Modicon TSX Compact (A120)
Modular Programmable Controller
Components for Railway Train Applications

User Manual

802 BHB 009 00 Date 05/96 22

Translation of the German Description
802 BHB 009 02 (A91M.12-700 019.22)

Notes

Application Note

Caution The relevant regulations must be observed for control applications involving safety requirements.
For reasons of safety and to ensure compliance with documented system data, repairs to components should be performed only by the manufacturer.

Training
AEG Schneider Automation offers suitable training that provides further information concerning the system (see addresses).

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The addresses are given at the end of this publication.

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Terminology

Note This symbol emphasizes very important facts.

Caution This symbol refers to frequently appearing error sources.

Warning This symbol points to sources of danger that may cause financial and health damages or may have other aggravating consequences.

Expert This symbol is used when a more detailed information is given, which is intended exclusively for experts (special training required). Skipping this information does not interfere with understanding the publication and does not restrict standard application of the product.

Path This symbol identifies the use of paths in software menus.

Figures are given in the spelling corresponding to international practice and approved by SI (Système International d‘ Unités).
I.e. a space between the thousands and the usage of a decimal point (e.g.: 12 345.67).

Objectives

This manual is a supplement to the user manual for Compact TSX (A120). It describes the components developed specifically for the railway train applications of the A120 and which have the following alterations in comparison to the standard modules:

❒ Temperature range	continuous operation:	–25 ... +70 °C
	operation </= 10 min.:	–30 ... +85 °C
❒ Supply	24 VDC, +/–5 %	
❒ Schock, Vibration	according to LES–DB	
❒ LEDs	green replaced by yellow	

Related Documents

Catalogue
Programmable Controller A120
Product Family Modicon
A91V.05-234 836

General Manual
A120
DIN–Rail Mount Controller
(Basic Document)
User Manual
A91M.12-271 629

Software
Dolog AKF → A120 (AKF12)
Software-Kit
E-Nr. 424 271 521

and

A120, Dolog AKF
Standard Function Blocks
Block Library
A91M.12-703 265

or

Dolog AKF → A120 / A250
(AKF125)
Software-Kit
E-Nr. 424 275 182

and

A120, Dolog AKF
Standard Function Blocks
Block Library
A91M.12-703 265

Table of Contents

Appendix A
Module Descriptions

The module descriptions are arranged alphabetically according to their abbreviations.

ADU 214
Analog Inputs
Module Description

The analog/digital converter of the **ADU 214** module works according to the principle of integrated conversion procedure (dual slope) with fast back-integration. It is used for measuring analog data providing up to 8 non-isolated inputs. The main characteristics are:

- four analog inputs, 4-pole (temperature or resistance)
  Alternatively these inputs can be used for 2-pole voltage measurement. Thus it is possible to choose between up to 8 unipolar voltage inputs or up to 4 bipolar voltage inputs. (or combinations of both)

- several measuring ranges with a resolution of 15 bit + arithm. sign:

▫ Voltage measurement	0 ... 0.5, 0 ... 1, 0 ... 5, 0 ... 10 V, 0.1 ... 0.5, 0.2 ... 1, 1 ... 5, 2 ... 10 V, $\pm$0.5, $\pm$1, $\pm$5, $\pm$10 V
▫ current measurement with externalprecision resistance	0 ... 5, 0 ... 10, 0 ... 20 mA, 1 ... 5, 2 ... 10, 4 ... 20 mA, $\pm$5, $\pm$10, $\pm$20 mA
▫ Temperature measurement	−160/-60 ... +160 °C, resolution $\leq$0.02 °C −200 ... +320 °C, resolution $\leq$0.04 °C −200 ... +640 °C, resolution $\leq$0.08 °C
▫ Resistance measurement	0 ... 100, 0 ... 200, 0 ... 500 Ω, 0 ... 1000, 0 ... 2000 Ω

- Broken wire testing of all 4-pole lines. Self calibration using built-in reference resistances andreference voltages. Characteristic curve linearizing for platinum and nickel reference resistances according to IEC 751 / DIN 43 760 (Pt 100 ...1000, Ni 100 ...1000).

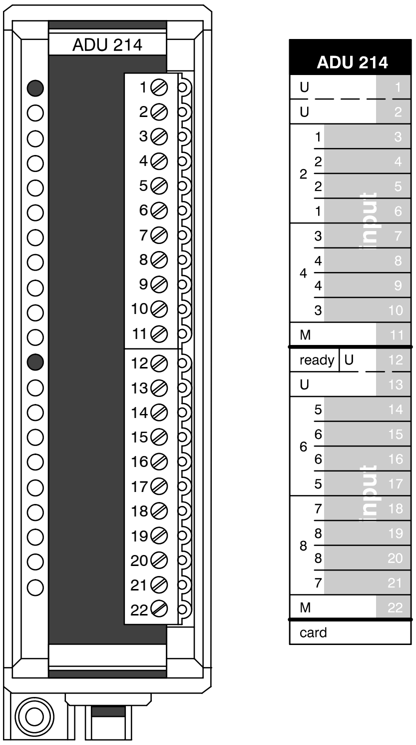


Figure 1 Front view and fill-in-label of ADU 214 module

1 General Characteristics

Measuring ranges for voltage, current, temperature and resistancecan be set individually for each input via control bytes from the CPU of the controller.

Noise suppression can be switched from 50 Hz to 60 Hz.

Analog inputs are scanned cyclically. The PLC accesses the most recently filed values asynchronically.

The ADU can be inserted into any slot of subracks DTA 200, 201, 202.

SW-Modules
The ADU can be used without S/W-Modules.
If the additional scaling-modules SKAL and DSKAL are used word-based operations can directly process the measured values.
The module GRENZ provides boundary value control for the upper and lower boundaries (of words).

1.1 Physical Characteristics

The module resides in a standard housing. It provides a backplane bus system and peripheral connections on the front. Screw/plug-in terminal blocks support process signal connection.

One of the included fill-in-labels can be inserted into the cover of the housing next to the LED display area. The label has fields which have been prepared for filling in field data specifications like signalnames.

1.2 Mode of Functioning

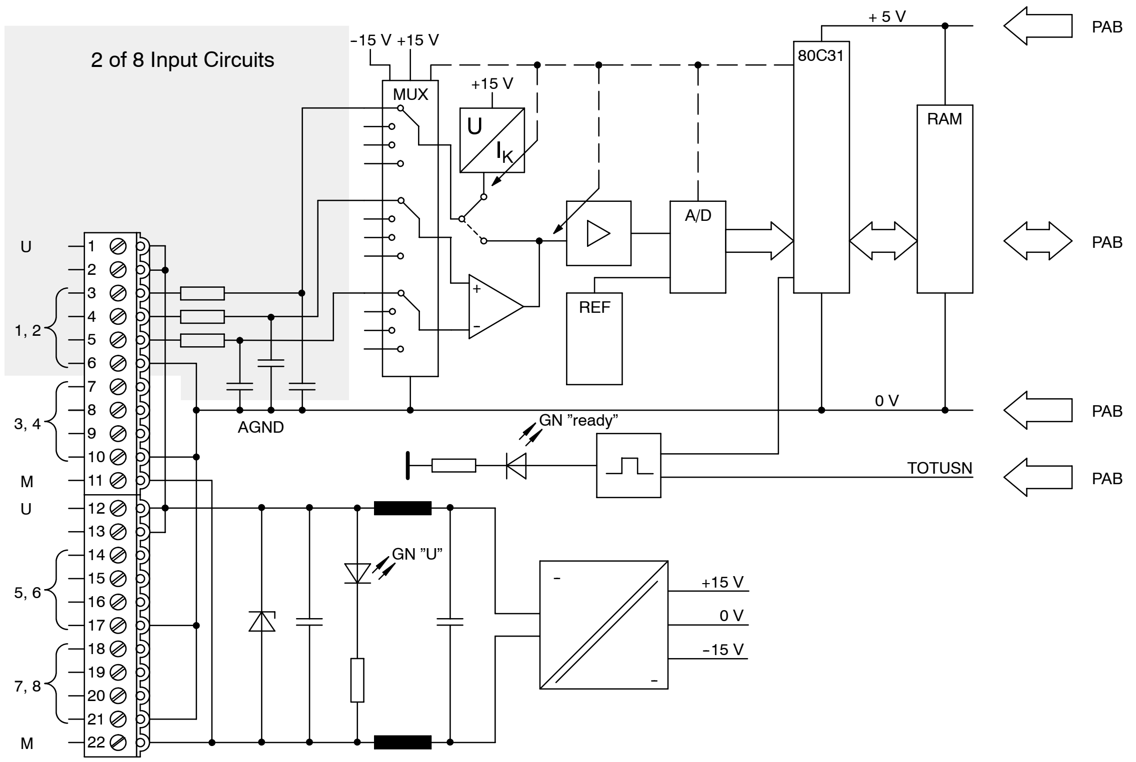


Figure 2 Schematic circuit diagram of ADU 214

2 Elements for Operation and Display

The front side of the ADU contains the following status displays:

- 1 green LED ”U” indicating 24 V power status
  on: power supply available
  off : power failure

- 1 green LED ”ready” indicating processor status
  on: processor running
  off : processor failure

At initial startup a DIP-switch has to be set. For details see page 11.

3 Configuration

For selecting your configuration consider the following points:

- Number of I/O drop (see user manual, chapter 3 ”Equipment list...”).
  The module does not contain any hardware for setting the node number

- Measuring range selection and error analysis (see 3.1)

- Noise suppression (see 3.2)

- Fritting procedure of the connections 3.3)

- Cable connections (cable rooting, shielding, see 3.4)

- Assignment of connections and signal addresses (see 3.5)

- Representation of peripheral signal connections (DIN A3 forms, see 3.6)

3.1 Measuring range selection and error analysis

3.1.1 Measuring range selection

Measuring either current or voltage input depends on the type of connector used (i.e. with or without measuring resistance). The appropriate measuring range is selected individuallyfor each input via AKF-software in operand QBx.1 ... QBx.8[1)]. The selected value can be changed at random during operation.

Default positions for QBx.1 ...QBx.8 are set to ”0”, i.e. allinputs are inactive.

In addition to the default values the following individual settings can be selected:

1) x = node number

Table 1 QBx.1 ... QBx.8 [2] Possible binary settings for voltage and current measuring ranges

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
0	0	0	0	0	0	0	0	inactive channel
0	0	*	*	*	0	0	1	10 V
					0	1	0	5 V
					0	1	1	1 V / 20 mA [3] / 10 mA [4]
					1	0	0	0.5 V / 10 mA [3] / 5 mA [4]
0	0	*	*	0	*	*	*	0 ... 100 % value representation
		0	*	1	*	*	*	20 ... 100 % value representation (with Offset = LIVE-ZERO)
0	0	0	0	*	*	*	*	negative values are limited to 0
			1	*	*	*	*	negative values are outputted up to error message −1.6 %
0	0	0	*	*	*	*	*	up to 8 unipolar inputs
		1	0	0	*	*	*	up to 4 bipolar inputs

Table 2 Possible binary settings for QBx.1 ... QBx.8 [2] for temperature and resistance measuring ranges

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
0	1	0	*	*	*	0	0	temperature with Ni up to +160 ºC
						0	1	temperature with Pt up to +160 ºC
						1	0	temperature with Pt up to +320 ºC
						1	1	temperature with Pt up to +640 ºC
0	1	0	*	0	0	*	*	detector 100 Ohm
				0	1			detector 200 Ohm
				1	0			detector 500 Ohm
				1	1			detector 1000 Ohm
								resistance measuring ranges
0	1	1	*	0	0	0	0	0 ... 100 Ohm
					0	0	1	0 ... 200 Ohm
					0	1	0	0 ... 500 Ohm
					0	1	1	0 ... 1000 Ohm
					1	0	0	0 ... 2000 Ohm
0	1	*	0	*	*	*	*	4-wire detector
			1	*	*	*	*	2-wire detector with 10 Ohm wire extension

2) x = node number
3) with measuring resistance 50 Ω
4) with measuring resistance 100 Ω

Table 3 Possible decimal or hexadecimal settings for QBx.1 ... QBx.8 [5] for voltage and current measuring ranges.

Content of QBx.1...QBx.8 [5] DEZ	HEX	measuring rangefor IWx.1 ... IWx.8	parameters
0	0	input is inactive (no conversion)	
2-pole unipolar measuring ranges			
1	1	0 ... 10 V	+ limit
2	2	0 ... 5 V	+ limit
3	3	0 ...1 V / 0 ... 20 mA [6] / 0 ...10 mA [7]	+ limit
4	4	0 ... 0.5 V / 0 ...10 mA [6] / 0 ... 5 mA [7]	+ limit
5	5	- (invalid measuring range)	
:	:		
8	8	-	
9	9	2 ... 10 V	+ limit
10	A	1 ... 5 V	+ limit
11	B	0.2 ... 1 V / 4 ... 20 mA [6] / 2 ...10 mA [7]	+ limit
12	C	0.1 ... 0.5 V / 2 ...10 mA [6] / 1 ... 5 mA [7]	+ limit
13	D	-	
:			
16	10	-	
17	11	0 ... 10 V	$\pm$ limit
18	12	0 ... 5 V	$\pm$ limit
19	13	0 ... 1 V / 0 ... 20 mA [6] / 0 ...10 mA [7]	$\pm$ limit
20	14	0 ... 0.5 V / 0 ...10 mA [6] / 0 ... 5 mA [7]	$\pm$ limit
21	15	-	
:			
24	18	-	
25	19	2 ... 10 V	$\pm$ limit
26	1A	1 ... 5 V	$\pm$ limit
27	1B	0.2 ...1 V / 4 ... 20 mA [6] / 2 ...10 mA [7]	$\pm$ limit
28	1C	0.1 ... 0.5 V / 2 ...10 mA [6] / 1 ... 5 mA [7]	$\pm$ limit
29	1D	-	
:			
32	20	-	
2-pole bipolar measuring ranges (related inputs must be set to same measuring range)			
33	21	$\pm$10 V	(+ limit of single input)
34	22	$\pm$5 V	(+ limit of single input)
35	23	$\pm$1 V / $\pm$20 mA [6] / $\pm$10 mA [7]	(+ limit of single input)
36	24	$\pm$0.5 V / $\pm$10 mA [6] / $\pm$5 mA [7]	(+ limit of single input)
37	25	-	
:			
63	3F	-	

5) x = node number
6) with measuring resistance 50 Ω
7) with measuring resistance 100 Ω

Table 4 Possible decimal or hexadecimal QBx.1 ... QBx.8 [8] settings for temperature and resistance measuring ranges

content of QBx.1...QBx.8 [8] DEZ	HEX	measuring rangefor IWx.1 ... IWx.8	parameters
4-pole measuring ranges, temperature detector with 4-pole wire connection [9]			
64	40	-60 ... +160 °C with Ni 100	I_K = 2.5 mA
65	41	-160 ... +160 °C with Pt 100	I_K = 2.5 mA
66	42	-200 ... +320 °C with Pt 100	I_k = 2.5 mA
67	43	-200 ... +640 °C with Pt 100	I_k = 2.5 mA
68	44	-60 ... +160 °C with Ni 200	I_k = 2.5 mA
69	45	-169 ... +160 °C with Pt 200	I_k = 2.5 mA
70	46	-200 ... +320 °C with Pt 200	I_k = 2.5 mA
71	47	-200 ... +640 °C with Pt 200	I_k = 2.5 mA
72	48	-60 ... +160 °C with Ni 500	I_k = 2.5 mA
73	49	-160 ... +160 °C with Pt 500	I_k = 2.5 mA
74	4A	-200 ... +320 °C with Pt 500	I_k = 2.5 mA
75	4B	-200 ... +640 °C with Pt 500	I_k = 1.5 mA
76	4C	-60 ... +160 °C with Ni 1000	I_k = 1.5 mA
77	4D	-160 ... +160 °C with Pt 1000	I_k = 1.5 mA
78	4E	-200 ... +320 °C with Pt 1000	I_k = 1.5 mA
79	4F	-200 ... +640 °C with Pt 1000	I_k = 1.5 mA
4-pole measuring ranges, temperature detector with 2-pole wire compensation(10 Ohm) [9]			
80	50	-60 ... +160 °C with Ni 100	I_K = 2.5 mA
81	51	-160 ... +160 °C with Pt 100	I_K = 2.5 mA
82	52	-200 ... +320 °C with Pt 100	I_K = 2.5 mA
83	53	-200 ... +640 °C with Pt 100	I_K = 2.5 mA
84	54	-60 ... +160 °C with Ni 200	I_K = 2.5 mA
85	55	-160 ... +160 °C with Pt 200	I_K = 2.5 mA
86	56	-200 ... +320 °C with Pt 200	I_K = 2.5 mA
87	57	-200 ... +640 °C with Pt 200	I_K = 2.5 mA
88	58	-60 ... +160 °C with Ni 500	I_K = 2.5 mA
89	59	-160 ... +160 °C with Pt 500	I_K = 2.5 mA
90	5A	-200 ... +320 °C with Pt 500	I_K = 2.5 mA
91	5B	-200 ... +640 °C with Pt 500	I_K = 1.5 mA
92	5C	-60 ... +160 °C with Ni 1000	I_K = 1.5 mA
93	5D	-160 ... +160 °C with Pt 1000	I_K = 1.5 mA
94	5E	-200 ... +320 °C with Pt 1000	I_K = 1.5 mA
95	5F	-200 ... +640 °C with Pt 1000	I_K = 1.5 mA
4-pole measuring ranges for resistance measuring with 4-pole wire [9]			
96	60	0 ... 100 Ohm,	I_K = 2.5 mA
97	61	0 ... 200 Ohm,	I_K = 2.5 mA
98	62	0 ... 500 Ohm,	I_K = 2.5 mA
99	63	0 ... 1000 Ohm,	I_K = 2.5 mA
100	64	0 ... 2000 Ohm,	I_K = 1.5 mA
101	65	-	
:			
111	6F	-	
4-pole measuring ranges for resistance measuring with 2-pole wire compensation (10 Ohm) [9]			
112	70	0 ... 100 Ohm	I_K = 2.5 mA
113	71	0 ... 200 Ohm	I_K = 2.5 mA
114	72	0 ... 500 Ohm	I_K = 2.5 mA
115	73	0 ... 1000 Ohm	I_K = 2.5 mA
116	74	0 ... 2000 Ohm	I_K = 1.5 mA
117	75	-	
:			
255	FF	-	

8) x = node number
9) The referenced input with an odd number has to be set to 0 (inactive) for all 4-pole measuring ranges.

☞ **Note** After system startup a measured value IWx.1 ... IWx.8 [10] remains 0, until the module can be addressed. After that the module displays ”invalid station identification” -32 768 until the value is converted by selecting a valid measuring range (operand) QBx.1 ... QBx.8. This leads to a display of the valid value.
Changing that measuring range results in the display ” invalid station identification” -32 768 in the following cycle, until in the subsequent cycle the measured value becomes valid after max. 300 ms.

☞ **Note** In case of 2-polemeasurement
Up to a response value of -1.6 % of the rated value negative values in unipolar operation mode and + limit result in a digital value ”0” without causing an error message. If measured values fall belowthis limit error message SMBx.1 [10] = y5 [11] (see Table 5) and a measured value IWx.y = -32 767 will be displayed.
Negative measuring values in unipolar operation mode and ± limit produce a digital value (up to -512) of the referred negative value without error message - up to a response value of -1.6 % of the rated value. If measured values fall below this limit error message SMBx.1 = y5 (see Table 5) and a measured value IWx.y = -32 767 will be displayed.
In case of measuring ranges with a 20 % Offset (LIVE-ZERO) the maxixmum response limit for valued measure underflow is about. 10 % of the rated value. The negativ digital value with ± limit can fall to -3 840.

☞ **Note** 4-pole measurement
Constant current only flowswhen measuring with this input. Thus the effective current for warming up the reference resistance is smaller. The current, however, depends upon the number of active inputs. In case of one active input with a 4-pole detector the keying ratio is 1: 2. This is because one reference measurement occurs in between each measurement (effective value = I_K x 0.71). In case of four active inputs the keying ratio is 1: 5 (effective value = I_K x 0.45).

3.1.2 Integration into application program

A transfer of operands QBx.1 ... QBx.8 [10] to the ADU occurs within each program cycle.
In constant measuring ranges it is not necessary that the operands QBx.1...QBx.8 be loaded in each program cycle (slowing down of processing time).
Therefore when loading you can use the switch-on marker in combination with a jumper operand, e.g.:

```
      :A   SM2
      :JF  =Y1
      :LD  V1 ... 116
      :=   QB2.1
           :
           :
      :LD  V1 ... 116
      :=   QB2.8
Y1    :***
```

10) x = node number
11) y = input number

3.1.3 Error Evaluation

In case of an ADU error the user-related system marker SMx.1 [12)] stores a multiaddress message. Detailed error information can be obtained from operand SMBx.1 . The values in SMBx.1 are constantly updated. If the cycle is error-freethe content of all inputs is deleted. As it is impossible to store errors until they are queried short-term errors can be lost if the A120-cycle is slower than the ADU cycle.

The coding of SMBx.1 [12)] gives the incorrect input accompanied by an error number.

Binary	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
data format:	input number (1 ... 8)				error number (1 ... 7)			
hexadecimal	y [13)] (left digit)				n (right digit)			
data format:	input number (1 ... 8)				error number (1 ... 7)			

input number

Should errors occur simultaneously in several inputs the error with the lowest input number will be displayed until it is debugged. After that the error with the next highest input numberwill be displayed and so on.

Table 5 Possible error messages

Content of SMBx.1 [12)]

BIN	HEX	meaning
0000 0000	00	no error
xxxx 0001	y1	parameter error / invalid measuring range
xxxx 0010	y2	inputs 1, 3, 5, 7 only allow 2-pole measuring.
xxxx 0011	y3	at inputs 2, 4, 6, 8 associated inputs 1, 3, 5, 7 must be inactive.
xxxx 0100	y4	broke wire detected at 4-pole measuring
xxxx 0101	y5	measuring range underflow, detector short-circuit when measuring temperature or broke wire at Live-Zero
xxxx 0110	y6	measuring range overflow
xxxx 0111	y7	in bipolar operating mode both connected inputs must be set to same measuring range.
1111 1111	FF	system error or voltage drop / low voltage U_{B24} results in module reset and Totmann trash. relations between SM 31 ... 48, SMx.1 und SMBx.1 see Table 6.

When an error has occured the transfered measured value of the inputs concerned is set (IWx.y [12) 13)]) to defined constants.

-32 768	inactive input / invalid measuring range / broke wire at four-pole measuring
+32 767	measuring range overflow
-32 767	measuring range underflow
0	parameter error in bipolar operation mode of the corresponding input.

12) x = node number
13) y = input number

The following relations exist between common system markers SM 31 ... 48 and user-related system markers SMx.1 [14] (multiaddress-marker) und SMBx.1 (detail marker):

Table 6 relations between SM 31 ... 48, SMx.1 und SMBx.1 [14]

SM31 ... SM48	SMx.1	SMBx.1	IWx.1 ... IWx.8	meaning
1	0	00	00	module not plugged in
1	1	00	00	module plugged in, U_B = 24 V nonexistent
0	0	00	00	module plugged in, AWP running with U_B = 24 V
0	1	FF	alt	module plugged in, AWP running, U_B = 24 V switched off again
1	0	00	00	User program running, U_B = 24 V, module removed
0	0	00	new	User program running, U_B = 24 V, module plugged in again (after about 1 s)
0	1	FF	alt	module plugged in, AWP running, U_B = 24 V switched off
1	0	00	00	User program running, U_B = 24 V switched off and module removed
1	0	00	00	User program running, U_B = 24 V switched off and module plugged in again

14) x = node number

3.2 Noise Suppression (DIP-switch B1)

The ADU provides a suppression of mains frequencies on the peripheral lines. ADUs are shipped with 50 Hz suppression, which can be switched to 60 Hz with DIP-switch B1.

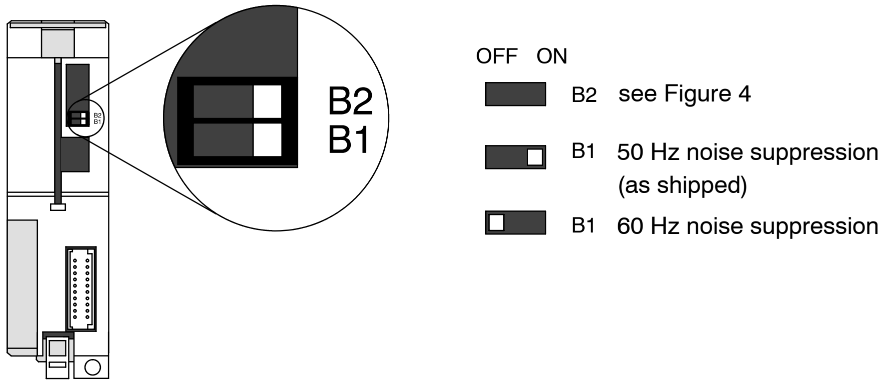


Figure 3 Back view of ADU (Noise suppression)

3.3 Fritting procedure of input connections (DIP-switch B2)

Fritting prevents an increase of transfer resistance on peripheral plug-ins. Fritting is accomplished by adding voltages >10 V und 0 to the contacts at defined time intervals. The resulting current (flowing for about 1 ms) is limited to <8 mA. The contacts of the current and voltage paths of 4-pole connections automatically receive this load with each measurement. The contacts of the active voltage inputs are frittedcyclically every 30 minutes.
The fritting process is switched on and off with DIP-switch B2.

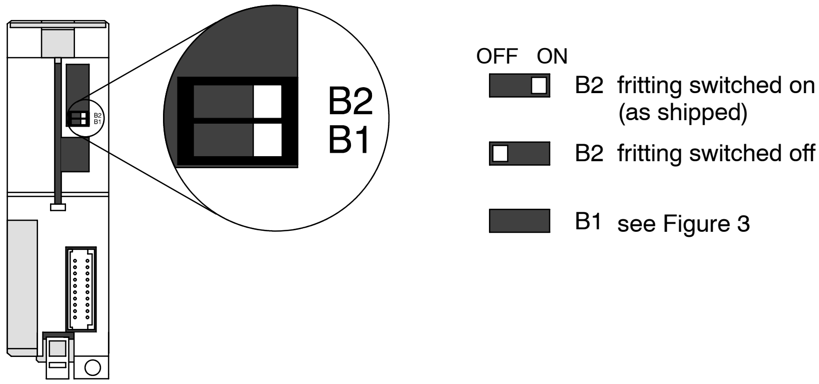


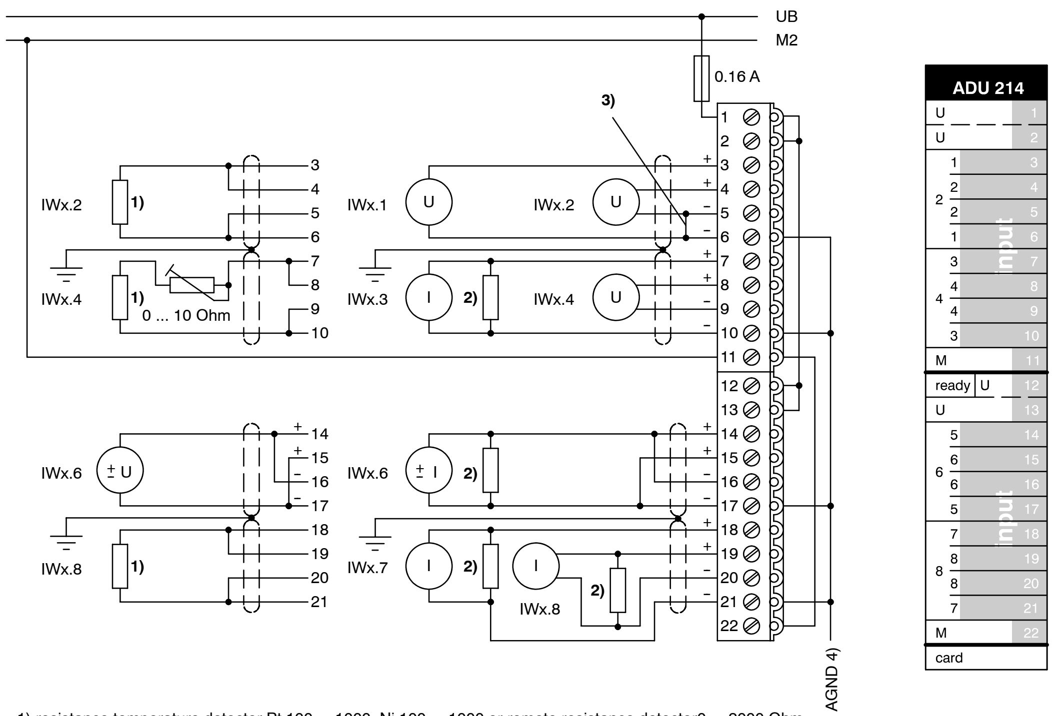
Figure 4 Back view of ADU (fritting connections)

3.4 Wiring

Note For general wiring and set-up instructions please refer to youruser manual, chapter 5.2.1 ”Measures Taken Regarding Installation and Wiring”.

- Foil-shielded cables (2 x or 4 x 0.5 mm^2, twisted per channel) have to be used for connections. All channels can be run within one joint shielded cable.
- If detectors are connected with 4-pole wires, e.g Ni 100, Pt 100, conductors for current and voltage path must be twisted in pairs.
- The connections between the shield and ground must be as closely as possible (<20 cm) at one end. If higher noise levels exist, the cable shield has to be earthed at both ends (see also user manual, chapter 5.2 ”EMC Measures”.
- The cable must not be run together with energy supply lines or similar electrical disturbers. Distance >0.5 m

3.5 Connection and Signal Address Assignment



1) resistance temperature detector Pt 100 ... 1000, Ni 100 ... 1000 or remote resistance detector0 ... 2000 Ohm

2) external reference resistance 50 or 100 Ohm, 0.1 %, 0.125 W, Tk 25

3) see chapter 3.5.1, page 13

4) The common reference point ”AGND” is internally connected to 0 V (reference potential of PLC).

Figure 5 Example for wiring of ADU 214

Fill in the signal names or names of the actuators into the label of the module housing.

You can connect a
4-poleresistance detector oder
2-poleresistance detector with
10 Ω wiring compensation or

2-polevoltage detector unipolar	0 ... 0.5, 0 ... 1, 0 ... 5, 0 ... 10 V, 0.1 ... 0.5, 0.2 ... 1, 1 ... 5, 2 ... 10 V,
or	
2-polevoltage detector bipolar	±0.5, ± 1, ±5, ±10 V
oder	
2-polecurrent detector unipolar	0 ... 5, 0 ... 10, 0 ... 20 mA, 1 ... 5, 2 ... 10, 4 ... 20 mA,
oder	
2-polecurrent detector bipolar	±5, ± 10, ±20 mA

The common reference point ”AGND” is internally connected to 0 V (reference potential of PLC).

Additionally 8 bridges are supplied with the ADU 214 package. Use these, if you have to short-circuit 2 neighbouring terminal blocks, e.g. when using two-wire resistancetemperature detectors.

Inputs which are not used have to be set to measuring range ”inactive” (0).By doing so, you avoid error messages and the cycle time of conversion decreases.

After conversion, analog input values are put into input words IWx.1 ... IWx.8.

3.5.1 Voltage and Current Measurement

Each 4-pole input can be switched to a 2 x 2-pole unipolar voltage input. In this case the first input is single-ended and the second input is a differential input.
For positive voltages with the same reference point, AGND voltage inputs 1, 3, 5, 7 can be used as single ended. Inputs 2, 4, 6, 8, can be used as differential inputs for positive or negative voltages. With regard to differential inputs, however, you always have to take care that voltages on both the positive input and negative inputs must not exceed the common-mode voltage rangeagainst common reference point AGND (UE $\leq$ $\pm$11 V). Therefore, with potential-free detectors there always has to be a reference between a random point of the circuit and AGND, e.g. as shown in Figure 5 Picture 5,by connecting the negative input terminal block toAGND. For connecting, use the bridges supplied with the module.

For bipolar measuring both inputs are connected (this occupies 2 inputs). As in the case of four-pole measuring the measured value is filed in the even numbered input (IWx.2, 4, 6, 8). The corresponding second input (IWx.1, 3, 5, 7) produces value -32 768 " invalid station identification".

Measuring either voltage input (U) or current input (I) depends on the mode of connection(mixed operation mode possible).
If you want to connect a current detector, a reference resistance e.g. 50 Ω or 100 Ω, $\pm$0.1 %, $\geq$0.1 W, Tk $\leq$25 ppm has to be wired to the voltage input in parallel.

3.5.2 Temperature and resistance measurement

For 2-pole temperature and resistance measurment with line compensation asupplementary resistance has to be wiredexternally and must be calibrated to 10 Ω . For this purpose the detector can be short-circuited at the beginning of the line and calibrated to the reference value of 10 Ω (=3 200) with the ADU 214 in the resistance measuring range 0 ... 100 Ω (QBx.2 = 96).

Note In resistance measuring range 0 ... 100 Ω + 10 Ω (QBx.2 = 112) negative values are limited to 0.

Please note that only the constant part of the line resistance can be compensated in line compensation.Temperature dependent resistancevariation of the line (at Cu +4.3 x 10^{-3} /°C) influences measuring accuracy.

3.5.3 Grounding of shields

- Shielded cables have to be run on cable earting bar CER 001
- Remove shield isolation at the position of the correspondingterminal block
- Push cable with bared shield into clamping device (contacting hat rail)
- Use cable straps to provide cable grip as shown in Figure 6

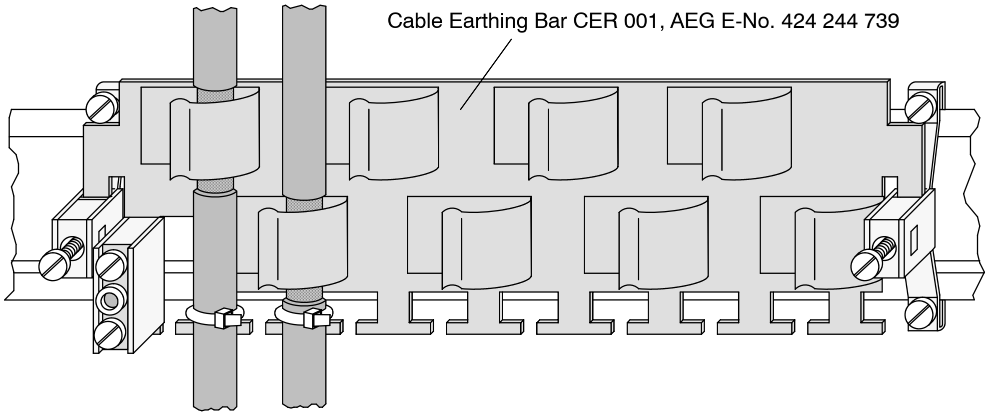


Figure 6   Grounding shields

3.6 Documentation aids

For project specific documentation and representation of the connected processperipherals A3 forms are provided.

These forms are used for documenting

- conventional processing as part of the A120 form pad (compare orderingdetails)
- Ruplan processing (TVN version) as part of the A120 data base

4 Technical specifications according to IEC 1131

4.1 Assignment

Device	A120, Geadat 120
Location	I/O structure

4.2 Supply

external supply	U_B = 24 VDC, typ. 70 mA, max. 150 mA
Potential isolation	U_B = 24 V against 0 V (AGND)
Isolation test voltage	350 VAC
supply internal via system bus	5 VDC; typ. 45 mA, max. 100 mA

4.3 Inputs

Number	4 Inputs, 4-pole/2-pole, temperature/resistance or 4 Inputs, 2-pole current / voltage bipolar or 8 Inputs, 2-pole current / voltage unipolar mode of connection mixable
no potential isolation	among inputs and against 0 V
Potential isolation	against U_B = 24 V

4.4 Static Characteristics of Inputs

Voltage Measuring

Input impedance	>1 MΩ
measuring ranges unipolar	0 ... 0.5 V, 0 ... 1 V, 0 ... 5 V, 0 ... 10 V, 0.1...0.5 V, 0.2 ... 1 V, 1 ... 5 V, 2 ... 10 V
measuring ranges bipolar	±0.5 V, ±1 V, ±5 V, ±10 V
Resolution	ca. 0.003 % of final value, 15 Bit + sign

Measuring fault at environmental temperature 25 °C

for measuring ranges 0.5 V / 1 V	±0.02 % of MFV [15], ±0.15 % of MV [16]
for measuring ranges 5 V / 10 V	±0.01 % of MFV, ±0.02 % of MV

Measuring fault at environmental temperatures 0 ... 60 °C

for measuring ranges 0.5 V / 1 V	±0.10 % of MFV, ±0.35 % of MV
for measuring ranges 5 V / 10 V	±0.02 % of MFV, ±0.11 % of MV

Typical measuring error	≤0,5 of above maximal errors

Inphase voltage range (differential input for voltage measuring)

Voltage of each input against AGND	≤ ±11 V
Inphase suppression	≥60 dB

maximal overvoltage

static (1 Input for each module)	±30 V (module with 24 V power supply) ±20 V (module without 24 V power supply)
dynamic	±50 V for ≤100 ms

15) MFV = measuring range final value
16) MV = measured value

Table 7 Conversion values of unipolar voltage inputs

analog value, voltage inputs unipolar (V)								decimal value	notes
0...0.5 V	**0...1 V**	**0...5 V**	**0...10 V**	**0.1...0.5 V**	**0.2...1 V**	**1...5 V**	**2...10 V**		
< -0.008	< -0.016	< -0.08	< -0.16	< +0.052	< +0.104	< +0.52	< +1.04	-32 767	underflow error
-	-	-	-	+0.052 ...	+0.104 ...	+0.52 ...	+1.04 ...	0 (-3 840)	overload range [17]
-0.008 ...	-0.016 ...	-0.08 .. .	-0.16 .. .	+0.094 ...	+0.187 ...	+0.936 ...	+1.87 ...	0 (-512) [17]	
-0.000	-0.000	-0.00	-0.00	+0.099	+0.199	+0.99	+1.99	0 (-1)	
0	0	0	0	0.1	0.2	1	2	0	rated value
0.000 02	0.000 03	0.000 16	0.000 31	0.100 0	0.200 0	1.000 1	2.000 3	+1	
0.000 25	0.000 5	0.002 5	0.005	0.100 2	0.200 4	1.002	2.004	+16	
0.000 5	0.001	0.005	0.01	0.100 4	0.200 8	1.004	2.008	+32	
0.005	0.01	0.05	0.10	0.104	0.208	1.04	2.08	+320	linear range
0.025	0.05	0.25	0.50	0.12	0.24	1.20	2.40	+1 600	
0.05	0.10	0.50	1.00	0.14	0.28	1.40	2.80	+3 200	
0.25	0.50	2.50	5.00	0.30	0.60	3.00	6.00	+16 000	
0.50	1.00	5.00	10.00	0.50	1.00	5.00	10.00	+32 000	rated value
0.500 0 ...	1.000 0 ...	5.000 ...	10.000 ...	0.500 ...	1.000 ...	5.00 ...	10.00 ...	+32 001 ...	
0.511 9	1.023 9	5.119	10.239	0.509	1.019	5.09	10.19	+32 766	overload range
≥0.512	≥1.024	≥5.12	≥10.24	>0.509	>1.019	>5.09	>10.19	+32 767	overflow error

Table 8 Conversion values of bipolar voltage inputs

analog value, voltage inputs(V)				decimal value	notes
±0.5 V	**±1 V**	**±5 V**	**±10 V**		
≤ -0.512	≤ -1.024	≤ -5.12	≤ -10.24	-32 767	underflow error
-0.511 9 ...	-1.023 ...	-5.119 ...	-10.239 ...	-32 766 ...	
-0.500 0	-1.000	-5.000	-10.000	-32 001	overload range
-0.50	-1.00	-5.00	-10.00	-32 000	rated value
-0.25	-0.50	-2.50	-5.00	-16 000	
-0.05	-0.10	-0.50	-1.00	-3 200	
-0.025	-0.05	-0.25	-0.50	-1 600	
-0.005	-0.01	-0.05	-0.10	-320	
-0.000 5	-0.001	-0.005	-0.01	-32	
-0.000 25	-0.000 5	-0.002 5	-0.005	-16	
0	0	0	0	0	linear range
+0.000 02	+0.000 03	+0.000 16	+0.000 31	+1	
+0.000 25	+0.000 5	+0.002 5	+0.005	+16	
+0.000 5	+0.001	+0.005	+0.01	+32	
+0.005	+0.01	+0.05	+0.10	+320	
+0.025	+0.05	+0.25	+0.50	+1 600	
+0.05	+0.10	+0.50	+1.00	+3 200	
+0.25	+0.50	+2.50	+5.00	+16 000	
+0.50	+1.00	+5.00	+10.00	+32 000	rated value
+0.500 0 ...	+1.000 0 ...	+5.000 ...	+10.000 ...	+32 001 ...	
+0.511 9	+1.023 9	+5.119	+10.239	+32 766	overload range
≥ +0.512	≥ +1.024	≥ +5.12	≥ +10.24	+32 767	overflow error

17) without brackets range with + limit, with brackets range with ± limit

Current Measurement (using voltage measuring range with external referance resistance)

measuring ranges with external 50 Ω referance resistance

0.1 %, 0.1 W, Tk 25 ppm	0 ... 10 mA (0 ... 0.5 V),	0 ... 20 mA (0 ... 1 V),
	2 ... 10 mA (0.1 ... 0.5 V),	4 ... 20 mA (0.2 ... 1 V),
	±10 mA (±0.5 V),	±20 mA (±1 V)

measuring ranges with external 100 Ω measuring resistance

0.1 %, 0.1 W, Tk 25 ppm	0 ... 5 mA (0 ... 0.5 V),	0 ... 10 mA (0 ... 1 V),
	1 ... 5 mA (0.1 ... 0.5 V),	2 ... 10 mA (0.2 ... 1 V),
	±5 mA (±0.5 V),	±10 mA (±1 V)

The tolerance of the referance resistance increases inaccuracy of measurment.

Resolution	ca. 0.003 % of final value,15 Bit + sign
Measuring inaccuracies	see voltage measuring range above + error ofreferance resistance
Critical values	see voltage ranges. Additionally load capacity ofreference resistance has to be taken into account. (at 50 Ω 0.1 W max., 40 mA continously)

Table 9 Conversion values of current inputs

analog value, current inputs (mA)					**decimal value**	**notes**
0...10 mA	**0...20 mA**	**2...10 mA**	**4...20 mA**	**±20 mA**		
< -0.16	< -0.32	< +1.04	< +2.08	≤ -20.479	-32 767	underflow error
-	-	-	-	-20.478 ...	-32 766 ...	
-	-	-	-	-20.000	-32 001	overload range [18]
-	-	+1.04 ...	+2.08 ...	-	0 (-3 840)	
-0.16...	-0.32...	+1.87 ...	+3.74 ...	-	0 (-512) [18]	
-0.00	-0.00	+1.99	+3.99	-	0 (-1)	
				-20.00	-32 000	
				-10.00	-16 000	
				-2.00	-3 200	
				-1.00	-1 600	
				-0.20	-320	
				-0.02	-32	
				-0.01	-16	linear range
0	0	+2	+4	0	0	
+0.005	+0.01	+2.004	+4.008	+0.01	+16	
+0.01	+0.02	+2.008	+4.016	+0.02	+32	
+0.1	+0.20	+2.08	+4.16	+0.20	+320	
+0.5	+1.00	+2.40	+4.80	+1.00	+1 600	
+1	+2.00	+2.80	+5.60	+2.00	+3 200	
+5	+10.00	+6.00	+12.00	+10.00	+16 000	
+10.0	+20.00	+10.00	+20.00	+20.00	+32 000	rated value
+10.000...	+20.000...	+10.00...	+20.00...	+20.000...	+32 001 ...	
+10.239	+20.478	+10.19	+20.38	+20.478	+32 766	overload range
≥ +10.24	≥ +20.479	> +10.19	> +20.38	≥ +20.479	+32 767	overflow error

18) without brackets range with + limit, with brackets range with limit

Temperature Measurement	(4-pole wire)
Input impedance	>1 MΩ
Resolution	<0.012 % vom Skalenendwert, ≥13 Bit + sign
Measuring ranges with Pt 100, Pt 200, Pt 500, Pt 1000	-160 ... +160 °C, resolution ≤0.02 °C -200 ... +320 °C, resolution ≤0.04 °C -200 ... +640 °C, resolution ≤0.08 °C
Measuring ranges with Ni 100, Ni 200, Ni 500, Ni 1000	-60 ... +160 °C, resolution ≤0.02 °C

Measuring fault at environmental temperature 25 °C (without inaccuracy of detector)
for measuring ranges -60 / -160 ... +160 °C

with Pt 100 ... Pt 1000	±0.35 °C (= ±0.22 % of MFV[19])
with Ni 100 ... Ni 1000	±0.3 °C (= ±0.2 % of MFV)

for measuring range -200 ... +320 °C

with Pt 100 ... Pt 1000	±0.5 °C (= ±0.16 % of MFV)

for measuring range -200 ... +640 °C

with Pt 100 ... Pt 1000	±0.8 °C (= ±0.13 % of MFV)

Measuring fault at environmental temperatures 0 ... 60 °C
for measuring ranges -60 / -160 ... +160 °C

with Pt 100, Ni 100	±0.8 °C (= ±0.5 % of MFV)
with Pt 200, Pt 500, Pt 1000	±0.65 °C (= ±0.4 % of MFV)
with Ni 200	±0.5 °C (= ±0.32 % of MFV)
with Ni 500, Ni 1000	±0.45 °C (= ±0.3 % of MFV)

for measuring range -200 ... +320 °C

with Pt 100	±1.1 °C (= ±0.35 % of MFV)
with Pt 200	±0.95 °C (= ±0.3 % of MFV)
with Pt 500, Pt 1000	±0.9 °C (= ±0.28 % of MFV)

for measuring range -200 ... +640 °C

with Pt 100	±1.6 °C (= ±0.25 % of MFV)
with Pt 200	±1.5 °C (= ±0.23 % of MFV)
with Pt 500, Pt 1000	±1.4 °C (= ±0.22 % of MFV)

Constant current [20]	ca. 1.5 mA or ca. 2.5 mA depending on measuring range, compare table Table 4 on page 7
Liniarization	according to IEC 751 and DIN 43 760 on module

19) MFV = measuring range final value
20) for resulting effective current compare page 8

Table 10 Conversion values of temperature inputs

analog value, temperature inputs(°C) -60 ... +160 °C	-160 ... +160 °C	-200 ... +320 °C	-200 ... +640 °C	decimal value	notes
< -60	< -160	< -200	< -200	-32 767	measuring range underflow (error)
-	-160	-	-	-32 000	
-	-100	-200	-	-20 000	
-60	-60	-120	-	-12 000	
-50	-50	-100	-200	-10 000	
-16	-16	-32	-64	-3 200	
0	0	0	0	0	
+0.005	+0.005	+0.01	+0.02	+1	
+0.08	+0.08	+0.16	+0.32	+16	
+0.16	+0.16	+0.32	+0.64	+32	linear range
+1.6	+1.6	+3.2	+6.4	+320	
+8	+8	+16	+32	+1 600	
+16	+16	+32	+64	+3 200	
+80	+80	+160	+320	+16 000	
+160	+160	+320	+640	+32 000	rated value
+160.005 ... +163.83	+160.005 ... +163.83	+320.01 ... +327.66	+640.02 ... +655.32	+32 001 ... +32 766	overload range
≥ +163.84	≥ +163.84	≥ +327.67	≥ +655.34	+32 767	measuring range overflow (error)

Resistance Measuring (4-pole)

Input impedance	>1 MΩ
Measuring ranges	0 ... 100 Ω, 0 ... 200 Ω, 0 ... 500 Ω, 0 ... 1000 Ω, 0 ... 2000 Ω
Resolution	$\leq$0.005 % of final value, $\geq$14 Bit

Measuring fault at environmental temperature 25 °C
for measuring range 100 ... 2000 Ω
$\pm$0.1 % of MFV [21)]

Measuring falut at environmental temperatures 0 ... 60 °C
for measuring range 100 Ω $\pm$0.30 % of MFV
for measuring range 200 Ω $\pm$0.25 % of MFV
for measuring range 500 ... 2000 Ω
$\pm$0.20 % of MFV

Constant current [22)] ca. 1.5 mA for measuring range 0 ... 2000 Ω
ca. 2.5 mA for measuring ranges 0 ... 100 Ω, 0 ... 200 Ω, 0 ... 500 Ω, 0 ... 1000 Ω

Table 11 Conversion values for resistance inputs

analog value, resistance inputs (Ω)					decimal value	notes
0...100 Ω	**0...200 Ω**	**0...500 Ω**	**0...1000 Ω**	**0...2000 Ω**		
< -1.6	< -3.2	< -8	< -16	< -32	-32 767 ...	underflow error
0...-1.6	0...-3.2	0...-8	0...-16	0...-32	0	overload range
0	0	0	0	0	0	
0.003	0.006	0.015	0.03	0.06	+1	
0.05	0.1	0.25	0.5	1	+16	
0.1	0.2	0.5	1	2	+32	
1	2	5	10	20	+320	
5	10	25	50	100	+1 600	linear range
10	20	50	100	200	+3 200	
50	100	250	500	1000	+16 000	
100	200	500	1000	2000	+32 000	rated value
100.00 ... 102.39	200.00 ... 204.78	500.01 ... 511.97	1000.03 ... 1023.94	2000.06 ... 2047.88	+32 001 ... +32 766	overload range
$\geq$ 102.40	$\geq$ 204.79	$\geq$ 511.98	$\geq$ 1023.97	$\geq$ 2047.94	+32 767	overflow error

4.5 Dynamic Characteristics of Imputs

Conversion time for all inputs	max. 300 ms
Input delay Time constant for HF suppression	typ. 0.12 ms
Measurement integration time	20 or 16,66 ms (switchable)

Interference voltage suppression (mains suppression)

for f = n x 50 or 60 Hz	n = 1, 2 ...
push-pull interferences	>60 dB (peak value of interference voltage and measuring voltage $\leq$ final value x 1.1)

21) MFV = measuring range final value
22) for resulting effective current compare page 8

4.6 Processor, Memory

Processor type	Microprocessor Intel 80C31 (8 Bit)
Memory	8 kByte RAM for data exchange 32 kByte EPROM for firmware

4.7 Data interface

Internal bus system	parallel I/O bus, compare user manual, chapter 4 ”Technical Specifications”
Totmann-monotime	75 ... 145 ms

4.8 Debugging

Displays	compare chapter 2, page 4
A120-System markers	
SM 31 ... SM 48	I/O drop on slot 1 ... 18 failed
SMx.1	multiaddress message in care of error
SMBx.1	error details, compare chapter 3.1.3, page 9

4.9 Physical Strucure

Module	1-slot box type module, shielded
Dimensions	3 HE, 8 T
Weight	350 g

4.10 Connections

Process	2 11-pole screw/plug-in terminal blocks, connections can be fritted
Cable for process connection	min. cross section 0.14 mm^2, twisted in pairs, reference conductor included, shielded e.g. JE-LiYCY 2 x 2 x 0.5
Line distance to potential disturbers	>0.5 m
cable length 4-pole	max. 50 m for voltage detector
cable length 2-pole	max. 100 m for voltage detector
line resistance 4-pole	max. 25 Ohm for each conductor
line capacity 4-pole	max. 10 nF for each conductor
system bus (internal)	backplane bus system with $^1/_3$ C30M

4.11 Environmental Ratings

Standards	VDE 0160, UL 508
System data	compare user manual, chapter 4 ”Technical Specifications”
Power dissipation	2 W typ., max. 3 W
Radio interference	EN 50 081-1, according to standard 243 of German Telecom (Post)

4.12 Ordering details

Module ADU 214	424 277 589
Cable JE-LiYCY for process connection	424 234 035
DIN A3 form pad, Process peripherals	A91M.12-271 683
Fill-in label (replacement)	424 277 592

We reserve the right to modify our products in line with ourpolicy of continous product improvement

ADU 256
Analog Inputs
Module Description

ADU 256 is an A/D converter based on the principle of successive approximation for the programmable controller A120.
It serves for the analog signal measurement and has 4 analog isolated inputs.

- The resolution is 11 Bit + sign.
- Different measuring ranges can be selected by using the software:
  Input voltage ±1 V; 0 ... 1 V; 0.2 ... 1 V;
  ±10 V; 0 ... 10 V; 2 ... 10 V
  Input current ±20 mA; 0 ... 20 mA; 4 ... 20 mA
- Each input can be set independently to the measuring ranges 1 V, 20 mA or 10 V
- Overrange- and open circuit monitoring via software
- When additionally scaling blocks SKAL and DSKAL are used, arithmetical operations can be executed directly with voltage or current values.
- The operating temperature is −23...+70°C

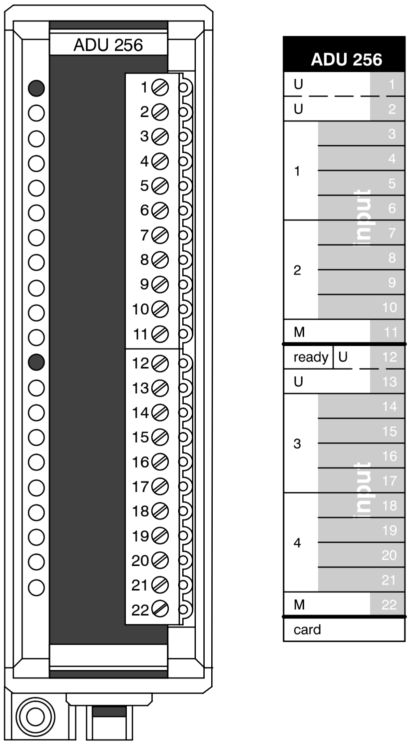


Figure 7 Front view and fill-in label of ADU 256

4 General

ADU 256 can be installed in any slot of the subracks DTA 200, 201 and 202.

4.1 Physical Characteristics

The standard size module has bus contact at the rear and periphery connection at the front via screw/plug-in terminals.

One of the enclosed fill-in labels is inserted in the attachable cover of the subrack near to the viewing window for the LED indicators. System relevant data (e.g. signal names) are to be entered in the fields provided.

4.2 Mode of Functioning

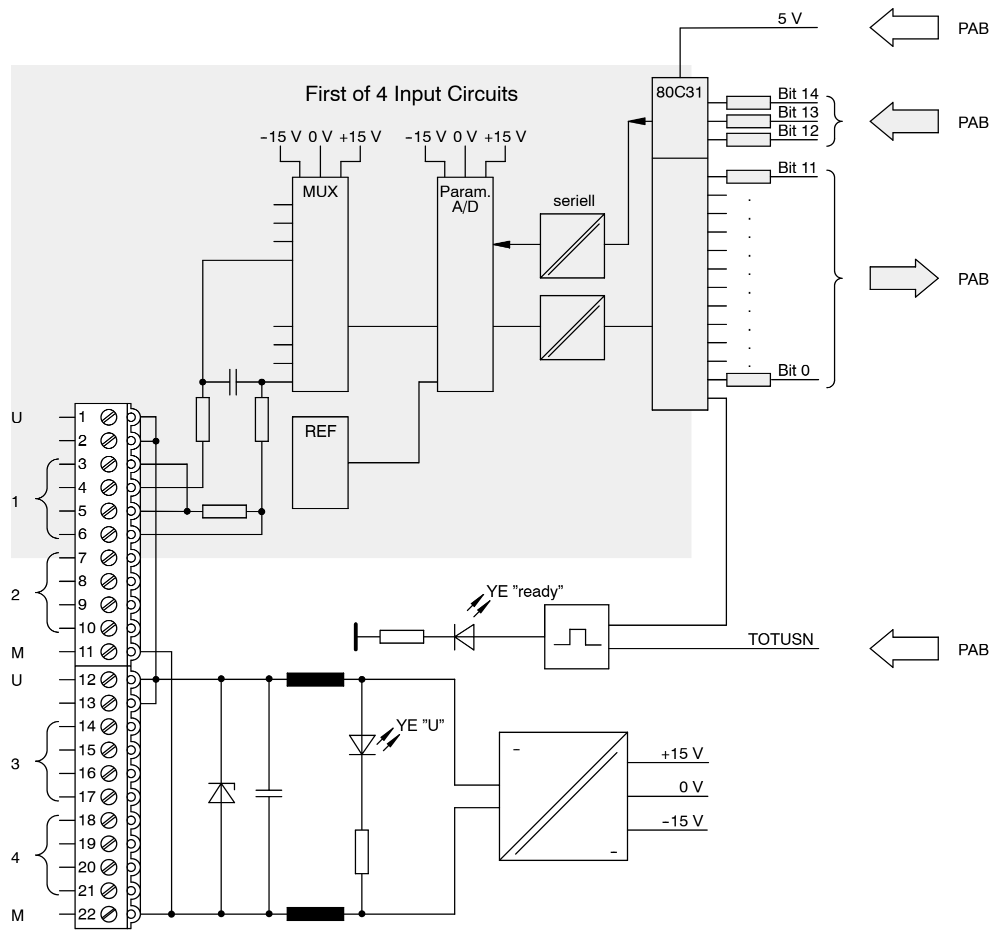


Figure 8 Simplified Schematic for the ADU 256

5 Operating and Display Elements

The front side of the ADU contains the follwing indicators:

- 1 x yellow LED "U" for the power supply 24 V
  ON: Power supply is available
  OFF: Power supply is not available

- 1 x yellow LED "ready" for the processor operation
  ON: Processor operation of the ADU and the ALU is without fault
  OFF: Fault in the processor operation

6 Configuration

The following should be configured:

- I/O slot adresses (compare 3.1)
- Type of input and error evaluation (compare 6.2)
- Cabling (running of cables, shielding, (compare 6.3)
- Connection and assignment of signal addresses (compare 6.4)
- Connection representation of the periphery signals (DIN A3 forms, compare 6.5)

6.1 I/O Slot Adresses

I/O slot addresses (to be determined according to the chapter 3, "Equipment and ...").
The module has no setting elements for addressing.
The moduls must be entered via Dolog AKF as "ADU 206" moduls instead of "ADU 256".

6.2 Type of Input and Error Evaluation

6.2.1 Type of Input (Selection of the Measuring Range)

The selection of the current input or voltage input is obtained through the type of connection. The setting of the corresponding measuring range is done with AKF software in the operand QBx.1[23].

In the initial stage QBx.1 = 0, that means:

- All 4 inputs are set to measuring range $\pm$1 V or $\pm$20 mA $\pm$1 V
- No monitoring for overrange
- No monitoring for open circuit
- Bipolar operation

Following presettings are available for the ADU 206. These settings are obtained by adding the following values:

QBx.1[23] =

1	(Bit 0)	Measuring range $\pm$10 V on input 1
2	(Bit 1)	Measuring range $\pm$10 V on input 2
4	(Bit 2)	Measuring range $\pm$10 V on input 3
8	(Bit 3)	Measuring range $\pm$10 V on input 4
16	(Bit 4)	Unipolar mode, Resolution 12 Bit without sign, can also be used in combination with open circuit monitoring, for outputs conversion of digital values is required.
32	(Bit 5)	All 4 inputs to measuring range 0.2 ... 1 V or measuring range 4 ... 20 mA when jumpers are used on the inputs with simultaneous open circuit monitoring for currents <2.08 mA or
47	(Bit 5)	all 4 inputs to measuring range 2 ... 10 V. No jumpers on the inputs.
64	(Bit 6)	Monitoring for measured values greater then nominal value + tolerance (overload capability) on all 4 inputs.
128	(Bit 7)	Without significance, set value always 0.

23) x = Node number

Table 12 Possible QBx.1[24] Combinations

Contens of QBx.1[24]	Input 1	Input 2	Input 3	Input 4	Polarity	Open-circuit-monit.	Overrange-monitoring
1	±10 V	±1 V / ±20 mA	±1 V / ±20 mA	±1 V / ±20 mA	Bipolar	no	no
2	±1 V / ±20 mA	±10 V	±1 V / ±20 mA	±1 V / ±20 mA	Bipolar	no	no
3	±10 V	±10 V	±1 V / ±20 mA	±1 V / ±20 mA	Bipolar	no	no
4	±1 V / ±20 mA	±1 V / ±20 mA	±10 V	±1 V / ±20 mA	Bipolar	no	no
5	±10 V	±1 V / ±20 mA	±10 V	±1 V / ±20 mA	Bipolar	no	no
6	±1 V / ±20 mA	±10 V	±10 V	±1 V / ±20 mA	Bipolar	no	no
7	±10 V	±10 V	±10 V	±1 V / ±20 mA	Bipolar	no	no
8	±1 V / ±20 mA	±1 V / ±20 mA	±1 V / ±20 mA	±10 V	Bipolar	no	no
9	±10 V	±1 V / ±20 mA	±1 V / ±20 mA	±10 V	Bipolar	no	no
10	±1 V / ±20 mA	±10 V	±1 V / ±20 mA	±10 V	Bipolar	no	no
11	±10 V	±10 V	±1 V / ±20 mA	±10 V	Bipolar	no	no
12	±1 V / ±20 mA	±1 V / ±20 mA	±10 V	±10 V	Bipolar	no	no
13	±10 V	±1 V / ±20 mA	±10 V	±10 V	Bipolar	no	no
14	±1 V / ±20 mA	±10 V	±10 V	±10 V	Bipolar	no	no
15	±10 V	±10 V	±10 V	±10 V	Bipolar	no	no
16	0 ... 1 V / 0 ... 20 mA	0 ... 1 V / 0 ... 20 mA	0 ... 1 V / 0 ... 20 mA	0 ... 1 V / 0 ... 20 mA	Unipolar	no	no
31	0 ... 10 V	0 ... 10 V	0 ... 10 V	0 ... 10 V	Unipolar	no	no
32[25]	0.2 ... 1 V / 4 ... 20 mA	0.2 ... 1 V / 4 ... 20 mA	0.2 ... 1 V / 4 ... 20 mA	0.2 ... 1 V / 4 ... 20 mA	Bipolar	yes	no
47[25]	2 ... 10 V	2 ... 10 V	2 ... 10 V	2 ... 10 V	Bipolar	yes [26]	no
48[27]	0.2 ... 1 V / 4 ... 20 mA	0.2 ... 1 V / 4 ... 20 mA	0.2 ... 1 V / 4 ... 20 mA	0.2 ... 1 V / 4 ... 20 mA	Unipolar	yes	no
63[27]	2 ... 10 V	2 ... 10 V	2 ... 10 V	2 ... 10 V	Unipolar	yes [26]	no
64	±1 V / ±20 mA	±1 V / ±20 mA	±1 V / ±20 mA	±1 V / ±20 mA	Bipolar	no	yes
65	±10 V	±1 V / ±20 mA	±1 V / ±20 mA	±1 V / ±20 mA	Bipolar	no	yes
66	±1 V / ±20 mA	±10 V	±1 V / ±20 mA	±1 V / ±20 mA	Bipolar	no	yes
67	±10 V	±10 V	±1 V / ±20 mA	±1 V / ±20 mA	Bipolar	no	yes
68	±1 V / ±20 mA	±1 V / ±20 mA	±10 V	±1 V / ±20 mA	Bipolar	no	yes
69	±10 V	±1 V / ±20 mA	±10 V	±1 V / ±20 mA	Bipolar	no	yes
70	±1 V / ±20 mA	±10 V	±10 V	±1 V / ±20 mA	Bipolar	no	yes
71	±10 V	±10 V	±10 V	±1 V / ±20 mA	Bipolar	no	yes
72	±1 V / ±20 mA	±1 V / ±20 mA	±1 V / ±20 mA	±10 V	Bipolar	no	yes
73	±10 V	±1 V / ±20 mA	±1 V / ±20 mA	±10 V	Bipolar	no	yes
74	±1 V / ±20 mA	±10 V	±1 V / ±20 mA	±10 V	Bipolar	no	yes
75	±10 V	±10 V	±1 V / ±20 mA	±10 V	Bipolar	no	yes
76	±1 V / ±20 mA	±1 V / ±20 mA	±10 V	±10 V	Bipolar	no	yes
77	±10 V	±1 V / ±20 mA	±10 V	±10 V	Bipolar	no	yes
78	±1 V / ±20 mA	±10 V	±10 V	±10 V	Bipolar	no	yes
79	±10 V	±10 V	±10 V	±10 V	Bipolar	no	yes
80	0 ... 1 V / 0 ... 20 mA	0 ... 1 V / 0 ... 20 mA	0 ... 1 V / 0 ... 20 mA	0 ... 1 V / 0 ... 20 mA	Unipolar	no	yes
95	0 ... 10 V	0 ... 10 V	0 ... 10 V	0 ... 10 V	Unipolar	no	yes
96[25]	0.2 ... 1 V / 4 ... 20 mA	0.2 ... 1 V / 4 ... 20 mA	0.2 ... 1 V / 4 ... 20 mA	0.2 ... 1 V / 4 ... 20 mA	Bipolar	yes	yes
111[25]	2 ... 10 V	2 ... 10 V	2 ... 10 V	2 ... 10 V	Bipolar	yes [26]	yes
112[27]	0.2 ... 1 V / 4 ... 20 mA	0.2 ... 1 V / 4 ... 20 mA	0.2 ... 1 V / 4 ... 20 mA	0.2 ... 1 V / 4 ... 20 mA	Unipolar	yes	yes
127[27]	2 ... 10 V	2 ... 10 V	2 ... 10 V	2 ... 10 V	Unipolar	yes [26]	yes

24) x = Node number
25) A valid measured value should be applied to the unused inputs. This can be achieved by using a reference measuring point or by voltage input (parallel circuit) or by current input (series circuit) to the inputs.
26) Monitoring for voltages <2 V.
27) Can be used for manufacturing index 274 905.13 (firmware 277 707.01) upwards.

☞ **Note** After switching on the first measured value corresponds to the initial state of the type of input. A change in the type of input influences the measured value at the earliest after the second cycle. As for ADU 206 a conversion cycle takes 10 ms, it can happen even later in case of scan time less than 10 ms.

☞ **Note** In unipolar operation a conversion of the digital values is required for outputs (see also Table 15, page 35).
The program for the conversion can be e.g. as follows:

```
:LD  IWx.1
:SHR V1
:=   MW1
```

6.2.2 Linking into the User Program

The loading of the operand QBx.1[24)] should not be done for each program cycle (unnecessary extension of the processing time).
Therefore, while loading use the switch-on marker in combination with a jump operand e.g. :

```
     :A   SM2
     :JF  =Y1
     :LD    V32
     :=   QB2.1
Y1   :***
```

6.2.3 Error Evaluation

System marker SMx.1 [28] sends a group signal when there is an error on the ADU 256. Detailed error data can then be scanned in the operand IBx.1 [28].

Table 13 Possible IBx.1[28] scanning combinations

IBx.1[28] binary	decimal	ADU doesn't work * Bit 7	U_B missing Bit 6	2...10 V / 4...20 mA on Input 1...4 Bit 5	Uni-polar Bit 4	Overrange or open circuit when current <2.08 mA on Inp. 4 Bit 3	Inp. 3 Bit 2	Inp. 2 Bit1	Inp. 1 Bit 0
0001 0000	16	0	0	0	1	0	0	0	0
0010 0000	32	0	0	1	0	0	0	0	0
1000 0000	–128	1	0	0	0	0	0	0	0
1000 0001	–127	1	0	0	0	0	0	0	1
1000 0010	–126	1	0	0	0	0	0	1	0
1000 0011	–125	1	0	0	0	0	0	1	1
1000 0100	–124	1	0	0	0	0	1	0	0
1000 0101	–123	1	0	0	0	0	1	0	1
1000 0110	–122	1	0	0	0	0	1	1	0
1000 0111	–121	1	0	0	0	0	1	1	1
1000 1000	–120	1	0	0	0	1	0	0	0
1000 1001	–119	1	0	0	0	1	0	0	1
1000 1010	–118	1	0	0	0	1	0	1	0
1000 1011	–117	1	0	0	0	1	0	1	1
1000 1100	–116	1	0	0	0	1	1	0	0
1000 1101	–115	1	0	0	0	1	1	0	1
1000 1110	–114	1	0	0	0	1	1	1	0
1000 1111	–113	1	0	0	0	1	1	1	1
1010 1111	–81	1	0	1	0	1	1	1	1
1100 0000	–64	1	1	0	0	0	0	0	0

* Cause: Overrange or open circuit on each of four inputs or
Processor monitoring active or
U_B = 24 V missing
ADU is initializing.

Values 16 and 32 are reflects of the default input option. They are not errors.

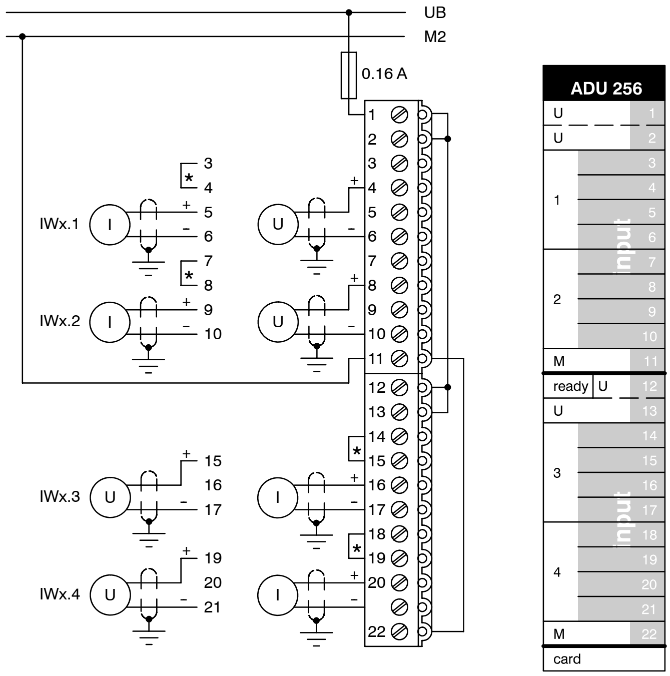
6.3 Cabling

Note For general cabling and installation guidelines see user manual, chapter 5.2 ”EMC Measures”.

- For the connection shielded cables (2 x or 4 x 0.5 mm^2, twisted per channel) should be used. All channels can be placed in a common shielded cable.
- The shield should be connected to ground at one side with short cable (<20 cm). For higher noise levels, the cable shield should be on both sides. See also user manual chapter 5.2 ”EMC Measures”.
- The cable should not be laid together with power supply lines or other similar sources of electrical disturbances. Distance >0.5 m.

28) x = Node number

6.4 Connection and Assignment of Signal Addresses



* For current inputs please use the enclosed jumpers.

Figure 9 Connection Example of ADU 256

The following can be connected:
2 pole voltage sensors ±1 V; 0 ... 1 V; 0.2 ... 1 V;
±10 V; 0 ... 10 V; 2 ... 10 V or
2 pole current sensors ±20 mA; 0 ... 20 mA; 4 ... 20 mA
The selection of current (I) or voltage (U) input is obtained depending on the connection (mixed operation permissible)
For connection of current sensors following jumpers are required:
Jumper 3-4 for IWx.1
7-8 for IWx.2
14-15 for IWx.3
18-19 for IWx.4.
The ADU is delivered with the jumpers installed.

Unused voltage inputs should be connected as follows:
Jumper 3-4 or 4-6 for IWx.1
7-8 or 8-10 for IWx.2
14-15 or 15-17 for IWx.3
18-19 or 19-21 for IWx.4.

For the measurung ranges ±1 V / ±10 V / ±20 mA each input can be used **independently** as required. The measuring ranges 2 ... 10 V / 4 ... 20 mA are always for **all** 4 inputs. In this case a valid measured value should be applied to the unused inputs.

The analog input values are transferred after conversion to the input words IWx.1 ... IWx.4.

Corresponding signal names or signal addresses should be entered in the fill-in labels.

6.4.1 Grounding of the Shields

- ❐ Lay the shielded cables over the cable earthing bar CER 001
- ❐ At the level of the corresponding cable cleat remove the shield insulation
- ❐ Press the cable with the opened shield in the cable cleat (contact to hat rail)
- ❐ With cable clip relieve each cable from traction as shown in Figure 10

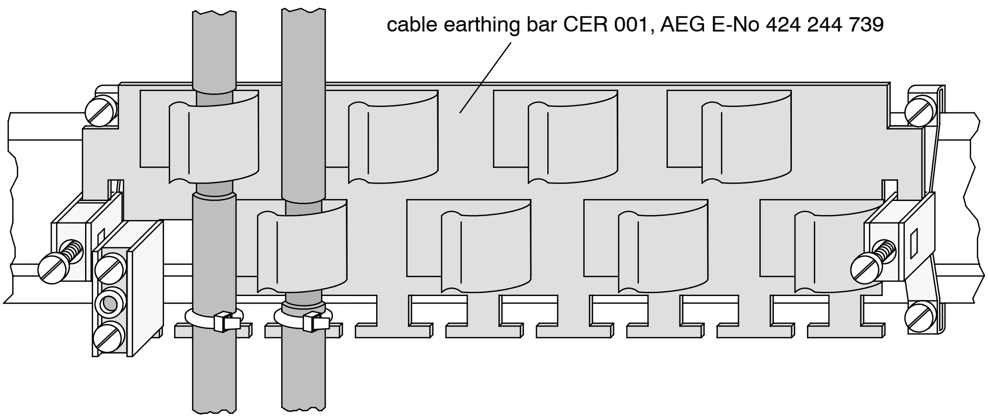


Figure 10 Grounding of the Shields

6.5 Documentation Aids

For project specific system documentation and representation of the connected process periphery A3 forms are provided.

These forms are for:

- ❐ conventional processing and are part of the A120 form block (see ordering details)
- ❐ Ruplan processing (TVN version) and are part of the A120 data base

4 Specifications

4.1 Allocation

Programmable Controllers	A120
Structure	In I/O structure

4.2 Power Supply

External Power Supply	U_B = 24 VDC, typ. 70 mA, max. 100 mA
Internal via I/O bus	5 VDC; typ. 60 mA, max. 100 mA

4.3 Inputs

No. of Inputs	4, (2 pole as voltage or current inputs)	
Isolation	Optical coupler, from internal system bus and 24 V supply, Varistor (voltage dependent protective resistor) to PE (protective earth), Inputs not isolated from each other.	
Linear Measuring Range	±1 V / ±20 mA	(depending on the connection)
	0.2 ... 1 V / 4 ... 20 mA	(depending on the connection)
	0 ... 1 V / 0 ... 20 mA	(depending on the connection)
	±10 V / 0 ... 10 V / 2 ... 10 V	(depending on the QBx.1)

Table 14 Conversion Values of ADU 256 on bipolar mode

Analog value					**Decimal value**	**Comments**
Voltage inputs (V)			**Current inputs (mA)**			
±1 V	**±10 V**	**2 ... 10 V**	**±20 mA**	**4 ... 20 mA**		
−1.024 ...	−10.24		−20.48 ...		−32 768 ...	Overrange
−1.001	−10.01 ...		−20.02		−32 016	
−1.00	−10.00		−20.00		−32 000	
−0.50	−5.00		−10.00		−16 000	
−0.10	−1.00		−2.00		−3 200	
−0.05	−0.50		−1.00		−1 600	
−0.01	−0.10		−0.20		−320	
−0.001	−0.01		−0.02		−32	
−0.0005	−0.005		−0.01		−16	linear
0.00	0.00	+2.00	0.00	+4.00	0	range
+0.0005	+0.005	+2.004	+0.01	+4.008	+16	
+0.001	+0.01	+2.008	+0.02	+4.016	+32	
+0.01	+0.10	+2.08	+0.20	+4.16	+320	
+0.05	+0.50	+2.40	+1.00	+4.80	+1 600	
+0.10	+1.00	+2.80	+2.00	+5.60	+3 200	
+0.50	+5.00	+6.00	+10.00	+12.00	+16 000	
+1.00	+10.00	+10.00	+20.00	+20.00	+32 000	
+1.001 ...	+10.01 ...	+10.01 ...	+20.02 ...	+20.02 ...	+32 016 ...	overrange
+1.024	+10.24	+10.19	+20.47	+20.38	+32 752	

Table 15 Conversion values of ADU 256 on unipolar mode

Analog-values Voltage inputs (V)				**Current inputs (mA)**		**Hexa-De-cimal-values**	**Decimal-values**
0 ...1 V	**0 ...10 V**	**0.2 ...1 V**	**2 ...10 V**	**0 ... 20 mA**	**4 ... 20 mA**	**HEX**	**DEZ**
0	0	0.2	2	0	4	0	0
0.1	1			2		1900	6 400
0.5	5			10		7D00	32 000
0.6	6			12		95F0	–27 136* (38 384)
1	10	1	10	20	20	FA00	–1 536* (64 000)

* displayed on programming panel

Common mode voltage on return conductors between each other	for 10 V, upper range value max. ±2 V for 1 V, upper range value max. ±11 V
Max. Voltage on Voltage Inputs	±30 V for inputs between each other for 1 min.
Max. Current on Current Inputs	40 mA continuous
Input Resistance	50 Ω for current inputs >1 MΩ for voltage inputs
Insulation Voltage	Max. 500 V, Process connection against internal I/O bus max. 500 V, Process connection against external power supply 24 V
Common Mode Suppression against ground	Min. 60 dB for 1 kHz
Filter time constant of the inputs	1.5 ms

4.4 Converter

Conversion Time	Max. 10 ms for all 4 inputs
Resolution of the converter	11 Bit + sign (bipolar) or 12 Bit (unipolar)
Operation Error Limit	Max. 0.4 % (0 . . . 60 ^{o}C) with respect to the used voltage range max. 0.56 % (0 . . . 60 ^{o}C) with respect to the used current range

4.5 Processor, Memory

Processor Type	Microprocessor Intel 80C31 (8 Bit)
Memory	128 Byte RAM for data exchange 32 kByte EPROM for firmware

4.6 Data Interface

Internal I/O Bus	Parallel I/O bus, see User Manual, chapter 4 ”Specifications”

4.7 Error Evaluation

Indicators	see chapter 5, page 27
A120 System Marker	(for 1 signal)
SM 31 ... SM 48	I/O node number on slot 1 ... 18 is absent
SMx.1	group signal when there is an error
IBx.1	For detailed error data see chapter 6.2.3, page 31

4.8 Physical Characteristics

Module	Standard size box
Format	3 HE, 8 T
Weight	330 g

4.9 Type of Connection

Process	2 pluggable 11 pole screw/plug-in terminals
Cable to Process	Minimum crosssection 0.5 mm^2, twisted pairwise reference conductor in cable, shielded e.g. JE-LiYCY 2 x 2 x 0.5
Distance to potential	>0.5 m to disturbance sources
Cable length	max. 100 m, longer cables on request
I/O bus (internal)	rearside connector $^1/_3$ C30M

4.10 Environmental Characteristics

Standards	VDE 0160, UL 508
System Data	See User Manual chapter 4 “Specification”
Temperature in Operation	-25 ... +70 °C constant -30 ... +85 °C short-time (10 minutes)
Power Dissipation	2 W typical, max. 3 W

4.11 Ordering Details

Module ADU 256	424 701 248
Cable to Process JE-LiYCY	424 234 035
DIN A3 Form Block, Process-Peripherals	A91M.12-271 683
Replacement Fill-in Label	424 701 662

Subject to technical modifications!

ALU 252
Central Processing Unit
Module Description

The CPU **ALU 252** together with the power supply DNP 255 and the DTA 200 form the basic unit of the A120 programmable controller.

This module provides the following features:

- a central processing unit (CPU)
- a memory for basic software, user program and processor signals
- an RS 232C port for the programming panel
- RS 485 port for Modnet 1/SFB (only slave).
- The operating temperature is −25 ... +70^{o}C

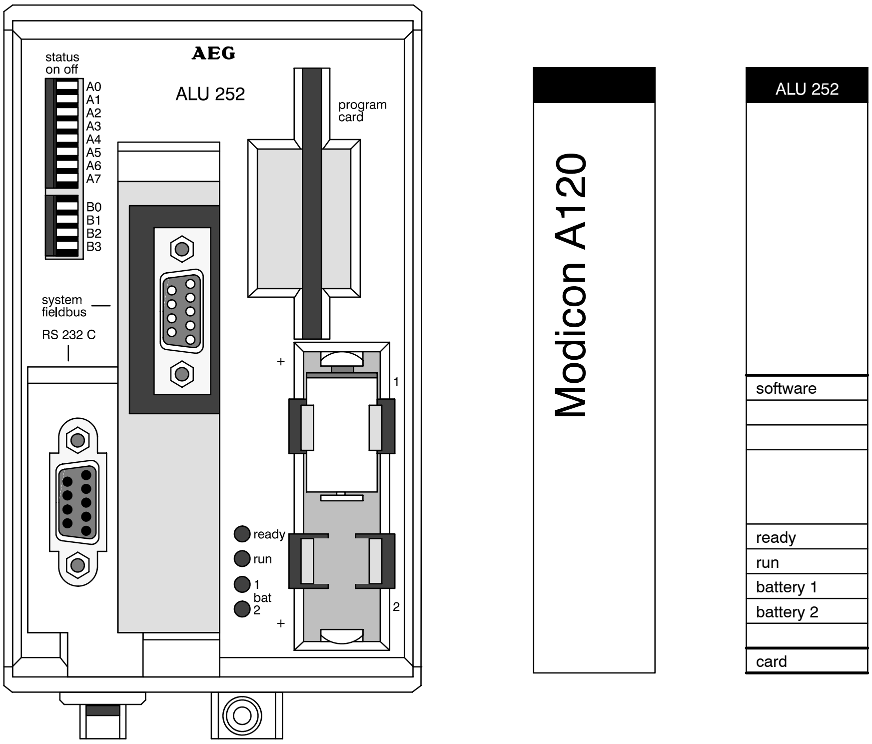


Figure 11 Front View and Fill-In Labels of ALU 252

1 General

The module ALU 252 contains the processor (CPU) of the A120 with an integrated communication port for the Modnet 1/SFB, via which it can be connected as a slave to a superior controller (master).
Together with the power supply DNP, the ALU generates an internal I/O bus (modified PAB1). The ALU 252 can only be inserted in slot 0 (left of the power supply) in the backplane DTA 200.

1.1 Physical Characteristics

The module consists of 3 PCBs which are assembled in a 2-slot size module with 16T construction width and 3HE construction height. They are connected using ribbon cable and bus planes. The essential components of the modules are:

- Micro-processor
- 32 KB EPROM for basic software
- 32 KB RAM for signal memory and system variables
- 64 KB RAM for user program and organization data (approx. 12 k instructions)
- Real time clock with date functions and calendar functions
- Front slot for EPROM card (PC 001)
- Battery compartments for 2 back-up batteries
- DIP switch for starting mode and start behavior
- Front port for programming panel (RS 232C)
- 3 rear ports for I/O bus (modified PAB1)

- DIP switch for slave address and transmission rate
- Front port for Modnet 1/SFB networking (RS 485)

Note PC 001 card should be used omly for the start-up operation (no continuous operation).

1.2 Functions

The processor provides the following features:

- Generation of an internal processing clock pulse
- Organization of internal data traffic on the I/O bus between all modules
- Writing the process input signals into the signal memory
- Processing of the user program
- Storing intermediate results (markers) in the signal memory
- Output of the process output signals from the signal memory
- Controlling of real time clock
- Operation of the serial ports for program transmissions
- Monitoring of : processor run,
  batteries,
  power supply voltage,
  program cycle
- Sending and receiving data telegrammes via Modnet 1/SFB

2 Operating and Display Elements

The module provides the following operation and indicators elements:

- yellow LED ”ready”
  on: power supply voltage available and processor is running
  off: power supply voltage is not available or the processor is not running

- yellow LED ”run”
  on: user program is running
  blinks with 3 puls./s: fault during loading of the user program from the PC 001
  blinks with 5 puls./s: ALU in EPROM operation and PC 001 is not available or no program on the PC 001
  blinks with 7 puls./s: only for ALU 201, basic software on the PC 001 and simultaneosly in EPROM of the ALU
  off: user program is not running

- red LED ”battery 1”
  on: battery 1 has low voltage or is missing
  off: battery 1 voltage is in the setpoint range

- red LED ”battery 2”
  on: battery 2 has low voltage or is missing
  off: battery 2 voltage is in the setpoint range

3 Configuration

Now you have to configure the following features:

- ❒ Type of ALU (compare 3.1)
- ❒ Start-up characteristics (compare 3.2)
- ❒ Operating mode (compare 3.3)
- ❒ Operation of the ALU as Slave (compare 3.5)
- ❒ Second back-up battery (compare 3.6)

3.1 Type of ALU

You have to enter the type of ALU in the menu ”Setup” via Dolog AKF software.

3.2 Set Start-up Characteristics (B0 and B1 DIP Switches)

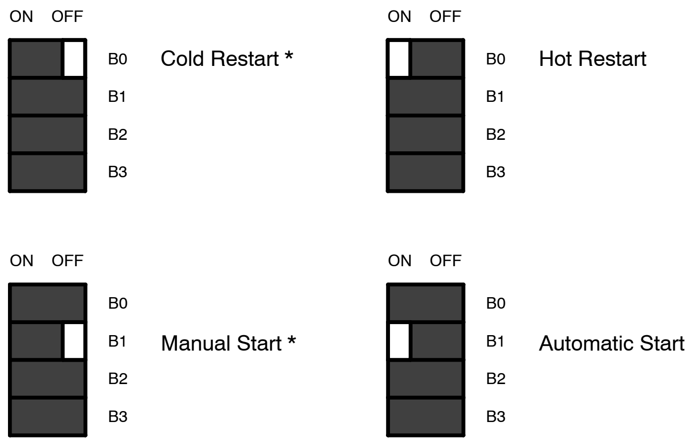
The start-up characteristic is set at the operating mode switch using B0 and B1. Four types of starting modes are possible:

Cold Restart The programmable controller starts using a initialized signal memory at the beginning of the program.

Hot Restart The programmable controller continues the program in principle at the interrupted position using the saved signal memory data.

Manual Start The programmable controller remains in a halt position when power supply is switched on. The programmable controller has to be started manually via a programming panel.

Automatic Start The programmable controller starts automatically when the power supply voltage is switched on.



* As Delivered

Figure 12 Set Start-Up Characteristics at the B0 and B1 DIP Switches

Caution during hot restart:

1. **In case of EPROM operation with PC 001, the PC automatically starts with a cold restart. Hot restart after a manual stop of the PC is possible via the progamming panel.**
2. **On switching off, it is necessary that the power supply circuits for the sensors (inputs) has a longer backup time than 5V bus power supply (see also chapter ”Connection Diagram of the U_B Supply” of the user manual.**

3.3 Setting the Operating Mode (B2 DIP Switch)

The user program is programmed off-line on the programming panel and can optionally be loaded

- via the EPROM card PC 001 into the RAM of the ALU. If you take this choise, the EPROM card has to be recorded previously using the EPROM programming station EPS 2000 (EPROM operation).
- from the programming panel into the RAM of the ALU (RAM operation)

You have to set the operating mode at the operating mode switch using B2.

Figure 13 Setting the Mode Selector at the B2 DIP Switch

Caution Insert PC 001 only in ALU if disconnected from supply

3.4 Real Time Clock

The in-built real time clock controls the following parameters:

Time:	Seconds, minutes and hours
Calendar:	Days of the week, the day’s date, month and year. Leap-years are corrected automatically.

You can set the clock in the software using the programming panel (AKF funktion).
No settings are necessary as far as the hardware is concerned.
The clock is backed up via the battery of the ALU 252, and therefore continues running if the power supply voltage is switched off.

3.5 Operation of the ALU as Slave

The ALU 252 can be linked to a master as slave via a RS 485 port (e.g. to the BIK 151 in a A350 and/or A500, compare Figure 14). In this case you have to take the following steps:

Set the transmission rate (compare 3.5.1)
Set the slave address (compare 3.5.2)
Prepare a bus cable (see user manual chapter 3.7 "Configuration the SystemFieldBus")

☞ **Note** If the ALU is not used in networking mode, the DIP switches B3 and A0 ... A7 which are provided for the setting of transmission rates are unimportant.

Apart from the A120, other programmable controllers (e.g. A350, A500) or I/O nodes such as DEA-H1/DEA-K1, DEA 105/DEA 106 can also be linked to the master. The max. number of linkable slaves is 28 slaves per BIK module. 16 is the maximum number of I/O nodes.

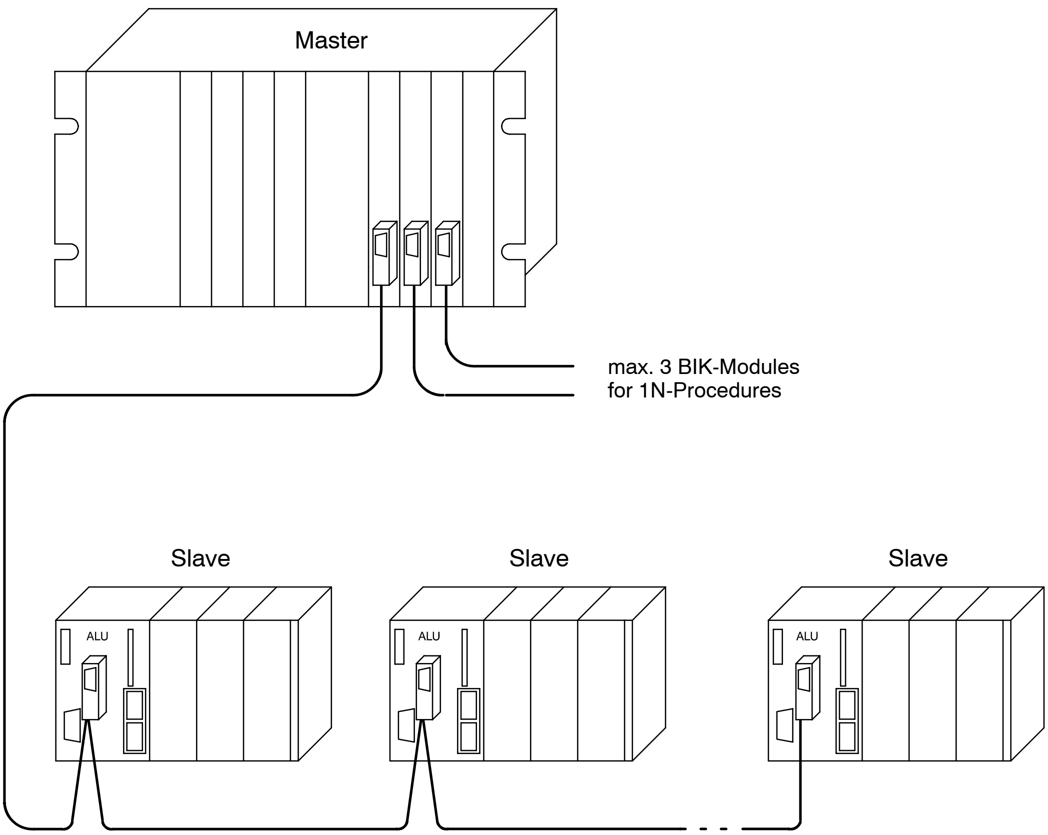


Figure 14 Beispiel einer Kopplung zwischen A500 (Master) und mehreren A120 (Slaves)

3.5.1 Setting the Transmission Rates for RS 485 (Modnet 1/SFB)

Self-Clocked mode is used for data transmission. Two different transmission rates are available depending on the cable length:

Table 16 Dependence of the Transmission Rate on the Length of Cable

Transmission Rate	max. Cable Length
62.5kBd	1200 m
375 kBd	300 m

In order to guarantee a correct data transfer, the cable lengths which are specified in Table 16 must not be exceeded.

The transmission rate is set using the DIP switch B3 on the front of the ALU (compare Figure 15).

* As Delivered

Figure 15 Setting the Transmission Rate at the B3 DIP Switch

Note Ensure that the same transmission rate is set on all network nodes of a bus line (master with its slaves). Furthermore, the network nodes which permit a choice between self-clocked-mode and synchronous mode should be set to the self-clocked-mode. For more information see the corresponding module descriptions.

3.5.2 Setting the Slave Address on the ALU

The slave address is set using the DIP switch A0 ... A7 (upper DIP switch field on the front of the module).

A number between 1 and 126 is allowed as an address. The address has to be dually coded first, before the switch position is determined. The position of the switches is determined by the coefficients of the two's power. A0 is the lowest value bit and A7 has the maximum value bit.

Figure 16 shows as an example the switch position for the address 52. Other addresses are listed in Table 17.

1
Address 52
Code Dually

$$
\begin{aligned}
\mathbf{0} * 2^0 &= 0\\
\mathbf{0} * 2^1 &= 0\\
\mathbf{1} * 2^2 &= 4\\
\mathbf{0} * 2^3 &= 0\\
\mathbf{1} * 2^4 &= 16\\
\mathbf{1} * 2^5 &= 32\\
\mathbf{0} * 2^6 &= 0\\
+\ \mathbf{0} * 2^7 &= 0\\
\hline
= \quad & 52
\end{aligned}
$$

2
Switch Position
Read A0 ... A7

A0 = **0**
A1 = **0**
A2 = **1**
A3 = **0**
A4 = **1**
A5 = **1**
A6 = **0**
A7 = **0**

0 → OFF
1 → ON

3
DIP Switch
Set A0 ... A7

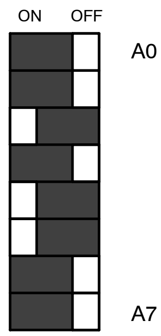


Figure 16 Addressing Example for Slave Address 52

Table 17 Setting of the Slave Address on the DIP Switch Field A (Switch A0 ... A7)

Switch	**Address**																
	0[29]	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
A0	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF
A1	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF
A2	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF
A3	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	ON	OFF
A4	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
A5	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
A6	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
A7	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Switch	**Address**																
	17	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**...**	**123**	**124**	**125**	**126**
A0	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	...	ON	OFF	ON	OFF
A1	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	...	ON	OFF	OFF	ON
A2	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF	ON	...	OFF	ON	ON	ON
A3	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	...	ON	ON	ON	ON
A4	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	...	ON	ON	ON	ON
A5	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	...	ON	ON	ON	ON
A6	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	...	ON	ON	ON	ON
A7	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	...	OFF	OFF	OFF	OFF

29) As Delivered

3.6 Back-up Batteries

A battery is included in the ALU but shall not be used before the initial start-up so that it can be conserved. It supplies the clock, the RAM of the signal memory and the RAM for the user-programmed logic. One can achieve a larger back-up reserve by mounting a second battery (see accessories).

The battery back-up switching is designed in such a manner that battery 1 supplies the back-up current until it has been used up. After this, battery 2 takes over the rest of the back-up without interruption. A used battery can also be replaced in this manner if the power voltage is interrupted - as long as the other one still functions.

If there is no voltage or only under voltage in one of the batteries, the red LED ”bat 1” and/or ”bat 2” is displayed. See “Specifications” for the life time of the batteries.

☞ **Note** Changing the batteries simultaneously can only be carried out without data loss if the power supply voltage is connected.

⚠ **Caution**

1. Due to voltage peaks do not touch the battery contacts of the ALU

2. Used batteries are special refuse. Please only dispose of them in the waste disposal containers provided.

3.7 Connection

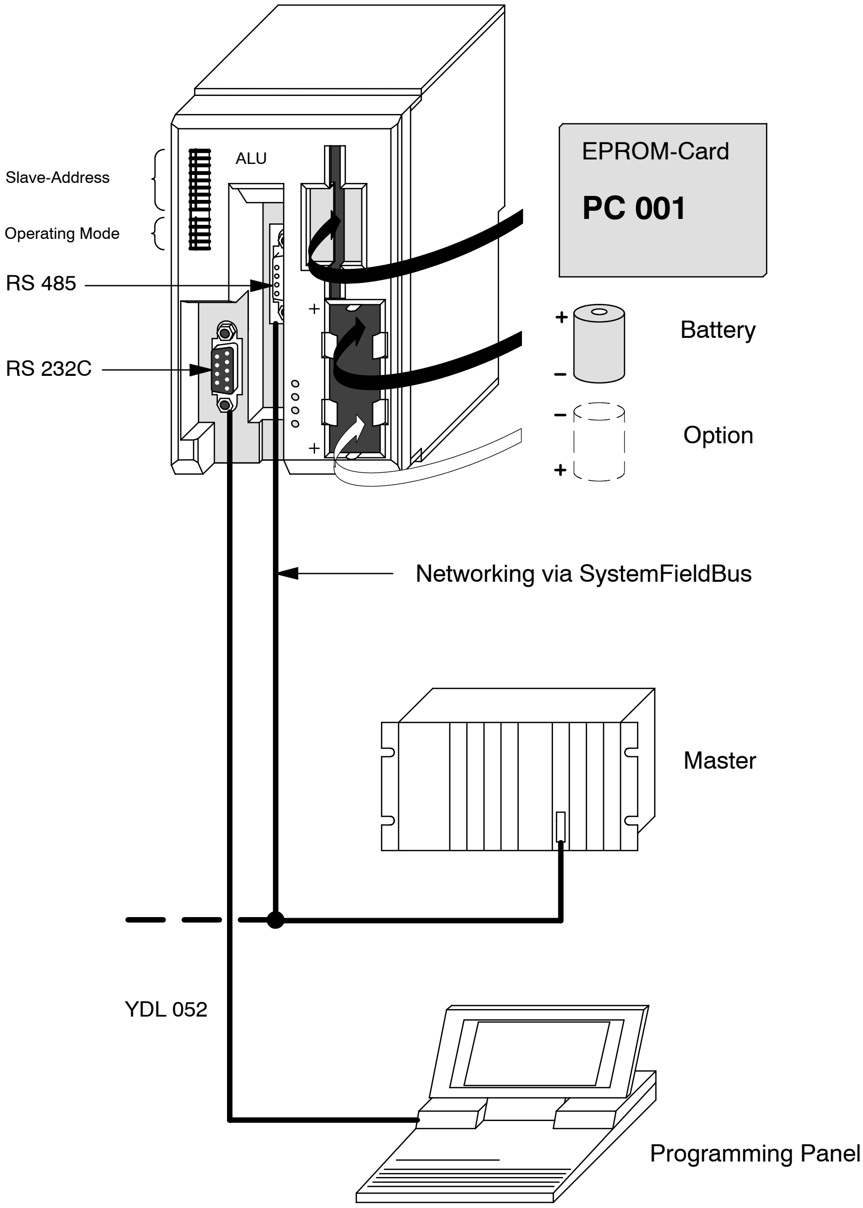
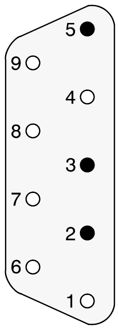


Figure 17 Connection

3.8 Connector Pin Assignment

3.8.1 RS 232C port



Pin	Signal	Meaning
2	D2	Received Data
3	D1	Transmitted Data
5	E2	Signal Ground

● Connector Pin Assigned
○ Connector Pin not Assigned

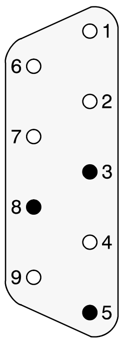
Figure 18 Pin Assignment of the RS 232C Port

For the connection of the ALU to the programming panel following 3 m cables can be used:

- ❒ YDL 048 for programming panel with 25 pole RS 232C port
- ❒ YDL 052 for programming panel with 9 pole RS 232C port

For terminal assignment with cable extensions please refer to the user manual ”Kabel für die Produktfamilie Modicon A...”. Document part number A91M.12-271 975.

3.8.2 RS 485 Port



Pin	Signal	Meaning
3	DATAN	Data Signal negated
5	RGND	Protective Ground, Shield (R-Ground)
8	DATA	Data Signal

● Connector Pin Assigned
○ Connector Pin not Assigned

Figure 19 Pin Assignment of the RS 485 Port

3.9 Documentation Aids

For the project specific system documentation e.g. start-up characteristics, operating mode etc. DIN A3 forms are provided.
These forms are for:

- conventional processing and are part of the A120 form block (see ordering details)
- Ruplan processing (TVN version) and are part of the A120 data base

3.10 Creating and Transmitting Programs at Initial Start-up

☞ **Note** The following items can also be found in the user manual Dolog AKF → A120 / A250 in the chapter ”Programming”.

- Dolog AKF12: Create user programm in off-line mode (see Dolog AKF12-Software part ”Programming”)

- Dolog AKF12: Transfer program to programmable controller RAM and test it
  - Connect programming panel
  - Switch on programmable controller (power on). Insert battery 1 in upper compartment (+ in upward position), note date
  - Use ”Load”, ”Set Date/Time” to enter the current data
  - Link programm under ”Load”, ”Program Link” (see AKF chapter ”Program Link”)
  - Transfer program to RAM with ”Load”, ”Program to PC” (see AKF chapter ”Program to PC”)
  - Start programmable controller with ”Online”, ”Start PC” (see AKF chapter ”Start PC”)
  - During cyclic processing of the user program the yellow function display ”run” is on at the ALU
  - Test the program with ”Online”, ”Dyn. Status Display” resp. ”Online”, ”Online-List” (see AKF chapter ”Online”)
  - Eliminate the faults when present. The notes mentioned under ”Error Evaluation” can be a help for this purpose. These are given in the ”Specifications” of the corresponding module (I/O module)
  - Possibly determine hardware status with ”Online”, ”PC-Status” (see AKF chapter ”PC-Status”)
  - If you want to change anything after the test, you can edit the program offline. Then the changed program part will be transferred to the running or not running programmable controller with ”Load”, ”Exchange Online”. Then the program has to be tested again (see AKF chapter ”Exchange Online”).

During this procedure the A120 with ALU 202 is running.

4 Specifications

4.1 Allocation

Device	A120
Structure	Slot 0 in the primary backplane DTA 200

4.2 Power Port

Internal (I/O bus)	+5 V, typical 500 mA, max. 800 mA
Internal (RS 232 C)	±12 V according to DIN 66020

4.3 Data Port

I/O Bus	Internal, parallel I/O bus. For further details please refer to "Specifications" in user manual
RS 232C (V.24)	serial port according to DIN 66 020, potentially linked
Pin Assignment	see Figure 18, page 47
Transmission Rate	9.6 kbaud
Data Format	see "Specifications" in user manual
Modnet 1/SFB	according to RS-485 (symmetrically-serial), floating
Pin Assignment	see Figure 19, page 47
Transmission Rate	62.5 kbaud at max. 1200 m 375 kbaud at max. 300 m
Data Format	see "Specifications" in user manual

4.4 Type of Processor

Intel 8344	Micro-processor (8 Bit) at ALU 252

4.5 Memory Capacity

RAM	32 KB for signal memory and system variables 64 KB (approx 12 k logical instructions) for user program 32 KB for basic software at ALU 202L
EPROM	32 kB for basic software at ALU 202
EPROM Card PC 001	128 kB in order to archive the user program (32 kB of these are reserved for basic software)

4.6 Clock

Frequence Stability	±100 ppm[30)]

4.7 Back-up Battery

Size	$^1/_2$ AA
Placed on the I/O Bus	in order to back up ALU RAM, clock
Voltage (No-Load Operation)	3.6 V
Capacity	0.85 Ah

Life Time

No-Load Operation (Not Connected)	10 years
Conserved Operation	3 years typical, at least 4 months

30) ppm → parts per million, 10^{-6}

4.8 LEDs

yellow LED (above)	ready
yellow LED (below)	run
red LED (above)	Battery error for battery 1
red LED (below)	Battery error for battery 2

4.9 Mechanical Structure

Module	in the 2-slot size module
Format	3 HE, 16 T
Weight	500 g

4.10 Type of Connection

I/O Bus	2 multipoint connectors $^1/_3$ C30M,1 female multipoint connector $^1/_3$ R30F
RS 232C	9 pole female multipoint connector
Modnet 1/SFB	9 pole multipoint connector (for BBS1)

4.11 Environmental Conditions

Standards	VDE 0160
System Data	See ”Specifications” in user manual
Permissible Ambiant Temperature in Operation	-25 ... +70 ^{o}C constant -30 ... +85 ^{o}C short-time (10 minutes)
Power Dissipation	2.5 W typical, max. 4 W

4.12 Ordering Details

Module ALU 252	424 274 957
EPROM Card PC 001	424 075 263
RS 485 Connector BBS 1	424 233 854
Cable JE-LiYCY	424 234 035
Connection Cable YDL 52	424 244 878
Connection Cable YDL 48	424 270 552
DIN A3 Form Block, Central Device Modules	A91M.12-279 382

Replacements

Batteries	424 249 065
Fill-In Label 1	424 277 905
Fill-In Label 2 (ALU 252)	424 274 982
Basic Software on EPROM for ALU 252 (BSW 126)	424 277 765
Plastic Pull Handle (TBP 000)	424 235 247

Data is subject to technical alterations!

DAP 250, DAP 258
Discrete Inputs and Outputs
Module Description

- The **DAP 250** is an output module with 8 discrete, isolated inputs 24 VDC and 8 discrete, isolated, semiconductor outputs 24 VDC, 2 A with short circuit and overload protection.
  The operating temperature is –25 ... +70 °C
- The **DAP 258** is a 8 point, discrete relay output module.
  The operating temperature is –25 ... +70 °C

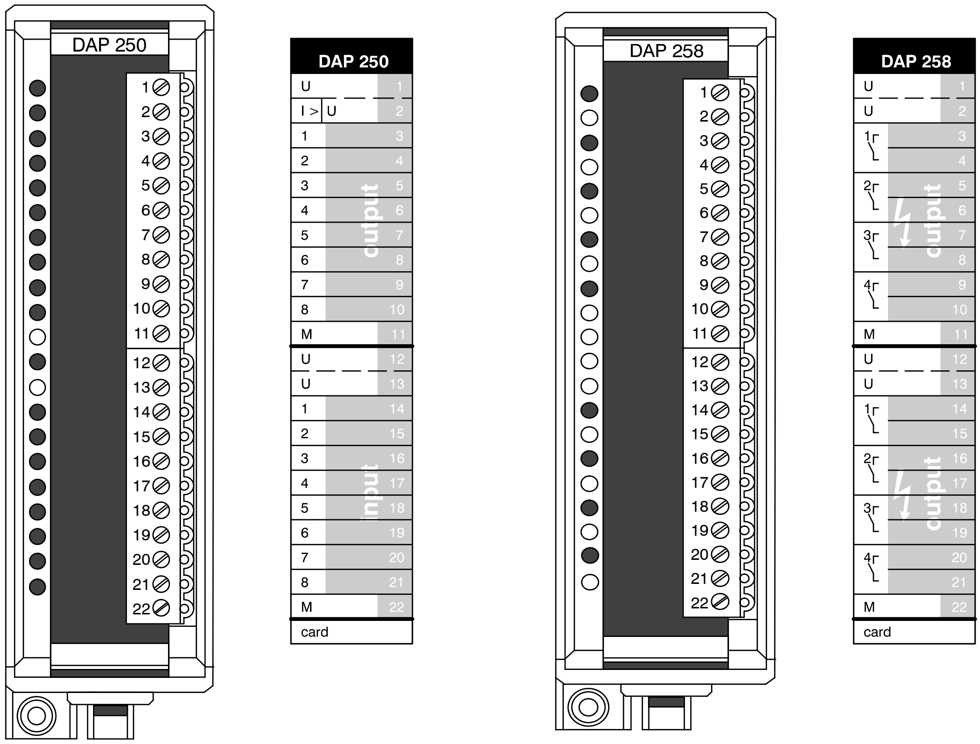


Figure 20 Front view and fill-in label of DAP 250 and DAP 258

1 General

The Module can be installed in any slot of the subracks DTA 200, DTA 201 und DTA 202.

The operating voltage U_B = 24 VDC for sensor supply (inputs) and of the relay coils and the working voltage U_S = 24 VDC for the outputs should be supplied externally. The 5 V voltage supply is obtained internally via the I/O bus.

1.1 Physical Characteristics

The standard box type module has bus contact at the rear and periphery connection via screw/plug-in terminals at the front.

One of the enclosed fill-in labels is inserted in the attachable cover of the subrack near to the viewing window for the LED displays. System relevant data (e.g. signal names) are to be entered in the fields provided.

1.2 Mode of Functioning

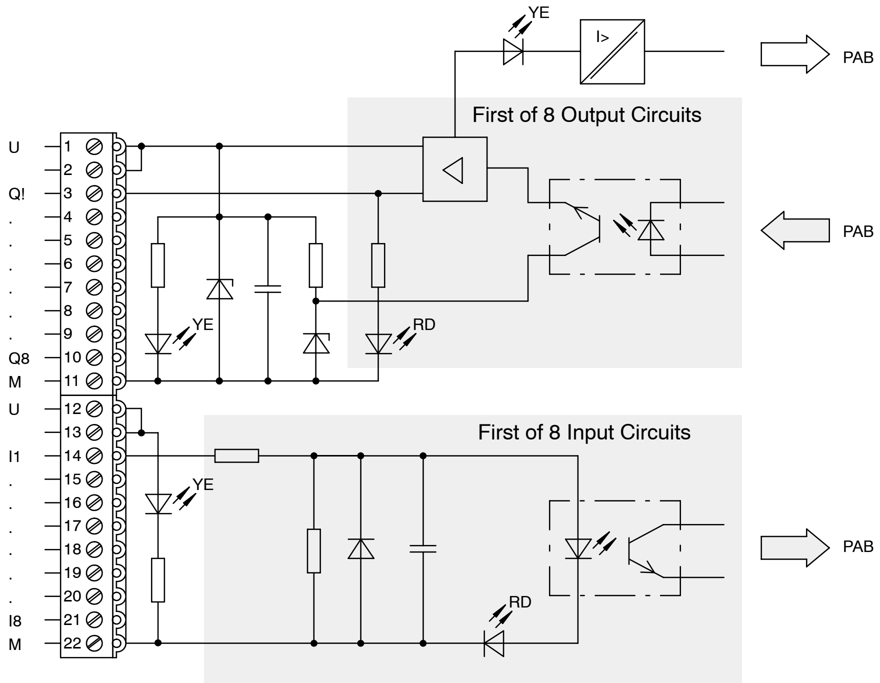


Figure 21 Simplified Schematic for the DAP 250

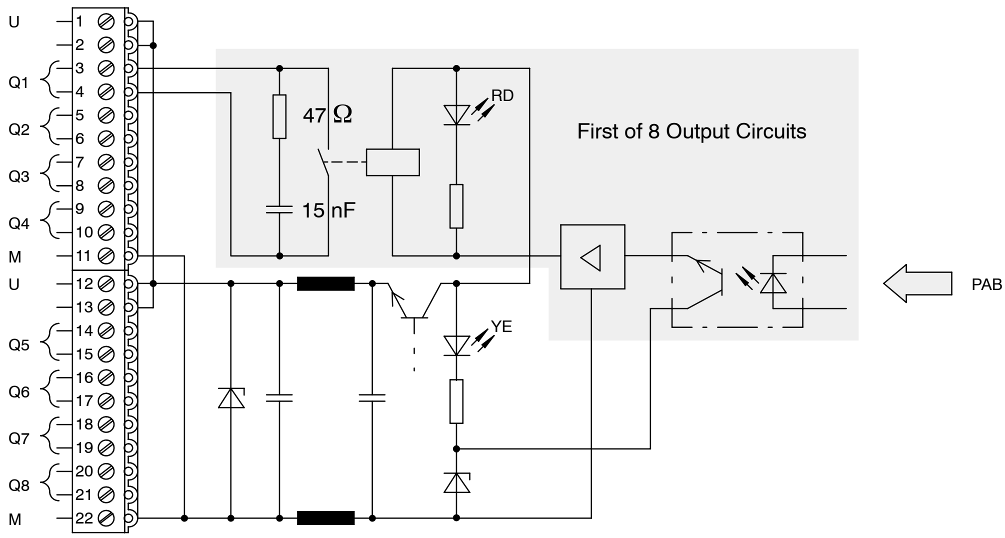


Figure 22 Simplified Schematic for the DAP 258

2 Operating and Display Elements

The front side of the module contains 19 indicators (from upper end):

DAP 250

- ❐ 1 x yellow LED ”U” for the working voltage of the 8 outputs
  - on: Working voltage is available
  - off: Working voltage is not available
- ❐ 1 x yellow LED ”I>” for overload or short circuit on the outputs
  - on: Short circuit or Overload
  - off: Operation without fault
- ❐ 8 x red LED ”1 ... 8” for the output signals
  - on: Output has ”1” signal
  - off: Output has ”0” signal
- ❐ 1 x yellow LED ”U” for external sensor supply
  - on: Sensor supply is available
  - off: Sensor supply is not available
- ❐ 8 x red LED ”1 ... 8” for input signals
  - on: Input has ”1” signal
  - off: Input has ”0” signal or not connected

    <u>Cause</u>

    - Sensor supply is not available
    - Reference potential M1 is cut

DAP 258

- ❐ 1 x yellow LED ”U” for the supply of the relay coils
  - on: Power supply voltage available
  - off: Power supply voltage not available

- ❐ 8 x red ”1 ... 8” for the output signals
  - on: Outputs lead to ”1” signal
  - off: Outputs lead to ”0” signal

For simulation purpose the simulator SIM 011 can be installed on the 8 inputs (lower 11 pole screw/plug-in terminal).

3 Configuration

The following should be configured:

- ❐ I/O slot addresses (compare 3.1)
- ❐ Assignment of signal addresses to periphery signals and connection (compare 3.2)
- ❐ Checking of the rated load, short circuit behaviou (compare 3.3)
- ❐ Connection representation of the periphery signals (DIN A3 forms, compare 3.4)

3.1 I/O Slot Addresses

I/O slot addresses (to be determined according to the chapter 3, ”Equipment and ...”).
The module has no setting elements for addressing.
The moduls must be entered via Dolog AKF as ”DAP 220” moduls instead of ”DAP 250”.
The moduls must be entered via Dolog AKF as ”DAP 208” moduls instead of ”DAP 258”.

3.2 Connection and Assignment of Signal Addresses

DAP 250

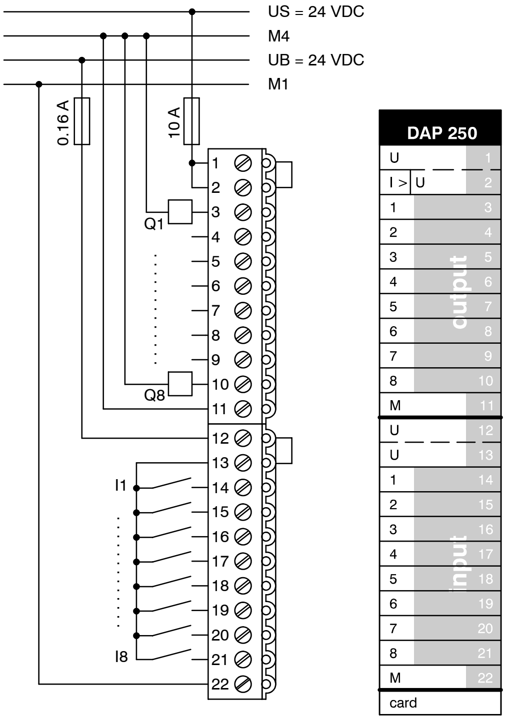


Figure 23 Connection Example for DAP 250

For inductive loads on the outputs use free wheeling diode directly parallel to the inductivity. This protective circuit is **absolutely necessary,** when in output lines switching contacts are present or when the wires to the periphery are very long.

Enter the corresponding signal names or addresses in the fill-in labels.

DAP 258

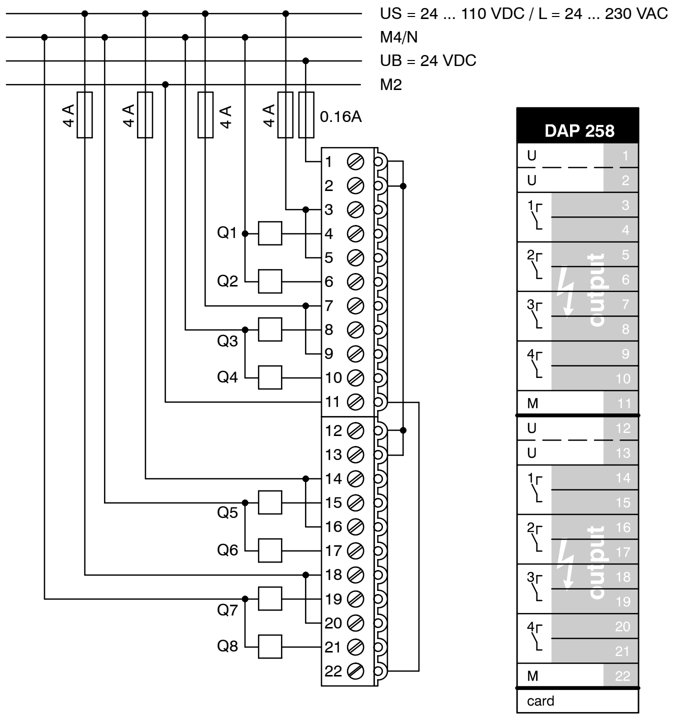


Figure 24 Connection Example for DAP 258

Each signal name resp. signal address should be entered in the fill-in lable.

If you connect inductive loads, you have to provide a protective circuit directly and parallel to inductivity (operating coil):

- for working voltages L = 230 VAC an additional, sufficiently provided (acc. to manufacturer) RC circuit, necessary for increased service life and EMC immunity
- for working voltages U_S = 24 VDC a clamping diode (suppressor diode) for increased service life

Note For general cabling and installation guidelines see user manual, chapter 5.2 "EMC Measures".

3.3 Testing the Permissible Load, Short Circuit Behaviour

The load current for all outputs must correspond to the specifications.
Protection measures and power supply connections should be carried out as given in user manual chapter 3.3 ”Layout of Power Supply”.

Short Circuit Behaviour of DAP 250
The output stages do not store overload information. When in case of overload the working voltage is not switched-off the system tries to switch-on at the output stages repeatedly. This causes an increase in the component temperature.

Therefore the systemmarker SMx.1 assigned to the slot of DAP 250 should be linked in the user program in such a way that in case of overload the outputs are switched over to 0 signal. This system marker switches to 1 signal when:

- The working voltage U_S is not available
- There is an occurence of short circuit or overload
- The 10 A safety fuse is blown

3.4 Documentation Aids

For project specific system documentation and representation of the connected process periphery A3 forms are available.

These forms are for:

- conventional processing and are part of the A120 form block (see ordering details)
- Ruplan processing (TVN version) and are part of the A120 data base

4 Specifications

4.1 Allocation

Programmable Controllers	A120
Structure	In I/O structure

4.2 Power Supply DAP 250

External Sensor Voltage	U_B = 24 VDC
Internal	5 V; typ. 35 mA, max. 60 mA via I/O bus

Power Supply DAP 258

External Sensor Voltage	U_B = 24 VDC
Internal	5 V; typ. 35 mA, max. 60 mA via I/O bus

4.3 Process Interface DAP 250

Inputs

Sensor Power Supply	U_B = 20 ... 30 V for all 8 inputs
Reference Potential M	M1 for all 8 inputs
No. of Inputs	8
Type of networking	Optical coupler, isolated against I/O bus and against outputs
Signal Rated Value	+24 V
Signal Level	1 signal +12 ... +30 V 0 signal −2 ... +5 V
Input Current	7 mA for 24 V 8.5 mA for 30 V
Input Delay	4 ms

Outputs

Working Voltage U	Us = 20 ... 30 VDC, for all 8 outputs
Reference Potential M	M4 for all 8 outputs
Number	8 semiconductor outputs
Construction	with short circuit and overload protection, without restart inhibit, group display for overload/short circuit, group signal via system marker S11x.1
Type of Networking	Potential-free (Optical coupler)
Load Connection	Between output and reference potential M4
Logic	Positive logic
Signal Output Level	1 signal U = U_S − 0.4 V; 0 signal 0 ... +2 V, <1 mA Limiting of the inductive switch-off voltage at −15 V (built in fast de-energization)
Load Current for each Output	10 mA ... 2 A, max. 10 W at bulbs
Switch-on Current for Bulbs	I_{on} = 10 x I_N
Load Current for all	

Outputs	max. 8 A
Required External Fuse	10 A, fast
Operating Delay	<1 ms
Protective Circuit for	Free wheeling diode directly parallel to the inductivity Inductive Loads **absolutely necessary,** when in output lines switching contacts are present or when the wires to the periphery are very long or when the load current is >1 A
Switching Cycles	1000 /h (0.28 /s) for inductive load and max allowable current for each output 100 /s for ohmic load 10 /s at max. bulb load

4.4 Process Interface DAP 258

Relay Outputs

Number	8 Normally open contacts (with LEDs)
Type of Networking	Contacts isolated
Operating Delay	approx. 10 ms
Working Voltages of the Contacts	U_S = 24 ... 110 VDC/U_L = 24 ... 230 VAC, max. 250 VAC
Minimal Load Current	10 mA for new value contacts
Load Currents at 230 VAC	max. 2 A lasting at cos φ = 1 max. 4 A short-term at cos = 1 max. 1 A lasting at cos φ = 0.5 max. 1.5 A/ 240 V acc. to AC 11, VDE 0660, part 200
Protective Circuit (**Absolutely Necessary** in Order to Increase Service Life and EMC Immunity)	all normally open contacts are wired with 68 Ω + 15 nF, remaining current approx. 1 mA, An additional sufficiently dimensioned RC wiring in place parallel to the inductivity (operating coil) is necessary for all inductive loads.
Load Current at DC	**Working voltage 24 VDC** max. 2 A lasting (ohmic laod max. 4 A short-term (ohmic load) max. 1 A lasting (L/R = 30 ms) max. 0.5 A / 24 V according to DC 11, VDE 0660, part 200 **Working voltage 60 VDC** max. 1 A lasting (ohmic load) max. 0.6 A (L/R = 30 ms) **Working voltage 110 VDC** max. 0.45 A lasting (ohmic load) max. 0.25 A (L/R = 30 ms)
Protective Circuit (**Absolutely Necessary** in Order to Increase Service Life)	Free-wheeling diode on-site parallel to inductivity (operating coil)
Overload Protection	should be provided externally

Service Life of Contacts, Reductions Factor
see Modul Desciption DAP 252, DAP 253

4.5 Data Interface

Internal I/O Bus	Parallel I/O bus, see User Manual, Chapter 4 ”Specifications”

4.6 Error Evaluation

Indicators	see chapter 2, page 54
A120 System Marker	(for 1 signal)
SM 31 ... SM 48	I/O node number on slot 1 ... 18 is absent
SMx.1	overload on one or more outputs, see also chapter 3.3, page 57

4.7 Physical Characteristics

Module	In standard size box
Format	3 HE, 8 T
Weight	
DAP 250	280 g
DAP 258	360 g

4.8 Type of Connection

Process	2 pluggable 11 pole screw/plug-in terminals
I/O Bus (Internal)	$^1/_3$ C30M

4.9 Environmental Characteristics

Standards	VDE 0160, UL 508
System data	see User Manual, Chapter 4 “Specifications”
Permissible Ambient	
Temperature in Operation	-25 ... +70 ^{o}C constant
	-30 ... +85 ^{o}C short-time (10 minutes)
Power Dissipation	
DAP 250	5 W typical
DAP 258	2 W typical

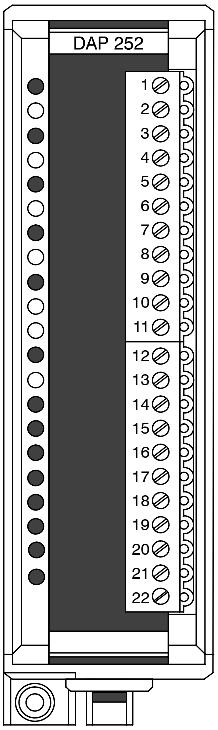
4.10 Ordering Details

Module DAP 250	424 700 586
Module DAP 258	424 700 626
DIN A3 Form Block	
Process-Periphals	A91 M.12-271 683
Replacement Fill-in Label	
for DAP 250	424 700 647
for DAP 258	424 700 843

Subject to technical modifications!

DAP 252, DAP 253 Discrete Inputs and Outputs Module Description

- The **DAP 252** is a 24 VDC (signal level 12 ... 37 V), 8 point isolated input and 4 point output relay module.
  The operating temperature is –25 ... +70 ^{o}C.
- The **DAP 253** is a 110 VDC (signal level 55 ... 170 V), 8 point isolated input and 4 point output relay module.
  The operating temperature is –25 ... +70 ^{o}C.



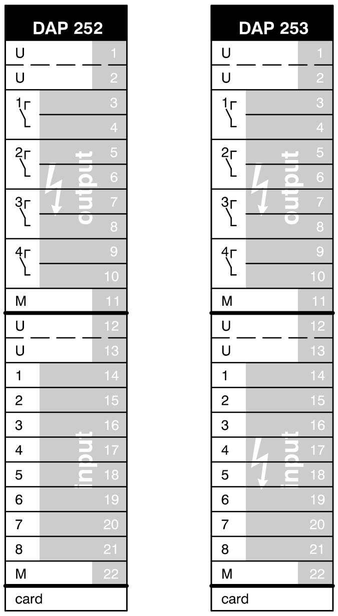


Figure 25 Front View and Fill-In Labels of the DAP 252 and DAP 253

1 General

The module can be inserted in the backplanes DTA 200, DTA 201 and DTA 202 on every I/O slot.

The 24 VDC supply of the relay coils and the 24 VDC sensor power supply should be supplied externally.
The 5 V power supply is realized internally via the I/O bus.

1.1 Physical Characteristics

The standard size module has rear bus contact and front peripheral connection via screw/plug-in terminal blocks.

One of the enclosed fill-in labels has to be inserted into the detachable covering of the backplane next to the LEDs.
The system retated data should be entered into the fields provided (e.g. signal names).

1.2 Mode of Functioning

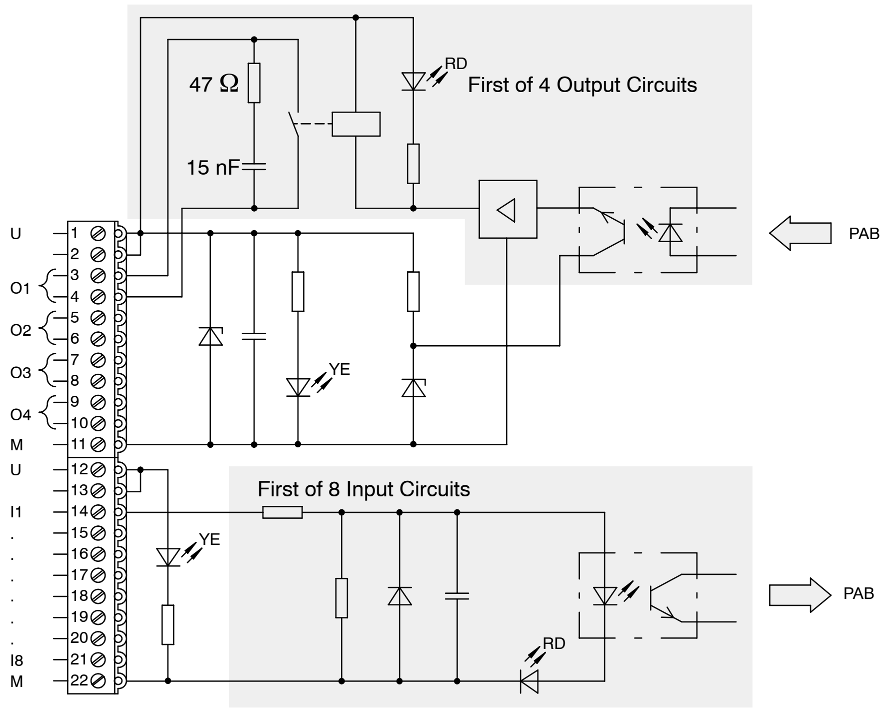


Figure 26 Simplified Schematic for the DAP 252

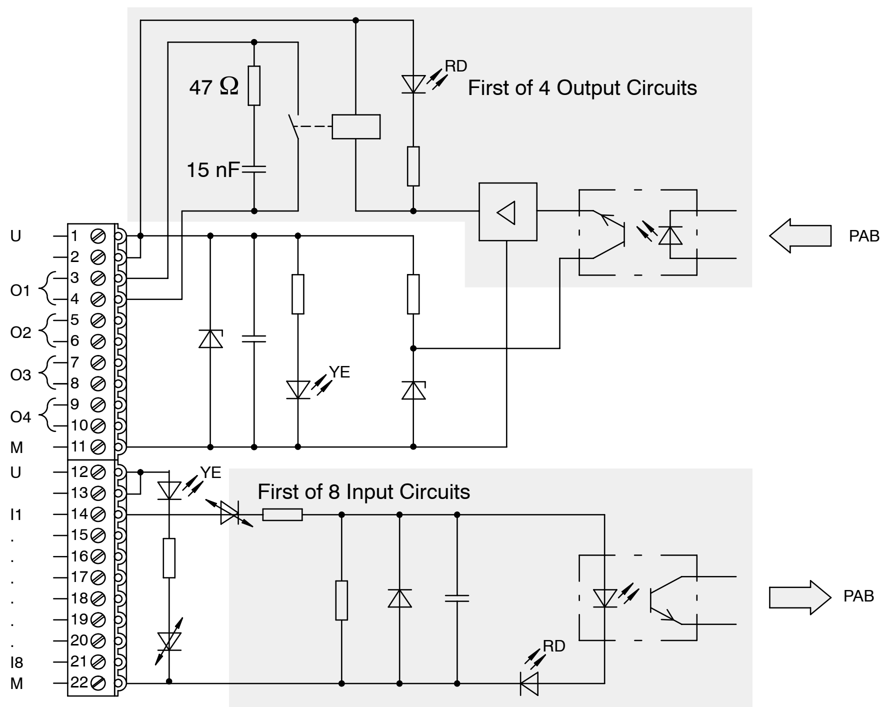


Figure 27 Simplified Schematic for the DAP 253

2 Operating and Display Elements

The front-plate of the module contains the following LEDs:

- 1 x yellow LED ”U” for the supply of the relay coils
  on: Supply voltage available
  off: Supply voltage not available
- 4 x red LEDs ”1 ... 4” for the output signals
  on: Outputs lead to ”1” signal
  off: Outputs lead to ”0” signal
- 1 x yellow LED ”U” for the sensor power supply
  on: Sensor power supply available
  off: Sensor power supply not available
- 8 x red LEDs ”1 ... 8” for the input signals
  on: Inputs lead to ”1” signal
  off: Inputs lead to ”0” signal

For simulation purpose the simulator SIM 011 can be installed on the 8 inputs (lower 11 pole screw/plug-in terminal).

Caution **The Simulator SIM 011 must not be used together with the DAP 253 module.**

3 Configuration

The following have to be configured:

- I/O slot addresses (compare 3.1)
- Allocation of signal addresses to peripheral signals (compare 3.2)
- Testing of the permissible load and plant-floor protective circuit in the event of inductive consumers (compare 3.3)
- Connection presentation of peripheral signals (DIN A3 forms, compare 3.4)

3.1 I/O Slot Addresses

I/O slot addresses (to be determined according to the chapter 3, "Equipment and ...").
The module has no setting elements for addressing.
The moduls must be entered via Dolog AKF as "DAP 212" moduls instead of "DAP 252" resp. "DAP 253".

3.2 Connection and Assignment of Signal Addresses

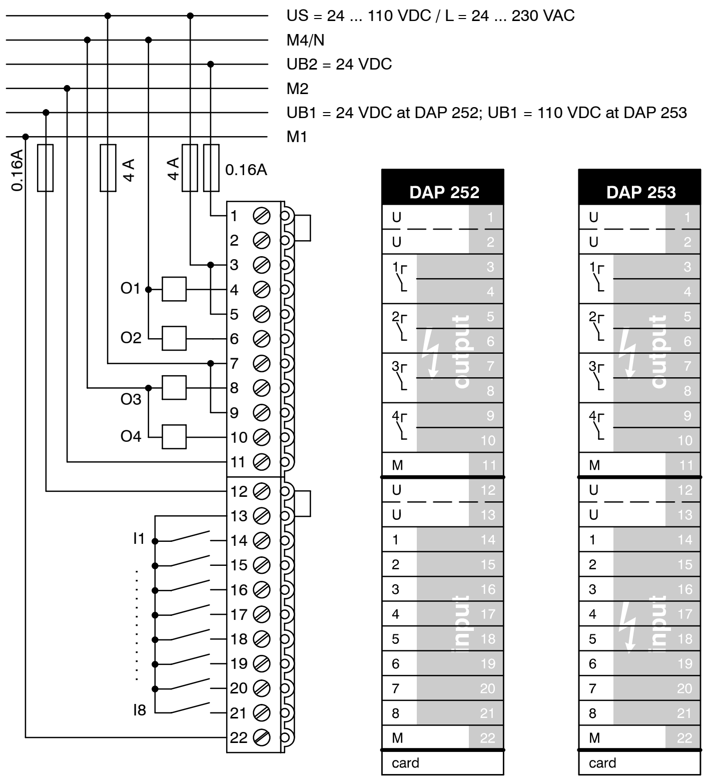


Figure 28 Connection Example for DAP 252, DAP 253

Each signal name resp. signal address should be entered in the fill-in lable.

If you connect inductive loads, you have to provide a protective circuit directly and parallel to inductivity (operating coil):

- for working voltages L = 230 VAC an additional, sufficiently provided (acc. to manufacturer) RC circuit, necessary for increased service life and EMC immunity
- for working voltages U_S = 24 VDC a clamping diode (suppressor diode) for increased service life

☞ **Note** For general cabling and installation guidelines see A120 user manual, chapter 5.2 "EMC Measures".

3.3 Testing the Permissible Load

Load data have to correspond to the specifications.
Please refer to A120 user manual, chap. 3.3 "Layout of Power supply" for connection and supply measures.

3.4 Documentation Aids

DIN A3 forms are available for project specific system documentation and process peripheral documentation.

These forms are:

- for conventional usage part of the A 120 form block (see ordering details)

- for Ruplan usage (Technical Sales Office version) part of the A 120 data base

4 Specifications

4.1 Allocation

Device	A120
Structure	in I/O structure

4.2 Power Supply

External Incoming Power	
Supply for Relay Coils	U_B = 24 VDC, ±5 %, max. 0.07 A
Reference Potential	M (M2)
Internal via I/O bus	5 V, max. 15 mA

4.3 Process Interface

Inputs of DAP 252

Sensor Power Supply	U_B = 24 VDC, ±40 %, for 8 inputs, residual ripple max. 20 % SS
Reference Potential	M (M1) for 8 inputs
Number of Inputs	8 (with LEDs)
Type of Networking	Optical coupler, isolation to the I/O bus
Signal Rated Value	+24 V
Signal Level 1 Signal	+12 ... +37 V
0 Signal	-2 ... +5 V
Input Current	4 mA at 24 V; 6 mA at 37 V
Operation Time	7 ms typical

Inputs of DAP 253

Sensor Power Supply	U_B = 110 VDC, ±40 %, for 8 inputs, residual ripple max. 20 % SS
Reference Potential	M (M1) for 8 inputs
Number of Inputs	8 (with LEDs)
Type of Networking	Optical coupler, isolation to the I/O bus
Signal Rated Value	+110 V
Signal Level 1 Signal	+55 ... +170 V
0 Signal	-2 ... +10 V
Input Current	2.2 mA typical
Operation Time	6 ms typical

Relay Outputs	
Number	4 Normally open contacts (with LEDs)
Type of Networking	Contacts, isolated
Operating Delay	approx. 10 ms
Working Voltages of the Contacts	U_S = 24 ... 110 VDC / L = 24 ... 230 VDC, max. 250 VAC
Minimal Load Current	10 mA for contacts as new
Load Currents at 230 VAC	max. 2 A lasting at cos φ = 1 max. 4 A short-term at cos = 1 max. 1 A lasting at cos φ = 0.5 max. 1.5 A/ 240 V according to AC 11, VDE 0660, part 200
Protective Circuit (**Absolutely Necessary** in Order to Increase Service Life and EMC Immunity)	all normally open contacts are wired with 68 Ω + 15 nF remaining current approx. 1 mA. An additional, sufficiently dimensioned RC wiring in place parallel to the inductivity (operating coil) is necessary for all inductive loads
Load Currents at DC	**Working Voltage 24 VDC** max. 2 A lasting (ohmic load max. 4 A short-term (ohmic load) max. 1 A lasting (L/R = 30 ms) max. 0.5 / 24 V according to DC 11, VDE 0660, Teil 200 **Working Voltage 60 VDC** max. 1 A lasting (ohmic load) max. 0.6 A (L/R = 30 ms) **Working voltage 110 VDC** max. 0,45 A lasting (ohmic load) max. 0,25 A (L/R = 30 ms)
Protective Circuit (**Absolutely Necessary** in Order to Increase Service Life)	Clamping diode in place parallel to the inductivity (operating coil)
Overloading protection	should be provided externally, see page 65
Service Life of Contacts	
Mechanical	20 mio. switching cycles
Electronic (Ohmic Load)	10 mio. switching cycles (230 VAC / 0.2 A) 7 mio. switching cycles (230 VAC / 0.5 A) typ. 8 mio switching cycles (30 VDC / 2 A, with clamping diode) typ. 1 mio. switching cycles (60 VDC / 1 A, with clamping diode)
electric cos φ = 0.5	5 mio. switching cycles (230 VAC / 0.5 A)

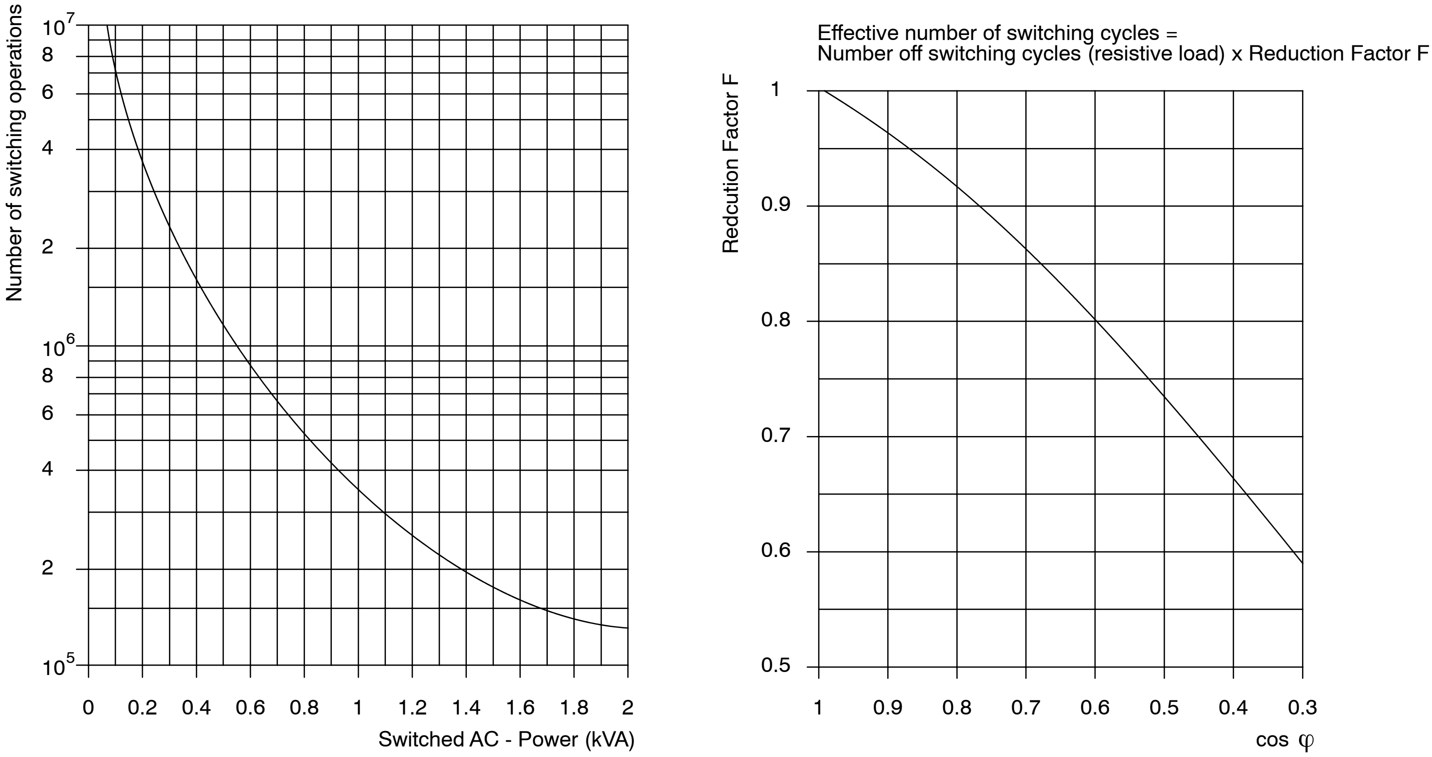


Figure 29 Left: Contact Service Life for Ohmic Load **Right: Reduction Factor for Inductive Load**

4.4	**Data Port**	
	Internal I/O Bus	parallel I/O bus, see A120 User Manual, chapter 4 ”Specifications”
4.5	**Error Evaluation**	
	Indicators	see chapter 2, page 64
	A120 System Marker	(for 1 signal)
	SM 31 ... SM 48	I/O node number on slot 1 ... 18 is absent
4.6	**Physical Characteristics**	
	Module	in the standard size module
	Format	3 HE, 8 T
	Weight	240 g
4.7	**Type of Connection**	
	Process	2 pluggable 11 pole screw/plug-in terminal blocks
	I/O Bus (internal)	$^{1}/_{3}$ C30M
4.8	**Environmental Conditions**	
	Standards	VDE 0160
	System Data	see A120 User Manual, chapter 4 ”Specifications”
	Permissible Ambient Temperature in Operation	-25 ... +70 °C
	Power Dissipation	2 W typical

4.9 Ordering Details

Module DAP 252	424 274 942
Module DAP 253	424 274 943
Simulator SIM 011	424 244 721
A3 Form Block	A91V.12-271 683

Replacement

Fill-In Label for DAP 252	424 274 984
Fill-In Label for DAP 253	424 274 986

Data is subject to technical alterations!

DAU 252 Analog Output Module Description

DAU 252 is an analog output module with 2 isolated outputs.
You can connect to each output:
Actuator for ±10 V or
Actuator for ±20 mA.
Each output can be used for current output (I) or voltage output (U).
The operating temperature is −25 ... +70 °C

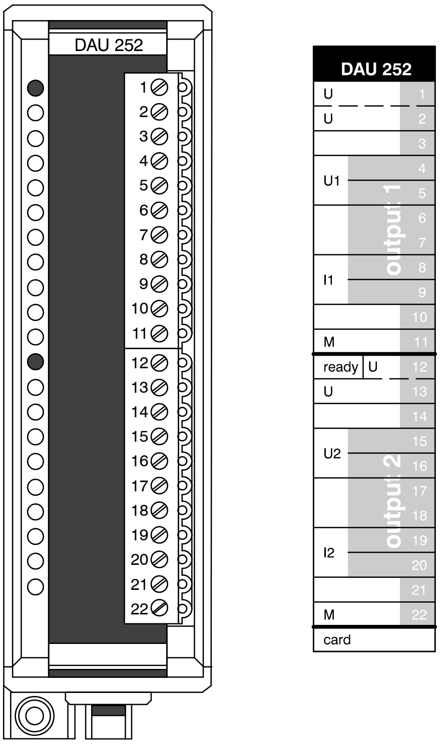


Figure 30 Front View and Fill-In Label of DAU 252

1 General

This module can be installed in the backplanes DTA 200, DTA 201 and DTA 202. It can be installed in any I/O slot.

The digital-analog converter has a resolution of 11 bit plus sign.
After conversion in the DAU, the decimal words QW ... are shown as analog values at the respective addresses.

1.1 Physical Characteristics

The standard size module has bus contact at the rear and peripheral connection at the front via 11 pole screw/plug-in terminal blocks.

One of the enclosed fill-in labels has to be inserted into the detachable covering next to the LEDs. The system related data should be entered into the fields provided (e.g. signal names).

1.2 Mode of Functioning

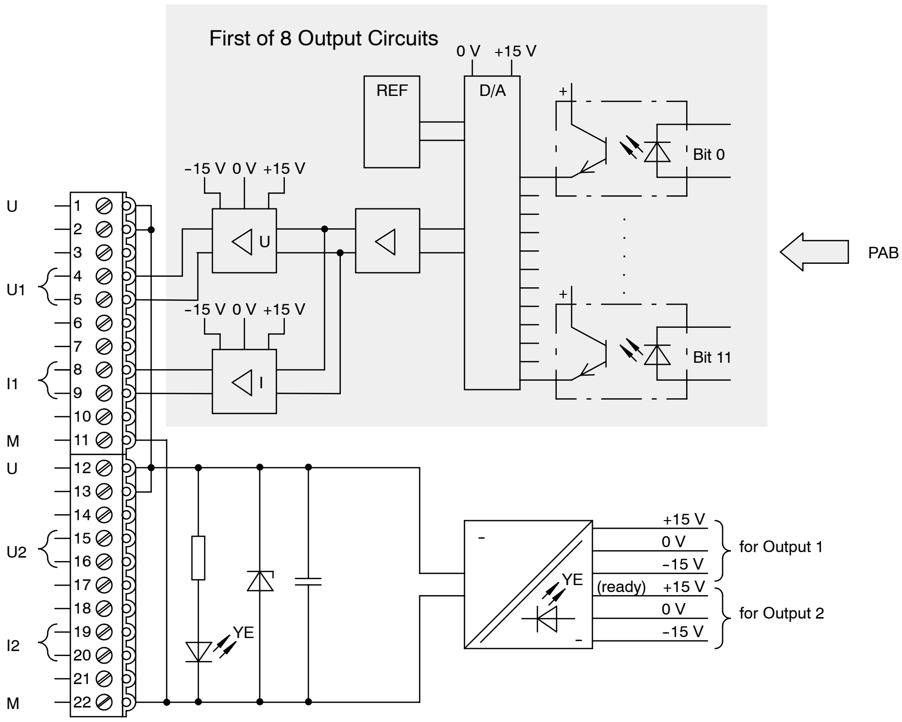


Figure 31 Simplified Schematic for the DAU 252

2 Operating and Display Elements

The front plate of the module contains 2 LEDs:

- 1 x yellow LED ”U” for 24 V power supply
  on: Power supply available
  off: Power supply is not available

- 1 x yellow LED ”ready”
  on: Isolated supply voltage available (DC/DC converter in operation)
  off: Isolated supply voltage not available

3 Configuration

The following has to be configured:

- I/O slot addresses (compare LEERER MERKER)
- Cabling (running of cables, shield, compare 3.2)
- Assignment of signal addresses to peripheral signals (compare 3.3)

3.1 I/O Slot Adresses

I/O slot addresses (to be determined according to the chapter 3, ”Equipment and ...”).
The module has no setting elements for addressing.
The moduls must be entered via Dolog AKF as ”ADU 202” moduls instead of ”ADU 252”.

3.2 Cabling

Note For general cabling and installation guidelines see user manual, chapter 5.2 ”EMC Measures”.

- Shielded cables (2 x 2 x 0.5 mm^2, twisted per channel) should be used for the connections. All channels can be placed in a common shielded cable.
- The shield should be connected to earth ground / earth at one end with short cable (<20 cm).
- The cable should not be laid together with power supply lines or other similar sources of electrical disturbances. Distance >0.5 m.

3.3 Connection and Assignment of Signal Addresses

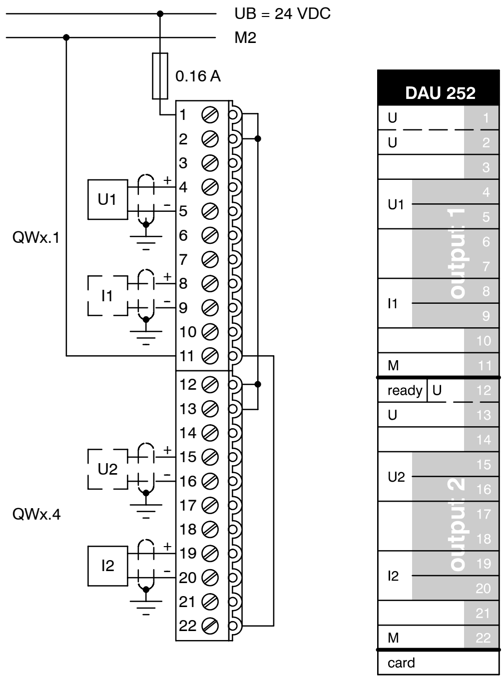


Figure 32 Connection Example DAU 252

Each output can be used for current output (I) or voltage output (U).

After conversion in the DAU, the decimal words QWx.1 and QWx.2 are shown as analog values at the respective addresses 1 and 2.

Enter the respective signal name or signal address in the fill-in label.

3.3.1 Earthing the Shields

- ❐ Lay the shielded cable via the cable earthing bar CER 001
- ❐ Remove shield insulation from the cable at the height of the cable cleat
- ❐ Press the cable with the shield removed into the cable cleat (contact to top hat rail)
- ❐ Use cable clips to relief strain on cables (see Figure 33)

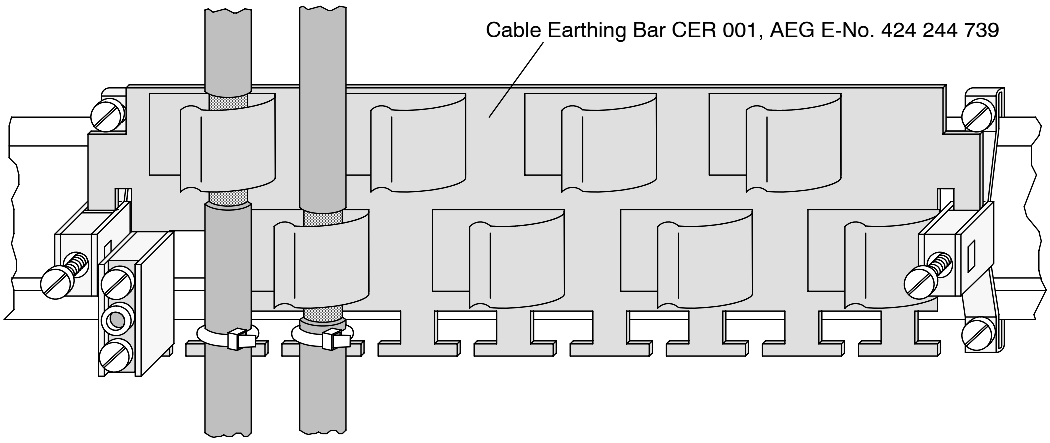


Figure 33 Earthing the Shields

3.4 Documentation Aids

DIN A3 forms are available for project specific system documentation and process peripheral documentation.

The connection of DAU 252 is identical to that of DAU 202. Therefore, please use use the forms of DAU 202.

4 Specifications

4.1 Allocation

Programmable Controller	A120
Structure	in I/O structure

4.2 Power Supply

External Power Supply	U_B = 24 V, ±5 % / max. 150 mA
Internal via I/O bus	5 VDC; typ. 40 mA, max. 60mA

4.3 Outputs

Number of outputs	2, Current or voltage output
Potential Isolation	Optical coupler, (from I/O bus, 24 V supply and 2. output)
Current Output	±20 mA, <500Ω
Voltage Output	±10 V, >5 kΩ, short-circuit-proof

Table 18 Conversion Value DAU 252

Analog Value Current Output mA	 Voltage Output V	Decimal value	Comments
+20.02 ... +20.50	+10.01 ... +10.25	+32 001 ... +32 767	Overrange
+20.00	+10.00	+32 000	linear Range
+10.00	+5.00	+16 000	
+2.00	+1.00	+3 200	
+1.00	+0.50	+1 600	
+0.62	+0.31	+1 000	
+0.20	+0.10	+320	
+0.02	+0.01	+32	
0.00	0.00	0	
−0.02	−0.01	−32	
−0.20	−0.10	−320	
−0.62	−0.31	−1 000	
−1.00	−0.50	−1 600	
−2.00	−1.00	−3 200	
−10.00	−5.00	−16 000	
−20.00	−10.00	−32 000	
−20.02 ... −20.50	−10.01 ... −10.25	−32 001 ... −32 768	Overrange

Overrange	ca. 2.4 %
Error at 0 ... 60 °C	ca. ±0.6 %
Conversion Time per Output	ca. 5 ms
Resolution	11 Bit plus Sign

4.4 Data Port

Internal I/O Bus	parallel I/O bus, see User Manual, chapter 4 ”Specifications”

4.5 Error Evaluation

indicators	see chapter 2, page 73
A120 System Marker	(for 1 signal)
SM 31 ... SM 48	I/O node number on slot 1 ... 18 is absent
SMx.1	Error during the generation of the internal ±15 V supply

4.6 Physical Characteristics

Module	Standard size module
Format	3 HE, 8 T
Weight	ca. 300 g

4.7 Type of Connection

Proces, Power Supply	2 pluggable 11 pole screw/plug-in terminal blocks
Process Cable	Min. cross section 0.5 mm^2, pairwise twisted, references conductor in cable, shielded e. g. JE-LiYCY 2 x 2 x 0.5
Installation Distance	>0.5 m (from potential interferences)
Cable Length	max. 100 m
I/O bus (internal)	$^1/_3$ C30M

4.8 Environmental Characteristics

Standards	VDE 0160
System Data	see User Manual, chapter 4 "Specifications"
Temperature in Operation	–25 ... +70 °C constant –30 ... +85 °C short–time (10 minutes)
Power Dissipation	4 W typical

4.9 Ordering Details

Module DAU 252	424 703 463
Cable to Process JE-LiYCY	424 234 035
DIN A3 Form Block Process-Periphals	A91M.12-271 683
Replacements	
Fill-in Label for DAU 252	424 703 479

Data is subject to technical alternations!

DEP 254
Discrete Input
Module Description

The **DEP 254** is a 16 point, isolated, 12 ... 60 VDC input module.
Its application with AKF12 is possible from version 6.0 upwards (AKF125 from version 5.0).
The operating temperature is –25 ... +70 ^{o}C

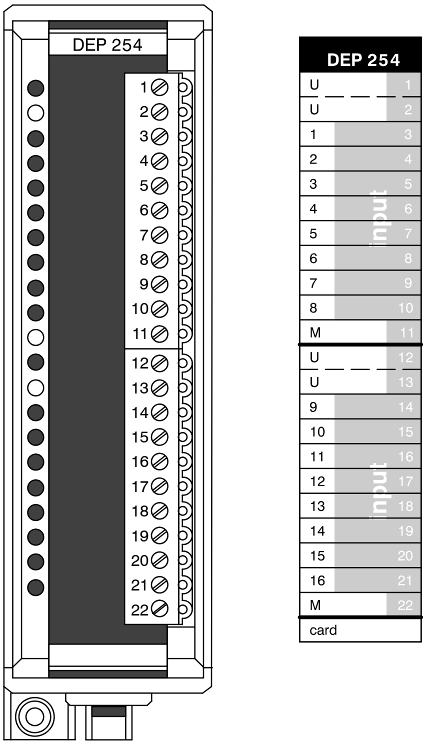


Figure 34 Front View and Fill-In Label of the DEP 254

1 General

The module can be inserted in the backplanes DTA 200, DTA 201 and DTA 202 on every I/O slot.

The discrete inputs are isolated via optical couplers.
The external sensor power supply 24 ... 48 VDC should be supplied externally for each 8 inputs.

1.1 Physical Characteristics

The standard size module has rear bus contact and front peripheral connection via screw/plug-in terminal blocks.

One of the enclosed fill-in labels has to be inserted into the detachable covering of the backplane next to the LEDs.
The system retated data should be entered into the fields provided (e.g. signal names)

1.2 Mode of Functioning

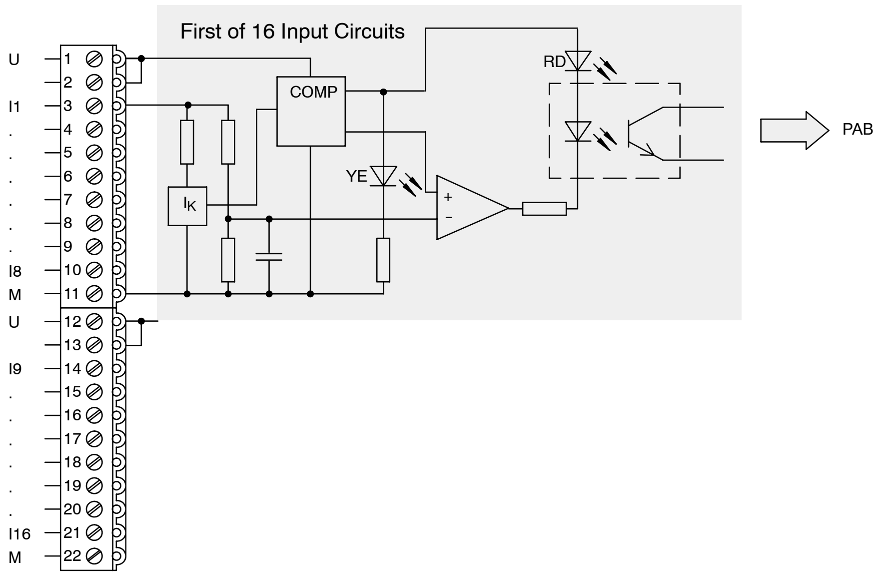


Figure 35 Simplified Schematic for the DEP 254

2 Operating and Display Elements

The front plate of the module contains the following LEDs:

❒ 2 x yellow LED ”U” for external sensor power supply
on: Sensor power supply available
off: Power supply not available

❒ 16 x red LEDs ”I1...16” for input signals
on: Input has ”1” signal
off: Input has ”0” signal or not connected
Cause
Sensor power supply is not available or
Reference potential M1 is interrupted

For simulation purpose the simulator SIM 011 can be installed on the 8 inputs (lower 11 pole screw/plug-in terminal).

3 Configuration

The following have to be configured:

- I/O slot addresses (compare 3.1)
- Allocation of signal addresses to peripheral signals (compare 3.2)

3.1 I/O Slot Adresses

I/O slot addresses (to be determined according to the chapter 3, ”Equipment and ...”). The module has no setting elements for addressing.
The moduls must be entered via Dolog AKF as ”DEP 214” moduls instead of ”DEP 254”.

3.2 Connection

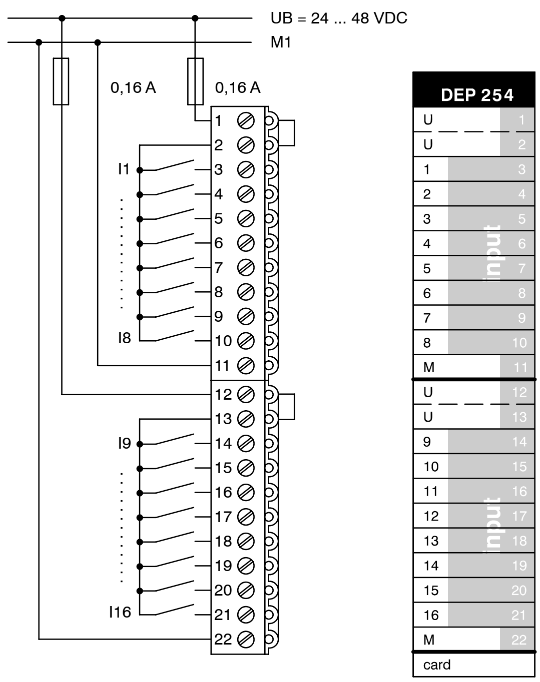


Figure 36 Connection Example for DEP 254

Each signal name resp. signal address should be entered in the fill-in lable.

Note For general cabling and installation guidelines see user manual, chapter 5.2 ”EMC Measures”.

3.3 Documentation Aids

The system documentation corresponds to that of DEP 216.

4 Specifications

4.1 Allocation

Device	A120
Structure	in I/O structure

4.2 Inputs

Sensor-Power Supply	U_B = 24 ... 48 V, $\pm$ 40% for 8 inputs residual ripple max. 20% SS
Reference Potential	M (M1) for 8 inputs
Number of Inputs	2 x 8 in groups
Type of Networking	Optical coupler, isolated 2 groups within each other and against I/O bus

Table 19 Switching level

Signal input Unenn	24 V	48 V
Signal Level at 0-Signal	−3 ... +5 V	−6 ... +10 V
Signal Level at 1-Signal	+11 ... +30 V	+33 ... +60 V
Current at 0-Signal	−1,7 ... +2.9 mA	−3,4 ... +2,5 mA
Current at 1-Signal (I_E)	+6,0 ... +7,1 mA	+2,0 ... +2,5 mA
Reference Current (I_R)	$\leq$10 mA	$\leq$7 mA

Switching Level (0 ↔ 1 Signal)	28 ... 33 % von Usch
Operation Time	4 ms
Operating Frequency	max.100 Hz

Input Current per Group

$I_G = 8 \times I_E + I_R$	max. 80 mA

4.3 Data Port

Internal I/O Bus	parallel I/O bus, see User Manual, chapter 4 "Specifications"
Power Supply (Internal)	5 V, max. 22 mA typical 15 mA, via I/O bus

4.4 Error Evaluation

Indicators	see chapter 2, page 81
A120 System Marker	(for 1 signal)
SM 31 ... SM 48	I/O node number on slot 1 ... 18 is absent

4.5 Physical Characteristics

Module	in standard size module
Format	3 HE, 8 T
Weight	260 g

4.6 Type of Connection

Process	2 pluggable 11 pole screw/plug-in terminal blocks
I/O Bus (Internal)	$^{1}/_{3}$ C30M

4.7 Environmental Conditions

Standards	VDE 0160
System Data	see User Manual, chapter 4 ”Specifications”
Permissible Ambient	
Temperature in Operation	-25 ... +70 °C constant
	-30 ... +85 °C short-time (10 minutes)
Power Dissipation	max. 4 W

4.8 Ordering Details

Module DEP 214	424 703 288
Simulator SIM 011	424 244 721
Replacement Fill-In Label	424 703 289

Data is subject to technical alterations!

DEP 255, DEP 257 Function Module Description

- The **DEP 256** is a 16 point, isolated, 24 VDC (12 ... 37 V) input module.
  The operating temperature is -25 ... +70 ^{o}C.
- The **DEP 257** is a 16 point, isolated, 110 VDC (55 ... 170 V) input module.
  The operating temperature is -25 ... +70 ^{o}C.

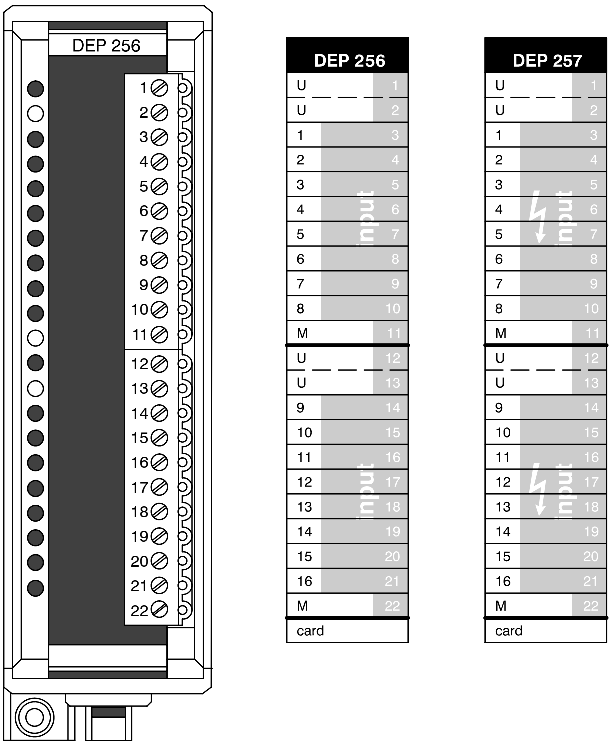


Figure 37 Front View and Fill-In Label of the DEP 256 and DEP 257

1 General

The module can be inserted in the backplanes DTA 200, DTA 201 and DTA 202 on every I/O slot.

The discrete inputs at DEP 256 and at DEP 257 are isolated via optical couplers.
The external sensor power supply 24 or 110 VDC should be supplied externally for each 8 inputs.
The 5 V power supply is realized internally via the I/O bus.

1.1 Physical Characteristics

The standard size module has rear bus contact and front peripheral connection via screw/plug-in terminal blocks.

One of the enclosed fill-in labels has to be inserted into the detachable covering of the backplane next to the LEDs.
The system retated data should be entered into the fields provided (e.g. signal names)

1.2 Mode of Functioning

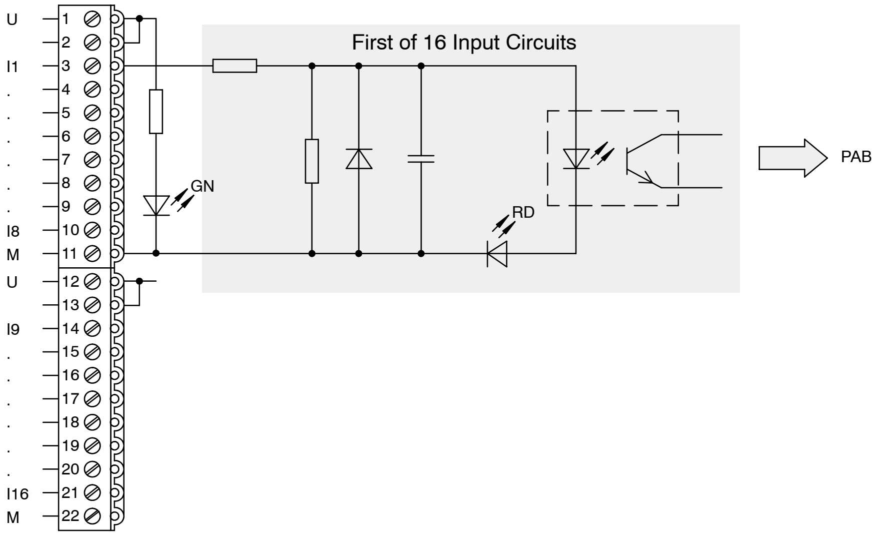


Figure 38 Simplified Schematic for the DEP 256 and DEP 257

2 Operating and Display Elements

The front plate of the module contains the following LEDs:

- 2 x yellow LED ”U” for external sensor power supply
  on: Sensor power supply available
  off: Power supply not available

- 16 x red LEDs ”E1...16” for input signals
  on: Input has ”1” signal
  off: Input has ”0” signal or not connected
  Cause
  Sensor power supply is not available
  Reference potential M1 is interrupted

For simulation purpose the simulator SIM 011 can be installed on the 8 inputs (lower 11 pole screw/plug-in terminal).

Caution The simulator SIM 011 must not be used together with the DEP 257 module.

3 Configuration

The following have to be configured:

- I/O slot addresses (compare 3.1)
- Allocation of signal addresses to peripheral signals (compare 3.2)

3.1 I/O slot addresses

I/O slot addresses (to be determined according to the chapter 3, ”Equipment and ...”). The module has no setting elements for addressing.
The moduls must be entered via Dolog AKF as ”DEP 216” moduls instead of ”DEP 256” resp. ”DEP 257”.

3.2 Connection

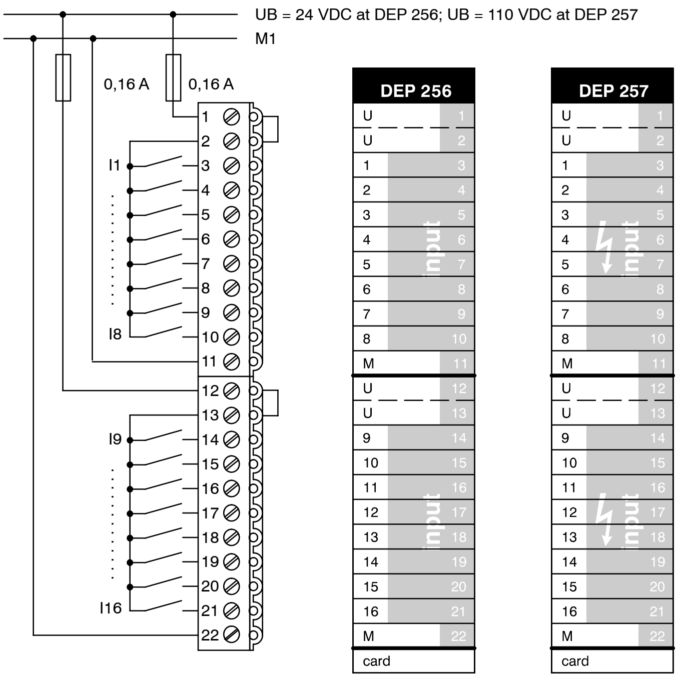


Figure 39 Connection Example for DEP 256 and DEP 257

Each signal name resp. signal address should be entered in the fill-in lable.

Note For general cabling and installation guidelines see user manual, chapter 5.2 ”EMC Measures”.

3.3 Documentation Aids

The system documentation corresponds to that of DEP 216.

4 Specifications

4.1 Allocation

Device	A120
Structure	in I/O structure

4.2 Inputs of DEP 256

Sensor-Power Supply	U_B = 24 VDC, ±40 % for 8 inputs residual ripple max. 20 % SS
Reference Potential	M (M1) for 8 inputs
Number of Inputs	2 x 8 in groups
Type of Networking	Optical coupler, isolated 2 groups within each other and against I/O bus
Rated Signal Value	+24 V
Signal Level 1 Signal	+12 ... +37 V
0 Signal	–2 ... +5 V
Input Current	4 mA at 24 V; 6 mA at 37 V
Operation Time	4 ms

4.3 Inputs of DEP 257

Sensor-Power Supply	U_B = 110 VDC, ±40 % for 8 inputs residual ripple max. 20 % SS
Reference Potential	M (M1) for 8 inputs
Number of Inputs	2 x 8 in groups
Type of Networking	Optical coupler, isolated 2 groups within each other and against I/O bus
Rated Signal Value	+110 V
Signal Level 1 Signal	+55 ... +170 V
0 Signal	–2 ... +10 V
Input Current	2.2 mA typical
Operation Time	4 ms

4.4 Data Port

Internal I/O Bus	parallel I/O bus, see A120 User Manual, chapter 4 ”Specifications”
Power Supply (Internal)	5 V, max. 25 mA via I/O bus

4.5 Error Evaluation

Indicators	see chapter 2, page 3
A120 System Marker	(for 1 signal)
SM 31 ... SM 48	I/O node number on slot 1 ... 18 is absent

4.6 Physical Characteristics

Module	in standard size module
Format	3 HE, 8 T
Weight	220 g

4.7 Type of Connection

Process	2 pluggable 11 pole screw/plug-in terminal blocks
I/O Bus (Internal)	$^1/_3$ C30M

4.8 Environmental Conditions

Standards	VDE 0160
System Data	see A120 User Manual, chapter 4 ”Specifications”
Permissible Ambient Temperature in Operation	–25 ... +70 ^{o}C
Power Dissipation	3 W typical

4.9 Ordering Details

Module DEP 256	424 703 464
Module DEP 257	424 703 465
Simulator SIM 011	424 244 721
DIN A3 Form Block, Process-Peripherals	A91M.12-271 683

Replacement

Fill-In Label for DEP 256	424 703 480
Fill-In Label for DEP 257	424 703 481

Data is subject to technical alterations!

DNP 255
Power supply
Module Description

The **DNP 255** is an isolated DC power supply for 24 VDC input voltage and 5 VDC/ 2 A output voltage.
The DNP is the power supply for the parallel I/O bus of the A120.
The operating temperature is −25 ... +70 ^{o}C

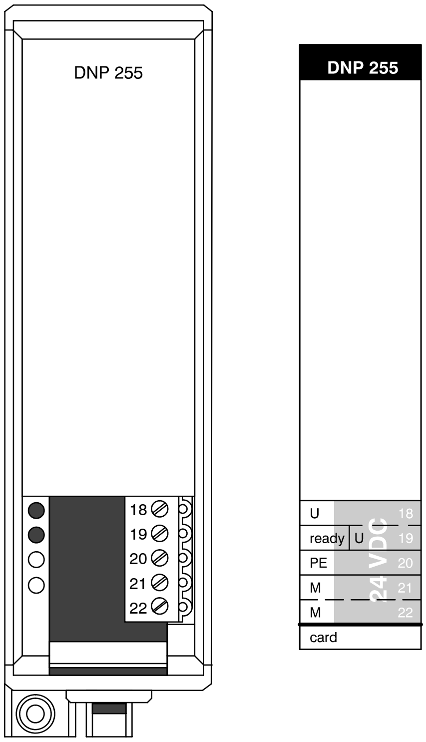


Figure 40 Front View and Fill-In Label of the DNP 255

1 General

The module can only be inserted in slot 1 (on the right next to the ALU).
The power supply voltage is 24 VDC.
The internal operating voltage of 5 V is generated from the power supply voltage.
The signal of under voltage monitor of primary and secondary voltage is used internally by the module.

1.1 Physical Characteristics

The module is a standard size module, has rear bus contact and front peripheral connection via screw/plug-in terminal blocks.
One of the enclosed fill-in labels has to be inserted into the detachable covering of the backplane next to the LEDs.
The system related data should be entered into the fields provided.

2 Operating and Display Elements

The front plate of the module contains the following LEDs:

- 1 x yellow LED ”U” for the 24 VDC power supply
  on: Power supply voltage available
  off: Power supply voltage not available

- 1 x yellow LED ”ready” for 5 V output voltage
  on: 5 V output voltage available
  off: Module not ready for operation, 5 V output voltage is not available

3 Configuration

The following have to be configured:

- Slot Addresses (compare 3.1)

- Connection (compare 3.2)

3.1 Slot Addresses

The module can only be inserted in slot 1 (on the right next to the ALU).
In addition it is necessary to enter the type designation via Dolog AKF-Software.
The module must be entered via Dolog AKF as ”DNP 205” moduls instead of ”DNP 255”.

3.2 Connection

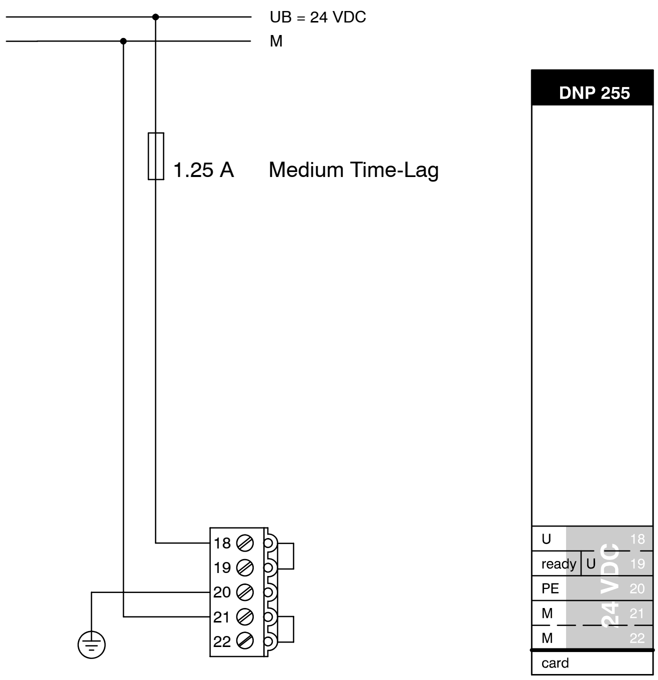


Figure 41 Connection Example

System-related data of supply should be entered in the fill-in lable.

The noise immunity can be increased, if discharge capacitors are connected to the U and M terminals of each module. For more information refer to user manual chapter ”Earthing the A120”.

3.3 Documentation Aids

DIN A3 forms are available for project specific system documentation and process peripheral documentation. These forms are:

- for conventional usage and they are part of the A 120 form block (see ordering details)
- for Ruplan usage (Technical Sales Office version) and they are part of the A 120 data base

20

4 Specifications

4.1 Allocation

Device	A120
Structure	in I/O stucture, slot 1

4.2 Power Supply

External Incoming	U_B = 24 VDC $\pm$ 5%, max. 0.85 A
Auxiliary Fuse	1.25 A medium-time lag
Making Current	20 A, time constant = 1 ms
Tolerancen, Limiting Value	see User Manual chapter 4 "Specifications"
Reference Potential M	M2
Protective Earth	PE
Secondary Voltage	5.15 VDC, max. 2 A, isolated
Back-Up Time	typical 5 ms at 24 VDC
Overload Protection	by current limitation

4.3 Physical Characteristics

Module	in standard size module
Format	3 HE, 8 T
Weight	350 g

4.4 Type of Connection

Power Supply	5 pole screw/plug-in terminal blocks
I/O Bus (Internal)	$^1/_3$ C30M

4.5 Environmental Conditions

Standards	VDE 0160
System Data	see User Manual chapter 4 "Specifications"
Permissible Ambient	
Temperature in Operation	-25 ... +70 °C constant
	-30 ... +85 °C short-time (10 minutes)
Power Dissipation	5 W typical

4.6 Ordering Details

Module DNP 255	424 274 958
DIN A3 Form Block,	
Central Device Modules	A91M.12-271 683
Replacement Fill-In Label	424 274 980

Data is subject to technical alterations!

Index