

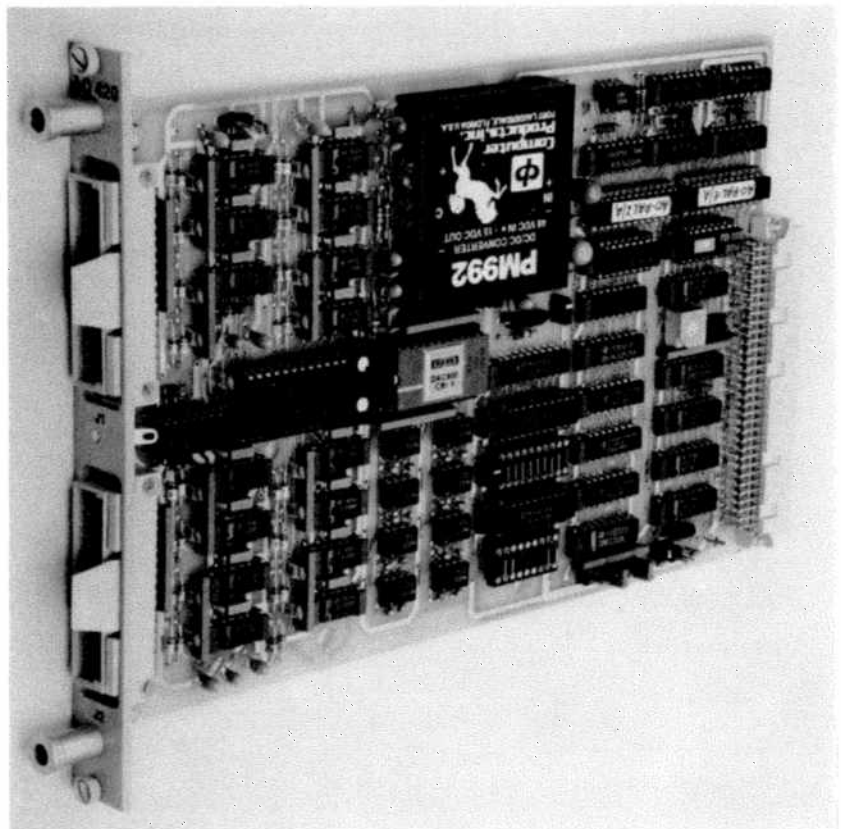
# OPERATING INSTRUCTIONS

## ANALOG OUTPUT

## AO 420

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## 1. GENERAL

The AO 420 is an analog output unit conforming to the BS 420 bus. It provides digital/analog conversion for 16 analog output channels. The output part is galvanically isolated from the bus system with opto-couplers and DC/DC converters.

## 2. FEATURES

- 16 analog output channels
- Galvanic isolation between the analog output section and the bus
- 12 bit D/A converter
- Jumper selectable output voltage ranges
  - Bipolar:  $\pm 10.00$  V or  $0 \dots \pm 10.240$  V
  - Unipolar:  $0 \dots +10.00$  V or  $0 \dots +10.235$  V
- Linear and, as an option, logarithmic format
- All outputs are automatically initialized when the supply voltage is turned on

## 3. SPECIFICATION

	Standard	with log. option
- Designation	AO 420	AO 420 L
- Parts list Nr.	BG 512 860 -T	BG 512 875 -T
- Diagram Nr.	BG 541 183 -S	
- Drawing Nr.	BG 542 861 -Z	
- Board format	SC 420 format	
- Voltage:	$+ 5$ V $\pm 5\%$ / 0.8 A typical $\pm 24$ V $\pm 2\%$ / 100 mA typical	
- Space requirements	1 slot	
- Bus interface		
- Bus load	0.5 DC load 1 AC load	
- Address space:	whole I/O page	
- Register:	1 command word AOCSR 1 data word AODBR	
- Data format	- without option: 12 bit right justified - with LOG option: <ul style="list-style-type: none"> <li>a) Linear representation: 12 bit left or right justified (selectable with command word)</li> <li>b) Log. representation 16 bit</li> </ul>	
- Fastest permissible throughput:		
- for command word	10 $\mu$ s	
- for channel data	15 $\mu$ s	
- Data transfer:	Write only (replay also with read)	
- Initialization:	With control word and BINIT	
- Time for initialization:	- with power up: 40 ms - with BINIT or MODE 0: 320 $\mu$ s	

- Analog Outputs:
  - Ranges and resolution:

Setting	Range	Resolution
a) Normal bipolar	-10.240 ... +10.235 V	5.00 mV
b) With jumpers bipolar	-10.000 ... +9.9951 V	4.88 mV
c) With jumpers unipolar	0 ..... +10.238 V	2.50 mV
d) With jumpers unipolar	0 ..... +9.9976 V	2.44 mV

- Output impedance: 2 x 100 Ohm sym.
- Output current: 1 mA max.
- Response time: (data input – analog output)
  - a) Channel  $\phi$  Rise to 0.01 % of end value, max. 20  $\mu$ s
  - b) Channels 1 – 15 Rise to 1 % of end value, max. 20  $\mu$ s
  - Channels 1 – 15 Rise to 0.01 % of end value, max. 480  $\mu$ s
- Accuracy 0.2 %
- Differential linearity monotone
- Galvanic isolation with reference to the instrument's ground: 25 V<sub>eff</sub> / 60 V DC with jumper H open
- Range of logarithmic representation: 3 decades: 3.33 V / decade; linear in the vicinity of the zero point

#### 4. DESCRIPTION

The AO 420 produces analog signals from digital data for 16 independent output channels. The data transmitted from the computer are stored separately for each channel in a 16 x 12 bit memory. The converter circuit (which works with a single D/A converter) accesses the data for the individual channel addresses one after the other, converts them and transmits them to a sample and hold (S & H) at each channel output. This conversion process is repeated cyclically for each channel which prevents the S & H from drifting (refresh cycle). When new channel data are received, the refresh process is interrupted for a cycle and the new data is processed. The refresh cycle then starts again and continues until new data is received, when the whole process is repeated again.

The response time for a channel is determined by the transient response time of the S & H. It is uniform for channels 1 ... 15. Channel 0 is an exception. Its response time is approximately 20 times faster. It is thus especially suited for outputting higher frequency signals (refer to response time in Section 3).

The basic model of the AO 420 converts the input data linearly into an analog signal.

With the logarithmic option it is possible to convert the data logarithmically across 3 decades (refer to Appendix A). The designation is then AO 420 L.

When the supply voltage is turned on and the computer carries out an INIT, all the output channels are automatically initialized to 0V.

Jumpers must be used to select the output ranges for all the channels. A choice must be made between unipolar and bipolar, and between 10.00 or 10.240 V output voltage range.

## 5. CONFIGURATION (Refer Appendix B)

### 5.1. Factory configuration

Function	Factory Configuration		User Configuration	
	Status	Jumpers / Switch	Status	Jumpers / Switch
a) Addressing:				
→ AOCSR	174 500	IN: A7, A9, A10 OUT: A6, A8, A11 A12		
AODBR	174 502	Switch S1 = "φ"		
b) Analog Output				
– Voltage range	Bipolar	B/1 – 2   IN C/1 – 2   IN D/1 – 2   IN		
	± 10.240 V	E           OUT		
c) Grounding:	To chassis	H/1 – 2   IN		
d) Log. Option	Not installed	J5/1 – 20 IN J5/2 – 19 IN J5/3 – 18 IN J5/4 – 17 IN J5/5 – 16 IN J5/6 – 15 IN J5/7 – 14 IN J5/8 – 13 IN J4/1 – 20 IN J4/2 – 19 IN J4/7 – 14 IN J4/8 – 13 IN		
e) Service Mode	Disabled	F/1 – 2   IN		

### 5.2 Selection of addresses

The AO 420 board can be allocated anywhere in the I/O address space (160000 .. 177774). Addresses are selected with jumpers A/6 ... A/12 and switch S1. Address block size is 2 words.



### 5.3.2 AO 420 with logarithmic option

The logarithmic option pc board is plugged into the two sockets once jumpers J4 and J5 have been removed.

The analog range must be set for  $\pm 10.240$  V (refer to section 5.3.1)

### 5.3.3 Galvanic isolation

Jumper "H" (0 Ohm resistor) is used to connect the analog output section to the "chassis ground" thus grounding it.

When jumper H is removed, the output section is isolated from the ground.

**Warning:** If jumper H is removed, be sure to follow local safety regulations.

## 6. INSTALLATION

### 6.1 Important information

Read the section "The installation of modules" in the SC 420 operating instructions.

- Before any manipulation is undertaken on the module or its connections, the unit and any external voltage sources must be turned off.
- Do not connect cables meant for other modules.

### 6.2 Installation in the SC 420

The AO 420 can be installed in any slot in the SC 420.

**Caution:** The galvanically isolated analog outputs are grounded over the back panel of the SC 420 when jumper H is inserted. For that reason it is important that the AO 420 is screwed down so that contact is assured for safety purposes.

### 6.3 Connections

Analog output connectors J1 and J2:

The analog outputs are galvanically isolated from the LSI 11 bus. To protect the AO 420 output a 100 Ohm resistor is integrated in each "Signal" and "GND" line.

**Caution:** The individual output channels are **not** galvanically isolated from one another.

Pin assingement:	J 1	J 2
Row a/c		
○1○	CHANNEL 0 OUT	CHANNEL 8 OUT
○2○	" 0 GND	" 8 GND
○3○	" 1 OUT	" 9 OUT
○4○	" 1 GND	" 9 GND
○5○	" 2 OUT	" 10 OUT
○6○	" 2 GND	" 10 GND
○7○	" 3 OUT	" 11 OUT
○8○	" 3 GND	" 11 GND
○9○	" 4 OUT	" 12 OUT
○10○	" 4 GND	" 12 GND
○11○	" 5 OUT	" 13 OUT
○12○	" 5 GND	" 13 GND
○13○	" 6 OUT	" 14 OUT
○14○	" 6 GND	" 14 GND
○15○	" 7 OUT	" 15 OUT
○16○	CHANNEL 7 GND	CHANNEL 15 GND

Comment: An adapter for the analog output connectors to 2 mm banana plugs is available for all 16 channels (connection box AB 020)

## 7. PROGRAMMING

Detailed information for the programmer is available in the Engineering Handbook.

## 8. MAINTENANCE

8.1 Periodic maintenance: none

### 8.2 Troubleshooting

Some program packages allow direct operation of the individual outputs in service mode. The outputs of units without a service mode can be easily tested with ODT (refer to LSI 11 documentation). Refer to the Engineering Handbook for details.

## 9. DETAILED DESCRIPTION

Detailed information for the trained service engineer is available in the Engineering Handbook.

## 10. ACCESSORIES (Option)

Refer to Section 11 for order numbers.

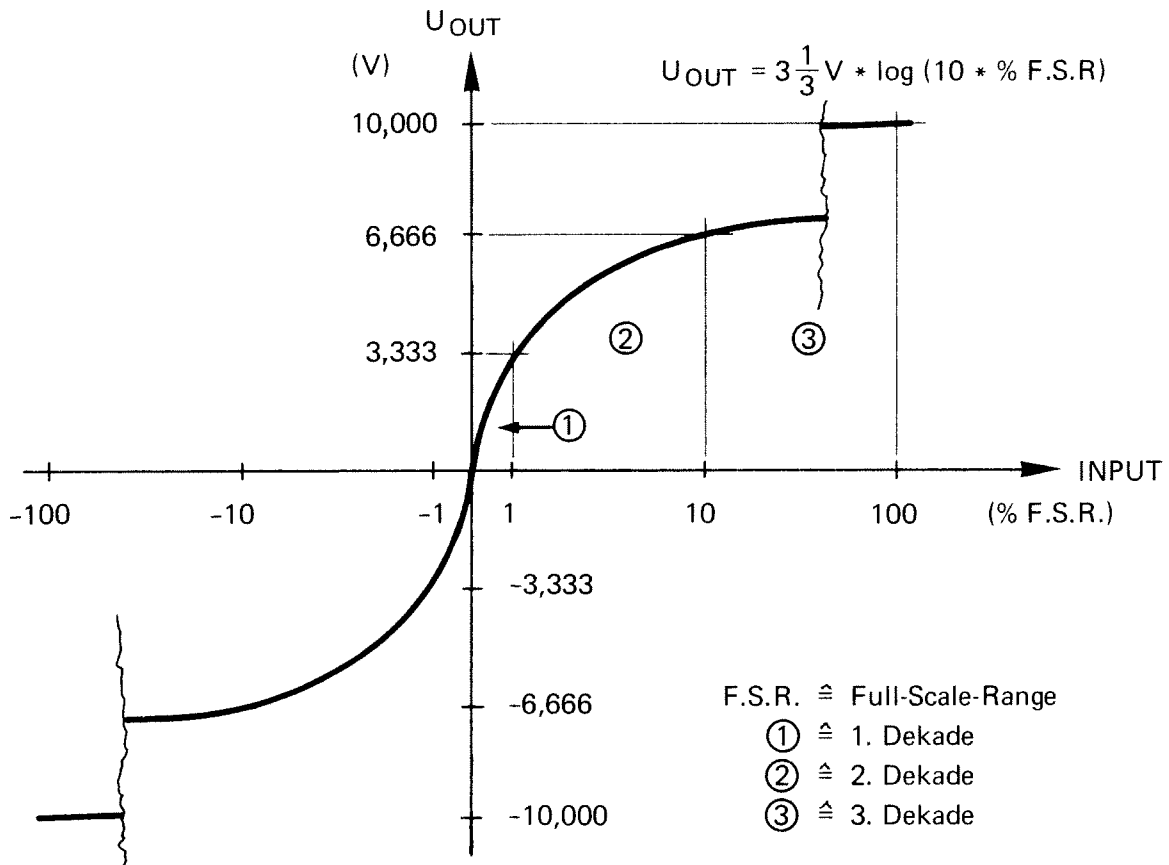
- Logarithmic option pc board (piggy-back board)
- Connection box AB 020 as adapter for 2 mm banana plugs.
- Cable connector for J1 and J2 (inserted for AO 420 L)

## 11. SPARE PARTS

Defective units are replaced in their entirety and returned to Balzers for repair.

			Description Teil	Item Pos.	Order No. Bestell-Nr.	S	Reference Bemerkungen
			Jumper		B 5097 929 KJ		J4, J5
			Log. Option PC board		BG 512 853 -T		
			Connection box "AB 020"		BG 546 420 -T		
			Connection plug / Anschlussstecker:				
	1		– Plug case / Steckergehäuse		BG 531 194 -T		
	1		– Support / Buchsenkörper		B 4717 354 AS		Crimp-Version
	32		– Contact / Kontakt		B 4717 354 KG		Crimp-Version
			– Female connector / Federleiste, 100–454, C/2, 32 P		B 4717 306 DL		Löt-Version
<b>Spare Parts for / Ersatzteile zu</b>						<b>BALZERS</b>	
		AO 420	BG 512 860 -T BG 512 875 -T (L)				BG 800 189 Ea

APPENDIX A: Logarithmic function



Zero correction (symmetric for positive and negative values)

