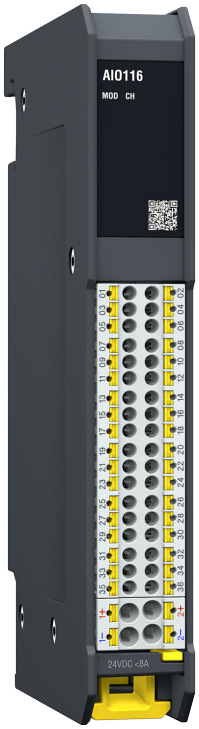

AIO116

Analog Input/Output Module

Temperature measurements represent the numerically largest group of analog interfaces in industrial automation. All the more reason why technical perfection and cost-effectiveness are important requirements here. The AIO116 module types cover both of these requirements in an exemplary manner. Up to 16 Pt100/Pt1000 sensors can be cost-effectively connected to a single module using a 2-wire connection technology.

The temperature is recorded with 16-bit resolution and, thanks to special measuring electronics, with very high sampling rates. Widely adjustable filter chains, precisely tuned to the signal path, ensure a configurable balance between interference suppression and measurement dynamics. A hardware-accelerated high-speed interpolation that can be activated as required provides continuous measurement signals independent of the filter settings and even with very short bus cycles. Alternatively, each individual channel can also be operated as a 14 bit current output (4 mA to 20 mA, 0 mA to 20 mA).

Part type designation	Part number
AIO116	00040872-00
AIO116 EC	00042165-00

Features

- 16-channel analog input/output module
- Configurable by channel: signal type and direction
- Pt100/Pt1000 2-wire temperature measurement
- Current output 4 mA to 20 mA, 0 mA to 20 mA, 0 mA to 2 mA, 0 µA to 200 µA
- Value range and measured value monitoring
- Synchronous clocks / latch

Common properties	
Basic function	16x analog input resistance thermometer / analog output current
System	Bachmann system M100
Analog inputs – resistance thermometer (RTD)	
Number of analog inputs	0 to 16 configurable
Signal standard	Pt100, Pt1000
Measurement range	-100 °C to +800 °C
Resolution (ADC)	16 bit
Accuracy at T_a = +25 °C	Measurement range Pt100: ±0.15 % FS Measurement range Pt1000: ±0.15 % FS
Connections per input	2-wire measurement (combined for current loop and resistance measurement)
Common mode voltage, max.	±3 V
Cross-talk rejection	> 60 dB
Internal scan rate, max.	10 kHz
Digital low pass filter cut-off frequency	875 Hz to 0.875 Hz configurable
Digital low pass filter slope	> 80 dB/decade
Input impedance	> 10 MΩ
Signal cable length, shielded, max.	1000 m
Signal cable length, unshielded, max.	3 m
Interpolation	Yes (linearly interpolated intermediate values, delayed output)
Oversampling	No
Process data	Analog value Diagnostics channel quality information
Time stamps	No
Analog ouputs – current	
Number of analog outputs	0 to 16 configurable At ambient temperatures above 60 °C only all even-numbered channels may be configured with the AOC function.
Signal standard	4 mA to 20 mA, 0 mA to 20 mA, 0 mA to 2 mA, 0 µA to 200 µA
Output range	4 mA to 21 mA, 0 mA to 21 mA, 0 mA to 2.1 mA, 0 µA to 210 µA
Resolution (DAC)	14 bit
Accuracy at T_a = +25 °C	Output range 4 mA to 20 mA: ±0.2 % FS Output range 0 mA to 20 mA: ±0.2 % FS Output range 0 mA to 2 mA: ±0.2 % FS Output range 0 µA to 200 µA: ±0.9 % FS
Connections per output	2 (+/- current loop)
Common mode rejection	> 60 dB
Cross-talk rejection	> 60 dB
Internal scan rate, max.	10 kHz
Load impedance, max.	600 Ω
Signal cable length, shielded, max.	1000 m
Signal cable length, unshielded, max.	3 m
Time triggered output	No
Process data	Analog value Diagnostics channel quality information
Module bus interface	
System	M100

Module bus interface	
Slot type	IO (1/E, 2, 3, 4, ...31)
Module data rate	Typ.: 0 Mbit/s to 33.6 Mbit/s depending on the configuration
Bus cycle time, min.	4.5 µs [1)]

[1)] *Depending on the fieldbus used and the respective configuration, lower data rates and longer cycle times can be expected.*

Synchronization/clocks	
Distributed clocks	Yes
Time stamp format	64 bit in ns
Time resolution	1 ns (64 bit)
Time precision	25 ns within the station 100 ns via network (typ.) 1 µs via network (max.)
Synchronization functions	Synced operation
Synced output	AOC
Field bus cycle time, min.	100 µs [1)]

[1)] *Depending on the fieldbus used and the respective configuration, lower data rates and longer cycle times can be expected.*

Diagnostics	
Electronic type plate	Yes (application interface and in the engineering tool)
Machine readable type plate	Yes (QR code with type and part information and internet link)
Environmental conditions sensor	Integrated (temperature)
Operational indications	LED "MOD" (red/green) module status LED "CH" (red/green) channel status summary
Error indications	Supply voltage too low Overload Cable break / open signal circuit Threshold value overshoot
Powerfail, logic supply	No
Powerfail, signal supply	Undervoltage < 15.0 V (fallback > 17.5 V)
Overload/short-circuit	Yes, per output channel
Open circuit	Yes (analog I/O)
Mismatch output readback	No
Measurement range monitoring	Yes, upper/lower limit
Configurable threshold monitoring	Yes, configurable upper/lower limit

Energy supply	
Supply voltage, nominal	24 V DC
Supply voltage, range	18 V DC to 32 V DC
Power consumption from 24 V signal supply	9.3 W
Maximum residual ripple 24 V signal supply	±2.4 V
Overcurrent protection required	No internal protection External protection with circuit breaker characteristic: B, C, D, Z or K Max. nominal current 8 A DC
Power dissipation, typ./max.	5.2 W / 9.9 W
Reverse polarity protection signal supply	Yes, continuously (up to -32 V)
Power consumption from backplane	510 mW
Supply terminal block bridge	Yes (1+ on to 2+, 1- on to 2-)

Product safety	
Galvanic isolation	850 V AC
Galvanic isolation between supply groups	No

Product safety	
Galvanic isolation between inputs	No
Permitted potential difference between analog channels	No isolation between channels
Degree of protection acc. IEC 60529	IP40, terminal block IP30
Protection class acc. IEC 61010-1, IEC 61010-2-201	III
Overvoltage category acc. IEC 61010-1	II
Rated impulse withstand voltage acc. IEC 61000-4-5	Supply DC: • 500 V DM • 1000 V CM
Short-circuit protected, outputs	Yes, continuously
Keying of terminal block	Yes (2-fold per 6 contacts)
Environmental conditions	
Temperature range, operating	Standard: -30 °C to +60 °C Extended Climate: -30 °C to +70 °C
Temperature range, transport and storage	-40 °C to +85 °C
Installation altitude, max.	Up to 2000 m without temperature derating 2000 m to 4500 m: Reduction of the max. ambient temperature by 0.1 °C per 100 m elevation
Air pressure	106 kPa to 58 kPa (0 m to 4500 m)
Relative humidity, operation	Standard: 0 % to 100 % noncondensing Extended Climate: 0 % to 100 % with temporary condensation
Pollution degree acc. IEC 61010-1	Standard: 2, noncondensing Extended Climate: 2
Vibration	6 g (14.1 Hz to 500 Hz) 7.5 mm amplitude (2 Hz to 14.1 Hz) Test duration: 15 h
Shock	45 g max. (test scope 18 shocks) 20 g permanently (test scope 6000 shocks)
Approvals/certificates	
Product safety	CE, UKCA cULus (NRAQ, NRAQ7)
Hazard area operation	ATEX: Ex II 3G Ex ec IIC Gc
Maritime	ABS, BV, DNV, KR, LR, NK, RINA: in preparation
Hazardous substances and waste treatment	RoHS, RoHS China, REACH, WEEE
Quality management	ISO 9001 for development and production
Engineering	
Configuration tool	SolutionCenter (≥ V2.85)
Firmware package update	Yes (via SolutionCenter or console interface on the head module)
Mounting/installation	
Mounting type	Inserting and screwing onto the backplane with integrated M4 screw
Ground connection for protection class I	No
Dimensions	
Number of slots	1
Size unpacked W × H × D	23.3 mm × 152.5 mm × 95.7 mm
Mass unpacked	284 g

Order data

Part type designation	Part number	Description
AIO116	00040872-00	Analog input/output multitype module system M100 Configurable: 16x analog In Pt100/Pt1000, 16 bit; analog Out 4 mA to 20 mA, 0 mA to 20 mA, 0 mA to 2 mA, 0 µA to 200 µA, 14 bit; synchronization, isolated from system, without terminal block
AIO116 EC	00042165-00	AIO116 with Extended Climate Range

Accessories

Part type designation	Part number	Description
BPR1nn	00039235-nn	Backplane for DIN-rail mounting Active backplane system M100: BPR1nn with nn = 04 to 16 slots in increments of 1, as well as 20, 24, 28, 32 slots, for DIN-rail mounting; delivery without backplane slot covers and without mounting rail
BPR1nn EC	00039236-nn	Like BPR1nn; Extended Climate Range
BPS1nn	00039237-nn	Backplane for direct screw mounting Active backplane system M100: BPS1nn with nn = 04 to 16 slots in increments of 1, as well as 20, 24, 28, 32 slots, for direct screw mounting; delivery without backplane slot covers and without screws
BPS1nn EC	00039238-nn	Like BPS1nn; Extended Climate Range
TPI100_W36_P3.45_Cgy_L1to36		Signal terminal block Completely removable terminal block, push-in spring connector for system M100, 36-way/contacts, pitch 3.45 mm, female, conductors flexible 0.2 mm² to 1.5 mm² (24 to 16 AWG), solid 0.2 mm² to 1.5 mm² (24 to 16 AWG), with wire end ferrules 0.25 mm² to 1.5 mm² (23 to 16 AWG), stripping length: 10 mm, rating: 160 V / 8 A per contact, connector color: gray, push-release: yellow, labeling: 1 to 36
TPI100_W4_P5.0_Cgy_Lsup		Supply terminal block Completely removable terminal block, push-in spring connector for system M100, 4-way/contacts, pitch 5.0 mm, female, conductors flexible 0.2 mm² to 2.5 mm² (24 to 14 AWG), solid 0.2 mm² to 1.5 mm² (24 to 16 AWG), with wire end ferrules 0.25 mm² to 1.5 mm² (24 to 16 AWG), stripping length: 10 mm, rating: 300 V / 8 A per contact, connector color: gray, push-release: yellow, labeling: 1+/1-/2+/2-
TKP106		Keying element Keying element for signal terminal blocks and supply terminal blocks TPI100 for system M100, plastic ring with 6 keying elements
TPI100_W36_W4_Set [1)]	00042499-00	Terminal block set for M100 HD modules: • 1x TPI100_W36_P3.45_Cgy_L1to36 • 1x TPI100_W4_P5.0_Cgy_Lsup • 2x TKP106

[1)] *All components of the set are also available in bulk packages.*