



Safety

SAI205 Safety Analog Input Module

Numerous security relevant 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 determine the security of technical processes and sequences. The SAI205 module offers a total of 5 safety channels for recording a large number of security relevant analog variables. The standard signal type current (4 mA to 20 mA) enables the connection of various sensors, making the use of the module extremely flexible. Temperatures are playing an important role in safety-related processes, which is why SAI205 supports Pt100 in 4- and 2-wire measurement. The special voltage inputs for strain gauge measurement enable reliable acquisition of mechanical voltages.

- 4 safety inputs for 4 mA 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 redundantly 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 variables of the security solution can also be visualized and are available for analysis via remote maintenance.

Part type designation	Part number
SAI205	00030796-00
SAI205 CC	00032462-00

Features

- 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 per channel pair for suppressing interference in the application
- 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 mA to 20 mA

General	
Number	4 inputs (not galvanically isolated)
Measuring range	4 mA to 20 mA
Input impedance	Typically 230 Ω Maximum 300 Ω
Filter setting range	0.875 Hz to 875 Hz
Resolution	16 bit
Sampling rate	1 kHz
I/O-Bus Sync (mode: non-secure area)	The sampling of the measured values (1 kHz) can be synchronized with the SYNC signal.
Accuracy at T _a -30 °C to 60 °C	± 0.5 % FS (± 0.1 mA)
Cable length	< 100 m with shielded and twisted pair cable
External withstand voltage	± 30 V
Monitoring	
Error detection open circuit	Yes
Measuring range monitoring	Yes, response below 2 mA and above +20.5 mA
Optional +24 V Encoder Power Supply	
Output voltage	U _{ext} – 1 V
Tolerance	Like U _{ext}
Maximum output current for all encoders together	400 mA
Residual ripple (20 MHz bandwidth)	Like U _{ext}
Short-circuit strength	Yes
Voltage monitoring	Yes, response below 16.6 V and above 37.4 V

SAI205 – Pt100 inputs

General	
Number	4 inputs (not galvanically isolated)
Measuring range	-50 °C to +200 °C
Sensor type	Pt100
Input type	4-wire measurement
Filter setting range	0.875 Hz to 55 Hz
Sensor current	1.3 mA
Resolution	16 bit
Sampling rate	1 kHz
I/O-Bus Sync (mode: non-secure area)	The sampling of the measured values (1 kHz) can be synchronized with the SYNC signal.
4-wire measurement accuracy at T _a -30 °C to 60 °C	± 0.8 °C (sensor temperature -5 °C to 5 °C) ± 1.75 °C (sensor temperature -50 °C to -5 °C and 5 °C to 200 °C)
Value representation	Absolute temperature °C, resolution 0.1 K
Cable length	< 30 m
External withstand voltage	± 24 V
Monitoring	
Error detection open circuit	Yes
Measuring range monitoring	Yes, response below -60 °C and above +210 °C

SAI205 – Strain gauge inputs

General	
Number	2 inputs (not galvanically isolated)
Measuring range	-100 mV to +100 mV
Input type	Differential
Input impedance	> 100 k Ω
Filter setting range	0.875 Hz to 3500 Hz
Resolution	16 bit
Sampling rate	1 kHz
I/O-Bus Sync (mode: non-secure area)	The sampling of the measured values (1 kHz) can be synchronized with the SYNC signal.
Accuracy at T _a -30 °C to 60 °C	± 0.25 % FS (± 0.5 mV)
Approved common mode voltage of measurement system	-1 V to +4 V
Common mode rejection	> 60 dB
Cable length	< 30 m
External withstand voltage	± 24 V
Monitoring	
Open circuit bridge supply	Yes
Open circuit measurement channel	Yes
Measuring range monitoring	Yes, response below -102 mV and above +102 mV
Strain gauge measuring bridge supply	
Output voltage	6 V
Tolerance	± 0.2 % (± 0.12 mV)
Maximum output current	20 mA
Maximum bridge resistance	1500 Ω
Short-circuit strength	Yes
Voltage monitoring	Yes, response below 5.917 mV and above 6.083 mV

SAI205 – Other technical data

Measured Value Conditioning		
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, approved range	+18 V to +34 V	
Input voltage Maximum value, $t < 1$ s/min	+40 V (must also be observed in the event of an error in the power supply unit)	
Current consumption from backplane	210 mA	
Power consumption	≤ 14 W at 24 V input voltage	
Reverse polarity protection	Yes	
Standards and approvals		
Machine safety	EN 61508:2010: Functional safety of E/E/PE safety-related systems	
Approved for	EN ISO 13849-1:2015: Safety of machinery EN 62061:2005/A2:2015: Functional safety machine-related E/E/PE systems EN 61511-1:2017 & IEC 61511-1:2016: Functional safety equipment and process industry	
Product standard	EN 61131-2:2007 & EN 61131-6:2012 UL 61010-1 & UL 61010-2-201	
Approvals/Certificates	Standard	ColdClimate (❄️)
Product safety	CE, UKCA, cULus	
Marine	ABS, BV, DNV, LR	ABS, BV, DNV, KR, LR, NK, RINA
Environmental conditions	Standard	ColdClimate (❄️)
Operating temperature	-30 °C to +60 °C (standard mounting position) ¹⁾ -30 °C to +55 °C (other mounting positions)	
Relative humidity, operation	5 % to 95 % noncondensing	5 % to 95 % with condensation
Storage temperature	-40 °C to +85 °C	
Relative humidity, storage	5 % to 95 % noncondensing	5 % to 95 % with condensation
Pollution degree (IEC 60664-1)	2 (noncondensing)	2
Maximum altitude	4500 m above sea level (operation) ²⁾	
¹⁾ Standard mounting position see User Manual "M-Base → Installation position"		
²⁾ For operation above an altitude of 2000 m above sea level, a derating of the maximum ambient temperature of -0.5 Kelvin per 100 m up to a maximum altitude of 4500 m above sea level must be taken into account		
Safety-related parameters		
Maximum performance level acc. to EN ISO 13849 1	PL d with category 3	
Maximum safety integrity level acc. to EN 62061	SIL 2	
DC	93.47 %	
SFF	97.17 %	
β	2 %	
PFD (operating time = 20 years)	5.5 · 10 ⁻⁴	
PFH (operating time = 20 years)	4.39 · 10 ⁻⁸	

Order data

Part type designation	Part number	Description
SAI205	00030796-00	Safety analog input module; SIL2/PLd: 2x analog In 0/4 mA to 20 mA, 2x analog In PT100 -50 °C to +200 °C, 1x analog In voltage measurement for strain gauge ±100 mV; 16 bit; AI filter configurable; Optional data preprocessing in the module, 1 ms sampling time; insulated
SAI205 CC	00032462-00	Like SAI205; ColdClimate (❄)

Accessories

Part type designation	Part number	Description
KZ-SAI205 B+C	00031165-00	Terminal set cage clamp narrow (2x KS 35/20; 1 x KZ 51/02) with labeling strips + keying elements