must also be observed in case of a power supply unit failure)	
Current consumption from backplane	210 mA	
Power consumption	$\leq 14$ W at 24 V input voltage	
Reverse polarity protection	Yes	
Standards and Approvals		
EN 61508:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 1 to 7	
EN 62061:2005 +A2:2015	Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems	
EN ISO 13849 1:2015	Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design	
EN 61511 1:2017	Functional safety - Safety instrumented systems for the process industry – Part 1: Framework, definitions, system, hardware and application programming requirements	
EN 61131 2:2007	Programmable controllers – Part 2: Equipment requirements and tests	
EN 61131 6:2012	Programmable controllers – Part 6: Functional safety	
Approvals / Certificates	Standard	ColdClimate (☼)
Product safety	CE, cULus NRAQ/7.E214207 in accordance with ANSI-UL61010 Part 1, Ed. 3 and ANSI-UL61010-2-201, Ed.2, CCC	
Marine	-	DNV (in preparation)
Ambient Conditions	Standard	ColdClimate (☼)
Operating temperature	-30 to +60 °C (std. installation position) <sup>1)</sup> -30 to +55 °C (other installation positions)	
Relative air humidity, operation	5 to 95 % no condensation	5 to 95 % with condensation
Storage temperature	-40 to +85 °C	
Relative air humidity, storage	5 to 95 % no condensation	5 to 95 % with condensation
Pollution degree	2 (without condensation; according to IEC 60664-1)	2 (according to IEC 60664-1)
Maximum altitude	4,500 m above sea level (operation) <sup>2)</sup>	

1) Standard installation position see **M-Base User manual**, chapter **Installation Position**

2) For operation above an altitude of 2,000 m above sea level, a derating of -0.5 Kelvin per 100 m up to a maximum altitude of 4,500 m above sea level must be taken into account.

Safety-Related Parameters	
Maximum performance level in accordance with EN ISO 13849 1	PL d with category 3
Maximum safety integrity level in accordance with EN 62061	SIL 2
DC	93.47 %
SFF	97.17 %
$\beta$	2 %
PFD (operating period = 20 years)	$5.5 * 10^{-4}$
PFH (operating period = 20 years)	$4.39 * 10^{-8}$

Order Codes		
Item	Item No.	Description
SAI205	00030796-00	Safety analog input module; SIL2/PLd: 2x analog In 0/4..20mA, 2x analog In PT100 -50 to +200°C, 1x analog In voltage measurement for strain gauge $\pm 100\text{mV}$ ; 16-bit; AI filter configurable; Optional data preprocessing in the module, 1 ms sampling time; insulated
SAI205 CC	00032462-00	As SAI205; ColdClimate (❄)
Accessories		
KZ-SAI205 B+C	00031165-00	Terminal set cage clamp small (2x KS 35/20; 1x KZ 51/02) with labeling strip and coding elements