

C-DIAS-Multi I/O Module

CIO 013

6 x digital inputs (+24V, 5mA, 5ms)

input 3 useable as interrupt (+24V, 5mA, 10 μ s)

2 x digital counter inputs (+5V, 5mA, 1 μ s)

8 x digital outputs (+24V, 2A, short-circuit protected, 400 μ s)

1 analog input 0 – 10V / 12 Bit / 10ms

1 analog input PT100 (– 50°C - +200°C)

1 analog output \pm 10 V / 12Bit / 50 μ s

The CIO 013 module has 8 short circuit protected digital outputs +24V / 2A (positive switching), as well as 8 digital inputs for reading the signal conditions 0 and 1. Two inputs can be used as counters and have an addition +5V level for incremental encoders. One input is interrupt capable.

One analog input is available for measuring (0 – 10V) and another is available for temperature measurements (PT100, 2-wire). An analog output is also available for voltages of \pm 10V. The supply voltage of each channel group is monitored for voltage loss.



Technical Data

Digital input specifications

Number	8
Status display	Optional (LEDs green)

Inputs 1 – 2	
Count function	Maximum Input frequency 25kHz
Input voltage	+5V
Switch threshold	Typically 2,5V
Input current	Typically 5mA at +5V
Input delay	1 μ s

Inputs 3	Used as interrupt (Interrupt only functions on the local C-DIAS bus)	
Signal level	Low: <+4 V	High: >+8 V
Switch threshold	Typically +6 V	
Input delay	Typically 10 μ s	

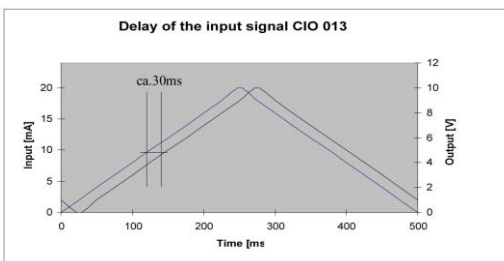
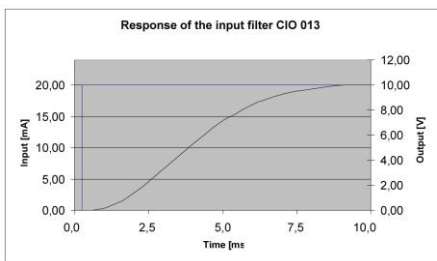
Inputs 3 – 8		
Count function	Typically +24 V	Maximum +30 V
Signal level	Low: <+8 V	High: >+14 V
Switch threshold	Typically +11 V	
Input current	Typically 5mA at +24 V	
Input delay	Typically 5ms	

Digital output channel specifications

Number	8
Short circuit protection	Yes
Maximum allowable continuous current / channel	2A
Maximum total current (per 4 channels)	6A (100 % of on time)
Maximum total current (entire Module)	12A (100 % of on time)
Maximum switch-off energy of the outputs (inductive load)	Maximum 0.25 Joule/channel
Voltage drop over the supply (output Active)	≤ 1 V
Residual output current (inactive)	$\leq 12\mu$ A
Turn on delay	<400 μ s
Turn off delay	<400 μ s
Status display	Optional (LEDs yellow)

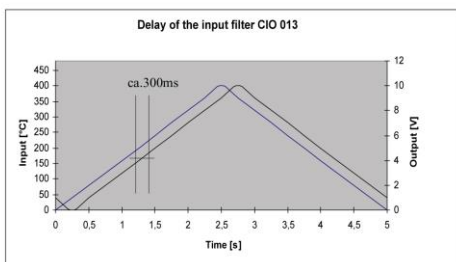
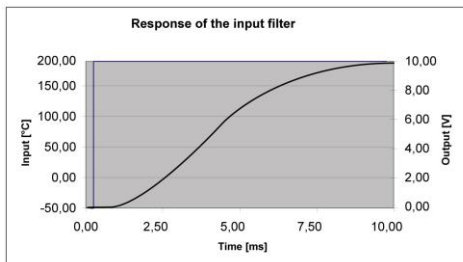
Analog input channel specifications

Number of channels	1 (4-wire connection)	
Measurement range	0 – 10 V	
Measurement values	0 – 4000	
Resolution	12 Bit	
Conversion time per channel	≤15μs	
Input resistance	>200kΩ	
Input filter	Cutoff frequency 100Hz (10 ms)	Low pass 3. level
Reference output	+10V / ±5%	
Load capacity of the Reference voltage per channel	2,5mA	
Analog channel accuracy	±0,5% of maximum measurement value	



Temperature measurement with thermal resistors

Measurement range	-50 to +200 °C
Sensor range	80,31 - 175,86 Ω
Measurement values	0 to 4000
Input resistance	10 kΩ
Input filter	10 ms
Applicable sensor type	PT 100 DIN IEC 751
Measurement accuracy	±0,5 %



Analog output channel specifications

Number of channels	1
Output voltage	-10 to +10V DC
Output values	-2000 to +2000
Resolution	12 Bit (5mV / Bit)
Load capacity of the Reference voltage	>10KΩ
Short circuit protection	Yes
Rise time	<50µs
Refresh time for all channels	<1ms
Analog channel accuracy	±0,5% of the output value

Electrical Requirements

Supply voltage +24V /1-2 for outputs (X6)	18 – 30 V DC	
Current consumption supply voltage +24V /1-2 for outputs	Corresponds to the load on the digital outputs (max. 6A / group of 4)	
Supply from the C-Dias bus	+5 V	
Current consumption on the C-Dias bus (+5V supply)	Typical 120mA	Maximum 145mA
Supply from C-Dias-Bus	+24 V	
Current consumption on the C-Dias bus (+24V supply)	Typical 50mA	Maximum 70mA

Voltage Monitoring

Supply voltage +24V /1-2	Supply voltage <18V (Error LED lights red)
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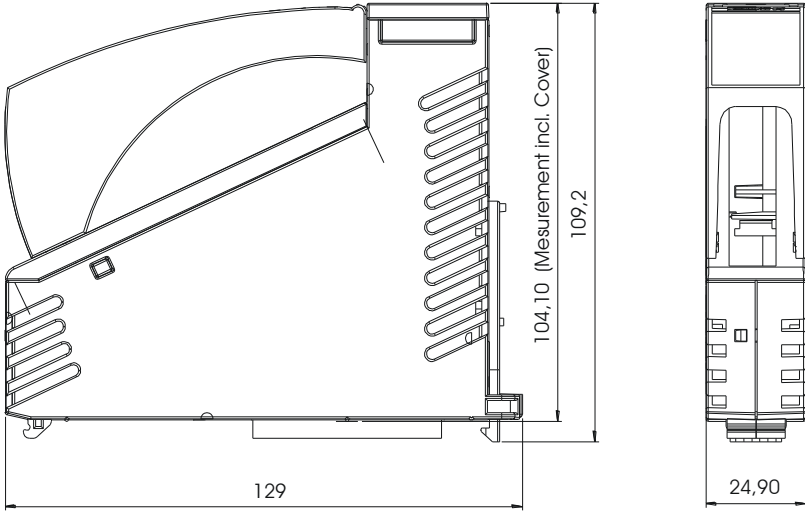
Miscellaneous

Article number	12-013-013 With status display (green, yellow and red LEDs) 12-013-013-T With painting
Hardware version	2.x
Standardization	UL (E247993)

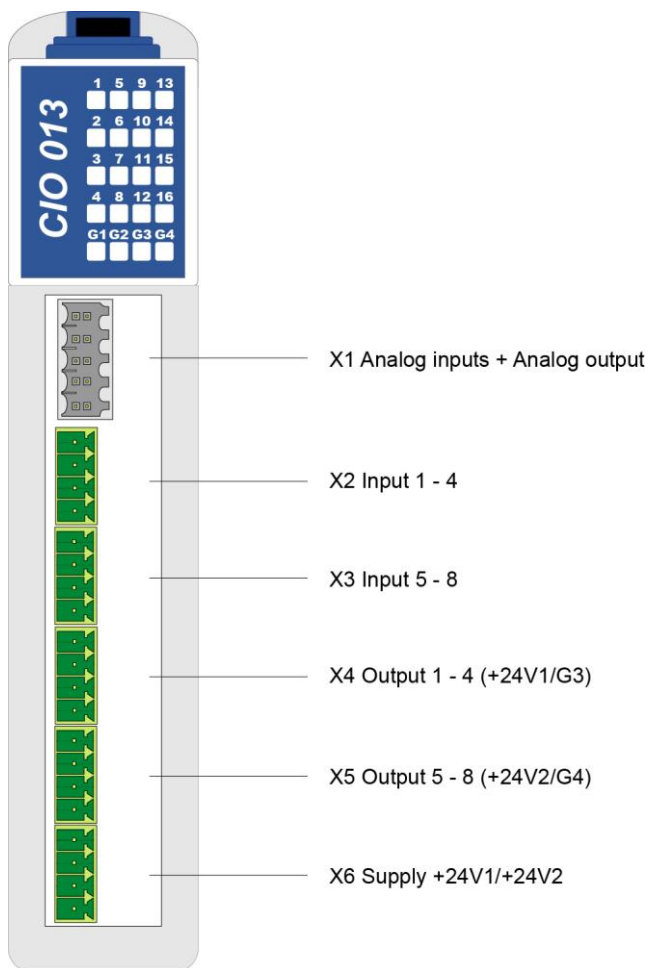
Environmental conditions

Storage temperature	-20 – +85 °C	
Environmental temperature	0 – +60 °C	
Humidity	0 – 95 %, uncondensed	
EMV stability	In accordance with EN 61000-6-2 (industrial)	
Shock resistance	EN 60068-2-27	150 m/s ²
Protection type	EN 60529	IP 20

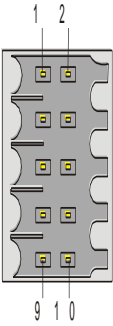
Mechanical Dimensions



Connector Assignment

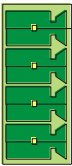


X1: Analog input connector + analog output



Pin	Function
1	AI1-
2	AI1+
3	AGND
4	+10 V
5	AI2-
6	AI2+
7	AGND (do not use)
8	+10 V (do not use)
9	AGND
10	AOUT

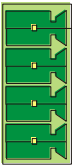
X2: Connector for inputs 1 – 4



Pin 1

Pin	Function
1	Input 1
2	Input 2
3	Input 3
4	Input 4

X3: Connector for inputs 5 – 8



Pin 1

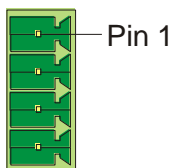
Pin	Function
1	Input 5
2	Input 6
3	Input 7
4	Input 8

X4: Connector for outputs 1 – 4 (+24V1/G3)

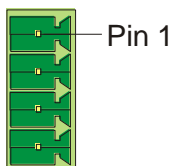


Pin 1

Pin	Function
1	Output 1
2	Output 2
3	Output 3
4	Output 4

X5: Connector for outputs 5 – 8 (+24V2/G4)


Pin	Function
1	Output 5
2	Output 6
3	Output 7
4	Output 8

X6: Supply connector


Pin	Function
1	+24V1 (for output 1 – 4)
2	+24V2 (for output 5 – 8)
3	EXGND
4	EXGND

Applicable connector plugs
Connector plug with spring terminal:

Phoenix Contact: FK-MCP 1,5/ 4-ST-3,5

Weidmüller: 10-pol. bus socket B2L 3,5/10

Connector plug with screw terminal:

Phoenix Contact: MC 1,5/ 4-ST-3,5

The complete C-Dias connector set, CKL 035 with spring terminals is available at sigmatek under the article number 12-600-035.

Status Display



LED no.	LED color	Meaning
1 – 8	green	Inputs 1 – 8
9 – 16	yellow	Outputs 1 – 8
G1 – G2	---	not used
G3 – G4	red	Error LED – missing voltage supply +24V1 (G3 for outputs 1-4) or +24V2 (G4 for outputs 5-8)

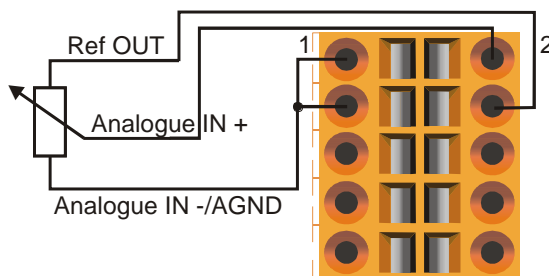
Wiring instructions

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 top-hat rail must be properly connected to earth.
- The connecting wires to the sources of the analogue signals must be as short as possible and avoid lying in parallel to wires carrying digital signals.
- The signal carrying wires should be screened.
- The screening must be connected to a common screening rail.

Voltage measurement with potentiometer (odometry)

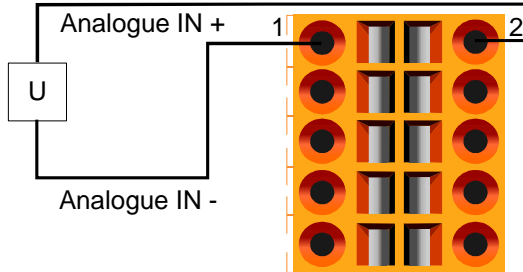
If the voltage at the analog inputs should be measured with a Potentiometer, the client "AI1_TypeOfChannel / AI2_TypeOfChannel" must be initialized with 0. The K- input must be connected to the analogue GND connection.



Connection pattern 1

Active voltage source

If a measurement should be taken at the analogue inputs with an active voltage source, the client "AI1_TypeOfChannel / AI2_TypeOfChannel" must be initialized with 1. With **voltage sources, which are not potential free**, no connection must be made between input and GND or analogue GND.

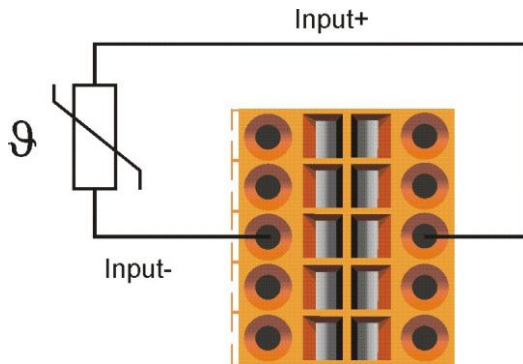


Connection pattern 2

Temperature Measurement Thermal Resistors

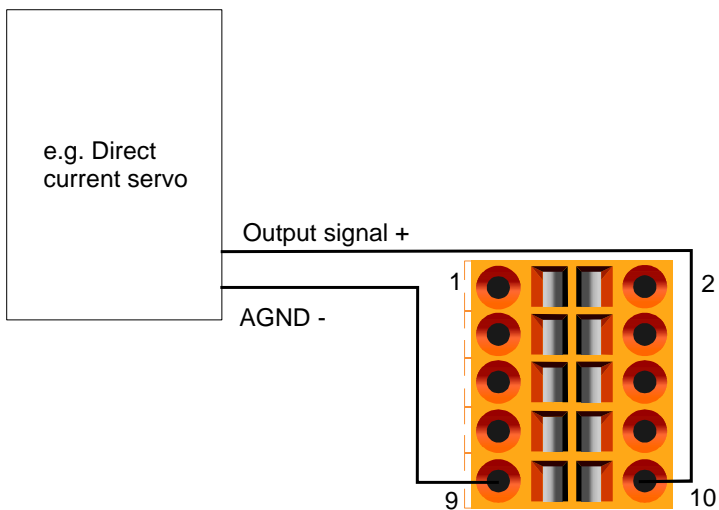
2-wire measurement

The 2-wire measurement is recommended for short sensor lines only, since the resistance of the circuit influences the measurement.



Connection pattern 3

Example of application: axis control for direct current servos, frequency converter



Connection pattern 4

Addressing

Address	Access	Function
00h	WR8	Digital Output1 – 8
01h	RD8	Digital Input 1 – 8
02h		Reserved
03h	RD8	+24 V-monitor: D0: 1 = 24V1 OK D1: 1 = 24V2 OK D2 – D7: Not used
04h	WR8	IRQ-Input (Digital Input 3) D0: 1 = rising flank evaluation D1: 1 = falling flank evaluation D2 – D7: not used
04h	RD8	IRQ-Status register D0: 1 = rising flank recognized D1: 1 = falling flank recognized D2 – D7: not used
05h	-	Reserved
06h	WR8	Counter Mode (Digital Input 1 / 2) 00: Counter 1 counts with rising Input 1 Counter 2 counts with rising Input 2 01: Reserved 02: NC 1x Input 1 = A, Input 2 = B (dir) Counter 1 counts, Counter 2 no function 03: NC 4x Input 1 = A, Input 2 = B Counter 1 counts, Counter 2 no function
08h	RD16	Counter 1, 16-Bit
0Ah	RD16	Counter 2, 16-Bit
10h	WR8	ADC channel 1 select, start previously selected channel conversion (Data arbitrary)
11h	WR8	ADC channel 2 (PT100) start previously selected channel conversion (Data arbitrary)
10h	RD8	ADC-read value 8-Bit (D0 – D7) -> last converted channel
12h	RD8	ADC- read value 4-Bit (D8 – D11) -> last converted channel
13h	RD8	ADC-Status D0: 1 = Conversion complete D1 – D7: Not used
14h	WR16	DAC-Write value 12-Bit
16h	WR8	Reference voltage 80h = activate reference (for ADC and DAC)
17h-1Fh	-	Reserved

Calibration Data CIO 013 (24C02 organized by Byte)

Address	Data	Description
\$00	\$xx	Checksum
\$01	123	Identification
\$02	28	Module group 28=CIO
\$03	3	Module variant
\$04	19	Channel number
\$05	10	Hardware version \$10=HW 1.0
\$06-\$3F	0	FILL
\$10		Serial number
		AI-Calibration data 0 – 10 Vref path
\$40	\$xxxx	Checksum
\$42	12345	Identification
\$44	7	Length of the following data block in WORD
\$46	2	Number of channels
\$48	-10	AI1 Offset
\$4A	4000	AI1 Multiplier
\$4C	4003	AI1 Divisor
\$4E	-10	AI2 Offset (PT100)
\$50	4000	AI2 Multiplier (PT100)
\$52	4009	AI2 Divisor (PT100)
\$54-\$7F	0	FILL
		AI-Calibration data 0 – 10 V
\$80	\$xxxx	Checksum
\$82	12345	Identification
\$84	7	Length of the following data block in WORD
\$86	2	Number of channels
\$88	-10	AI1 Offset
\$8A	4000	AI1 Multiplier
\$8C	4003	AI1 Divisor
\$8E	-10	AI2 Offset (PT100)
\$90	4000	AI2 Multiplier (PT100)
\$92	4009	AI2 Divisor (PT100)
\$94-\$BF	0	FILL
		AO-Calibration data +10 V
\$C0	\$xxxx	Checksum
\$C2	12345	Identification
\$C4	4	Length of the following data block in WORD
\$C6	1	Number of channels
\$C8	2054	AO1 Offset
\$CA	4040	AO1 Multiplier
\$CC	4000	AO1 Divisor
\$CE-\$FF	0	FILL

Counter Function

The module offers the possibility of a counter function. The inputs 1 – 2 are each assigned a counter with a maximum input frequency is 25kHz.

There are 3 configurable modes: Counter counts with positive flank
 1-x evaluation
 4-x evaluation

Assignment of the inputs to the counters:

Input	Counter
1	Counter 1
2	Counter 2

Counter mode register

With help from this register, the mode of each input can be defined (counter).

The following modes are available:

00:	Counter 1 counts with positive input 1 Counter 2 counts with positive input 2
01:	Reserved
02:	NC 1-x input 1 = A, input 2 = B (dir) Counter 1 counts, Counter 2 no function
03:	NC 4-x input 1 = A, input 2 = B Counter 1 counts, Counter 2 no function

Interrupt function

The module offers the possibility to change the condition of input 3 through hardware interrupts. Using interrupts, the module can be configured through the software.

The following register is available for the configuration of the input interrupt:

D0: 1 = Rising flank evaluation
D1: 1 = Falling flank evaluation
D2 – D7: Not used

Interrupt status register: With the READ access the interrupt is acknowledged and the register is cleared.

For technical reasons, the interrupt function can only be used on the local C-DIAS bus!

Pour des raisons techniques, la fonction d'interruption ne peut être utilisée que sur le bus C-DIAS local!

Linear table PT100 0 – 4000d to –50 °C - +200 °C

LINEAR d	PT100 °C
0	-50,0
100	-44,0
200	-38,0
300	-32,0
400	-26,0
500	-20,0
600	-14,0
700	-8,0
800	-1,9
900	4,2
1000	10,3
1100	16,4
1200	22,5
1300	28,6
1400	34,8
1500	41,0
1600	47,2
1700	53,4
1800	59,6
1900	65,8
2000	72,0
2100	78,2
2200	84,5
2300	90,8
2400	97,1
2500	103,4
2600	109,7
2700	116,1
2800	122,5
2900	128,9
3000	135,3
3100	141,7
3200	148,1
3300	154,5
3400	160,9
3500	167,4
3600	173,9
3700	180,4
3800	186,9
3900	193,4
4000	200,0