C-DIAS Temperature sensing module CAI 083

8 x temp. inputs 0 – 600°C

This analogue input module is used for the detection of temperature in the range of 0 – 600°C by means of a FeCuNi (Typ J) temperature sensor.

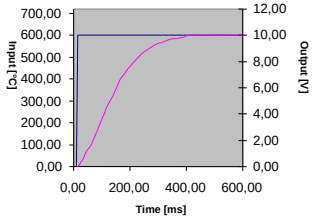
Technical data

Analogue channel specifications

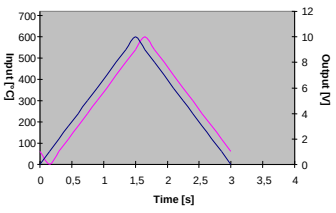
Number of channels	8	
Measuring range	0 – 600°C (0 – 33,1mV)	
Measured value	0 – 4000	Open input delivers 4095
Resolution	12 bit	
Transformation time per channel	≤14µs	
Suitable sensor type	FeCuNi (J) DIN 43710	
Input filter	0,5s	Low pass class 3
Common-mode range	±10V	
Sensor type for comparison measuring point	KTY10-62	
Comparison measuring point	-20 to 80°C	
Precision of the analogue channel	±0,75% of the maximum measured value *	

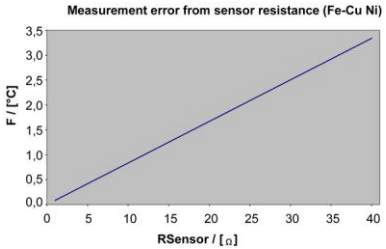
* when using the KTY 10-62 terminal compensation sensor

Response of the input filter 0-600 degree



Delay of the input filter 0-600 degree





Electrical requirements

Supply of the C-DIAS Bus	+5V and +24V	
Current consumption on the C-DIAS bus (+5V supply)	Typically 10mA	Maximum 20mA
Current consumption on the C-DIAS bus (+24V supply)	Typically 50mA	Maximum 70mA

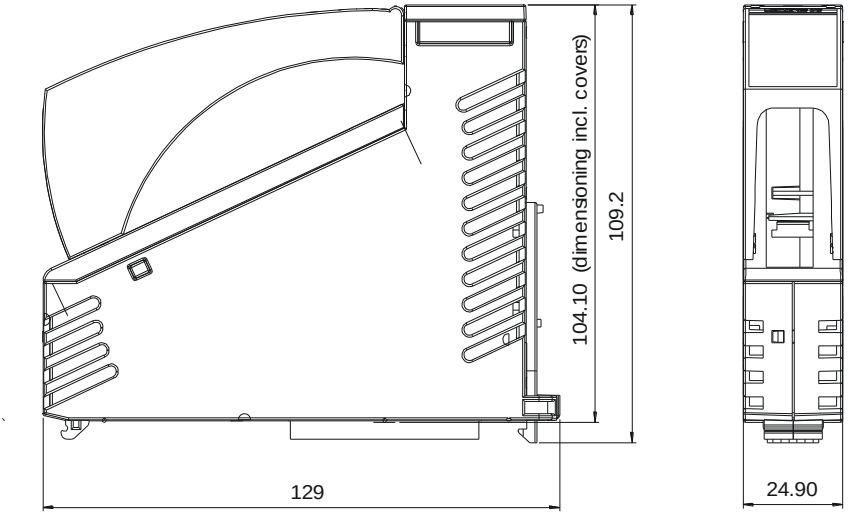
Miscellaneous

Article number	12-009-083
Hardware version	3.x
Standardization	UL (E247993)

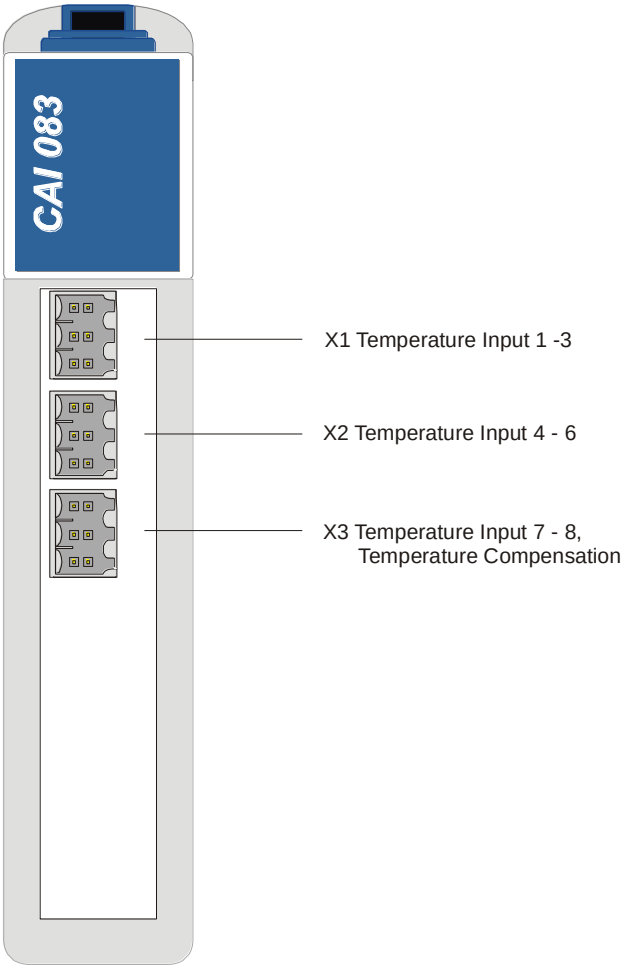
Environmental conditions

Storage temperature	-20 – +85°C	
Operating temperature	0 – +60°C	
Humidity	0 – 95%, without condensation	
EMV stability	In accordance with EN 61000-6-2:2001 (industrial)	
Resistance to shocks	EN 60068-2-27	150m/s²
Protective system	EN 60529	IP 20

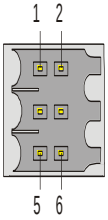
Mechanical dimensions



Connections

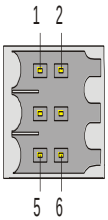


X1: Plug Temperature Input 1 - 3



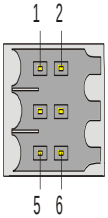
Pin	Function
1	Temperature Input 1-
2	Temperature Input 1+
3	Temperature Input 2-
4	Temperature Input 2+
5	Temperature Input 3-
6	Temperature Input 3+

X2: Plug Temperature Input 4 - 6



Pin	Function
1	Temperature Input 4-
2	Temperature Input 4+
3	Temperature Input 5-
4	Temperature Input 5+
5	Temperature Input 6-
6	Temperature Input 6+

X3: Plug Temperature Input 7 – 8, Temperature Compensation



Pin	Function
1	Temperature Input 7-
2	Temperature Input 7+
3	Temperature Input 8-
4	Temperature Input 8+
5	Temperature Compensation -
6	Temperature Compensation +

Useable connectors

X1-X3: 6-pole Weidmüller plug B2L/B2CF 3,5/6

The complete C-DIAS plug set CKL 042 with spring clamp is available from Sigmatek with the article number 12-600-042.

Wiring instructions

The signals detected from the analogue module are very small in comparison with the digital signals. In order to guarantee trouble free functioning it is essential to stick to a meticulous wiring arrangement.

- The 0V supply voltage connection must follow the shortest path the common 0V terminal.
- The connecting wires to the analogue inputs must be as short as possible and avoid lying in parallel to wires carrying digital signals.
- The signal carrying wires should be double or triple pole screened, or at least twisted together.

General comments on the comparison measuring point

Temperature measurement with thermocouples is based on the temperature dependent voltage (Seebeck effect), which arises at every connection made from two conductors of different metals (alloys).

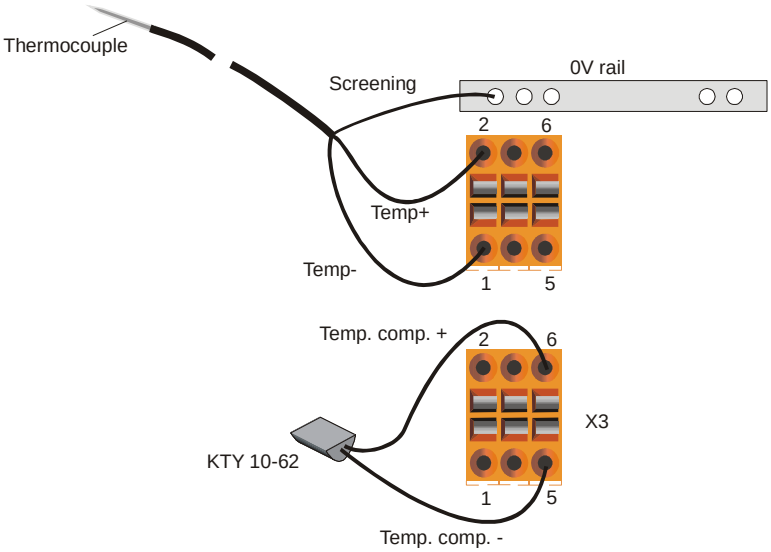
This voltage exists, therefore, not only at the point of measurement (where it is wanted) but also at the connection point between the thermocouple wires and copper (the connecting terminal). At this point the thermoelectric voltage is not desired, however it is unavoidable. (This voltage distorts the measured value by exactly the temperature of the terminal!)

An exact measurement is therefore only possible when the temperature of the terminal is measured and added to the measured voltage. All the switches necessary for this are integrated into the analogue card. The compensation is carried out directly by the electronics.

Thermocouples should, therefore, be lead directly (where necessary via compensating leads) to the connection socket on the analogue card.

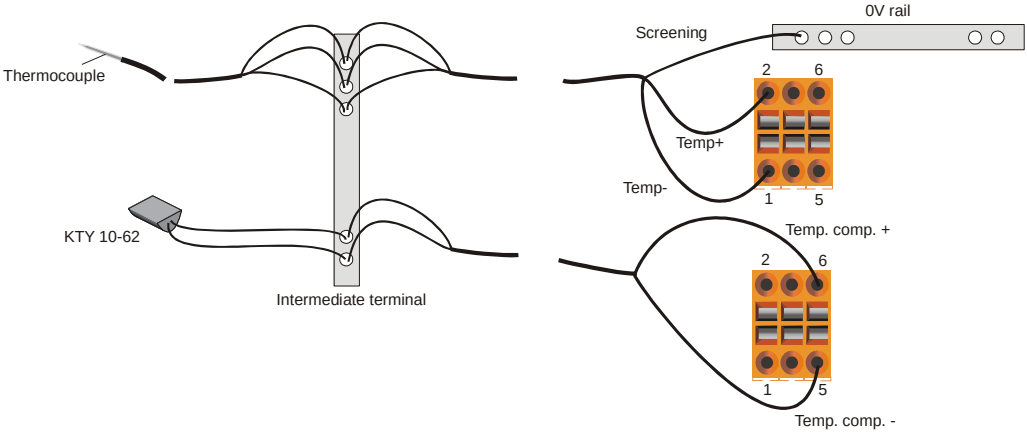
For thermocouple applications where the compensating lead is not led to the control, the comparison measurement must be carried out on the connecting terminal thermocouple (or compensating lead) and copper lead.

Direct connection of the thermocouples to the control



- If the sensor is electrically isolated, GND must be bridged with the temp- input to the terminal.
- With sensors that are not electrically isolated, a sufficiently sturdy earth lead must exist between the machine's earth and the 0V rail in the control box.
- The KTY 10-62 serves as the terminal voltage compensation.

Connection of the thermocouples via an intermediate terminal



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Addressing

Address	Access		Function
16#00	READ	WORD	Measured temperature value
16#02	READ	BYTE	Bit 0 : AD converter ready
16#00	WRITE	BYTE	Bit 0-2: Channel selection Temp. Input 000 Channel 1 001 Channel 2 010 Channel 3 011 Channel 4 100 Channel 5 101 Channel 6 110 Channel 7 111 Channel 8 Bit 3 : 0 Bit 4 : 1 Bit 5 : 0 Bit 6 : 1 Bit 7 : 0

For hardware matching, the matching values for offset, multiplier and divisor are determined at the factory. These values are saved in a serial EEPROM found in the module.

Data in EEPROM

Module data (organized byte-wise)

Address	Data	Description
$00	$xx	Check sum
$01	123	Identification
$02	5	Module group 5 = CAI
$03	1	Variant 1 = CAI083
$04	8	Number of channels
$05	$1x	Hardware version $10 = HW-V1.0, $11 = HW-V1.1, …
$10		Serial number

AI matching data (organized word-wise)

Address	Data	Description
$40	$xxxx	Check sum
$42	12345	Identification
$44	25	Length of the following data block in WORD
$46	$0008	Number of channels (8x AI)
$48	e.g. 0000	Offset for 0°C channel-1
$4A	e.g. 4000	Gain-Multiplicand channel-1
$4C	e.g. 4050	Gain-Divisor channel-1
$4E - $52	-	Matching values channel-2
$54 - $58	-	Matching values channel-3
$5A - $5E	-	Matching values channel-4
$60 - $64	-	Matching values channel-5
$66 - $6A	-	Matching values channel-6
$6C - $70	-	Matching values channel-7
$72 - $76	-	Matching values channel-8

Calculation of the analogue value read-in

e.g.:	Offset	0000
	Gain Multiplicand	4000
	Gain Divisor	4050

Conversion formula for analogue inputs

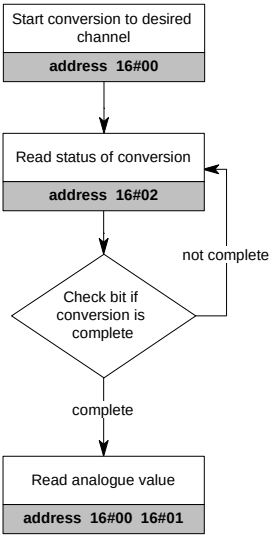
VALUE = (analogue input value + offset) * gain multiplicand / gain divisor

Example

e.g.: Value for 0°C: (0000+0000) * 4000 / 4050 = 0000
Value for 600°C: (4050+0000) * 4000 / 4050 = 4000

Operating diagram

Read-out of the analogue channel



Interpolation table for FeCuNi(j) temperature sensor DIN 43710

1/10 °C	BITS	mV
00000	0000	0,000
00323	200	1,655
00636	400	3,310
00943	600	4,965
01248	800	6,620
01549	1000	8,275
01848	1200	9,930
02146	1400	11,585
02443	1600	13,240
02741	1800	14,895
03040	2000	16,550
03339	2200	18,205
03640	2400	19,860
03939	2600	21,515
04240	2800	23,170
04539	3000	24,825
04837	3200	26,480
05133	3400	28,135
05426	3600	29,790
05716	3800	31,445
06000	4000	33,10