

Decentralised nodal modules

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1. Introduction

This manual describes the hardware concerning the digital and analog peripheral modules in the SELECONTROL[®] MAS automation system.

1.1 Unit testing

All units of the automation system SELECONTROL[®] MAS have been developed in accordance to fulfil the IEC 1131-2 standard (programmable controllers part 2, unit specifications).

Additional information and details in respect of these test standards can be found under section 'Test standards' as appendix of this manual.

1.2 Concept of the system

In the new automation system SELECONTROL[®] MAS control, measurement, regulation, optimisation, positioning, communication and networking are integrated within the system. This gives the user the facility to combine the single modular components corresponding to his system requirements, and to adapt it easily at any time to changed market requirements.

1.2.1 Distributed concept

The whole system can be built up in a distributed manner. The sturdy input and output modules are designed to be mounted directly at the sensor/actuator work place.

The following illustration shows these modules being used as the link between an industrial PC, PLC or process computer and the outer field containing the sensors and actuators.

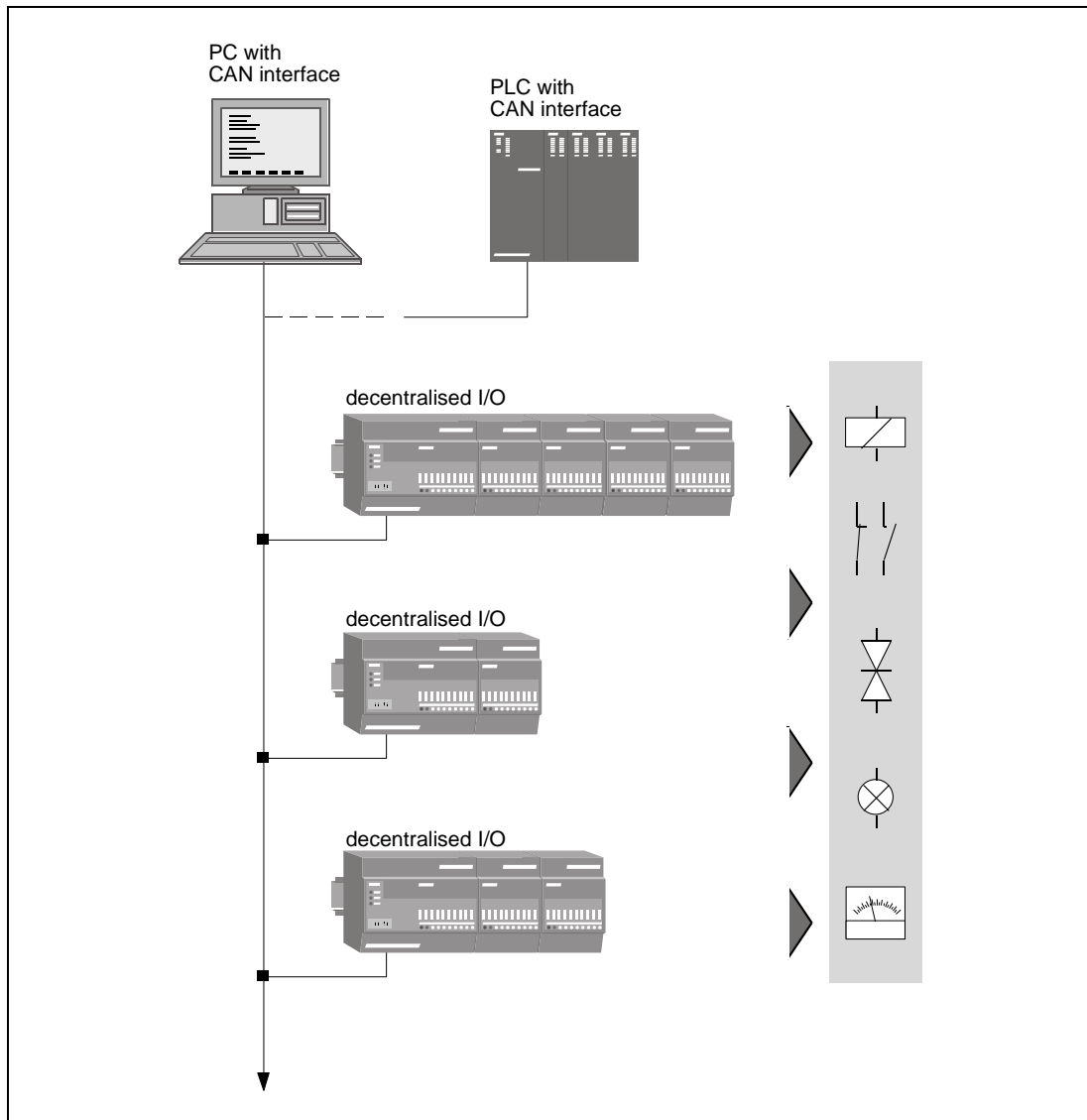


Fig. 8.1: Distributed concept

1.2.2 Expandability

The nodal modules can be expanded using units called expansion modules. The following table provides information about the expansion capabilities of the various nodal modules.

Nodal modules	expandable	Expansion modules	max. number ¹⁾
DIC 701	yes	DIT 70x, DOT 70x	7
DOC 701	yes	DIT 70x, DOT 70x	7
DDC 7xx/-T/-TH	yes	DIT 70x, DOT 70x, DDT 70x, AIT 70x, AOT 70x, PWT 70x	7
AIC 70x	no	-	-
AOC 701	no	-	-
AIC 71x	no	-	-
AOC 711	no	-	-

¹⁾ take care of the max. power consumption of the expansion modules. See chapter 'Decentralized expansion modules' under 'Power consumption at module bus'

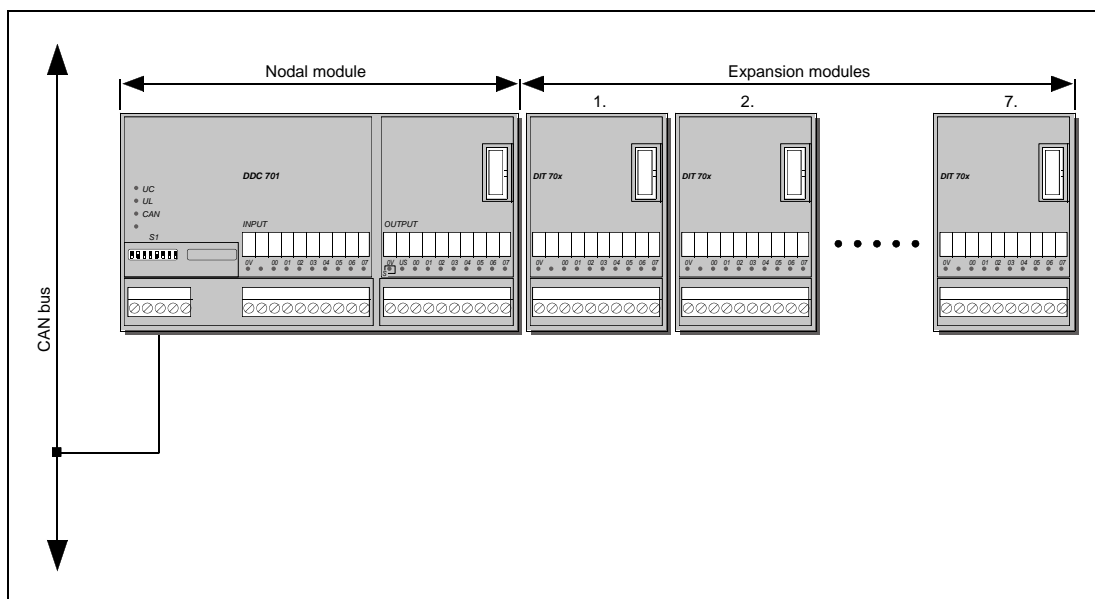


Fig. 8.2: Expandability



Expansion modules must not be inserted or removed while the power is on as this could result in the destruction of the module.

2. Nodal modules with communication protocol SeleCAN

2.1 Digital input module DIC 701

The nodal module type DIC 701 is provided with 8 digital inputs rated at 24 Vdc.

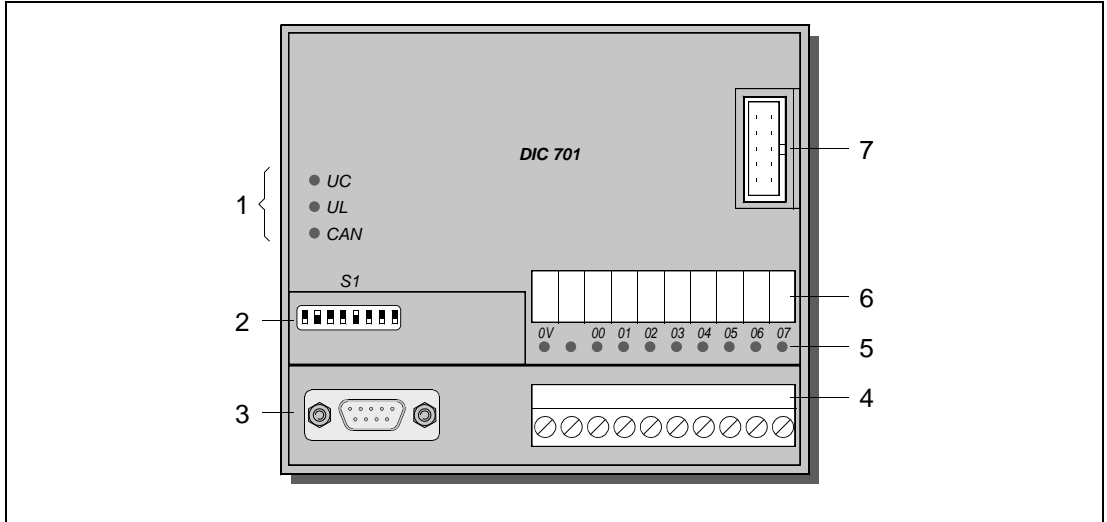


Fig. 8.3: Digital input module DIC 701

Legend:

	UC:	Supply voltage
1:	LEDs	UL: Logic supply
		CAN: Communication status
2:	DIP switch S1 for CAN bus	
3:	Connection for CAN bus and 24 Vdc supply (UC)	
4:	Terminal strip for 8 digital inputs	
5:	LEDGreen LED indicator for the inputs	
6:	Labeling strips	
7:	Link connector for expansion module	

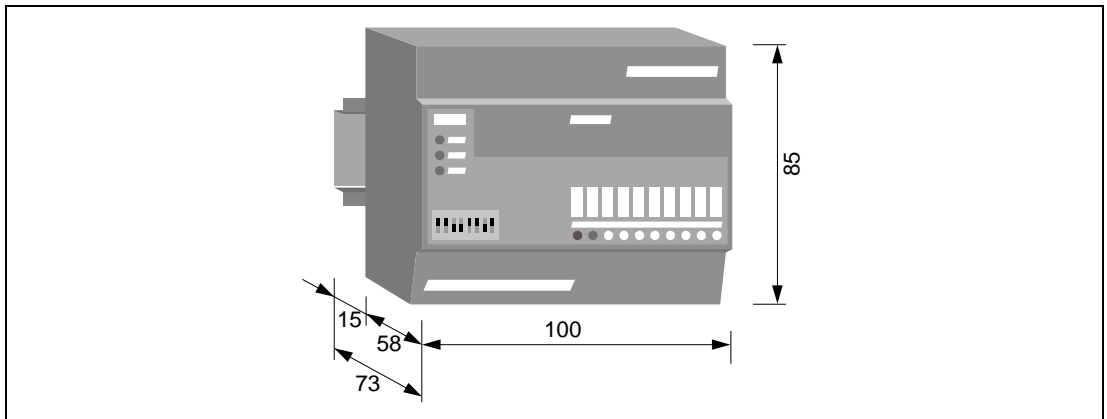


Fig. 8.4: Dimensions DIC 701

2.1.1 Terminal block assignment

The DIC 701 module is wired to a 10-pole terminal block.

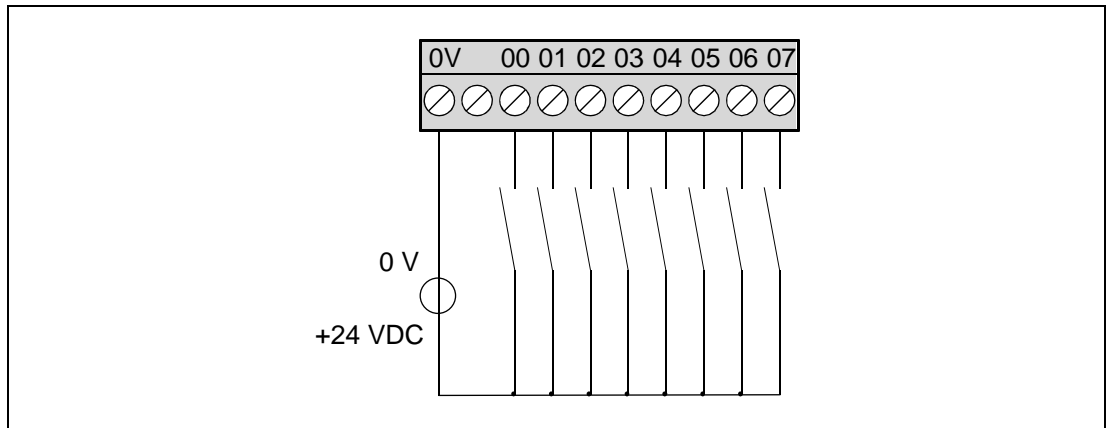


Fig. 8.5: Digital inputs 0...7

All the inputs are referred back to a common 0 V connection and a common power supply. The inputs are electrically isolated from the logic circuitry of the module.

2.1.2 Basic circuit DIC 701

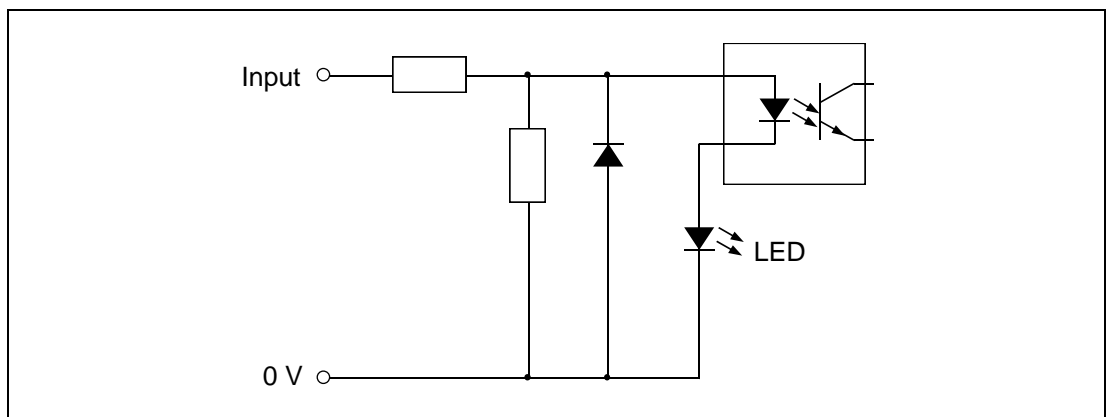


Fig. 8.6: Basic circuit DIC 701

2.1.3 Technical data, DIC 701

General data	DIC 701
Bus-connection	CAN (ISO 11898)
Supply voltage UC	
Nominal value	24 Vdc
Limits	18...30 Vdc
Power consumption max.	2.1 W without expansion modules
	9 W incl. 5 W for expansion modules
Ambient temperatures	
operating	0...+55 °C
storage	-25...+70 °C
Protection mode	IP 40
Dimensions (W x H x D) [mm]	100 x 85 x 58
Weight	220 g
Art. No	44120001

Digital inputs	DIC 701
Digital inputs	8
Input type as per IEC 61131-2	Type 1
Indicators	Green LEDs, lights on at signal =1
Output power for expansion modules max.	5 W
Input voltage	0...24 Vdc
Limits	-30...+30 Vdc
for signal = 0	< 5 Vdc
for signal = 1	> 14 Vdc
Input impedance typ.	3.9 kΩ
Input current for signal typ. = 1	6 mA (24 V)
Input delay time	0.6 ms typ. (input filter)
settable under software control	5.6 ms
Electrical insulation ¹⁾	
Supply ↔ logic and CAN	yes
Input ↔ logic and CAN	yes
Input ↔ input	no
Signal evaluation	static or dynamic (Edge detection)
Effect at change of input polarity	no destruction, no high currents
Sensor connecting cable	max. 100 m not screened
Plug in or plug out of the module bus if the supply voltage UC is connected to nodal module	Plug out allowed Plug in not allowed

¹⁾ Test voltages see appendix

Further technical data valid for all modules is given in the appendix under 'Test standards'.

2.2 Digital output module DOC 701

The nodal module type DOC 701 is provided with 8 digital outputs rated at 24 Vdc/0.5 A.

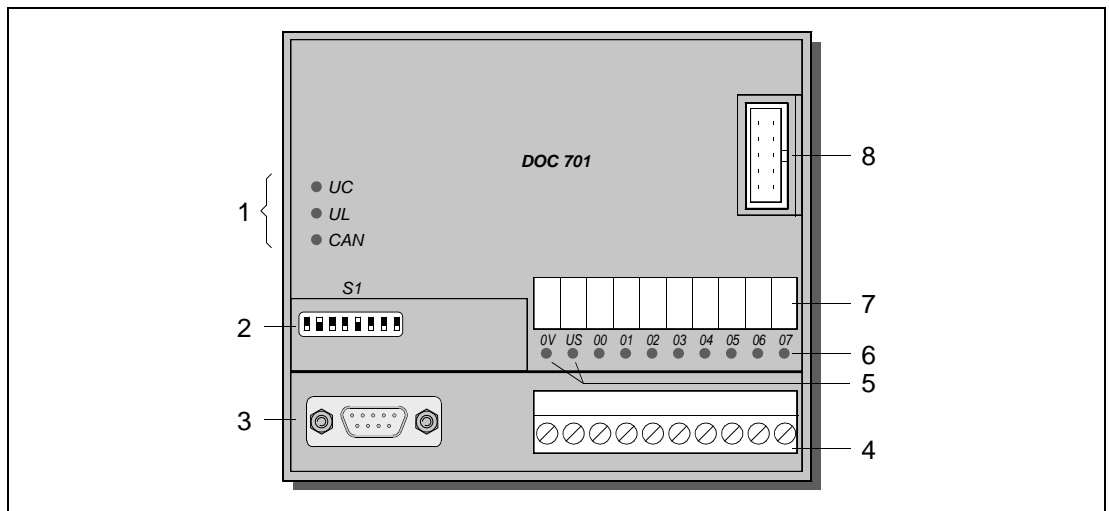


Fig. 8.7: Digital output module DOC 701

Legend:

	UC:	Supply voltage
1: LEDs	UL:	Logic supply
	CAN:	Communication status
2:	DIP switch S1 for CAN bus	
3:	Connection for CAN bus and 24 Vdc supply (UC)	
4:	Terminal strip for 8 digital inputs	
5:	LED indicators: Red (short-circuit), Green (US)	
6:	LED indicator orange for outputs	
7:	Labeling strips	
8:	Link connector for expansion module	

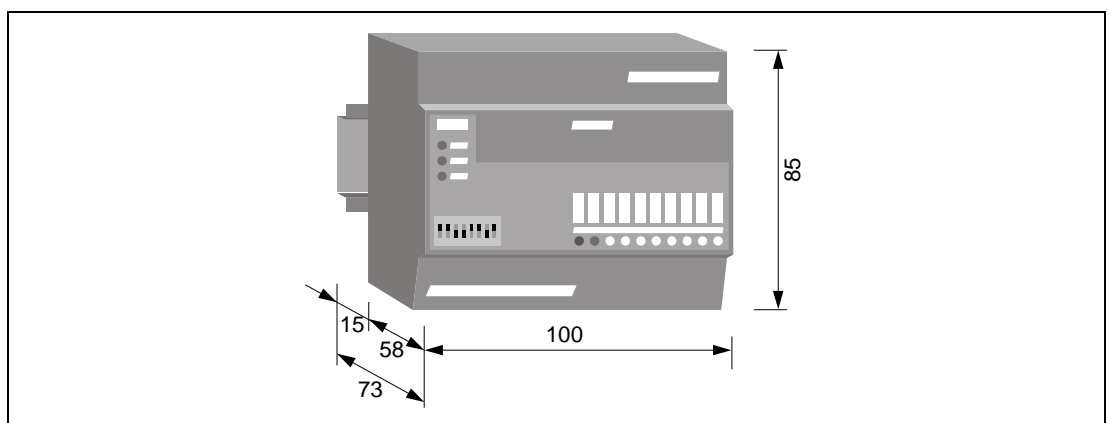


Fig. 8.8: Dimensions DOC 701

2.2.1 Terminal block assignment

The DOC 701 module is wired to a 10-pole terminal block.

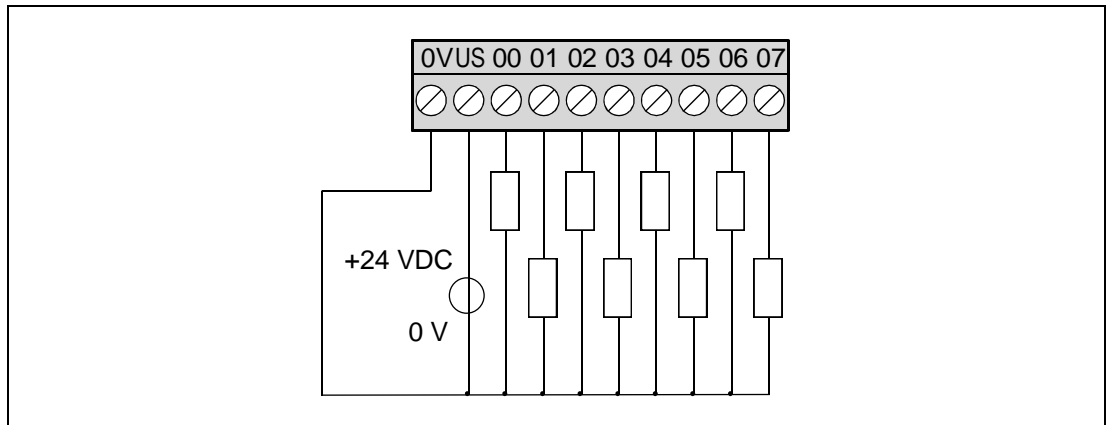


Fig. 8.9: Digital outputs 0...7:

All the outputs are taken back to a common 0 V connection and a common power supply connection. The outputs are electrically isolated from the logic circuitry of the module.

2.2.2 Basic circuit DOC 701

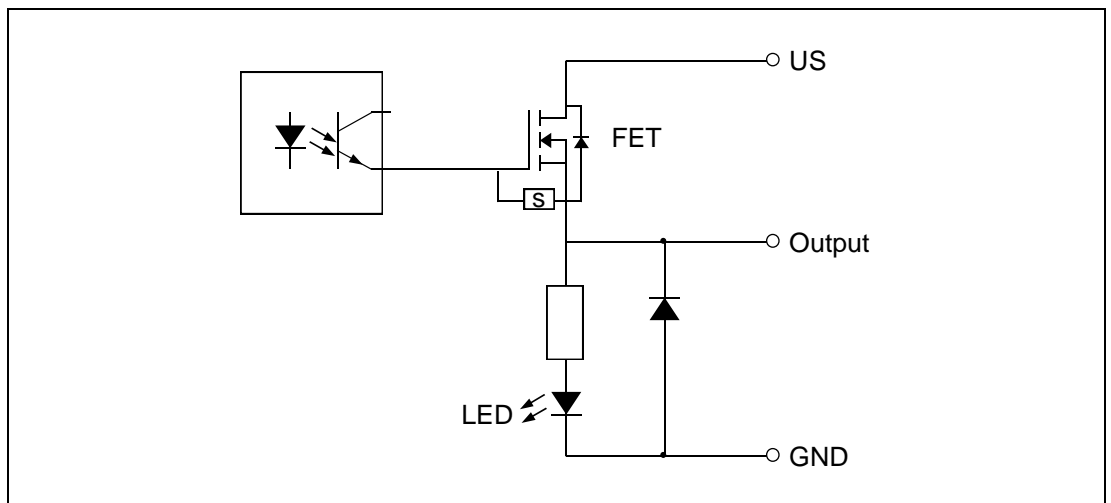


Fig. 8.10: Basic circuit DOC 701

2.2.3 Technical data, DOC 701

General data	DOC 701
Bus-connection	CAN (ISO 11898)
Supply voltage (UC)	
Nominal value	24 Vdc
Limits	18...30 Vdc
Power consumption max.	2.3 W without expansion modules
	9 W incl. 5 W for expansion modules
Ambient temperatures	
operating	0...+55 °C
storage	-25...+70 °C
Protection mode	IP 40
Dimensions (W x H x D) [mm]	100 x 85 x 58
Weight	220 g
Art. No	44120007

Digital outputs	DOC 701
Digital outputs	8
Type of output	FE-transistor, pulse connecting
Output indicator	LED orange, lights on at signal = 1
Supply voltage (US)	
Nominal value	24 Vdc
Limits	18...30 Vdc
Output power for expansion modules	5 W max.
Output current for signal = 1	0.5 A max.
Short-circuit current I_s typ.	5 A, switch off time 1.5 ms
Switch on time after cancel the short-circuit	≤ 5 s
Total loading	4 A
Min. switching current	100 μ A
Inductive spike suppr.	Protection diode
Output delay time TQD and TQT	
for signal 0 \rightarrow 1	600 μ s
for signal 1 \rightarrow 0	800 μ s
Switching rate	
Resistive load	100 Hz
Inductive load	2 Hz
Open circuit level	
Signal = 0	max. 2 Vdc
Signal = 1	18...30 Vdc
Plug in or plug out of the module bus if the supply voltage UC is connected to nodal module	Plug out allowed Plug in not allowed
Effect at overload	Outputs are switched off

Digital outputs	DOC 701
Output behaviour if CAN communication is interrupted	Outputs keep the actual state or are set to 0 (depending on the application)
Electrical insulation ¹⁾	
Supply ↔ logic and CAN	yes
Input ↔ logic and CAN	yes
Input ↔ input	no

¹⁾ Test voltages see appendix

Further technical data valid for all modules is given in the appendix under 'Test standards'.

2.3 Digital input/output module DDC 701/-T/-TH

- The nodal modules type DDC 701 /-T are provided with 8 digital inputs rated at 24 Vdc and 8 digital outputs 24 Vdc/0.5 A.
- The nodal module type DDC 701-TH is provided with 8 digital inputs rated at 36 Vdc and 8 digital outputs 36 Vdc/0.5 A.

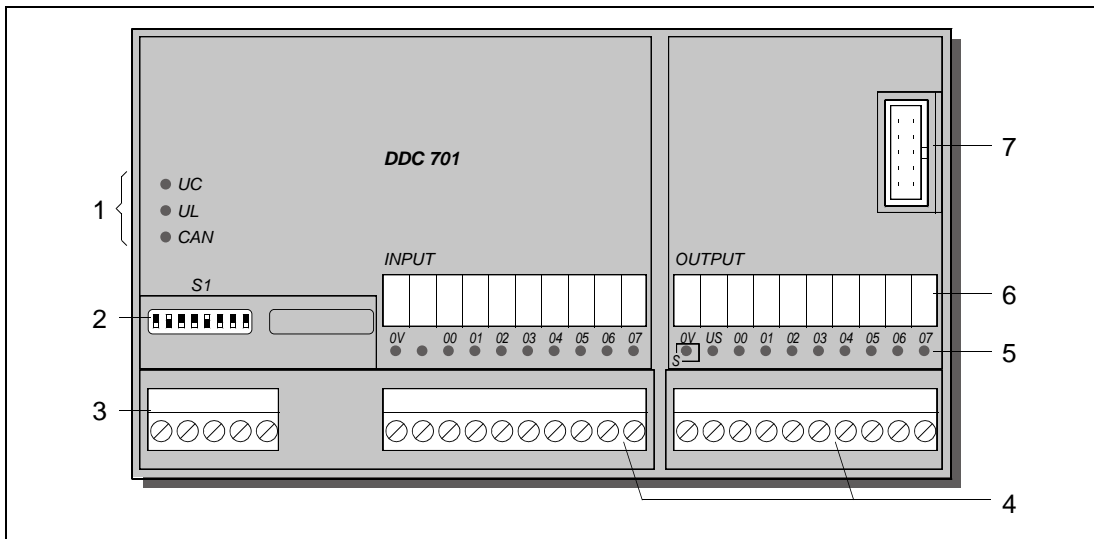


Fig. 8.11: Digital input/output module DDC 701/-T/-TH

Legend:

	UC:	Supply voltage
1:	LEDs	UL: Logic supply
	CAN:	Communication status
2:	DIP switch S1 for CAN bus	
3:	Connection for CAN bus and supply voltage (UC)	
4:	Terminal strip	
5:	LED indicators	
6:	Labeling strips	
7:	Link connector for expansion module	

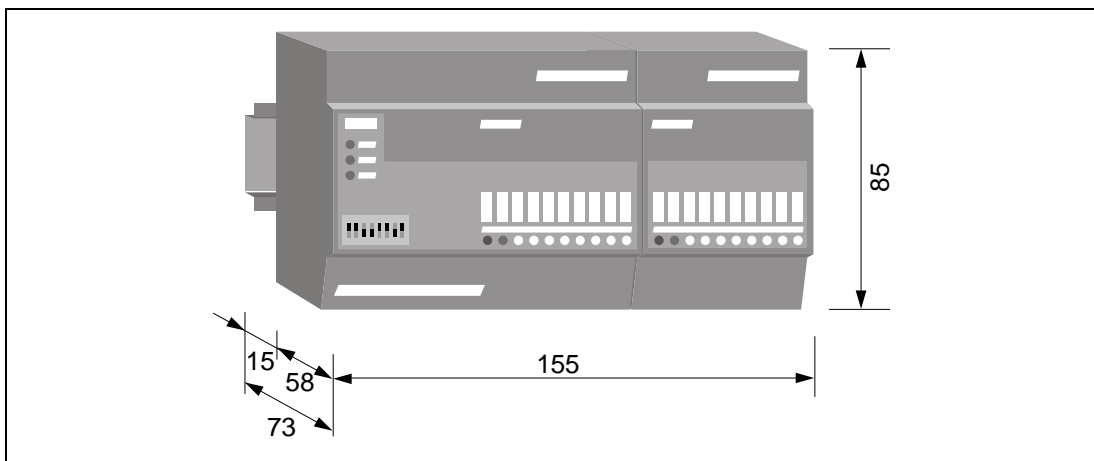


Fig. 8.12: Dimensions DDC 701/-T/-TH

2.3.1 Terminal block assignment digital inputs

The DDC 701/-T/-TH module is wired to two 10-pole terminal blocks.

All the inputs are referred back to a common 0 V connection. The inputs are electrically isolated from the logic circuitry of the module.

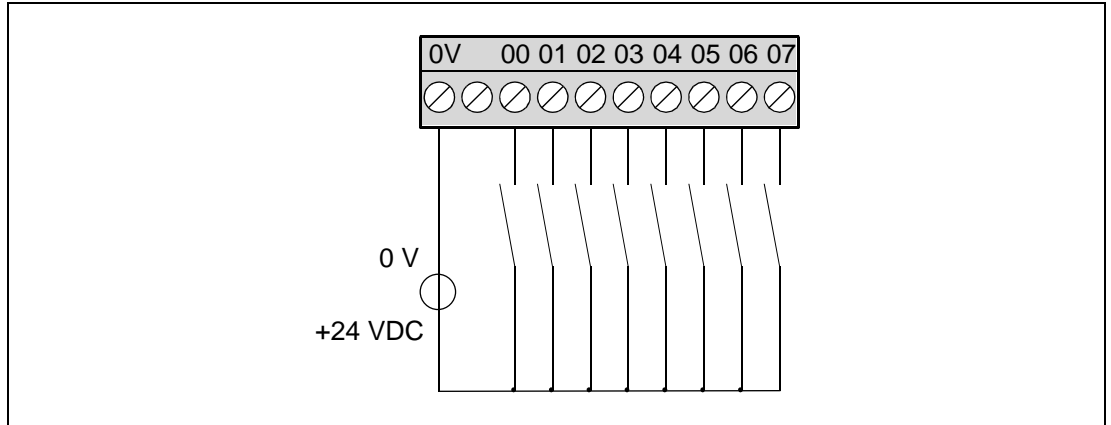


Fig. 8.13: Digital inputs 0...7

2.3.2 Basic circuit DDC 701/-T/-TH

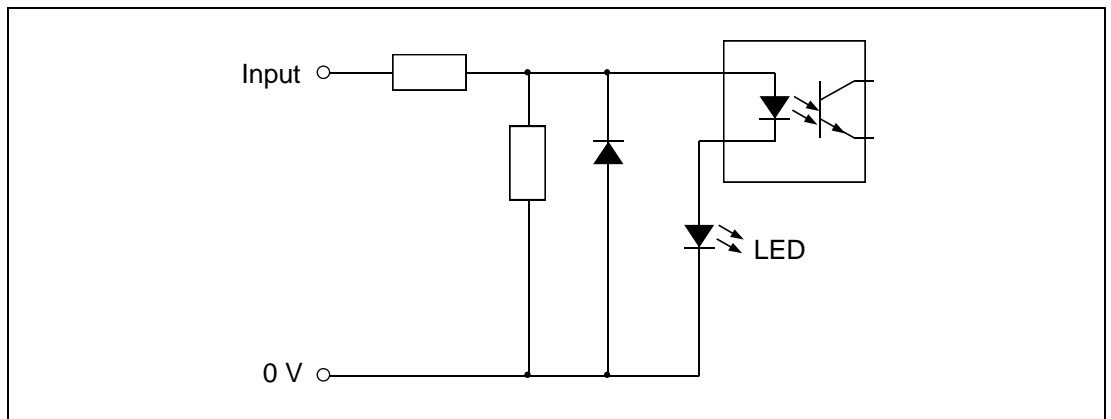


Fig. 8.14: Basic circuit DDC 701/-T/-TH

2.3.3 Terminal block assignment digital outputs

All the outputs are taken back to a common 0 V connection and a common power supply connection. The outputs are electrically isolated from the logic circuitry of the module.

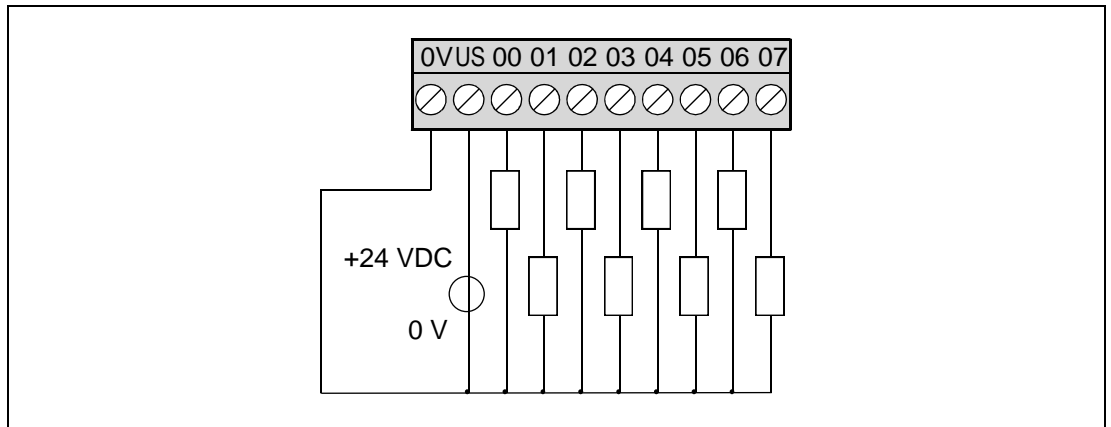


Fig. 8.15: Digital outputs 0...7

2.3.4 Basic circuit DDC 701/-T/-TH

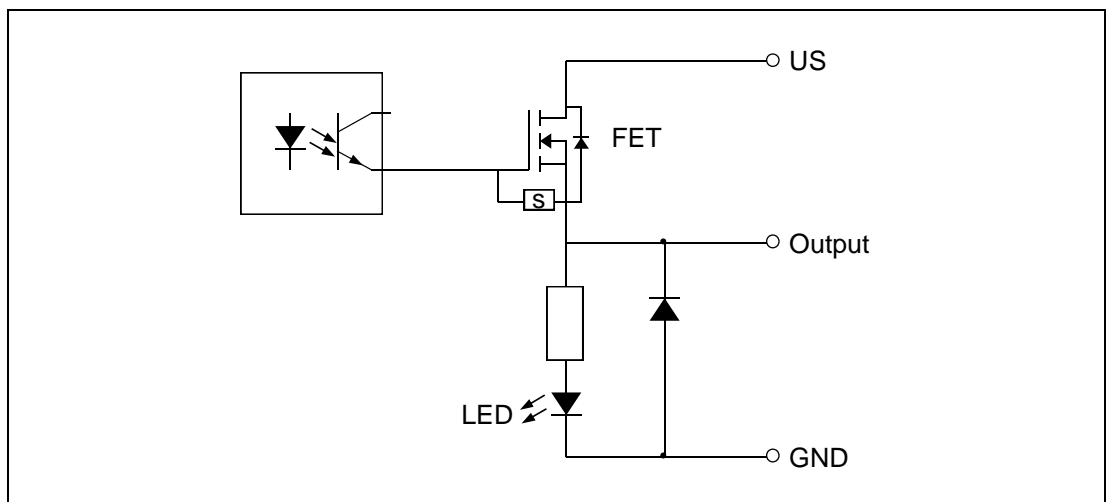


Fig. 8.16: Basic circuit DDC 701/-T/-TH

2.3.5 Technical data DDC 701

General data	DDC 701	DDC 701-T	DDC 701-TH
Bus-connection	CAN (ISO 1898)		
Supply voltage (UC)			
Nominal value	24 Vdc	24 Vdc	36 Vdc
Limits	18...30 Vdc	16.8...30 Vdc	25...45 Vdc
Power consumption max.	2.6 W	2.6 W	2.6 W
Ambient temperatures:			
operating	0...+55 °C	-25...+70 °C	-25...+70 °C
storage	0...+ 70 °C	-40...+ 85 °C	-40...+ 85 °C
Protection mode	IP 40	IP 40	IP 40
Dimensions (W x H x D) [mm]	155 x 85 x 58	155 x 85 x 58	155 x 85 x 58
Weight	360 g	360 g	360 g
Art. No	44120008	44120208	44120308

Digital inputs	DDC 701	DDC 701-T	DDC 701-TH
Digital inputs	8	8	8
Input type as per IEC 61131-2	Type 1	Type 1	Type 1
Display	Green LEDs, lights on at signal =1		
Power consumption logic typ.	100 mW	100 mW	100 mW
Input voltage	0...24 Vdc	0...24 Vdc	0...36 Vdc
Limits	-30...+30 Vdc	-30...+30 Vdc	-45...+45 Vdc
for signal = 0	< 5 Vdc	< 5 Vdc	< 7.5 Vdc
for signal = 1	> 14 Vdc	> 14 Vdc	> 19 Vdc
Input resistance typ.	3.9 kΩ	3.9 kΩ	6.8 kΩ
Input current at signal = 1 typ. ¹⁾	6 mA	6 mA	5.3 mA
Input delay time typ.	0.6 ms typ. (input filter)		
settable under software control	5.6 ms		
Electrical insulation			
Input ↔ logic	yes	yes	yes
Input ↔ input	no	no	no
Test voltage	560 Vac, 800 Vdc	560 Vac, 800 Vdc	560 Vac, 800 Vdc
Signal evaluation	static or dynamic (Edge detection)		
Effect at change of input polarity	no destruction, no high currents		
Sensor connecting cable	max. 100 m not screened		

Digital outputs	DDC 701	DDC 701-T	DDC 701-TH
Digital outputs	8	8	8
Type of output	FE-transistor, pulse connecting		
Output indicator	LED orange, lights on at signal = 1		
Supply voltage (US)			
Nominal value	24 Vdc	24 Vdc	36 Vdc
Limits	18...30 Vdc	16.8...30 Vdc	25...45 Vdc
Output voltage ¹⁾	≥ 23 Vdc	≥ 23 Vdc	≥ 35 Vdc
Electrical insulation ²⁾			
Output ↔ logic	yes	yes	yes
Output ↔ Output	no	no	no
Power consumption logic typ.	200 mW	200 mW	200 mW
Output current for signal = 1	0.5 A max.	0.5 A max.	0.5 A max.
Short-circuit current Is	5 A, switch off time 1.5 ms typ.		
Switch on time after cancel the short-circuit	≤ 5 s	≤ 5 s	≤ 5 s
Total loading	4 A	4 A	4 A
Min. switching current	100 µA	100 µA	100 µA
Inductive spike suppr.	Protection diode	Suppressor diode	Suppressor diode
Output delay time			
for signal 0 → 1	600 µs	600 µs	600 µs
for signal 1 → 0	800 µs	800 µs	800 µs
Switching rate			
Resistive load	100 Hz	100 Hz	100 Hz
Inductive load	2 Hz	2 Hz	2 Hz
Open circuit level			
Signal = 0	max. 2 Vdc	max. 2 Vdc	max. 2 Vdc
Signal = 1	18...30 Vdc	16.8...30 Vdc	25...45 Vdc
Short-circuit indicator	LED red	LED red	LED red
Output indicator	LED orange	LED orange	LED orange
Supply voltage indicator (US)	LED green	LED green	LED green
Effect at overload	Outputs are switched off		
Output behaviour if CAN communication is interrupted	Outputs keep the actual state or are set to 0 (depending on the application)		

¹⁾ at US = Nominal value

²⁾ Test voltages see appendix

Further technical data valid for all modules is given in the appendix under 'Test standards'.

2.4 Analog input module AIC 701

The AIC 701 nodal module has 4 differential analog inputs: 0 ...+10 V resp. 0 ...+20 mA. Analog modules cannot be extended.

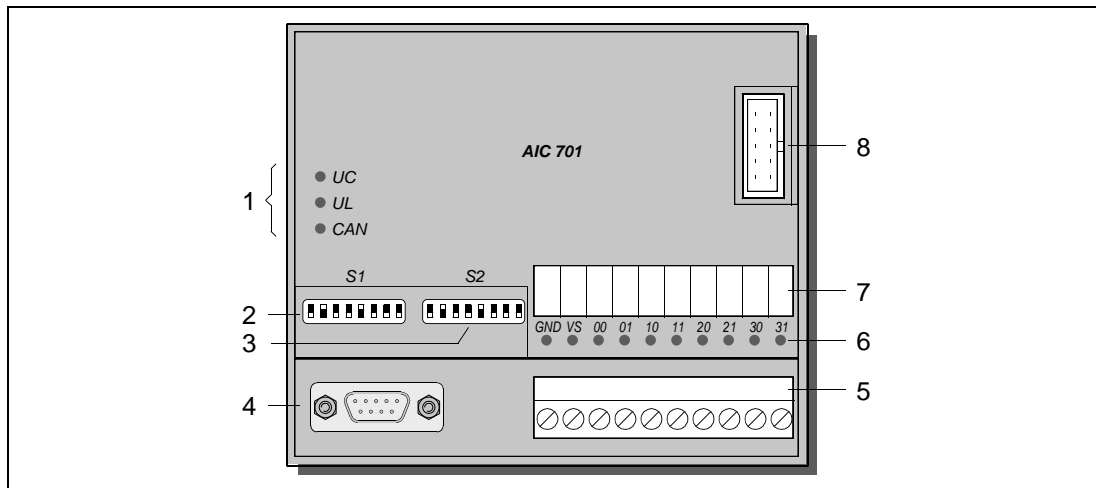


Fig. 8.17: Analog input module AIC 701

Legend:

	UC:	Supply voltage
1: LEDs	UL:	Logic supply
	CAN:	Communication status
2:	DIP switch S1 for CAN bus	
3:	DIP switch S2 for input configuration	
4:	Connection for CAN bus and supply voltage (UC)	
5:	Terminal strip for 4 analog inputs 0...10 V / 0...20 mA	
6:	LED indicators green for inputs	
7:	Labeling strips	
8:	Link connector for expansion module	

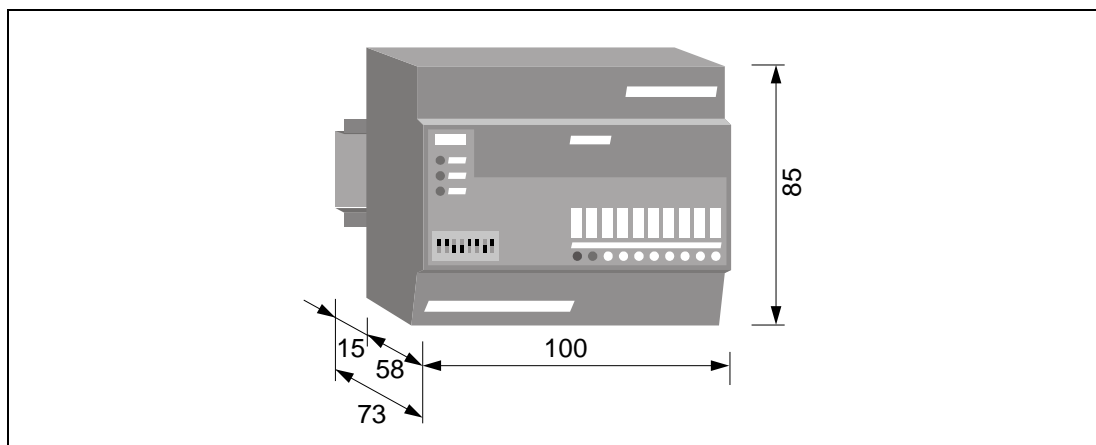


Fig. 8.18: Dimensions AIC 701

2.4.1 Terminal block assignment

The AIC 701 module is wired to a 10-pole terminal block.

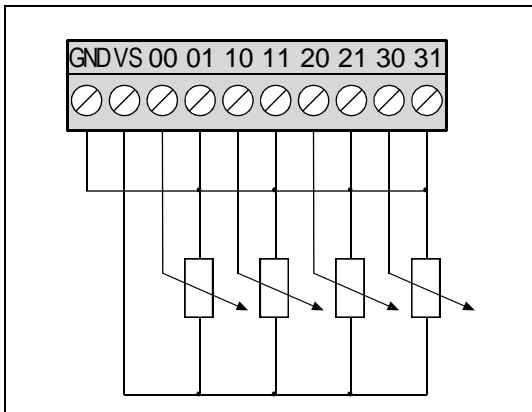


Fig. 8.19: Differential analog inputs 0...3

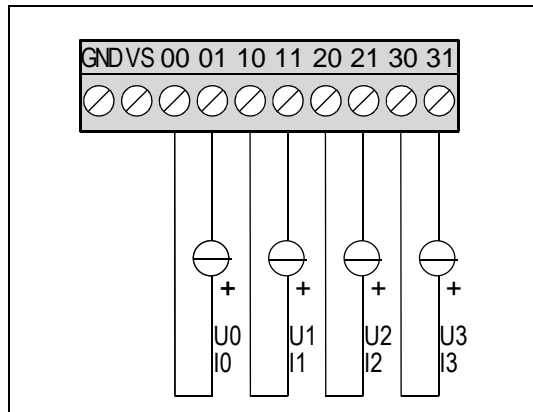


Fig. 8.20: Differential analog inputs 0...3

VS: Reference voltage source 10 Vdc

All differential analog inputs are electrically isolated from the module logic circuitry.

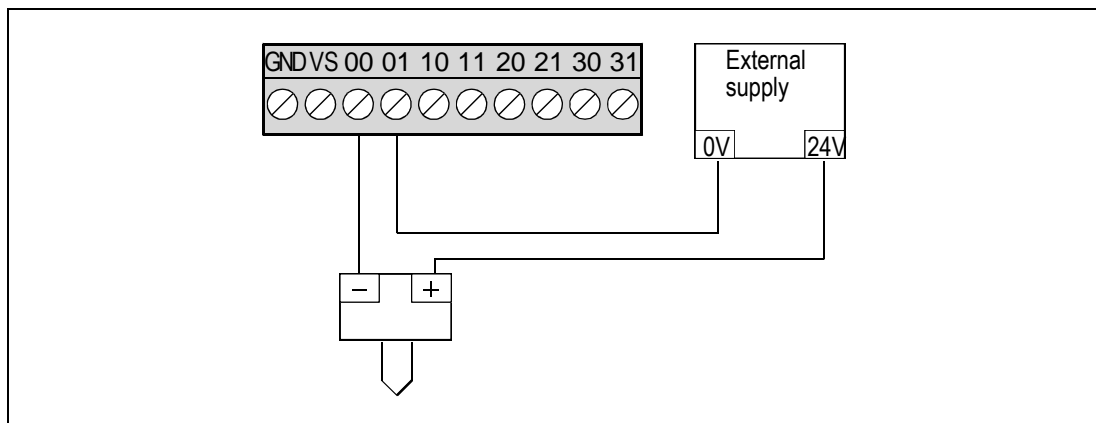


Fig. 8.21: Connection example for a 2-wire thermoelectric element

2.4.2 Basic circuit AIC 701

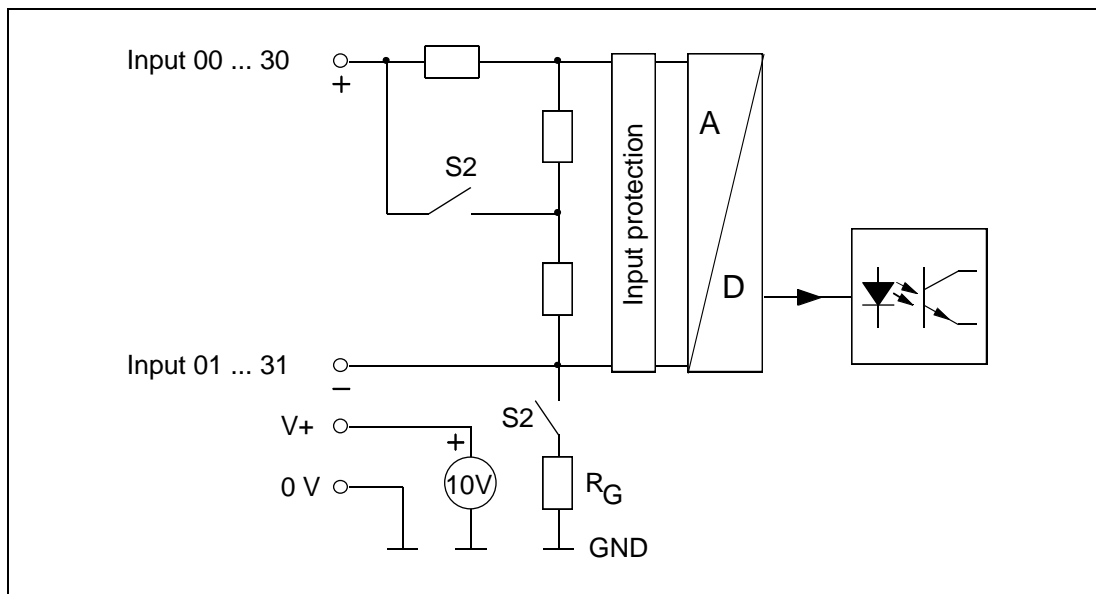


Fig. 8.22: Basic circuit AIC 701

2.4.3 Configuration of AIC 701 analog inputs

The AIC 701 analog inputs are configured with DIP switch S2.

DIP switch S2	Switch:	Function:
	1...4	Configuration of analog inputs 0...3
	5...8	Bleed resistance R_G connectable

Inputs and their parameters are set according to the following table:

Switch	Input	OFF	ON
1	U0 / I0	0...10 V	0...20 mA
2	U1 / I1	0...10 V	0...20 mA
3	U2 / I2	0...10 V	0...20 mA
4	U3 / I3	0...10 V	0...20 mA
5	U0 / I0	R_G off	R_G on
6	U1 / I1	R_G off	R_G on
7	U2 / I2	R_G off	R_G on
8	U3 / I3	R_G off	R_G on

R_G not connected (R_G off):

Differential measuring between input+ and input- without GND reference.

R_G connected (R_G on):

Differential measuring between input+ and input- with GND reference.

The setting R_G off makes only sense in applications as e.g. for signal generators connected in series.

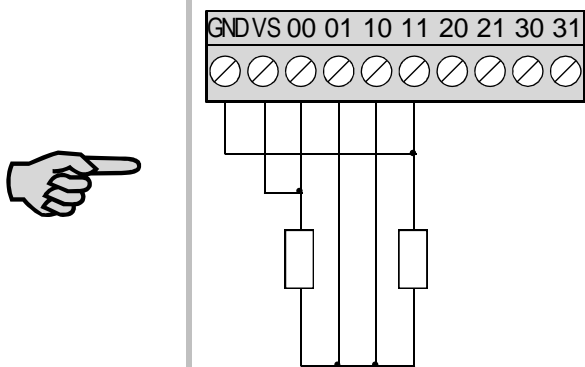


Fig. 8.23: R_G setting

2.4.4

Technical data, AIC 701

General data	AIC 701
Bus-connection	CAN (ISO 11898)
Supply voltage UC	
Nominal value	24 Vdc
Limits	18...30 Vdc
Power consumption max.	3.4 W
Ambient temperature	
Operating	0...+55 °C
Storage	-25...+70 °C
Non linearity over the whole range	0.025%
Protection mode	IP 40
Dimensions (W x H x D) [mm]	100 x 85 x 58
Weight	220 g
Art. No.	44120013

Analog inputs	AIC 701
Number of inputs (voltage/current)	4
Type of input	differential
Reference voltage source VS	10 Vdc
Output current I _S max.	10 mA
Signal ranges (switchable with S2)	0...10 V / 0...20 mA
Error message on range overflow	yes
Digital 50/60 Hz-filter selectable	yes
Input impedance	100 kΩ / 250 Ω
Presentation of the input signal	
Data format	Binary
Resolution	12 bit
Nominal range	4000 units
Value of the LSB bit	2.5 mV, 5 μA
Max. const. overload without destruction	±30 Vdc
Max. error at 25 °C and in the range 0...10 Vdc	±0.3 %
Max. error at 0...55 °C	±0.5 %
Parallel clock suppression (CMRR) / Range	U: > 60 dB / ±20 V
	I: > 60 dB / ±10 V
Linearization method	in the user program
Total conversion time	4 ms
Scanning time	1.7 ms
Input filter characteristic	1. class
Transition frequency f _T	35 Hz
Operation mode	Independent read in of the inputs
Conversion principle	successive approximation
Type of protective circuit	RC circuits and metal oxide varistors (MOV)
Crosstalk attenuation of the channels	> 60 dB
Electrical insulation ¹⁾	
Supply ↔ logic and CAN	yes
Input ↔ logic and CAN	yes
Input ↔ input	no

¹⁾ Test voltages see appendix

Further technical data valid for all modules is given in the appendix under 'Test standards'.

2.5 Analog input module AIC 702

The nodal module AIC 702 has 4 differential analog inputs Pt 100 resp. 0...500 mV. Analog modules cannot be extended.

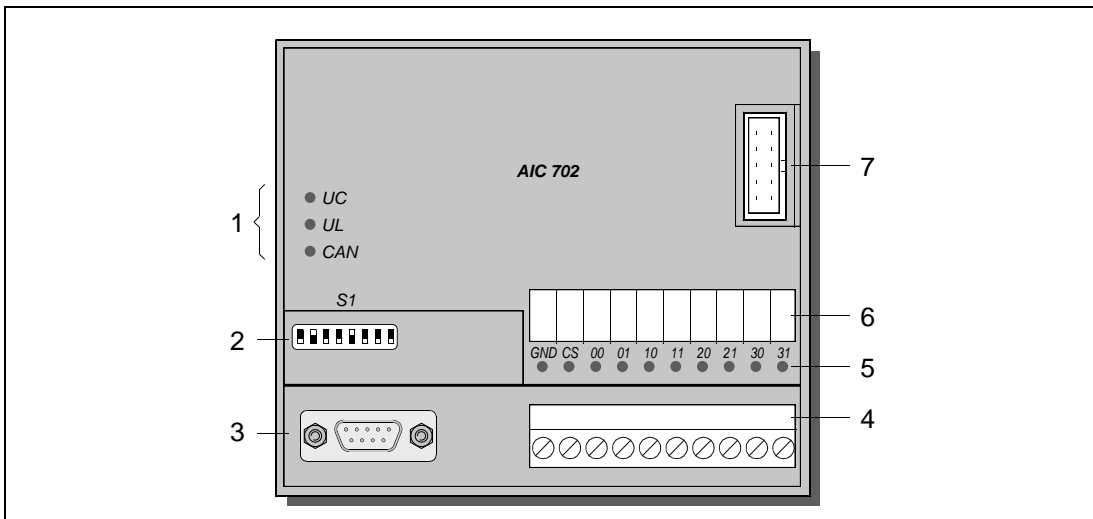


Fig. 8.24: Analog input module AIC 702

Legend:

		UC:	Supply voltage
1:	LEDs	UL:	Logic supply
		CAN:	Communication status
2:	DIP switch S1 for CAN bus		
3:	Connection for CAN bus and supply voltage (UC)		
4:	Terminal strip for 4 analog inputs Pt 100 / 0...500 mV		
5:	LED indicators green for inputs		
6:	Labeling strips		
7:	Link connector for expansion module		

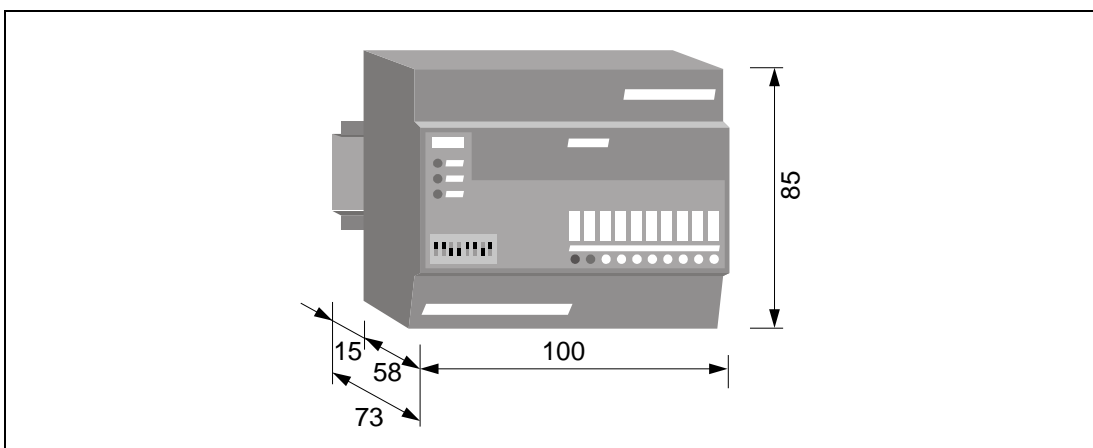


Fig. 8.25: Dimensions AIC 702

2.5.1 Terminal block assignment

The AIC 702 module is wired to a 10-pole terminal block.

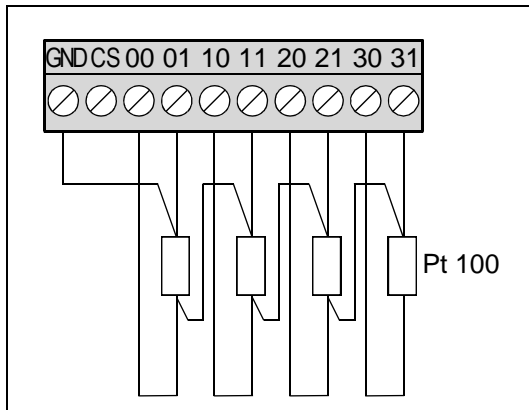


Fig. 8.26: 4-wire thermoelectric element Pt 100

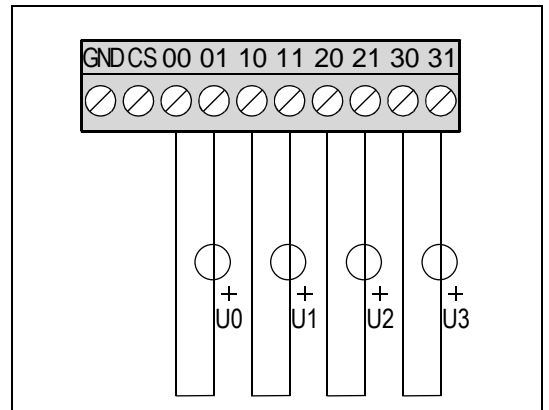


Fig. 8.27: Differential analog inputs 0...500 mA

CS: Current source

All differential analog inputs are electrically isolated from the module logic circuitry.

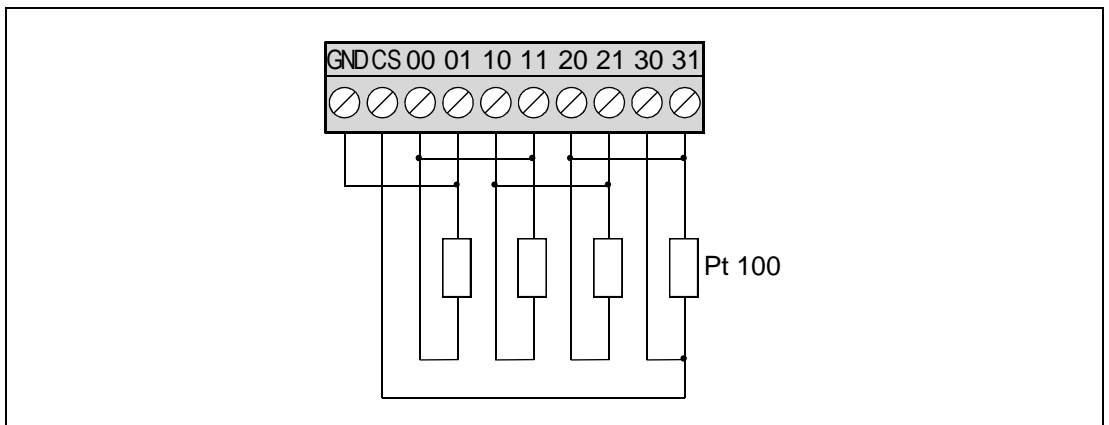


Fig. 8.28: Connection example for a 2-wire thermoelectric element

2.5.2 Basic circuit AIC 702

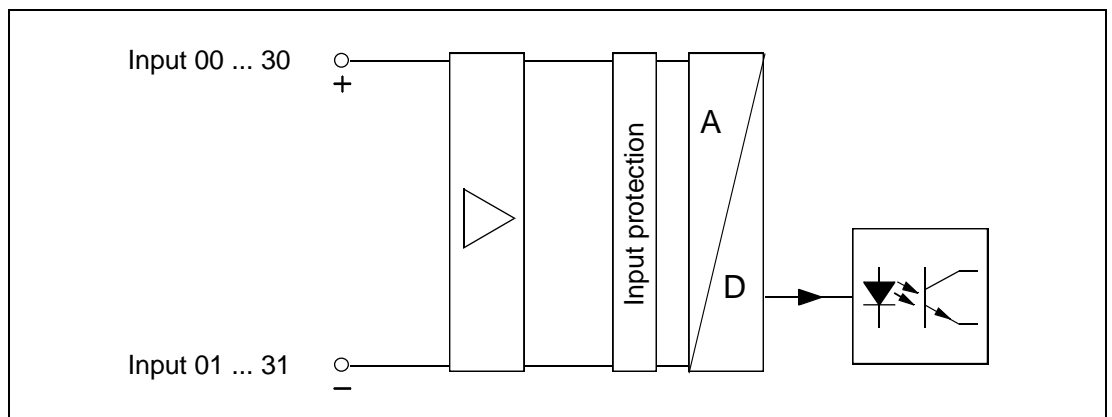


Fig. 8.29: Basic circuit AIC 702

2.5.3 Technical data, AIC 702

General data	AIC 702
Bus-connection	CAN (ISO 11898)
Supply voltage UC	
Nominal value	24 Vdc
Limits	18...30 Vdc
Power consumption max.	3.4 W
Ambient temperature	
Operating	0...+55 °C
Storage	-25...+70 °C
Non linearity over the whole range	0.025%
Protection mode	IP 40
Dimensions (W x H x D) [mm]	100 x 85 x 58
Weight	220 g
Art. No.	44120014

Analog inputs	AIC 702
Number of inputs (voltage/current)	4
Type of input	differential
Current source CS	2 mA
Output current I _{CS} max.	2 mA
Signal range	0...+500 mV
Error message on range overflow	yes
Digital 50/60 Hz-filter selectable	yes
Input impedance	1 MΩ
Presentation of the input signal	
Data format	Binary
Resolution	12 bit
Nominal range	4000 units
Value of the LSB bit	125 μV
Max. const. overload without destruction	±30 Vdc
Max. error at 25 °C and in the range 0...10 Vdc	±0.3 %
Max. error at 0...55 °C	±0.5 %
Parallel clock suppression (CMRR) / Range	> 60 dB / ± 10 V
Linearization method	in the user program
Total conversion time	4 ms
Scanning time	1.7 ms
Input filter characteristic	1. class
Transition frequency f _T	35 Hz
Operation mode	Independent read in of the inputs
Conversion principle	successive approximation

Analog inputs	AIC 702
Type of protective circuit	RC circuits and metal oxide varistors (MOV)
Crosstalk attenuation of the channels	> 60 dB
Electrical insulation ¹⁾	
Supply ↔ logic and CAN	yes
Input ↔ logic and CAN	yes
Input ↔ input	no

¹⁾ Test voltages see appendix

Further technical data valid for all modules is given in the appendix under 'Test standards'.

2.6 Analog output module AOC 701

The nodal module AOC 701 is provided with 4 analog outputs 0...10 V, ±10 V resp. 0...20 mA. The output voltage range is setup by means of software.

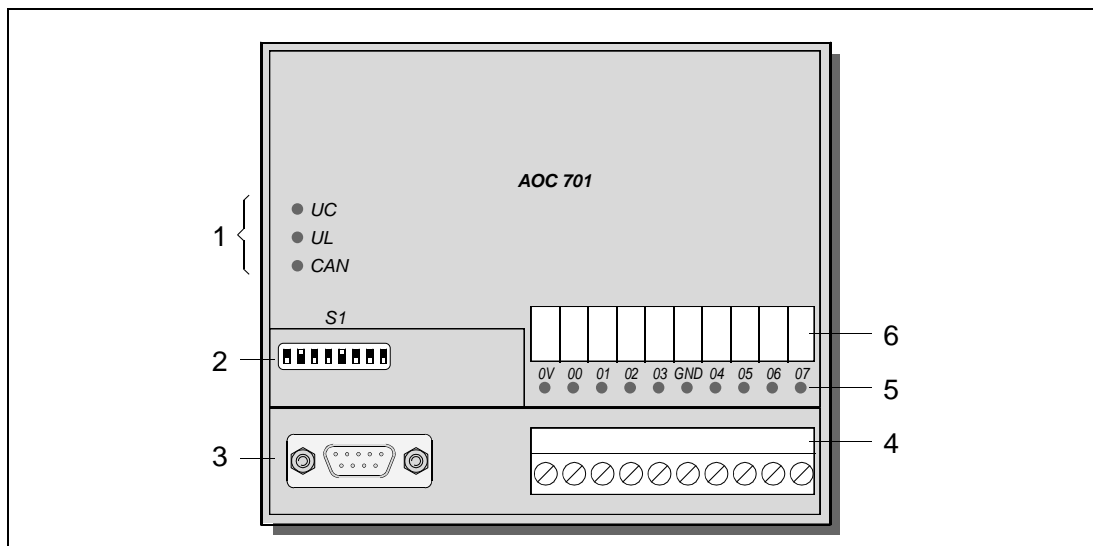


Fig. 8.30: Analog output module AOC 701

Legend:

	UC:	Supply voltage
1:	LEDs	UL: Logic supply
		CAN: Communication status
2:	DIP switch S1 for CAN bus	
3:	Connection for CAN bus and supply voltage (UC)	
4:	Terminal strip for 4 analog inputs 0...10V, ±10V / 0...20mA	
5:	LED indicators green for outputs	
6:	Labeling strips	

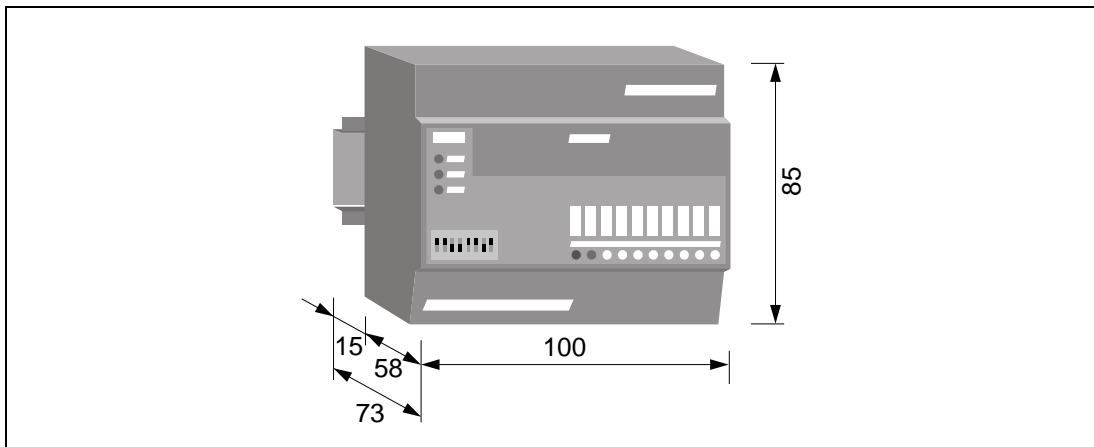


Fig. 8.31: Dimensions AOC 701

2.6.1 Terminal block assignment

The AOC 701 module is wired to a 10-pole terminal block.

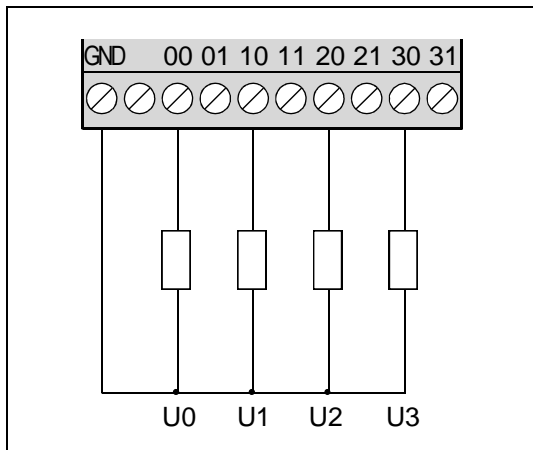


Fig. 8.32: Analog outputs 0...3

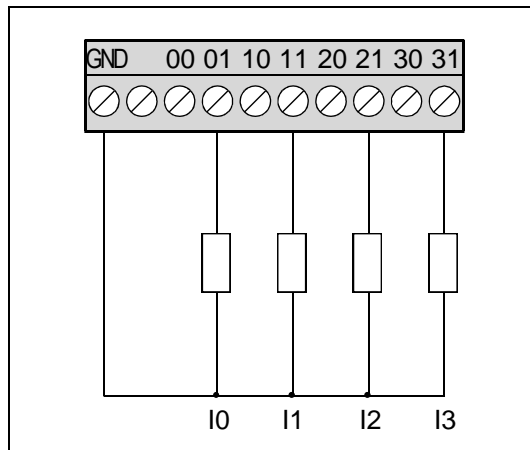


Fig. 8.33: Analog outputs 0...3

All outputs are referred back to a common ground (GND) and electrically isolated from the module logic circuitry. The following signals are available on each channel:

Channel	Signal	Range
U0...U3	Voltage	0...10 Vdc / ±10 Vdc
I0...I3	Current	0...20 mA

2.6.2 Basic circuit AOC 701

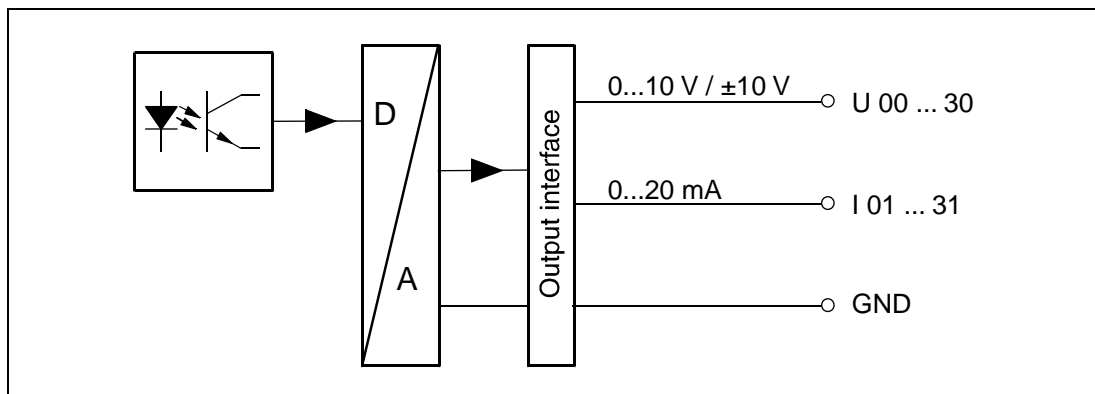


Fig. 8.34: Basic circuit AOC 701

2.6.3 Technical data, AOC 701

General data	AOC 701
Bus-connection	CAN (ISO 11898)
Supply voltage UC	
Nominal value	24 Vdc
Limits	18...30 Vdc
Power consumption max.	6.1 W
Ambient temperature	
Operating	0...+55 °C
Storage	-25...+70 °C
Protection mode	IP 40
Dimensions (W x H x D) [mm]	100 x 85 x 58
Weight	226 g
Art. No.	44120019

Analog outputs	AOC 701
Number of outputs	4
Signal ranges	
Voltage output	0...10 Vdc, ±10 Vdc
Current output	0...20 mA
Digital resolution	12 bit, signed
Value per increment	4.88 mV / 9.8 µA
Conversion time per channel typ.	100 µs
Conversion time total	2 ms
Overshoot	no
Output signal, increasing monotone	yes
Crosstalk attenuation of the channels	> 60 dB
Non linearity over the whole range	0.025%

Analog outputs	AOC 701
Ripple on the output signal	1 mV _{eff}
Load resistance	
Voltage output U	≥ 2 kΩ
Current output I	≤ 300 Ω
Max. cap. load for voltage output	1 mF
Max. ind. load for current output	1 mH
Short-circuit resistance, output U	Continuous short-circuit
Type of protective circuit	Metal oxide varistors (MOV)
Max. error at 25 °C and in the ranges	
0...10 Vdc	±0.3%
0...20 mA	±0.4%
Max. error at 0...55 °C	±0.5%
Electrical insulation ¹⁾	
Supply ↔ logic and CAN	yes
Input ↔ logic and CAN	yes
Output ↔ output	no

¹⁾ Test voltages see appendix

Further technical data valid for all modules is given in the appendix under 'Test standards'.



With the AOC 701, if more than 2 power outputs 0...20 mA are operated, this results in an overload of the linear voltage regulator (15 Vdc) and it switches off after a few minutes. The total load rating of the regulator is 40 mA.

With the AOC 71 nodal modules, the following variants are possible:

Variant	max. load at full power
2 current outputs 0...20 mA	40 mA
1 current output 0...20 mA and 3 voltage outputs ca. 5 mA	35 mA

3. Nodal modules with communication protocol CANopen

3.1 Digital input/output module DDC 71x/-T/-TH

- DDC 71x /-T: 8 digital inputs rated at 24 Vdc and 8 digital outputs 24 Vdc/0.5 A.
- DDC 71x-TH: 8 digital inputs rated at 36 Vdc and 8 digital outputs 36 Vdc/0.5 A.

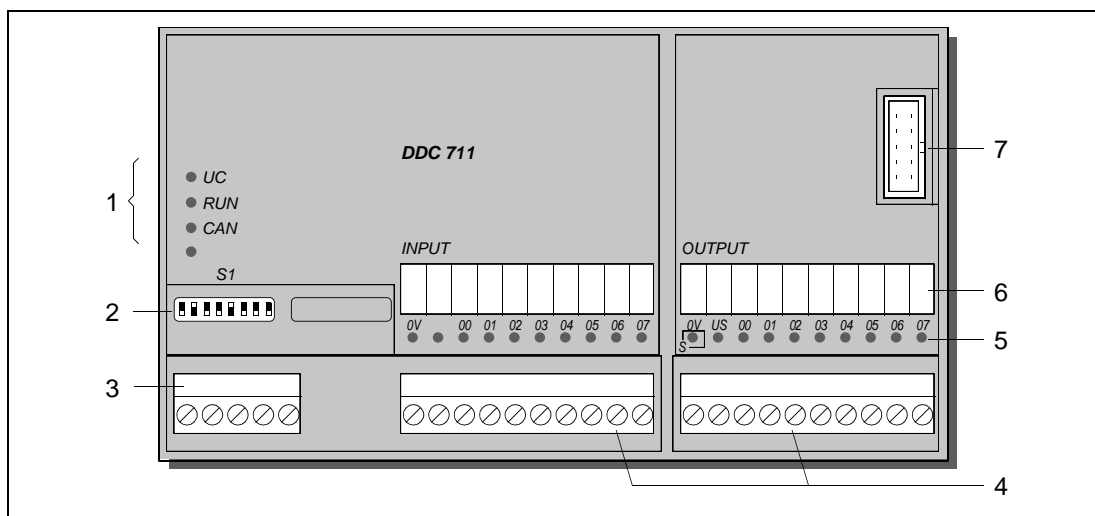


Fig. 8.35: Digital input/output module DDC 71x/-T/-TH

Legend:

	UC:	Supply voltage
1:	LEDs	RUN: Logic supply
		CAN: Communication status
2:	DIP switch S1 for CAN bus	
3:	Connection for CAN bus and supply voltage (UC)	
4:	Terminal strip	
5:	LED indicators	
6:	Labeling strips	
7:	Link connector for expansion module	

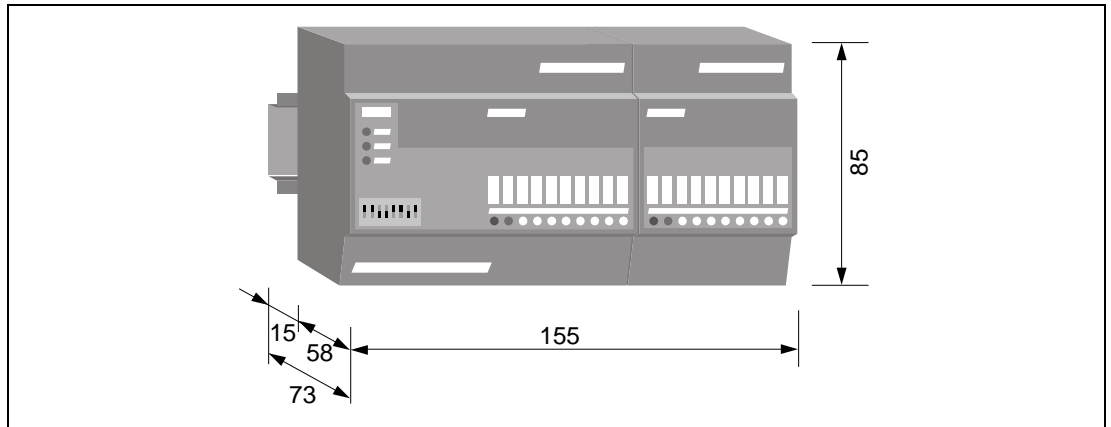


Fig. 8.36: Dimensions DDC 71x/-T/-TH

3.1.1 Terminal block assignment digital inputs

The DDC 711 module is wired to two 10-pole terminal block.

All the inputs are referred back to a common 0 V connection. The inputs are electrically isolated from the logic circuitry of the module.

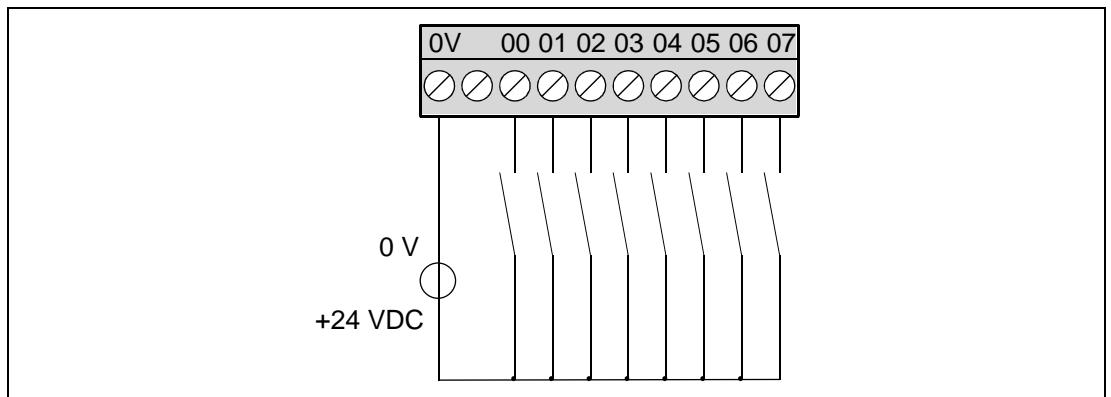


Fig. 8.37: Digital inputs 0...7

3.1.2 Basic circuit digital inputs DDC 71x/-T/-TH

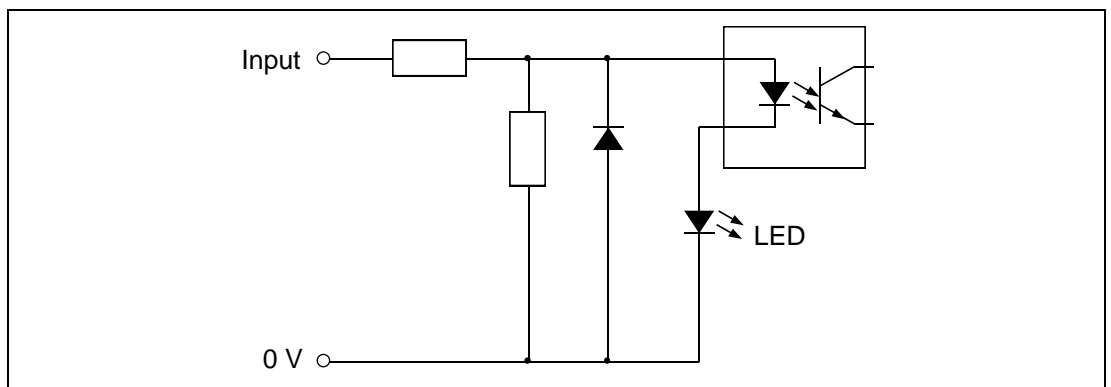


Fig. 8.38: Basic circuit digital inputs DDC 71x/-T/-TH

3.1.3 Terminal block assignment digital outputs

All the outputs are taken back to a common 0 V connection and a common power supply connection. The outputs are electrically isolated from the logic circuitry of the module.

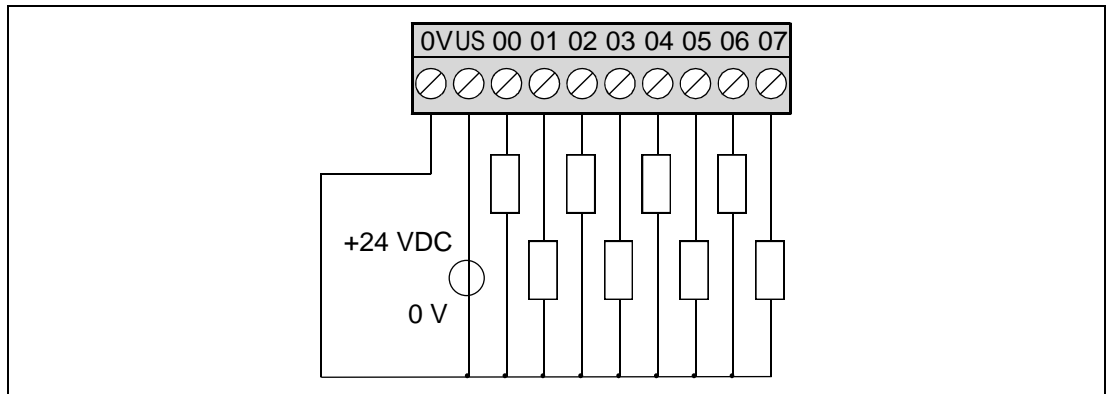


Fig. 8.39: Digital outputs 0...7

3.1.4 Basic circuit digital outputs DDC 71x/-T/-TH

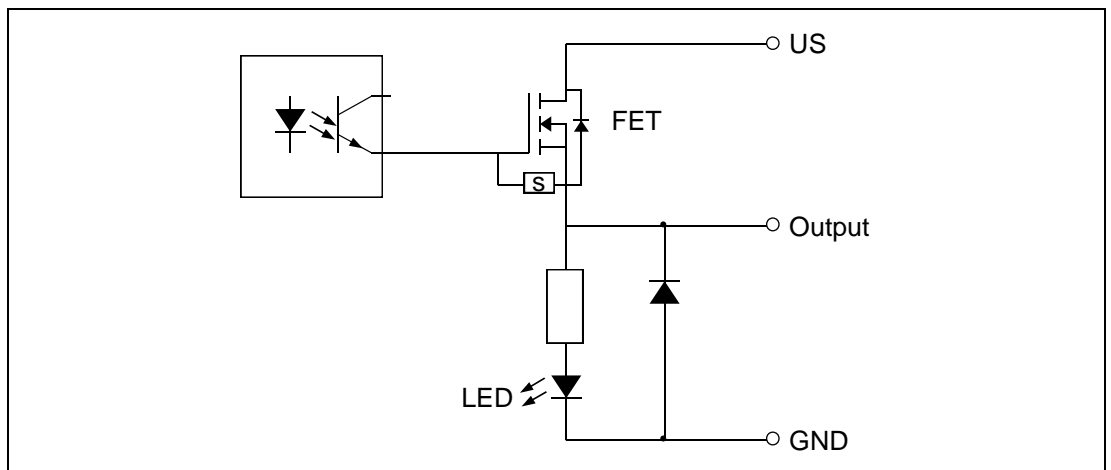


Fig. 8.40: Basic circuit digital outputs DDC 71x/-T/-TH

3.1.5 Technical data DDC 71x/-T/-TH

General data	DDC 71x	DDC 71x-T	DDC 71x-TH
Bus-connection	CAN (ISO 1898)	CAN (ISO 1898)	CAN (ISO 1898)
Communication Profile:			
DDC 711/-T/-TH	CiA-DS301 / V3	CiA-DS301 / V3	CiA-DS301 / V3
DDC 712/-T/-TH	CiA-DS301 / V4	CiA-DS301 / V4	CiA-DS301 / V4
Supply voltage (UC)			
Nominal value	24 Vdc	24 Vdc	36 Vdc
Limits	18...30 Vdc	16.8...30 Vdc	25...45 Vdc
Power consumption max.	2.6 W	2.6 W	2.6 W
Ambient temperatures:			
operating	0...+55 °C	-25...+70 °C	-25...+70 °C
storage	0...+ 70 °C	-40...+ 85 °C	-40...+ 85 °C
Protection mode	IP 40	IP 40	IP 40
Dimensions (W x H x D) [mm]	155 x 85 x 58	155 x 85 x 58	155 x 85 x 58
Weight	360 g	360 g	360 g
Art. No.			
DDC 711/-T/-TH	44120080	44120200	44120300
DDC 712/-T/-TH	44120084	44120210	44120310

Digital inputs	DDC 71x	DDC 71x-T	DDC 71x-TH
Digital inputs	8	8	8
Input type as per IEC 61131-2	Type 1	Type 1	Type 1
Display	Green LEDs, lights on at signal =1		
Power consumption logic typ.	100 mW	100 mW	100 mW
Input voltage	0...24 Vdc	0...24 Vdc	0...36 Vdc
Limits	-30...+30 Vdc	-30...+30 Vdc	-45...+45 Vdc
for signal = 0	< 5 Vdc	< 5 Vdc	< 7.5 Vdc
for signal = 1	> 14 Vdc	> 14 Vdc	> 19 Vdc
Input resistance typ.	3.9 kΩ	3.9 kΩ	6.8 kΩ
Input current at signal = 1 typ. ¹⁾	6 mA	6 mA	5.3 mA
Input delay time typ.	0.6 ms typ. (input filter)	0.6 ms typ. (input filter)	0.6 ms typ. (input filter)
settable under software control	5.6 ms	5.6 ms	5.6 ms
Electrical insulation			
Input ↔ logic	yes	yes	yes
Input ↔ input	no	no	no
Test voltage	560 Vac, 800 Vdc	560 Vac, 800 Vdc	560 Vac, 800 Vdc
Signal evaluation	static or dynamic (Edge detection)		
Effect at change of input polarity	no destruction, no high currents		
Sensor connecting cable	max. 100 m not screened		

Digital outputs	DDC 71x	DDC 71x-T	DDC 71x-TH
Digital outputs	8	8	8
Type of output	FE-transistor, pulse connecting		
Output indicator	LED orange, lights on at signal = 1		
Supply voltage (US)			
Nominal value	24 Vdc	24 Vdc	36 Vdc
Limits	18...30 Vdc	16.8...30 Vdc	25...45 Vdc
Output voltage ¹⁾	≥ 23 Vdc	≥ 23 Vdc	≥ 35 Vdc
Electrical insulation ²⁾			
Output ↔ logic	yes	yes	yes
Output ↔ Output	no	no	no
Power consumption logic typ.	200 mW	200 mW	200 mW
Output current for signal = 1	0.5 A max.	0.5 A max.	0.5 A max.
Short-circuit current I _s typ.	5 A, switch off time 1.5 ms typ.		
Switch on time after cancel the short-circuit	≤ 5 s	≤ 5 s	≤ 5 s
Total loading	4 A	4 A	4 A
Min. switching current	100 µA	100 µA	100 µA
Inductive spike suppr.	Protection diode	Suppressor diode	Suppressor diode
Output delay time			
for signal 0 → 1	600 µs	600 µs	600 µs
for signal 1 → 0	800 µs	800 µs	800 µs
Switching rate			
Resistive load	100 Hz	100 Hz	100 Hz
Inductive load	2 Hz	2 Hz	2 Hz
Open circuit level			
Signal = 0	max. 2 Vdc	max. 2 Vdc	max. 2 Vdc
Signal = 1	18...30 Vdc	16.8...30 Vdc	25...45 Vdc
Short-circuit indicator	LED red	LED red	LED red
Output indicator	LED orange	LED orange	LED orange
Supply voltage indicator (US)	LED green	LED green	LED green
Effect at overload	Outputs are switched off		
Output behaviour if CAN communication is interrupted	Outputs keep the actual state or are set to 0 (depending on the application)		

¹⁾ at US = Nominal value

²⁾ Test voltages see appendix

Further technical data valid for all modules is given in the appendix under 'Test standards'.

3.2 Analog input module AIC 711

The AIC 711 nodal module has 4 differential analog inputs: 0...+10 V resp. 0...+20 mA.

Analog modules cannot be extended.

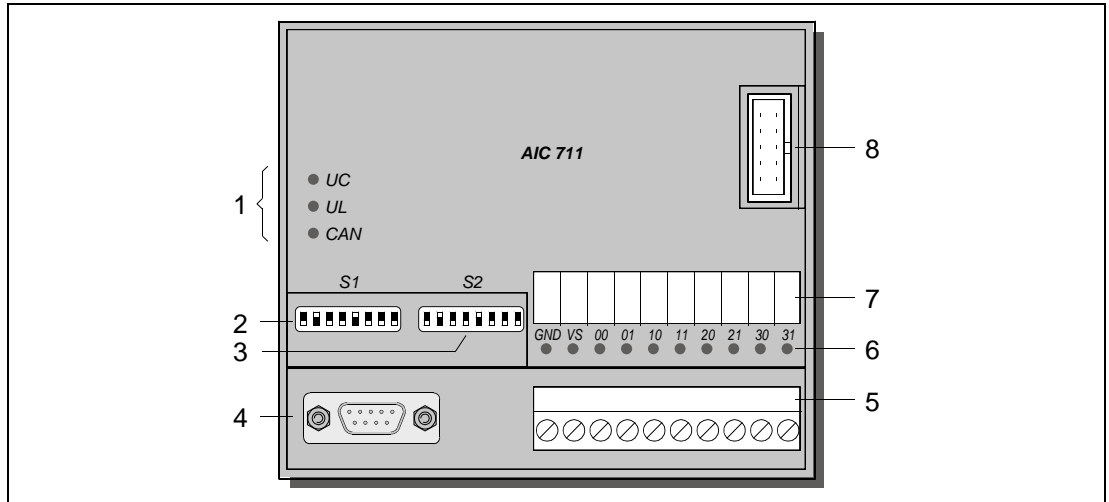


Fig. 8.41: Analog input module AIC 711

Legend:

	UC:	Supply voltage
1:	LEDs	UL: Logic supply
	CAN:	Communication status
2:	DIP switch S1 for CAN bus	
3:	DIP switch S2 for input configuration	
4:	Connection for CAN bus and supply voltage (UC)	
5:	Terminal strip for 4 analog inputs 0...10 V / 0...20 mA	
6:	LED indicators green for inputs	
7:	Labeling strips	
8:	Link connector for expansion module	

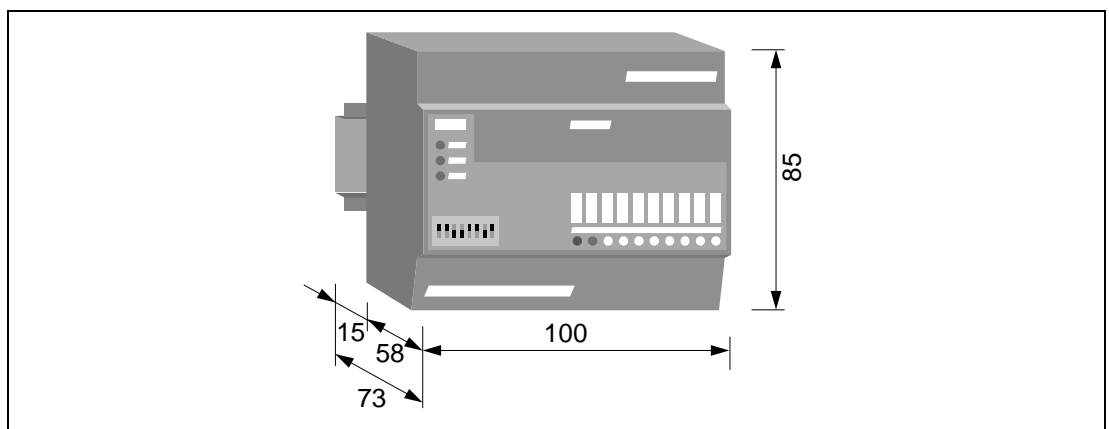


Fig. 8.42: Dimensions AIC 711

3.2.1 Terminal block assignment

The AIC 711 module is wired to a 10-pole terminal block.

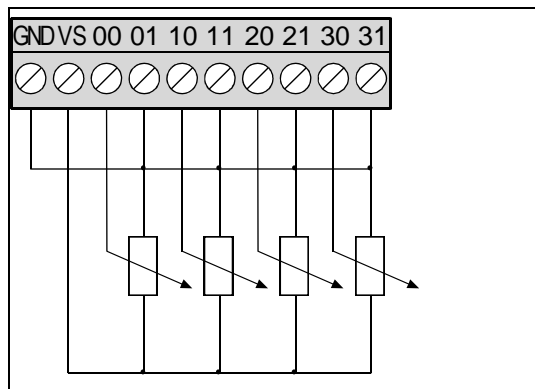


Fig. 8.43: Differential analog inputs 0...3

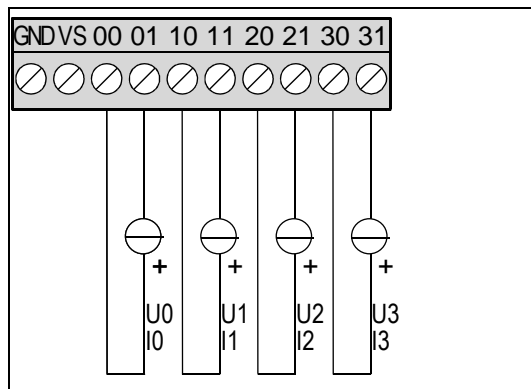


Fig. 8.44: Differential analog inputs 0...3

VS: Reference voltage source 10 Vdc

All differential analog inputs are electrically isolated from the module logic circuitry.

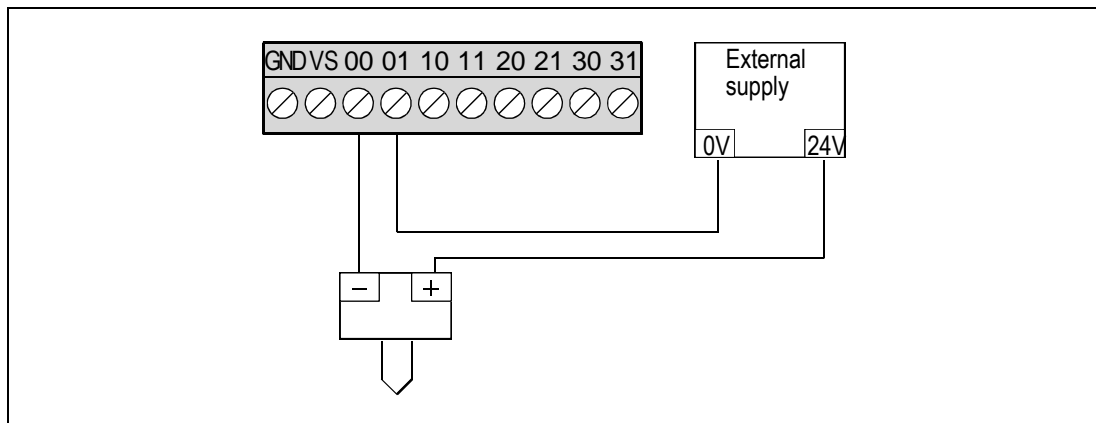


Fig. 8.45: Connection example for a 2-wire thermoelectric element

3.2.2 Basic circuit AIC 711

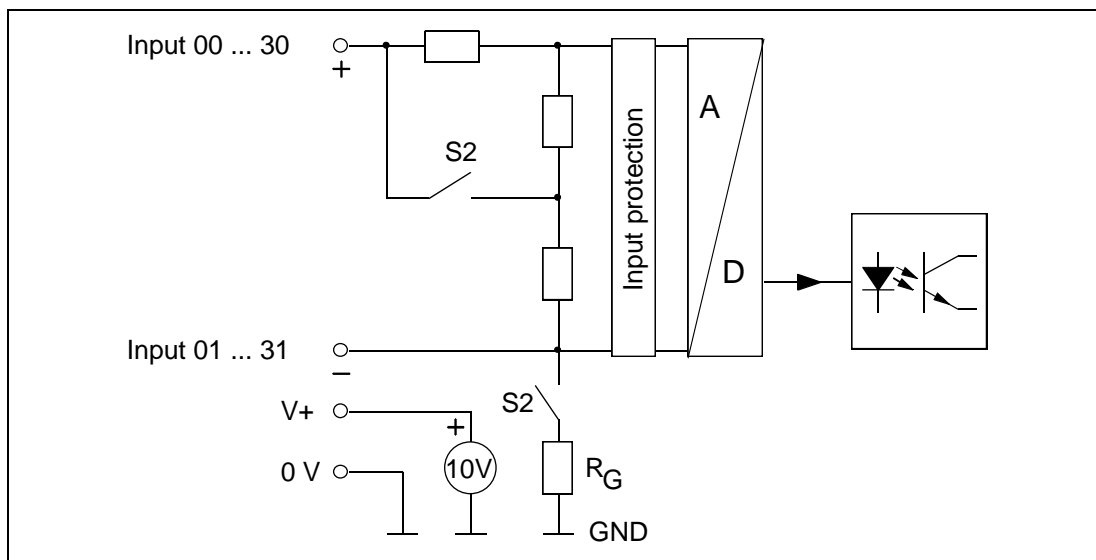



Fig. 8.46: Basic circuit AIC 711

3.2.3 Configuration of AIC 711 analog inputs

The AIC 711 analog inputs are configured with DIP switch S2.

DIP switch S2	Switch:	Function:
	1...4	Configuration of analog inputs 0...3
	5...8	Bleed resistance R_G connectable

Inputs and their parameters are set according to the following table:

Switch	Input	OFF	ON
1	U0 / I0	0...10 V	0...20 mA
2	U1 / I1	0...10 V	0...20 mA
3	U2 / I2	0...10 V	0...20 mA
4	U3 / I3	0...10 V	0...20 mA
5	U0 / I0	R_G off	R_G on
6	U1 / I1	R_G off	R_G on
7	U2 / I2	R_G off	R_G on
8	U3 / I3	R_G off	R_G on

R_G not connected (R_G off):

Differential measuring between input+ and input- without GND reference.

R_G connected (R_G on):

Differential measuring between input+ and input- with GND reference.

The setting R_G off makes only sense in applications as e.g. for signal generators connected in series.

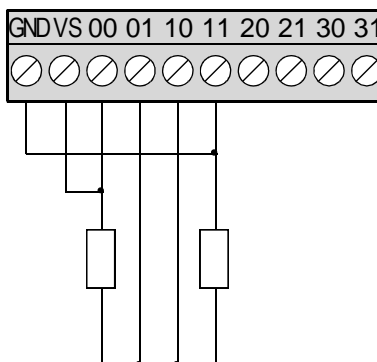


Fig. 8.47: R_G setting

3.2.4 Technical data, AIC 711

General data	AIC 711
Bus-connection	CAN (ISO 11898)
Communication Profile	CiA-DS301 / V3
Supply voltage UC	
Nominal value	24 Vdc
Limits	18...30 Vdc
Power consumption max.	3.4 W
Ambient temperature	
Operating	0...+55 °C
Storage	-25...+70 °C
Non linearity over the whole range	0.025%
Protection mode	IP 40
Dimensions (W x H x D) [mm]	100 x 85 x 58
Weight	220 g
Art. No.	44120015

Analog inputs	AIC 711
Number of inputs (voltage/current)	4
Type of input	differential
Reference voltage source VS	10 Vdc
Output current I _{VS} max.	10 mA
Signal ranges (switchable with S2)	0...10 V / 0...20 mA
Error message on range overflow	yes
Digital 50/60 Hz-filter selectable	yes
Input impedance	100 kΩ / 250 Ω
Presentation of the input signal	
Data format	Binary
Resolution	12 bit
Nominal range	4000 units
Value of the LSB bit	2.5 mV, 5 μA
Max. const. overload without destruction	±30 Vdc
Max. error at 25 °C and in the range	
0...10 Vdc	±0.3 %
0...20 mA	±0.3 %
Max. error at 0...55 °C	±0.5 %
Parallel clock suppression (CMRR) / Range	
U:	> 60 dB / ±20 V
I:	> 60 dB / ±10 V
Linearization method	in the user program
Total conversion time	4 ms
Scanning time	1.7 ms
Input filter characteristic	1. class
Transition frequency f _T	35 Hz
Operation mode	Independent read in of the inputs
Conversion principle	successive approximation
Type of protective circuit	RC circuits and metal oxide varistors (MOV)
Crosstalk attenuation of the channels	> 60 dB
Electrical insulation ¹⁾	
Supply ↔ logic and CAN	yes
Input ↔ logic and CAN	yes
Input ↔ input	no

¹⁾ Test voltages see appendix

Further technical data valid for all modules is given in the appendix under 'Test standards'.

3.3 Analog input module AIC 712

The nodal module AIC 712 has 4 differential analog inputs Pt 100 resp. 0...500 mV.

Analog modules cannot be extended.

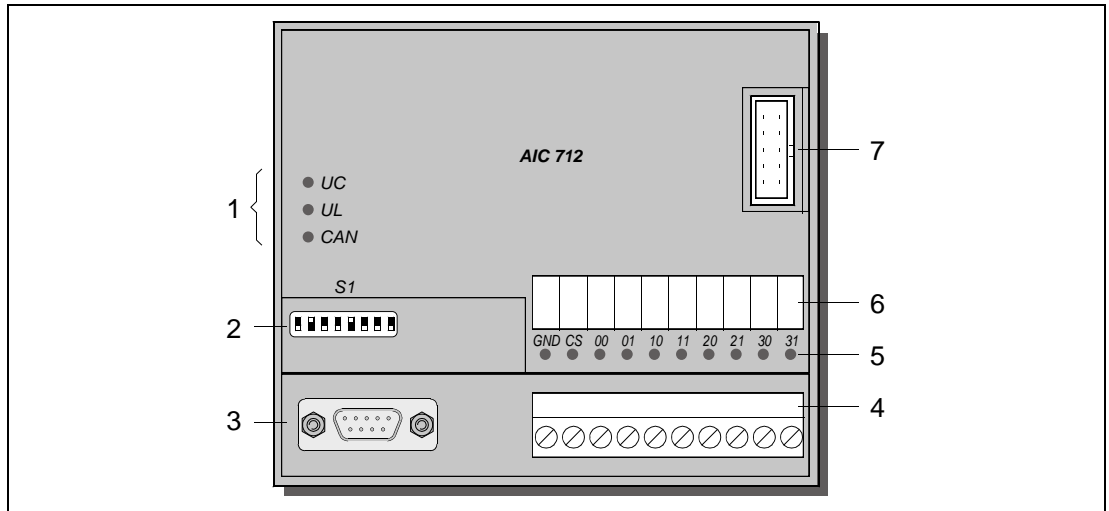


Fig. 8.48: Analog input module AIC 712

Legend:

	UC:	Supply voltage
1: LEDs	UL:	Logic supply
	CAN:	Communication status
2:	DIP switch S1 for CAN bus	
3:	Connection for CAN bus and supply voltage (UC)	
4:	Terminal strip for 4 analog inputs Pt 100 / 0...500 mV	
5:	LED indicators green for inputs	
6:	Labeling strips	
7:	Link connector for expansion module	

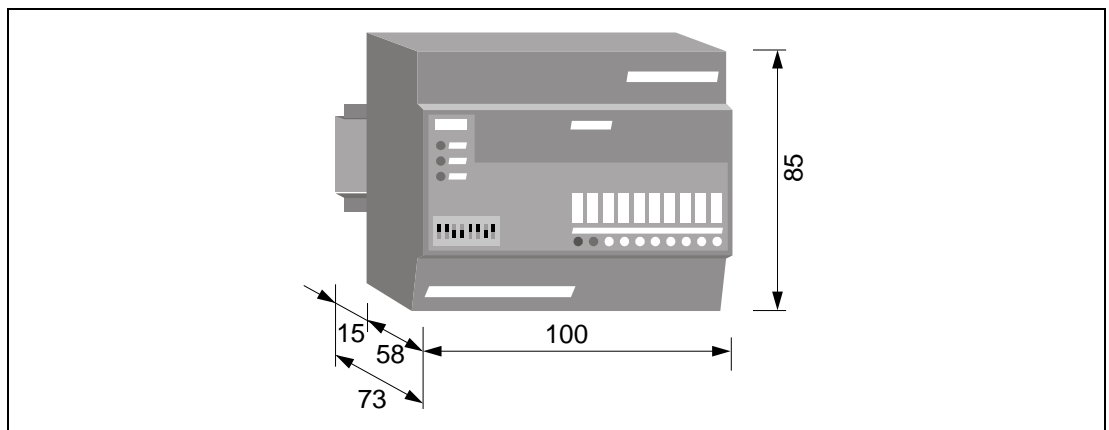


Fig. 8.49: Dimensions AIC 712

3.3.1 Terminal block assignment

The AIC 712 module is wired to a 10-pole terminal block.

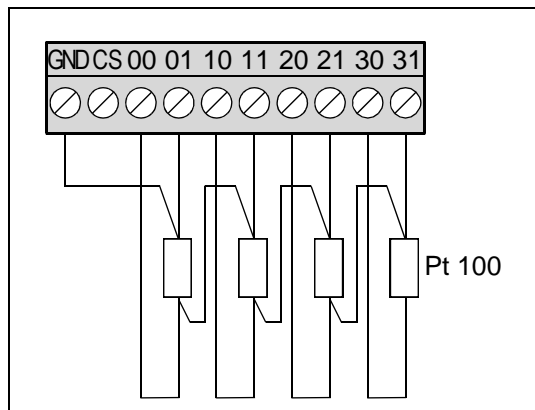


Fig. 8.50: 4-wire thermoelectric element Pt 100

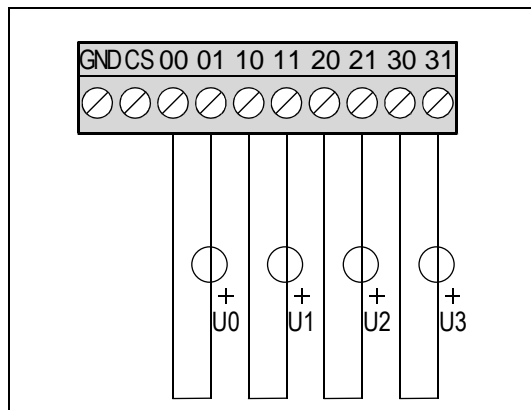


Fig. 8.51: Differential analog inputs 0...500 mA

CS: Current source

All differential analog inputs are electrically isolated from the module logic circuitry.

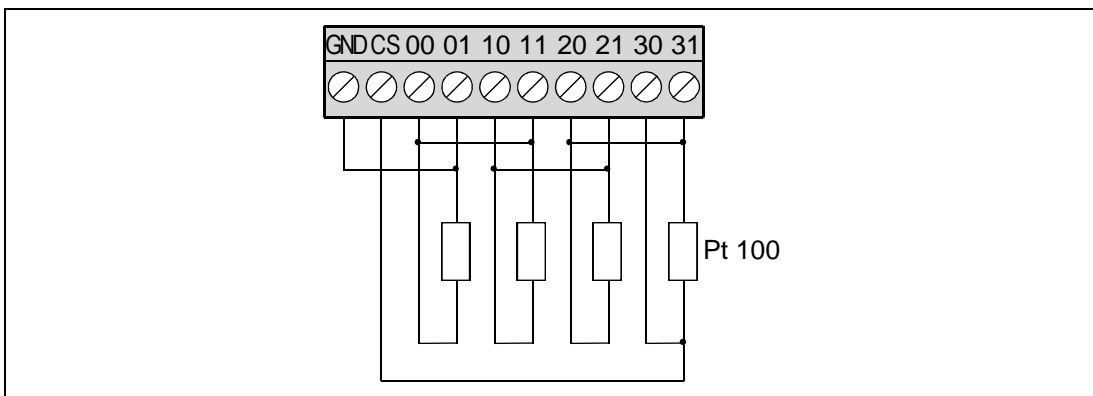


Fig. 8.52: Connection example for a 2-wire thermoelectric element

3.3.2 Basic circuit AIC 712

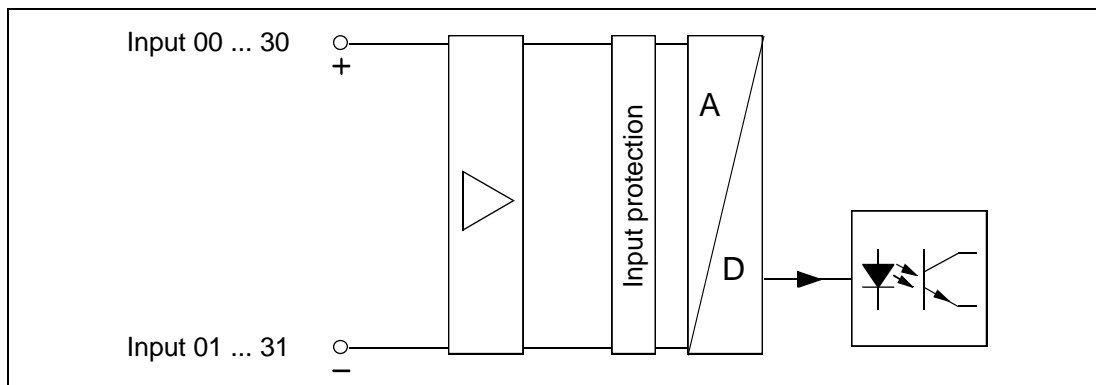


Fig. 8.53: Basic circuit AIC 712

3.3.3 Technical data, AIC 712

General data	AIC 712
Bus-connection	CAN (ISO 11898)
Communication Profile	CiA-DS301 / V3
Supply voltage UC	
Nominal value	24 Vdc
Limits	18...30 Vdc
Power consumption max.	3.4 W
Ambient temperature	
Operating	0...+55 °C
Storage	-25...+70 °C
Non linearity over the whole range	0.025%
Protection mode	IP 40
Dimensions (W x H x D) [mm]	100 x 85 x 58
Weight	220 g
Art. No.	44120017

Analog inputs	AIC 712
Number of inputs (voltage/current)	4
Type of input	differential
Current source CS	2 mA
Ausgangsstrom I_{CS} max.	2 mA
Signal range Pt 100	0...+500 mV (resolution 122 μ V) -273...+409 °C
Error message on range overflow	yes
Digital 50/60 Hz-filter selectable	yes
Input impedance	1 M Ω
Presentation of the input signal	
Data format	Binary
Resolution	12 bit
Nominal range	4000 units
Value of the LSB bit	125 μ V
Max. const. overload without destruction	\pm 30 Vdc
Max. error at 25 °C and in the range 0...500 mV	\pm 0.3 %
Max. error at 0...55 °C	\pm 0.5 %
Parallel clock suppression (CMRR) / Range	> 60 dB / \pm 10 V
Linearization method	in the user program
Total conversion time	4 ms
Scanning time	1.7 ms
Input filter characteristic	1. class
Transition frequency f_T	35 Hz
Operation mode	Independent read in of the inputs
Conversion principle	successive approximation

Analog inputs	AIC 712
Type of protective circuit	RC circuits and metal oxide varistors (MOV)
Crosstalk attenuation of the channels	> 60 dB
Electrical insulation ¹⁾	
Supply ↔ logic and CAN	yes
Input ↔ logic and CAN	yes
Input ↔ input	no

¹⁾ Test voltages see appendix

Further technical data valid for all modules is given in the appendix under 'Test standards'.

3.4 Analog output module AOC 711

The nodal module AOC 711 is provided with 4 analog outputs 0...10 V, ±10 V resp. 0...20 mA. The output voltage range is setup by means of software.

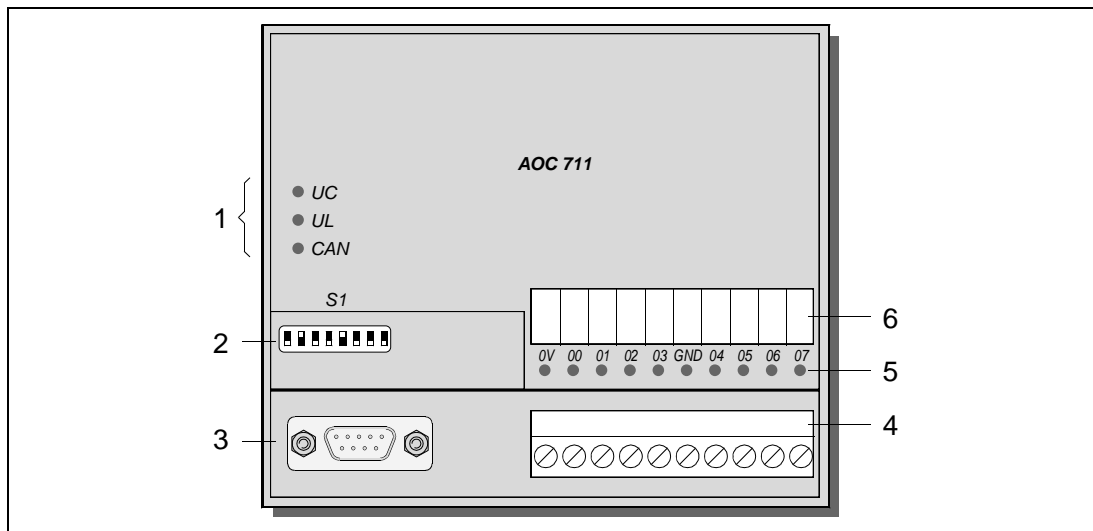


Fig. 8.54: Analog output module AOC 711

Legend:

	UC:	Supply voltage
1:	LEDs	UL: Logic supply
		CAN: Communication status
2:	DIP switch S1 for CAN bus	
3:	Connection for CAN bus and supply voltage (UC)	
4:	Terminal strip for 4 analog outputs 0...10V,±10V / 0...20mA	
5:	LED indicators green for outputs	
6:	Labeling strips	

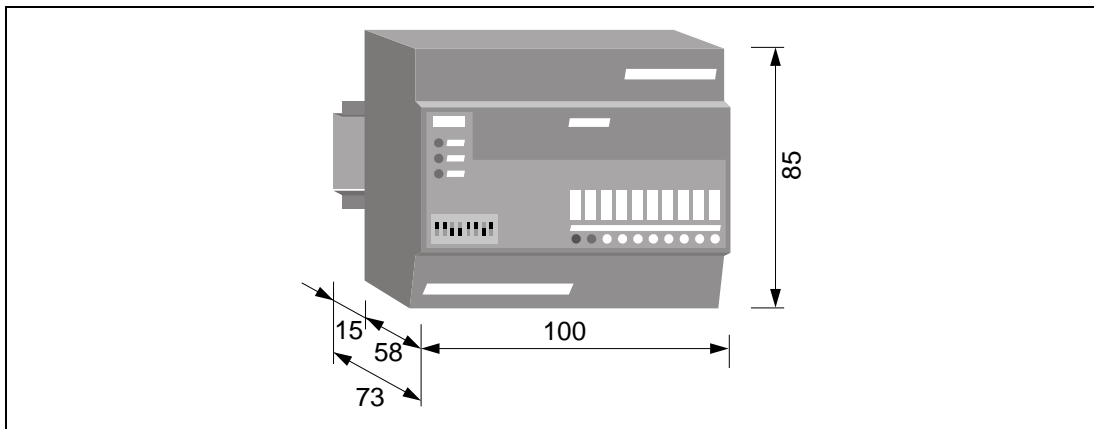


Fig. 8.55: Dimensions AOC 711

3.4.1 Terminal block assignment

The AOC 711 module is wired to a 10-pole terminal block.

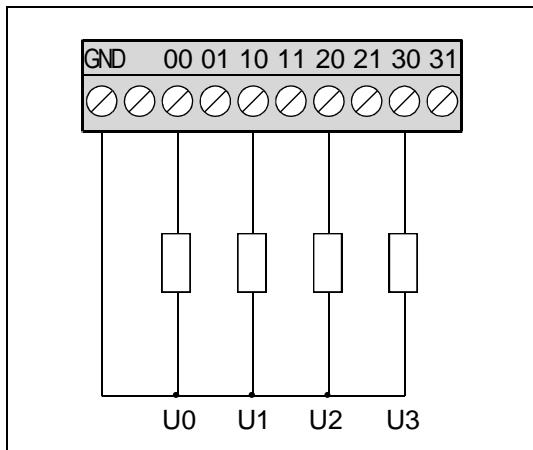


Fig. 8.56: Voltage outputs 0...3

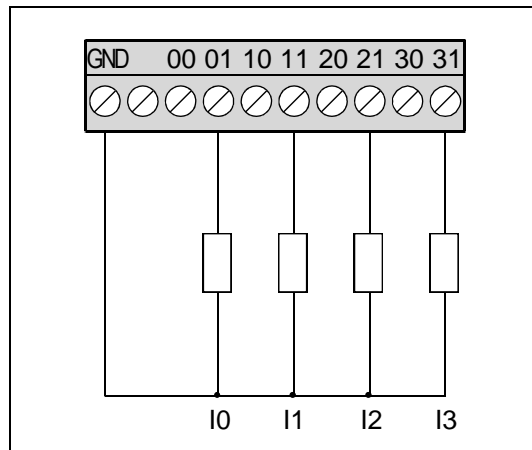


Fig. 8.57: Current outputs 0...3

All outputs are referred back to a common ground (GND) and electrically isolated from the module logic circuitry. The following signals are available on each channel:

Channel	Signal	Range
U0...U3	Voltage	0...10 Vdc / -10...+10 Vdc
I0...I3	Current	0...20 mA

3.4.2 Basic circuit AOC 711

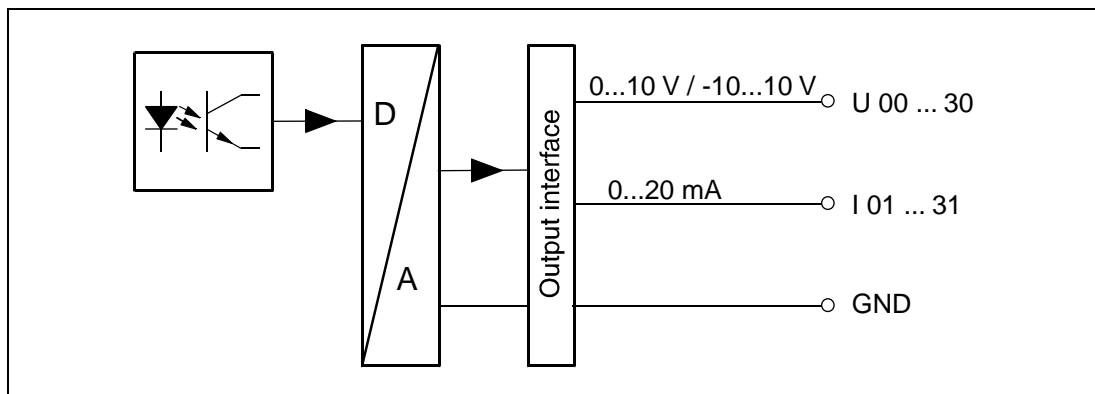


Fig. 8.58: Basic circuit AOC 711

3.4.3 Technical data, AOC 711

General data	AOC 711
Bus-connection	CAN (ISO 11898)
Communication Profile	CiA-DS301 / V3
Supply voltage UC	
Nominal value	24 Vdc
Limits	18...30 Vdc
Power consumption max.	6.1 W
Ambient temperature	
Operating	0...+55 °C
Storage	-25...+70 °C
Protection mode	IP 40
Dimensions (W x H x D) [mm]	100 x 85 x 58
Weight	226 g
Art. No.	44120020

Analog outputs	AOC 711
Number of outputs	4
Signal ranges	
Voltage output	0...10 Vdc, ±10 Vdc
Current output	0...20 mA
Digital resolution	12 bit, signed
Value per increment	4.88 mV / 9.8 µA
Conversion time per channel typ.	100 µs
Conversion time total	2 ms
Overshoot	no
Output signal, increasing monotone	yes
Crosstalk attenuation of the channels	> 60 dB
Non linearity over the whole range	0.025%

Analog outputs	AOC 711
Ripple on the output signal	1 mV _{eff}
Load resistance	
Voltage output U	≥ 2 kΩ
Current output I	≤ 300 Ω
Max. cap. load for voltage output	1 mF
Max. ind. load for current output	1 mH
Short-circuit resistance, output U	Continuous short-circuit
Type of protective circuit	Metal oxide varistors (MOV)
Max. error at 25 °C and in the ranges	
0...10 Vdc	±0.3%
0...20 mA	±0.4%
Max. error at 0...55 °C	±0.5%
Electrical insulation ¹⁾	
Supply ↔ logic and CAN	yes
Input ↔ logic and CAN	yes
Output ↔ output	no

¹⁾ Test voltages see appendix

Further technical data valid for all modules is given in the appendix under 'Test standards'.



With the AOC 701, if more than 2 power outputs 0...20 mA are operated, this results in an overload of the linear voltage regulator (15 Vdc) and it switches off after a few minutes. The total load rating of the regulator is 40 mA.

With the AOC 711 nodal modules, the following variants are possible:

Variant	max. load at full power
2 current outputs 0...20 mA	40 mA
1 current output 0...20 mA and 3 voltage outputs ca. 5 mA	35 mA

4. Module configuration for the CAN bus

The DIP-switch S1, mounted on the front of the nodal module, enables the interface to the CAN-bus to be configured. Not only the CAN node address for the module but also the transmission rate is set up using this DIP-switch.



The switch positions will be read only at start-up.

DIP switch S1	Switch	Function
ON	1...5 and 8	CAN address
	6 and 7	Bitrate CAN bus
	8	Commutation address group 1 and 2



See the "CAN bus connection" section in the "Installation and commissioning" chapter for the settings.

5. Functions of the LEDs

5.1 UC LED

The UC LED serves to monitor the UC power supply:

LED status	Meaning
Off	Supply voltage UC < Powerfail threshold
Green on	Supply voltage UC ok

5.2 UL LED

The UL LED serves to display the logic voltage and the status of the Selecan nodal modules:

LED status	Meaning
Green blinking	Logic voltage present, module in Standby mode: nodal modules not actuated by host.
Green on	Logic voltage present and host communicating with nodal modules.

5.3 RUN LED

The RUN LED serves to display the logic voltage and the status of the CANopen nodal modules:

LED status	Meaning
Green blinking	Logic voltage present, module in Standby mode: nodal modules not actuated by host. (Preoperational status)
Green on	Logic voltage present and host communicating with nodal modules. (Operational status)

5.4 CAN LED

The CAN LED serves to display the status of CAN communication:

LED status	Meaning
Off	The CAN controller is in 'Bus Off' state off. No CAN communication possible.
Green on	CAN / CAN 1 no fault, normal operating status
Green blinking	Data transmission seriously disrupted. The warning limit has been reached. CAN communication is possible with restrictions.

5.5 S LED

The S LED displays a short-circuit at the digital outputs.

LED status	Meaning
Off	No short-circuit.
Red on	Short-circuit detected at a digital output. All outputs of the module affected are switched off.