

# OPERATING INSTRUCTIONS

## Bus Chassis

## SC 420

including the components:

– Power supply

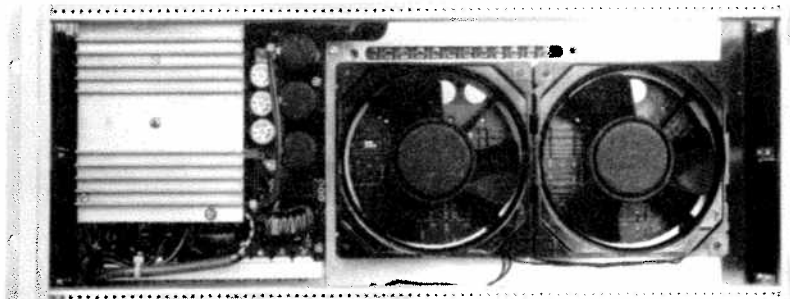
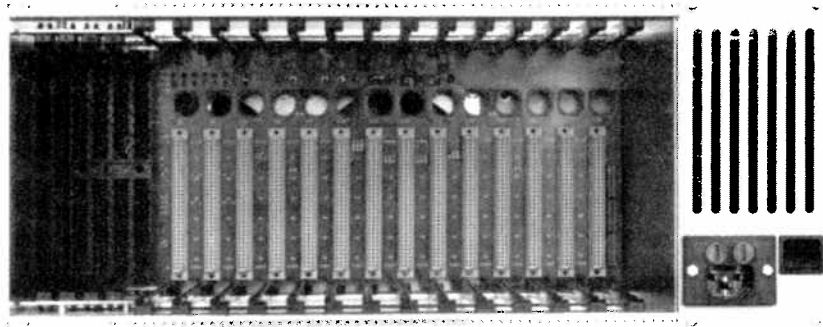
PS 420

– Bus

BS 420

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## 1. GENERAL

The SC 420 is a 19" rack module with power supply, bus and a fan system. It is designed for the installation of plug-in pc boards in SC 420 and DEC format. The SC 420 is used to assemble different measurement and control devices.

## 2. FEATURES

- DEC LSI 11 compatible
- Space for 4 DEC dual height modules
- Space for 14 Balzers SC 420 modules
- Space for control panel and display elements
- Back panel has two RS232C connectors
- Power supply and fans included
- Power switch on back panel as standard
- Power switch on front panel on request
- Available as rack or bench model (housing available as accessory)

\* DEC, LSI 11, Q-BUS are trade marks of the Digital Equipment Corp.

## 3. TECHNICAL DATA

### Bus Chassis

- Designation SC 420
- Parts list Nr. BG 512 810 -T
- Diagram Nr. BG 541 256 -S
- Drawing Nr. BG 512 811 -Z
- Dimensions 19" rack module, 482 mm wide  
4 height units, 177 mm  
438 mm deep
- Weight 12.5 kg without boards
- Ambient temperature 0 ... 40 °C operation  
– 40 ... + 85 °C storage
- Ventilation with fans, air filters at both sides

### Power supply

- Designation PS 420
- Mains connection Europa connector
- Technical data see Appendix A

### Bus

- Designation BS 420
- Parts list Nr. BG 512 820 -T
- Diagram Nr. BG 541 176 -S
- Drawing Nr. BG 512 821 -Z
- Power consumption 5 V / 0.4 A
- DEC part Q-22 standard
- Number of slots 4 (DEC dual height format)
- Back panel with two RS232 connectors (25 pole, socket)

- BALZERS part as per LSI 11/2 bus
- Number of slots 14
- Addressing 16 bit (incl. bank 7)
- Interrupts level 4, BEVNT, DMA
- Supply + 5 V,  $\pm 24$  V
- Other see description and diagram
- Connector type DIN 41612 (64 pole sockets)
- SC 420 module format 144.5 x 220 x 20 mm (4 TE)
- Termination 220 Ohm (plug-in components)

**4. DESCRIPTION**

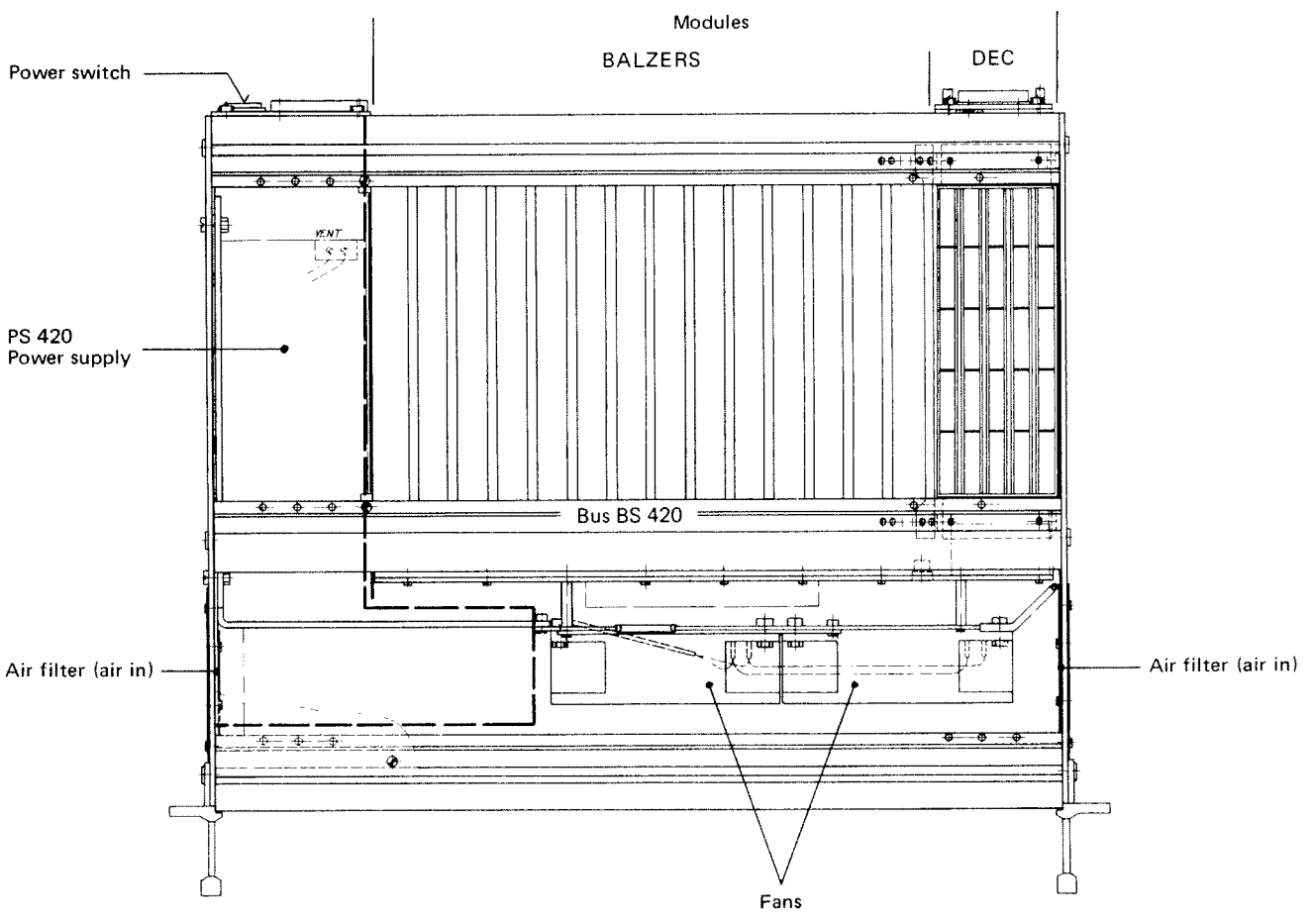


Fig. 1

#### 4.1 SC 420 bus chassis

The SC 420 bus chassis contains the power supply, the bus and the cooling fans with air filters. It has space for plug-in pc board modules. A control and display panel can be mounted behind the front panel.

Both the DEC and the Balzers modules are inserted from the back of the SC 420. The DEC modules (taking up 4 slots) are covered with a single partial back panel which contains the connectors and cables to the DEC boards.

The Balzers modules have individual partial back panels in which the input/output connector is installed directly. Modules can also comprise several boards with a common backplate. The additional  $\pm 24$  V supply and space available allow the modules in the Balzers section to draw more power than those in the Q-bus part. This is optimized for the actual data processing tasks.

Cooling air enters at both sides of the front section and exits at the rear of the rack module. The cooling system is fitted with filters which are accessible from outside the SC 420.

A separately available housing with folding legs allows the SC 420 to be converted to a bench unit.

#### 4.2 PS 420 power supply

See Appendix A.

#### 4.3 BS 420 bus

The DEC section (J1 ... J4) is completely Q22 bus compatible. The +5 VB (battery) and +12 VB (battery) connections are not supplied by the power supply. They are conducted to connection points that can be supplied by an auxiliary supply.

The SRUN signal can be conducted from any of the 4 slot J1 ... J4 via a jumper to the first Balzers slot (J5). The MM 420 module, which has a RUN indicator LED, is usually installed in this slot. This makes it possible to only partially fill the DEC section without having to use bus continuity boards (to connect the daisy chained lines).

The Balzers section deviates from the Q-bus standard in the following:

- Mechanical part and connector conform to DIN
- No 12 V, but  $\pm 24$  V
- 16 bit address line (including BBS7)
- Only BIRQ4, BEVNT and DMA

The bus lines for both sections are connected through directly and terminated with 220 Ohm (plug-in SIP's).

The first Balzers slot (J5) is specially equipped for the MM 420 board. The MM 420 receives, among others, the LTC and PF signals from the power supply and uses them to generate the BPOK, BDCOK and BEVNT bus signals.

## 5. CONFIGURATION

The configuration of the individual modules including the addresses and other settings (jumpers) is made according to the corresponding operating instructions and instrument and software data.

Normally, units based on the SC 420 are configured, assembled, and provided with the appropriate software at the factory. Knowledge of the software features and the hardware rules is a prerequisite before any modifications in the selection of modules for the SC 420 are made. Only those in agreement with the information in the operating instructions are allowed as only those modules included in the software can function. In addition, missing modules can cause partial or total failure of other modules.

In general, the rules published by DEC for the LSI 11 bus (such as those in the PDP 11 Architecture Handbook, code EB-23657-18, Appendix E) apply for the selection of components on the bus and expansion of the bus.

### 5.1 Installation of the CPU

In contrast to DEC units, here the CPU does not necessarily need to be in slot 1. However, it must be placed in the lowest numbered slot used. There may be no empty slots between the CPU and the Balzers section. If the CPU generates the SRUN signal (not for "Falcon"), the SRUN jumper must be placed according to the slot used.

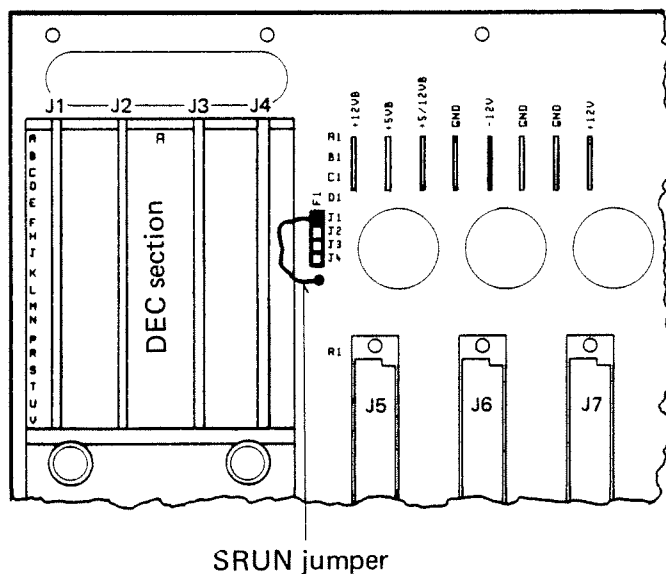


Fig. 2

### 5.2 Additional DEC modules

Additional DEC modules such as memories, interfaces etc. are to be installed in slots numbered higher than the CPU slot. There may be no empty slots between modules. The modules must be installed in the sequence specified for that particular unit. When replacing with other types of modules, attention must be paid to the interrupt priorities.

### 5.3 Balzers SC 420 module

If the voltage monitoring, the line clock (LTC) and the RUN lamp are to be used in the MM 420 (multi-function module), the MM 420 must be installed in slot J5.

Further boards are to be installed in the slots immediately following to maintain the interrupts and the DMA daisy chains. If the modules in the higher numbered slots do not generate such signals, these rules need not be followed. Jumpers must be inserted for modules requiring two or more slots and having no through connection for the BIAK and BDGM signals. These modules (such as the PE 420 Penning board) can also be inserted after all the interrupt capable boards to avoid having to insert jumpers.

Read and take note of the documentation for the entire instrument here as the proximity of certain boards and the influence of electromagnetic fields may also be important criteria in addition to the priority sequence.

#### **5.4 Configuration table**

The configuration table (Appendix B) helps in the dimensioning of a unit. It is used to determine space requirements, bus load, power supply load, and arrangement and configuration of the boards.

The maximum permissible values in the table may under no circumstances be exceeded.

The data for the individual modules can be found in the corresponding operating instructions for those modules and the DEC handbooks. An up-to-date module specification (BG 513 000) is available from Balzers on request. The copy in Appendix C is for general information purposes only.

When combining several bus chassis, the applicable DEC rules and the operating instructions for the expander modules must be followed.

## **6. INSTALLATION**

### **6.1 Setting up**

The SC 420 is installed in a 19" rack or can be provided with a housing to convert it to a bench model.

When setting up, special attention must be paid that the two lateral air filters are easily accessible, as these must be periodically cleaned.

The air circulation in the rack must be good. The hot air exiting the unit must not be allowed to reenter the air inlets.

Depending on the ambient temperature, the number of units in the rack, and the type of rack, rack ventilation must be provided so that the maximum permissible ambient temperature is not exceeded.

Lower temperatures have a positive effect on equipment reliability and lifetime.

### **6.2 Power connection**

Before making the power connection, check that the data on the nameplate located on the back panel of the power supply corresponds with the local mains data. If this is not the case, the unit must be converted:

- Pull the power plug out of the back panel
- Remove the back panel from the power supply
- For 115 V: place two jumpers in the appropriate terminals, both mains fuses are 10 A slow.
- For 230 V: place one jumper in the appropriate terminal, both mains fuses are 5 A slow.
- Correct the voltage data on the nameplate

Because the mains plugs differ from country to country, Balzers only supplies Europa apparatus plugs. You must either manufacture a cable as shown in Fig. 3 or use an appropriate cable. Pay special attention to correct placement of the protective ground lead.

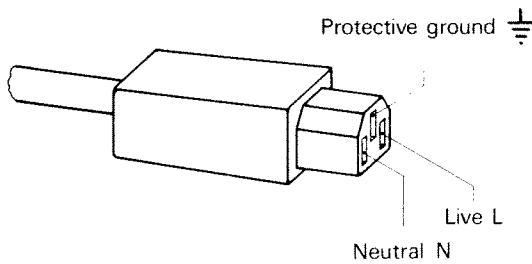


Fig. 3

### 6.3 Installing the modules

**WARNING:** Certain modules and the power supply operate on fatal levels of voltage! Incorrect handling can also destroy other modules.

For these reasons always do the following before manipulating the modules or their connections:

- Disconnect the unit and any external voltages sources from the mains
- Wait until the capacitors in the power supply have discharged

Refer to Section 5.

The component sides of the DEC section boards face the BALZERS section.

First carefully mount the cables in the back panel of the DEC section, then install the back panel and cables together as a unit.

All modules must be screwed in place. Their back panels also serve as an interference shield. The surfaces of the back panel that make contact with the frame must be kept clean.

Empty slots must be covered with blanking panels for touch protection purposes, as some modules operate on dangerous levels of voltage.

Refer to the electrical diagram binder in the customer documentation for connecting the power distributor with the system components.

## 7. MAINTENANCE

For maintenance refer to the operating instructions for the individual instruments as well as the individual instructions for the modules.

**\*WARNING: ALWAYS PULL THE POWER PLUG BEFORE OPENING THE INSTRUMENT**

- Only properly trained personnel may work on the open instrument
- No metal may fall into the instrument, don't reach into it!
- Never insert or remove modules while the instrument is on.

### 7.1 Air filters and fans

The air filters on the left and right hand walls of the rack module must be checked periodically and cleaned if necessary. If this is not done the instrument will overheat. How often this needs to be done will depend

on the individual operating conditions.

Remove the two middle screws, only loosen the four outer screws. The filter holder can now be pushed away and the filter taken out. The filters can be cleaned with soap and water and should be dried (such as with a towel). In some cases, such as when the dust is dry, the filters can be simply cleaned in place with a vacuum cleaner, and need not be removed at all.

The fans are maintenance-free, but should nevertheless be checked at regular intervals.

To check the fans, connect the power and turn the unit on briefly when the cover panel (or if the front panel has power switch) is open. Both fans must run. Check for noise caused by worn bearings. If necessary, replace the fans.

## 7.2 Power supply

The power supply contains no parts needing periodic maintenance

## 7.3 Modules

Refer to the maintenance instructions in the individual operating instructions for all the modules installed in your SC 420.

# 8. TROUBLESHOOTING

CAUTION: Note the WARNINGS in Section 7.

## 8.1 Power supply

Refer to Appendix A for specification.

- In the event of excess temperature, the integrated thermal protection circuit in the PS 420 switches the power supply off. When the power supply has cooled down, the circuit switches it back on again automatically.
- Check the power supply line and the primary fuses

CAUTION: Careless handling can damage several modules at one time!

- Check the voltages at the bus terminals.
- If there is no voltage at a particular terminal, loosen the terminal and check the open circuit voltage and possibly also the current.
- Depending on the results of the above tests, find out the faulty load module (also consider the BS 420 with capacitors) or check the fuses for the power supply
- The fuses between the transformer windings and the recifier are located behind:
  - the power supply back panel for + 5 V and + 12 V
  - the front panel for + 24 V and - 24 V

Refer to Fig. 4

The PF and LTC signals can only be checked when the MM 420 is in slot J5.

- If the fault cannot be repaired by the above measures, the PS 420 (or the SC 420) should be repaired by the BALZERS Service Department. Because of the unit's compact design, further checks should only be made by properly trained personnel.

10 A slow (from back)  
(5 V / 12 V)

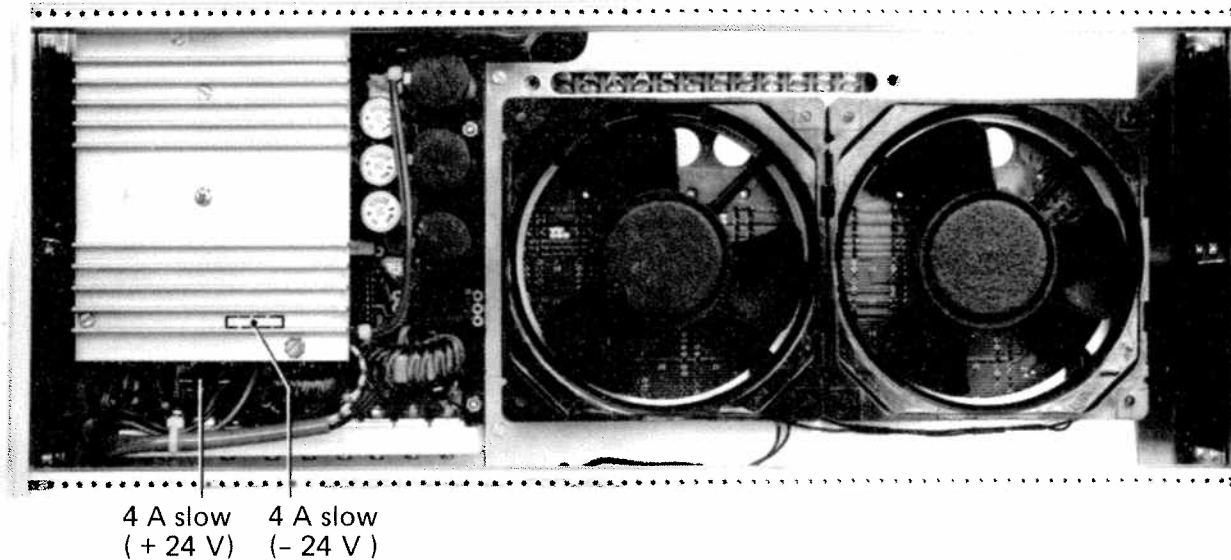


Fig. 4

## 8.2 BS 420 Bus

- Defective capacitors on the BS 420 can short circuit supply voltages; defective connectors or metal particles can cause malfunctions.
- The direct connectors to the DEC modules are relatively sensitive to contamination. If an instrument malfunctions, we recommend cleaning the DEC connectors with contact spray.
- The BE 420 bus extender allows measurements on the bus lines and current consumption measurements to be easily made. The individual bus lines can be disconnected by opening jumpers.

## 9. ACCESSORIES

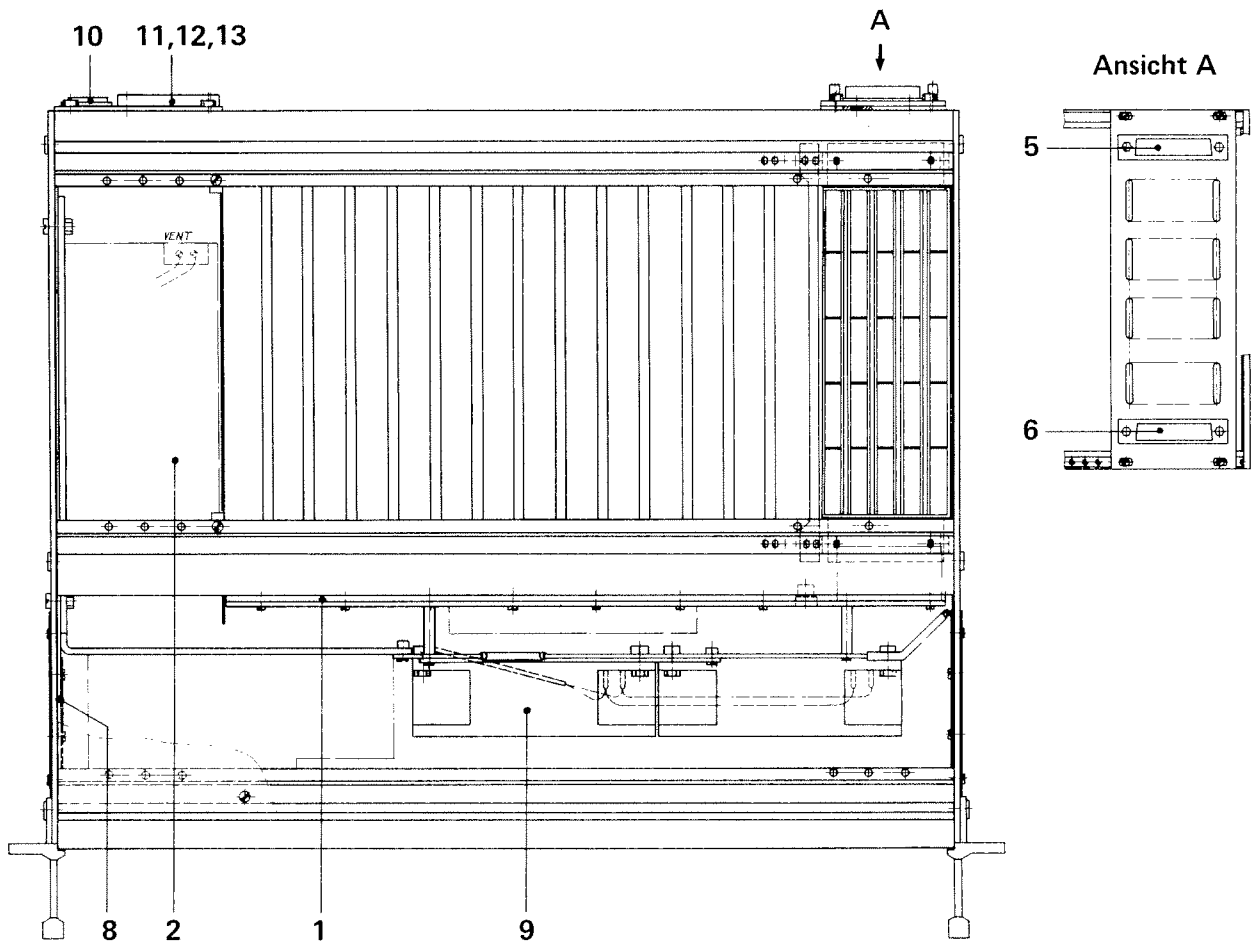
	Order Nr.:
Housing (to convert the SC 420 to a bench model)	BG 544 054 -T
BE 420 (bus extender)	BG 512 733 -T

## 10. SPARE PARTS

Defective units are to be completely replaced and sent to BALZERS for repair.



	Description Teil	Item Pos.	Order No. Bestell-Nr.	S	Reference Bemerkungen
1	Bus pc board / Busprint BS 420	1	BG 512 820 -T		
1	Power supply comp. / Netzteil kpl. PS 420, 5 V / 12 V	2	B 5181 210 AA		
		3			
		4			
1	Cable / Flachband-Kabel, 10P	5	BG 541 780 -T		Length/Länge = 0,1 m
1	Cable / Flachband-Kabel, 10P	6	BG 541 781 -T		Length/Länge = 0,14 m
1	Cable / Flachband-Kabel	7	BG 541 868 -T		Length/Länge = 0,9 m
2	Filter	8	BG 512 807		
2	Ventilator / Lüfter, MU2B1, 115 V, 50 – 60 Hz	9	B 5099 115 B1		
1	Switch / Wippenschalter, 0 – 1/2P	10	B 4752 302 PN		
1	Socket / Stecker, 8843 – 2SP, FL53/60, 6A, 250 V	11	B 4707 301 SE	J3	
2	Fuse slow / Gerätesicherung träge, 5 x 20, 250 V, 5A	12	B 4666 450	F1, F2	for/für 220 V
2	Fuse slow / Gerätesicherung träge, 5 x 20, 250 V, 10A	13	B 4666 456	F1, F2	for/für 110 V
		14			
		15			
		16			
		17			



Spare Parts for / Ersatzteile zu

Control unit / Steuergerät SC 420

BG 512 810 -T

**BALZERS**

BG 800 181 E/1

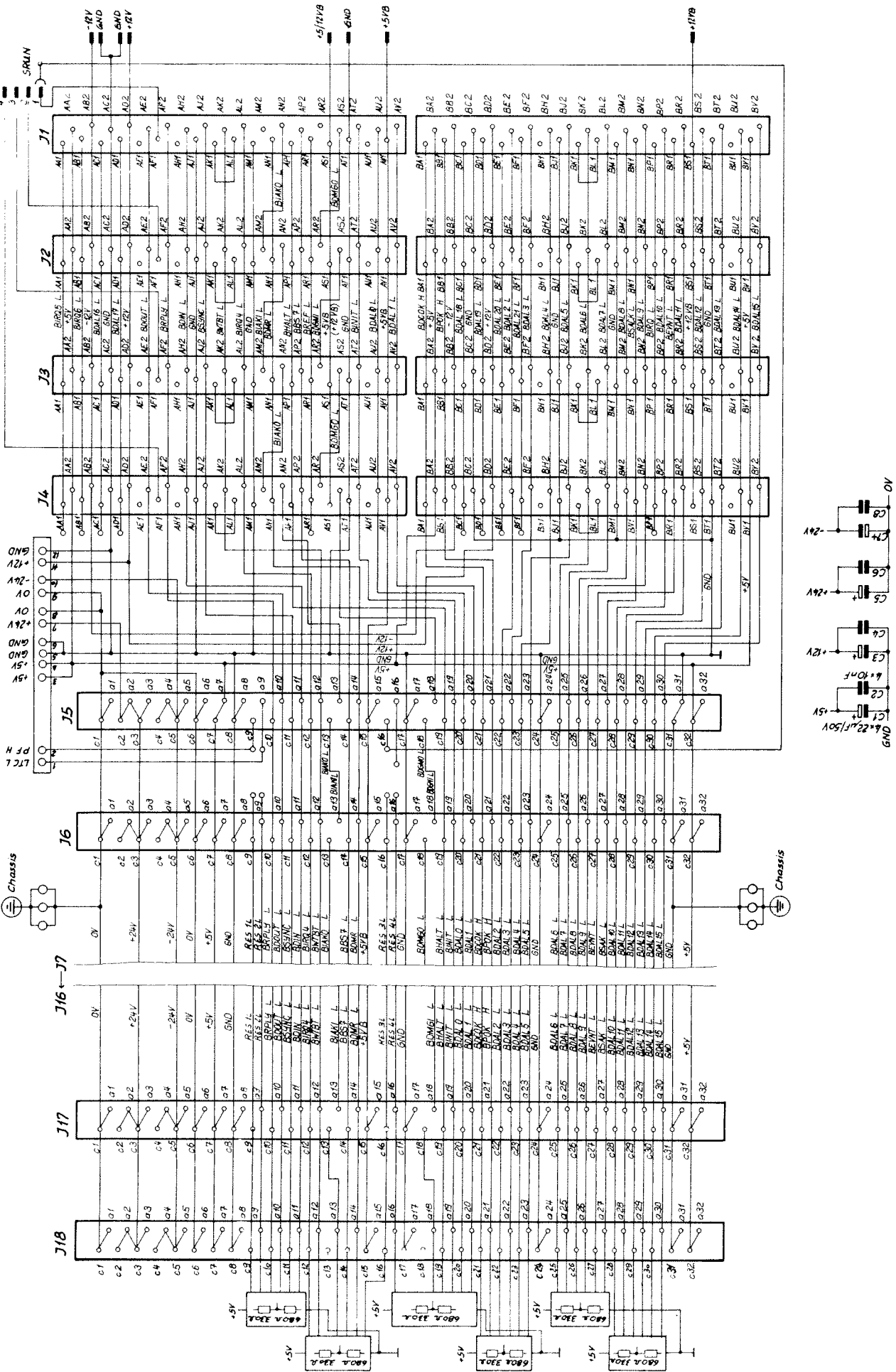
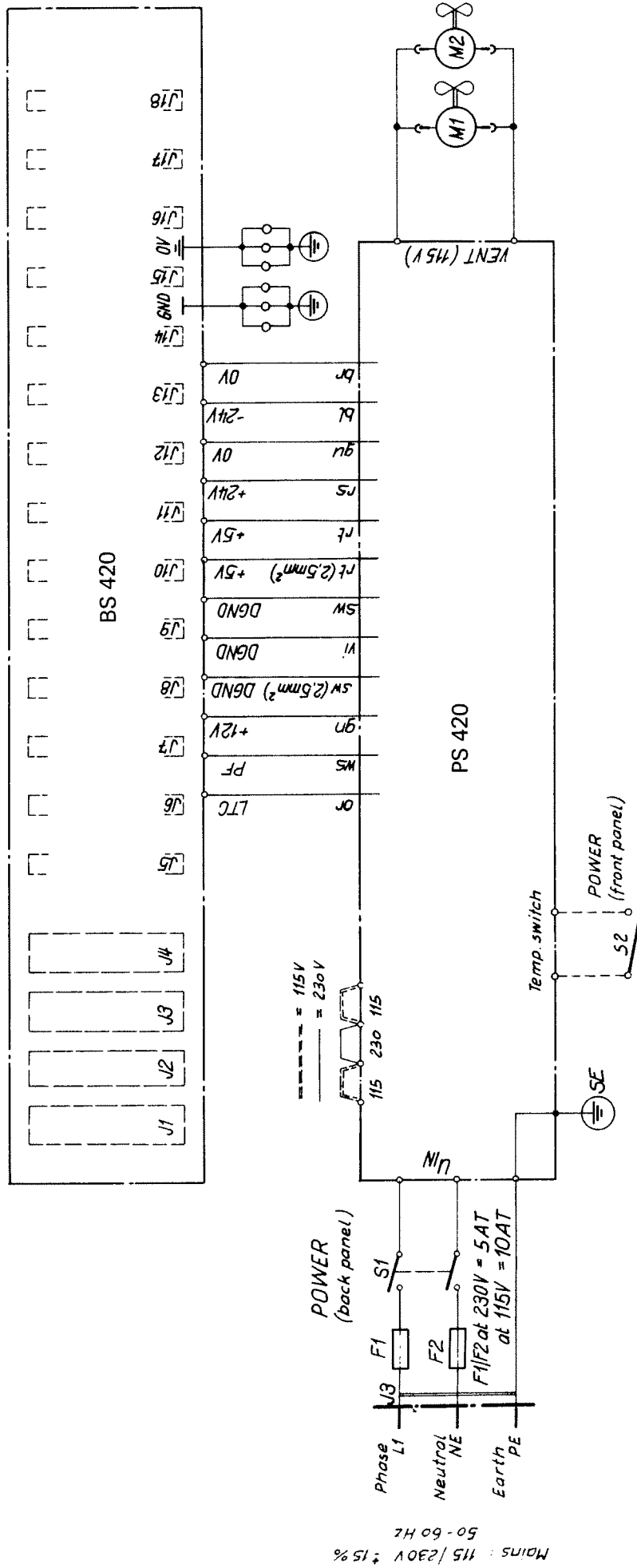
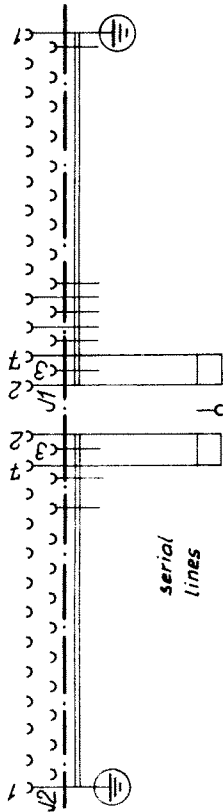


Diagram / Schema BS 420



PIN1 SHIELD  
 PIN2 TRANSMITTER  
 PIN3 RECEIVER  
 PIN7 SIGNAL GND



## APPENDIX A: PS 420 power supply

### 1. ELECTRICAL DATA

**1.1 Mains power connection** 115/230 V, convertible with jumpers  
 $\pm 15\%$   
 50 – 60 Hz  
 420 W max

**1.2 Primary fuses:** 5 A slow for 230 V (5 x 20 mm)  
 10 A slow for 115 V

**1.3 Secondary fuses:** integrated 5 x 20 mm  
 10 A slow for U1 and U2  
 4 A slow for U3  
 4 A slow for U4

Thermal protection switch installed to protect against ventilation failure.

#### 1.4 Four outputs according to the following table:

	U1	U2	U3	U4
Voltage (1) (2)	+ 5 V	+ 12 V	+ 24 V	- 24 V
Tolerance (3) max:	+/- 2 %	+/- 2 %	+/- 2 %	+/- 2 %
Range of adjustment min:	+/- 5 %	+/- 5 %	+/- 5 %	+/- 5 %
Current	0...15 A	0...2,0 A	0...4,2 A	0...4,2 A
Current limitation effect max.	22 A	2,5 A	5 A	5 A
Noise and ripple max.	50 mVpp	120 mVpp	100 mVpp	100 mVpp

(1) U1 and U2 common ground, U3 and U4 isolated from that ground.

(2) The  $\pm 24$  V load can be referred to GND but can also go directly from +24 V to -24 V.

(3) Excess temperature, mains voltage, and load range.

#### 1.5 Overvoltage protection:

Max. 120% for U2, U3, U4; max. 6.3 V for U1

#### 1.6 Line time clock (LTC)

One output signal per mains period, TTL open collector,  $U_{ce} = 15$  V,  $I_{out} = 2$  mA at 0.4 Volt, with reference to the 5 V ground, duty cycle 50% ( $\pm 25\%$ )

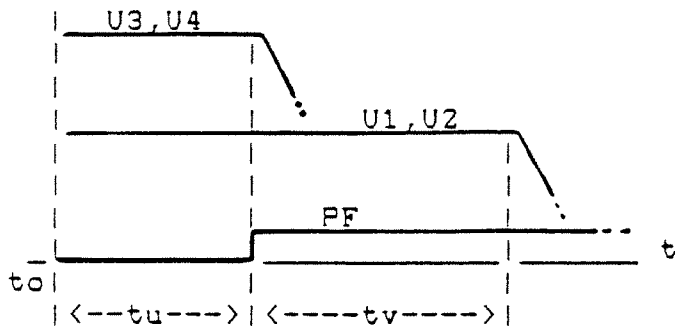
#### 1.7 Power fail signal (PF)

TTL open collector 15 Volt, fan out as per Section 1.6, Low for mains ok, High for undervoltage  $> 15\%$ .

A prewarning time of min 10 ms (tv) is necessary for all mains and load conditions, before U1 or U2 leaves the tolerance range. See Fig. A1.

### 1.8 Power fail hold-up

Hold-up time ( $t_u$ ) min 10 ms for all outputs. For all mains and load conditions before turn off and without response of the power fail signal. See Fig. A1.



$t_0$  = Point at which the power failure occurs

$t_u$  = Hold-up time

$t_v$  = Prewarning time

Fig. A1 Power fail behavior

### 1.9 Turn on sequence

+5 V and +12 V should have a rise time of less than 50 ms from 5 to 95%. Both voltages must rise within the same 50 ms.

## 2.0 FURTHER TECHNICAL DATA

2.1 Secondary switching regulator

2.2 Safety according to VDE 0804, prim / sec 2500 V AC / 1 min

2.3 Ambient temperature: 0 ... +50 °C, with forced cooling, integrated in the SC 420 (bus chassis)

2.4 MTBF: 20,000 hours at full load and +50 °C ambient

2.5 Interface suppression according to VDE 0871 Curve A or better