



ROHDE & SCHWARZ

GENERATOR SPN



GENERATOR 1 Hz - 1.3 MHz · SPN

330.3019.02

kHz
Hz
MAX

V
mV
dBV
dBm

LISTEN
TALK
REMOTE

VAR.

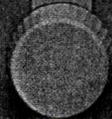
VAR.

FREQUENCY
VAR.

VAR.

LEVEL LEVEL
VAR.

MADE IN GERMANY



SWP

kHz

Hz

LOG

V

mV

dBV

dBm

600

50

5

7	8	9	STC
4	5	6	REL
1	2	3	←
0	→	□	→

SWEEP



R_i = 10 kΩ
1.3 V MAX

TTL



600
50
5



LOC

NETZ POWER

CHARACTERISTICS

- Compact, attractively priced generator with wide frequency range from 1 Hz to 1.3 MHz
- High frequency stability
- Extremely low distortion
- Wide output-voltage range
- High spectral purity
- Flat frequency response
- Sinewave and squarewave outputs
- Switch-selected output impedance
- Input for external sweep voltage (lin/log)
- Output voltage proportional to frequency
- Standardized octave and third-octave sequences selectable
- Easy to operate through microprocessor
- Options: IEC bus and balun

Characteristics

The **Generator SPN** is a programmable synthesizer whose sinewave output signal features a wide level range and low distortion. It is suitable both for use in computer-controlled test assemblies (photo below) and for manual operation. Due to its attractive price and remote-control capability via the IEC bus, the SPN finds a wide field of use in production, service, research and development. Since the SPN combines latest technology and modern circuit design, it is able to comply with the most exacting requirements in measurements, e.g. in acoustics and hifi technology. There is also a large number of other fields in which accurate frequencies are required, for instance in telemetry and physics or in mechanical control processes. In addition, the outputs of two SPN generators can be connected in parallel for measuring non-linear distortions.

Frequency. Modern synthesizer technology ensures highly accurate, crystal-referenced output frequencies from 1 Hz to 1.3 MHz with a frequency setting time of only 15 ms. The short setting time is important in computer-controlled test systems with a high measuring rate or for the generation of tone sequences such as those required for measurements on selective calling equipment. The frequency entered via the keyboard is read out on the display in five digits (smallest resolution: 0.1 Hz) with a floating decimal point. The frequency can be varied quasi-continuously using a rotary knob. The SPN offers another

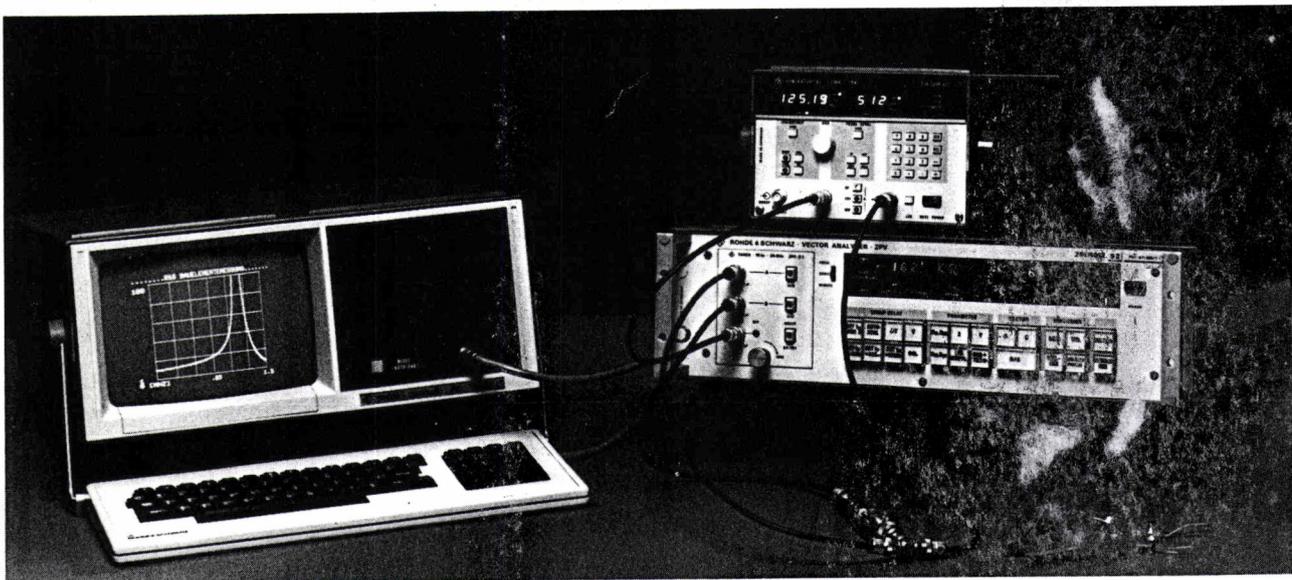
convenient way of frequency variation by frequency jumps with selectable step size and by calling up the standard octave and third-octave sequences. Logarithmic frequency variation is possible by entering a multiplication or division factor between 1.00 and 2.00.

Output level (sinewave output). Adjustable between 0.1 mV and 10 V with smallest resolution of 0.01 mV (depending on output impedance selected). The output level is read out in three digits with a floating decimal point on the level display (in mV, dBV or dBm). The output level entered can also be varied quasi-continuously or in steps and it can be converted from one unit into another simply at the push of a button. The maximum output EMF is 10 V_{rms}.

Distortion is as low as 0.03% in the frequency range from 50 Hz to 100 kHz, so that the SPN fulfils the most demanding requirements of the audio-frequency range.

Output impedance. The output impedance of the sinewave output can be selected between 600, 50 and approximately 5 Ω at the push of a button and thus be matched to the standard system impedances. The output impedance is linear and real, allowing the sinewave outputs of two SPN generators to be connected in parallel. The output level can be switched off at another push of the impedance button.

Squarewave output. In addition to the sinewave output, an output with a squarewave signal of the same frequency is available for driving digital circuits as well as for other measuring tasks; output level: TTL, positive.



Automatic test assembly with Generator SPN, Vector Analyzer ZPV and Process Controller PUC

SPECIFICATIONS

Specifications

Frequency Range Setting
 1 Hz to 100 MHz
 100 Hz to 100 MHz
 1 kHz to 100 MHz
 10 kHz to 100 MHz
 100 kHz to 100 MHz
 1 MHz to 100 MHz

Indication Resolution
 100 Hz
 1 kHz
 10 kHz
 100 kHz
 1 MHz

Accuracy
 ±0.1% (100 Hz to 100 MHz)
 ±0.2% (100 Hz to 100 MHz)
 ±0.5% (100 Hz to 100 MHz)
 ±1.0% (100 Hz to 100 MHz)

Output
 100 mV (100 Hz to 100 MHz)
 1 V (100 Hz to 100 MHz)
 10 V (100 Hz to 100 MHz)
 100 V (100 Hz to 100 MHz)

Impedance
 50 Ω (100 Hz to 100 MHz)
 100 Ω (100 Hz to 100 MHz)
 1 kΩ (100 Hz to 100 MHz)
 10 kΩ (100 Hz to 100 MHz)

Frequency Range
 100 Hz to 100 MHz
 1 kHz to 100 MHz
 10 kHz to 100 MHz
 100 kHz to 100 MHz
 1 MHz to 100 MHz

Accuracy
 ±0.1% (100 Hz to 100 MHz)
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Output
 100 mV (100 Hz to 100 MHz)
 1 V (100 Hz to 100 MHz)
 10 V (100 Hz to 100 MHz)
 100 V (100 Hz to 100 MHz)

Impedance
 50 Ω (100 Hz to 100 MHz)
 100 Ω (100 Hz to 100 MHz)
 1 kΩ (100 Hz to 100 MHz)
 10 kΩ (100 Hz to 100 MHz)

Options

IEC Bus SPN-24 System Functions
 IEC 625 (IEEE 488)
 IEC 603 (IEEE 1364)
 IEC 604 (IEEE 1365)
 IEC 605 (IEEE 1366)
 IEC 606 (IEEE 1367)
 IEC 607 (IEEE 1368)
 IEC 608 (IEEE 1369)
 IEC 609 (IEEE 1370)
 IEC 610 (IEEE 1371)
 IEC 611 (IEEE 1372)
 IEC 612 (IEEE 1373)
 IEC 613 (IEEE 1374)
 IEC 614 (IEEE 1375)
 IEC 615 (IEEE 1376)
 IEC 616 (IEEE 1377)
 IEC 617 (IEEE 1378)
 IEC 618 (IEEE 1379)
 IEC 619 (IEEE 1380)
 IEC 620 (IEEE 1381)
 IEC 621 (IEEE 1382)
 IEC 622 (IEEE 1383)
 IEC 623 (IEEE 1384)
 IEC 624 (IEEE 1385)
 IEC 625 (IEEE 1386)
 IEC 626 (IEEE 1387)
 IEC 627 (IEEE 1388)
 IEC 628 (IEEE 1389)
 IEC 629 (IEEE 1390)
 IEC 630 (IEEE 1391)
 IEC 631 (IEEE 1392)
 IEC 632 (IEEE 1393)
 IEC 633 (IEEE 1394)
 IEC 634 (IEEE 1395)
 IEC 635 (IEEE 1396)
 IEC 636 (IEEE 1397)
 IEC 637 (IEEE 1398)
 IEC 638 (IEEE 1399)
 IEC 639 (IEEE 1400)

Controller
 IEC 625 (IEEE 488)
 IEC 603 (IEEE 1364)
 IEC 604 (IEEE 1365)
 IEC 605 (IEEE 1366)
 IEC 606 (IEEE 1367)
 IEC 607 (IEEE 1368)
 IEC 608 (IEEE 1369)
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 IEC 636 (IEEE 1397)
 IEC 637 (IEEE 1398)
 IEC 638 (IEEE 1399)
 IEC 639 (IEEE 1400)

Frequency Range
 100 Hz to 100 MHz
 1 kHz to 100 MHz
 10 kHz to 100 MHz
 100 kHz to 100 MHz
 1 MHz to 100 MHz

Accuracy
 ±0.1% (100 Hz to 100 MHz)
 ±0.2% (100 Hz to 100 MHz)
 ±0.5% (100 Hz to 100 MHz)
 ±1.0% (100 Hz to 100 MHz)

Output
 100 mV (100 Hz to 100 MHz)
 1 V (100 Hz to 100 MHz)
 10 V (100 Hz to 100 MHz)
 100 V (100 Hz to 100 MHz)

Impedance
 50 Ω (100 Hz to 100 MHz)
 100 Ω (100 Hz to 100 MHz)
 1 kΩ (100 Hz to 100 MHz)
 10 kΩ (100 Hz to 100 MHz)

External sweeping. The generator frequency can be swept in a linear or logarithmic mode over the entire frequency range or certain subranges – required sweep voltage 0 to 1.3 V. The logarithmic conversion is done internally. The sweep range is from 1 Hz up to the upper range limit which can be selected and is indicated on the display.

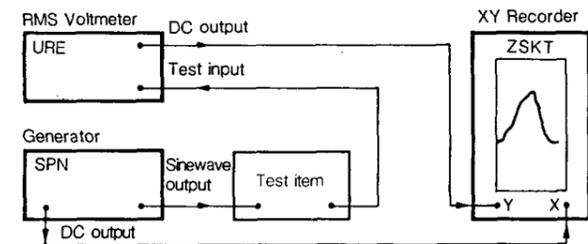
Range 1	1 Hz to 1.3000 kHz
2	1 Hz to 13.000 kHz
3	1 Hz to 130.00 kHz
4	1 Hz to 1300.0 kHz

Setting example: sweep range from 1 Hz to 130 kHz



Frequency-proportional output voltage. In the manual and remote control mode the SPN provides at the SWEEP socket a DC output voltage proportional to the frequency (0 to 1.3 V), the value of 1.3 V corresponding to the selected upper frequency limit (as in sweep mode). This output voltage can be used for plotting the measured curves, e.g. frequency responses, on XY recorders.

With logarithmic frequency variation the DC output voltage also varies logarithmically.



Test setup for frequency response recording using the generator's frequency-proportional DC voltage at the X input of the recorder

Options

For special applications the performance of the SPN Generator can be extended simply and at low cost.

Remote control. All settings of the Generator SPN can be made remotely using the IEC Bus option SPN-B4 which can easily be retrofitted. The short programming time makes the SPN suitable for use in automatic measuring assemblies and test systems.

Balun SPN-Z1. Used for feeding balanced line systems or amplifiers and for eliminating hum pickup in test setups; stepdown transformation, therefore low internal impedance (approx. 15 Ω); mumetal-shielded, therefore immune to external interference fields.




Opening for bringing out sinewave or squarewave output
IEC-bus connector and address switch

Operation

High operating convenience. Thanks to the microprocessor control the SPN is easy to operate. Data entry is made via keys, the numerical value being entered first, then the unit. Quasi-analog settings are possible using the rotary knob.

Frequency setting

1.1303 kHz

5 Hz

Step-up by 1 kHz

Step-down by 100 Hz

Variation with 100 Hz step size

Logarithmic variation (10%)

(Freq.)

Level setting

9.85 V

122 mV

18.2 dBV

6 dBm

Variation with 10 mV step size

(Level)

Output impedance

50 Ω

Storage facility. The SPN can store five complete instrument settings (memory addresses: 1 to 5). RCL recalls either complete settings or individual frequency or level settings.

Storage: complete setting

Recall: complete setting

level value only

frequency value only

Special functions. The frequency steps commonly used in acoustics (DIN 45401, ISO 266) are possible by calling up special functions:

for 1st octave sequence (16/31.5/63/125/... Hz)

for 2nd octave sequence (22.4/45/90/180/... Hz)

for 1st third-octave sequence (16/20/25/31.5/... Hz)

for 2nd third-octave sequence (18/22.4/28/35.5/... Hz)

The VAR knob allows the selected sequence to be stepped up or down.

Programming

Programming examples for the Process Controller PUC from Rohde & Schwarz for setting the level, output impedance and frequency on the Generator SPN (address 11).

Setting of
 level IECOUT11,"9.85V"
 output impedance IECOUT11,"R5"
 frequency IECOUT11,"1.1303KH"
 Several instructions in one program line
 IECOUT11,"9.85V R5 1.1303KH"

IEC-bus commands. The setting instructions consist of data and a combination of two characters which are also the delimiter.

Function	Data	Instructions
Setting the frequency in kHz in Hz for short transient time in kHz in Hz	max. 5 digits with or without decimal point	KH HZ KS HS
Setting the level in V in mV in dBV in dBm Switching off the level	max. 3 digits with or without decimal point	V MV DV DM R0
Switching on linear SWEEP range 1 range 2 range 3 range 4 Switching off SWEEP		S1 S2 S3 S4 S0
Switching on logarithmic SWEEP range 1 range 2 range 3 range 4 Switching off log SWEEP		L1 L2 L3 L4 L0
Setting the output impedance 600 Ω 50 Ω ≈ 5 Ω		R6 R5 R1
Storing the complete setting		ST n
Recalling the complete setting		RC n
Recalling the frequency	n: storage location 1 to 5	RCKH n RCHZ n
Recalling the level		RCV n RCMV n RCDV n RCDM n
Switching on the special function	n: number of special function	RC n
Enabling service request		SR



ROHDE & SCHWARZ

Manual

GENERATOR 1Hz to 1.3 MHz
SPN

336.3019.02

Printed in West Germany

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 MANUAL CHANGE INFORMATION

Rohde & Schwarz ist bemüht, alle Produktverbesserungen und Ergänzungen zum frühestmöglichen Zeitpunkt in die Geräte einzubauen. Es kann daher vorkommen, daß die Gerätebeschreibungen in einzelnen Punkten den neuesten Stand noch nicht beinhalten. Um den Kunden trotzdem über den aktuellen Zustand seines Gerätes zu informieren, sind nachfolgende Ergänzungsblätter eingefügt.

Rohde & Schwarz endeavours to implement all improvements and extensions to their instruments at the earliest opportunity. Thus, it may happen that certain sections of the manual are not quite up to date. In order to provide the customer with the latest information on his instrument, the following supplementary sheets are enclosed with each manual.

Gerätetyp: SPN 336.3019.02 F Nr. 879.671/.....
 Instrument Type:

Baugruppe: Subassembly:	Änderung: Modification:
336.4038.01 10 V Endstufe/ Output stage	C 51 6,8 n (CG023.1726) → 22 n (CG060.1055)

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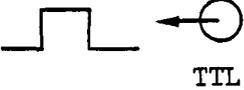
2. Operating Instructions

The values mentioned in this section are not guaranteed; only the specifications in the Data Sheet or Technical Information are binding.

For the designation and number of the panel controls refer to Figs. 2-7 and 2-8.

2.1 Legend for Figs. 2-7 and 2-8

No.	Marking	Function
1		5-digit readout indicating the frequency setting.
2	kHz Hz MAX	3 LEDs indicating the unity and the maximum sweep range.
3		3-digit readout indicating the output level
4	V mV dBV dBm	4 LEDs indicating the unit of the output level
5	LISTEN TALK REMOTE	3 LEDs indicating the remote-controlled mode in the case of IEC-bus programming.
6	7 8 9 STO 4 5 6 RCL 1 2 3 - 0 . C +	Keyboard for data entry: frequency with keys <u>13</u> ; level with keys <u>10</u> . C clears the entry or a blinking readout; STO stores, RCL recalls 5 complete instrument settings or 5 frequency and 5 level settings as well as 5 special functions.
7	POWER (OFF)	Power switch.
8	LOC.	Key for switching over from the IEC-bus to the manual mode.
9		Sinewave output; BNC female connector.

No.	Marking	Function
10	V mV dBV dBm	4 keys for level entry. They define the desired unity of the preceding level-value entry (keyboard <u>6</u>)
11	600Ω 50Ω $\approx 5 \Omega$	3 keys for entering the output impedance. LED incorporated in the key lights up to indicate the impedance selected.
12	 TTL	Squarewave output; BNC female connector.
13	kHz Hz	2 keys for entering the frequency unit after having entered the frequency value on keyboard <u>6</u> .
14	 SWEEP $R_i = 10 \text{ k}\Omega$ 1.3 V MAX.	Input and output for the sweep voltage; BNC female connector.
15	LOG.	Key for selecting the logarithmic sweep. Indicated by built-in LED.
16	SWP	Key for switching the sweep on and off. With the sweep on, the built-in LED lights up.
17	VAR.	Knob for quasi-continuous variation of frequency or level after entry with key <u>18</u> ; variation either in steps or logarithmic after entry on keyboard <u>6</u> .
18	VAR	2 keys for entering the frequency or level variation. The associated VAR indicator below readout <u>1</u> or <u>3</u> lights up.

No.	Marking	Function
19	ADDRESS	6-pole switch for setting the IEC-bus address.
20	IEC 625 BUS	IEC-bus connector.
21		Opening provided for bringing the sinewave output out on the rear panel.
22	 47-63 Hz	AC supply connector
23	100 V/120 V M1C 220 V/240 V MO.5C	Fuse holder and AC supply voltage selector.
24	1 MHz REF. TTL 0.2 to 2 V $R_i > 500 \Omega$	Socket for the output of the internal crystal reference frequency. The connection can be changed for the input of an external reference frequency.

2.2 Preparation for Use

The Generator SPN is designed for operation from 100-V, 120-V, 220-V and 240-V AC supplies. The instrument is factory-set for operation from 220 V. To change over to a different supply voltage, withdraw the cover of the voltage selector 23 (Fig. 2-8) and reinsert it with the fuse holder such that the desired voltage is below the triangular marking. The instrument is then ready to be operated from the new AC supply voltage. Use a MO.5C (0.5 A) fuse for 220 V and 240 V and a M1.0C (1.0 A) fuse for 100 V and 120 V.

The Generator SPN has half the width of a 19" case. It is also suitable for use in 19" racks. For this purpose a rack adapter is available (see under "recommended extras"). For rack incorporation, remove the lateral screws, withdraw the two hoods, the lateral bars and the carrying handle.

The threaded openings for fixing the rack adapter are provided on the instrument. The opening for changing over the output from the front panel to the rear panel is provided on the rear panel.

Make sure that ventilation is not obstructed.

2.3 Manual Mode

Various keys and a knob are provided for manual operation of the Generator. The entry keys and the digital readouts are conveniently arranged in three groups. The lefthand section contains the frequency readout, the frequency variation key and the sweep setting keys. This section also comprises the sweep input and output BNC connectors. The section in the centre includes the level readout, the keys for entering the level and the output impedance, the level variation key and the squarewave output. The righthand section includes the keyboard for entering data for all parameters, the LISTEN, TALK and REMOTE indicators, the power switch, the go-to-local key and the sine-wave output. Setting with the aid of the keys is performed in the following order: numerical value, unit or function. Quasi-continuous adjustment is possible by means of the rotary knob. Unpermissible settings will not be accepted. The readout in which the value should have appeared blinks until the entry has been cleared by pressing the C key or a new valid entry has been made. A blinking readout then always signals that the desired setting cannot be accepted.

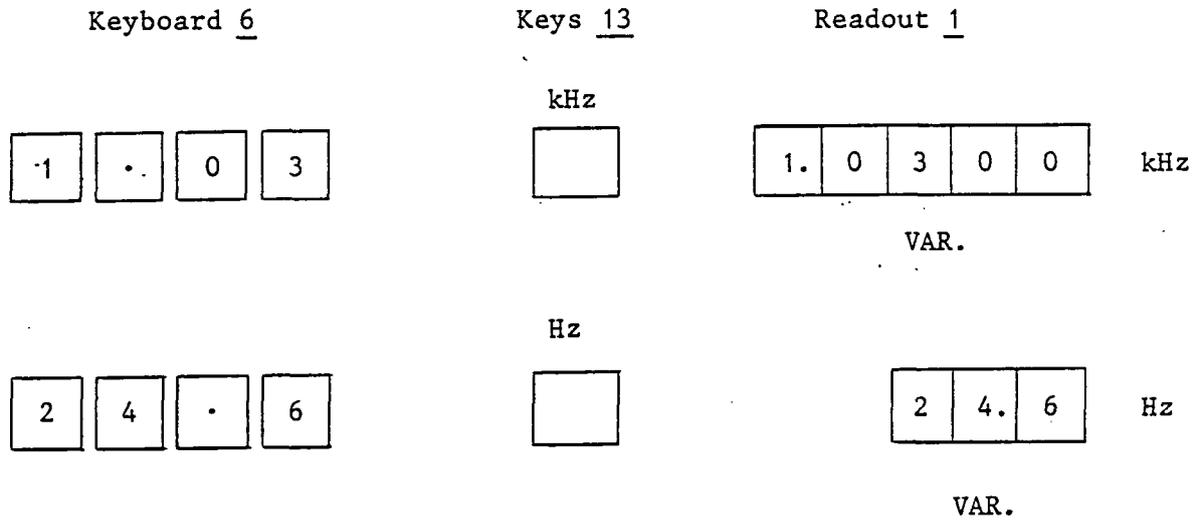
2.3.1 ON Status

After the instrument has been switched on with the power switch 7, the SPN performs a display test and displays the IEC-bus address selected. After a warmup of about 15 s indicated by a count down in the display, the instrument is ready for operation. When the count down readout is extinguished, the frequency of 10.000 kHz is set. The output voltage is fixed at 1 mV in order to protect sensitive test items.

2.3.2 Setting the Frequency

The frequency range of the SPN is 1 Hz to 1.3 MHz. The frequency is set by entering the desired value on keyboard 6 (Fig. 2-7) and pressing one of keys 13 for the unit (kHz or Hz). Zeros at the end of the value to be entered after the decimal point need not be filled up. Entries after the decimal point which exceed the acceptable number of digits are ignored. The frequency is displayed in readout 1 in kHz or Hz with the decimal point.

Examples:



If the value entered exceeds the limits of the frequency range, the readout starts to blink.

The blinking can be eliminated by pressing key C (keyboard 6) - the old setting being retained - or by performing a new, valid entry.

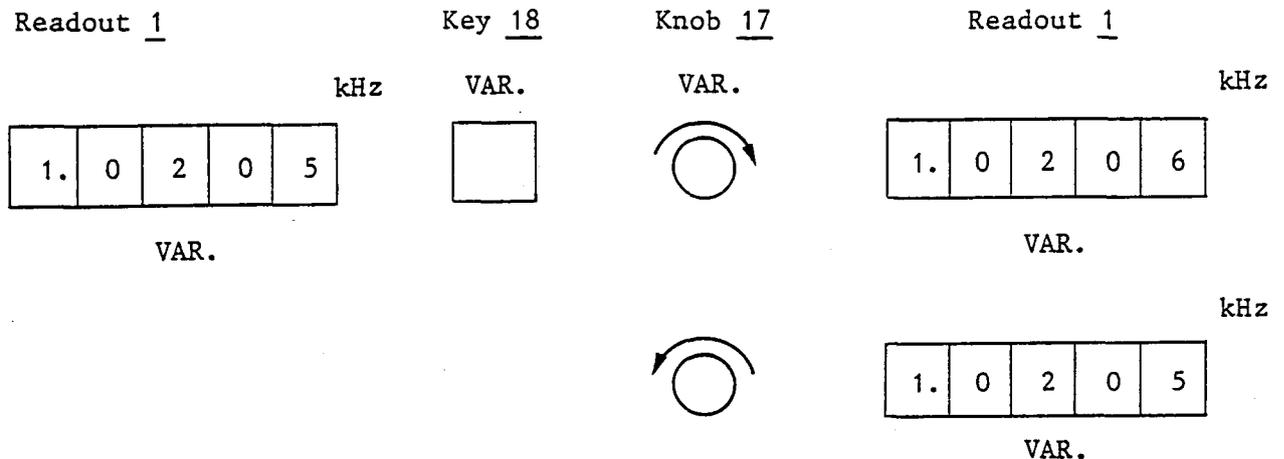
2.3.2.1 Frequency Variation

A frequency entered via the keyboard 6 (Fig. 2-7) can be varied either with knob 17 in four different ways (a to d) or with the + and -keys 6 in freely selectable steps.

a) Single-step variation

After switching the set on or pressing key 18, use knob 17 to increment the last frequency digit displayed.

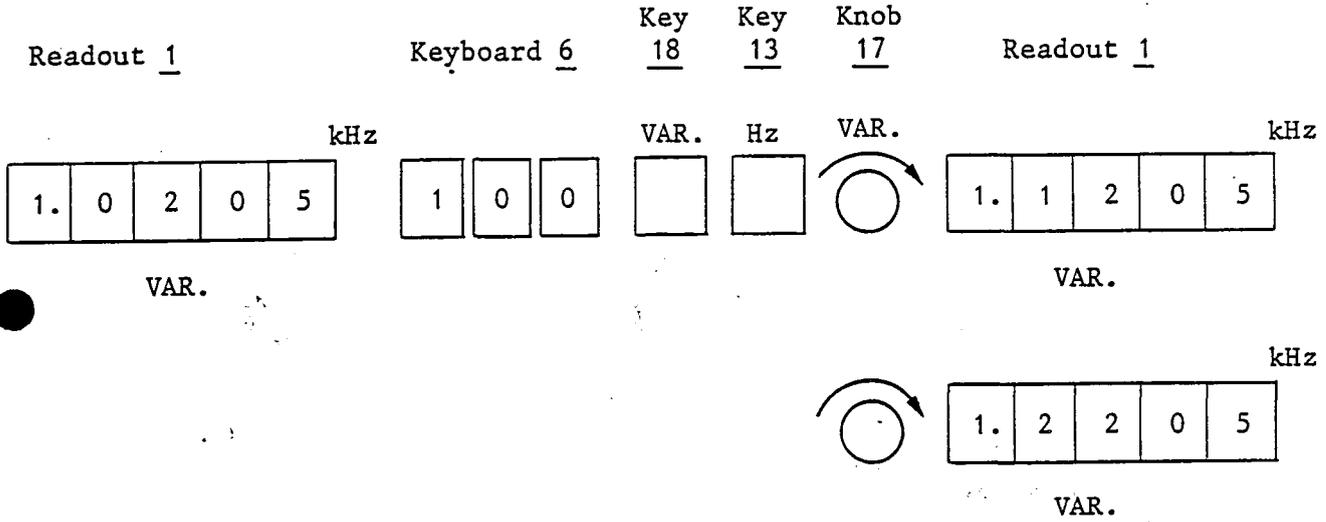
Example:



b) Variation in random steps

The frequency set can be varied in random steps with knob 17.
 For this purpose, first enter the numerical value on keyboard 6,
 and then the variation step with key 18 and the unit with key 13.

Example: 100-Hz variation



If the frequency variation entered cannot be executed because of the insufficient frequency resolution, LED 18 is blinking and the frequency value is no longer increased. This may also happen if, with a continuous variation, the frequency range is automatically changed and thus also the resolution of the readout.

2.3.3 Setting the Output Level

2.3.3.1 Level Entry

The output level is set by entering the desired numerical value via keyboard 6 (Fig. 2-7). Next, press one of keys 10 (V, mV, dBV or dBm) which then defines that the entered value is a level value designating the unit selected. In the case of negative dBV or dBm values, the negative sign has to be entered prior to the numerical value. Zeros at the end of the numerical value need not be filled up after the decimal point.

The entered unit lights up in the readout.

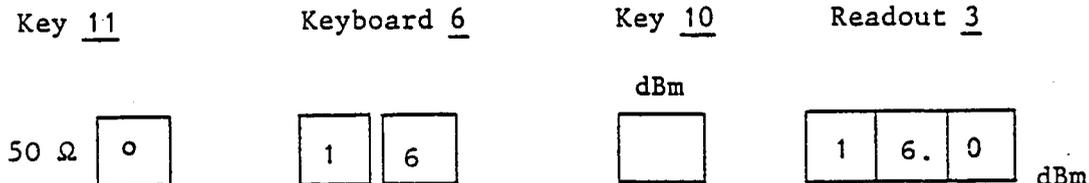
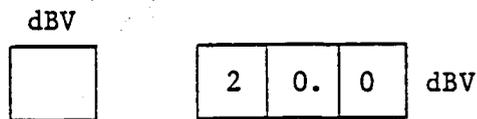
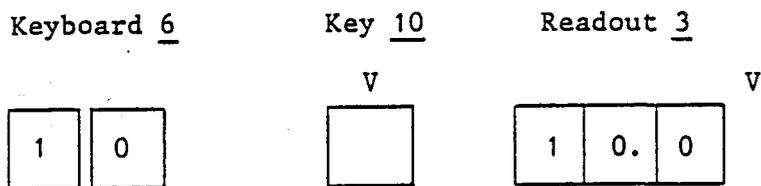
Permissible ranges for level entries:

- 60 dBV to 20 dBV or 1 mV to 10 V for $R_i = 600$ and 50Ω
- 80 dBV to 0 dBV or 0.1 mV to 1 V for $R_i = 5 \Omega$

The microprocessor selects the unit suitable for the readout (example: 1000 mV yield the display 1.00 V).

If keys 10 are pressed, the displayed level can be converted into mV, V, dBV or dBm without requiring any previous entry of a numerical value.

Example:



If the output impedance is switched over, the EMF - if level is shown in dBm - is changed automatically so that the indicated level supplied at Bu 9 is made available at the correct impedance matching.

If the unit is mV, V or dBV, readout 3 displays the open-circuit voltage. In the dBm indication mode, the power referred to 1 mW into a load corresponding to the output impedance of the SPN is displayed. With a finite load, the voltage across the load can be calculated. It depends on the output impedance selected.

Thus

$$V_{load} = V_C \frac{Z_{load}}{Z_{out} + Z_{load}}$$

where V_C = the open-circuit voltage
and V_{load} = the voltage across Z_{load} .

On the other hand, the open-circuit voltage required for a given voltage V_{load}

$$V_C = V_{load} \frac{Z_{out} + Z_{load}}{Z_{load}}$$

If the load impedance is equal to the output impedance, the systems are matched and the voltage occurring across the load is half the value of the open-circuit voltage or the output level is 6 dB less than the open-circuit level.

In addition to levels indicated in terms of dBV, values in dB referred to 0.775 V and dB μ V are commonly used. Open-circuit voltage read on the SPN can easily be converted to these levels.

Value in	corresponds to		
	dB μ V	dB referred to 0.775 V	dBV
dB μ V		+117.8	+120
dB referred to 0.775 V	-117.8		+2.2
dBV	-120	-2.2	

2.3.3.1.1 Switching the Level Off

Press the illuminated key 11 (output impedance); the level is switched off without affecting the settings and readouts of frequency or level.

This status is indicated by the fact that all the LEDs in keys 11 are off.

When the level is switched off, the output impedance is $\approx 5 \Omega$.

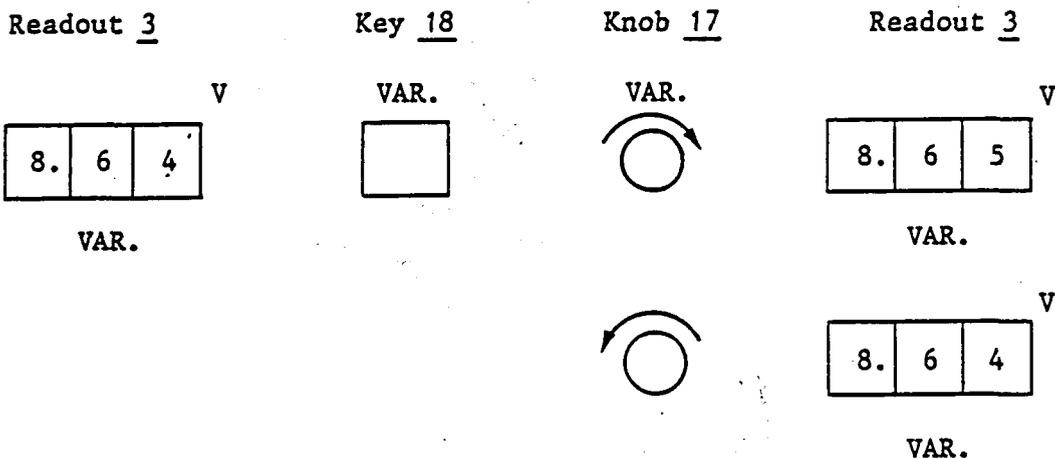
Press one of keys 11 again to switch the level and the output impedance on.

2.3.3.2 Varying the Output Level

Press the righthand key 18, a quasi-continuous level variation is possible with the aid of knob 17 (Fig. 2-7). This variation is logarithmic for dBV and dBm or linear for V and mV (indicated by LEDs 4).

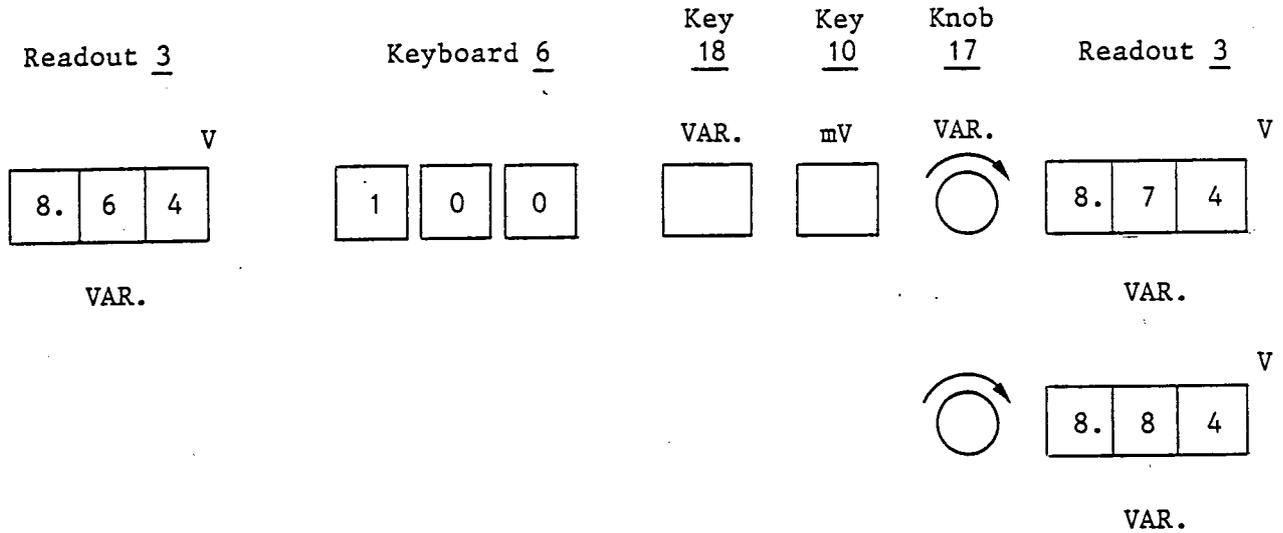
After pressing the LEVEL VAR key 18, use knob 17 to step the last digit of the displayed level up or down.

Example:



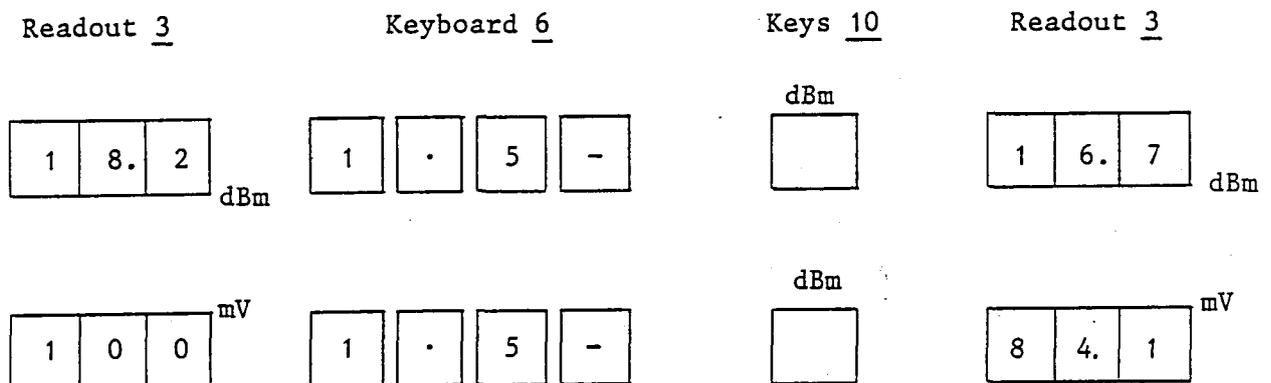
The level set can also be varied in random steps with the aid of the rotary knob. For this purpose, first enter the numerical value on keyboard 6, next the variation with key 18 and the unit with one of keys 10.

Example: 100-mV variation



A level step can be added to or subtracted from the level set. This step can be entered in mV, V or dB. The result is displayed in terms of the unit of the previously set level. To perform this step, first enter the numerical value on keyboard 6 (Fig. 2-7), then the sign and finally the unit. To enter a step in dB, one of the dBV or dBm keys must be pressed.

Exemple: 1.5-dBm step down in level



The level limits cannot be exceeded by turning the variation knob. If the knob is turned further, the minimum or maximum value remains unchanged.

2.3.3.3 Setting an Extremely Small Voltage

If extremely small voltages are to be applied to a load, the connection of the SPN to the load should be made with the utmost care. An improper connection between generator and load or insufficient earthing of these units may cause an unwanted voltage at the input of the load; this voltage may be higher than the wanted signal itself. Fig. 2-1 shows the generation of an unwanted voltage.

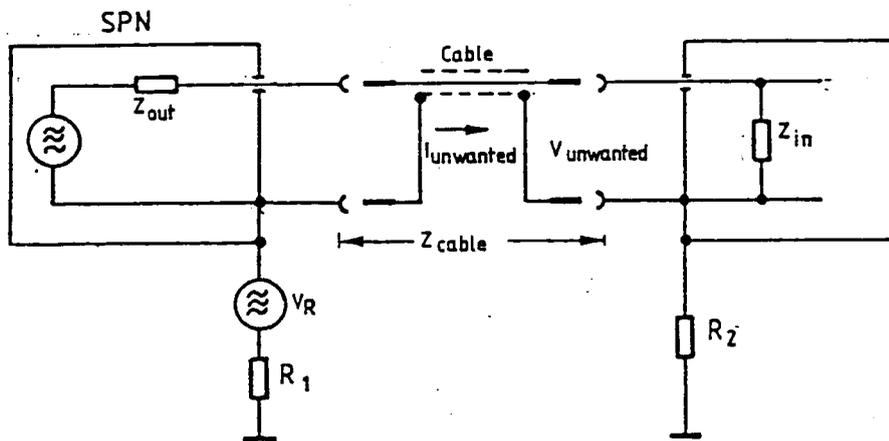


Fig. 2-1 Unwanted voltage produced by ground loops

This voltage becomes effective at the load input whenever an unwanted current I_{unwanted} flows through the outer conductor of the coaxial connecting cable and thus a voltage drop of $V_{\text{unwanted}} = I_{\text{unwanted}} \cdot Z_{\text{cable}}$ occurs across Z_{cable} of this outer conductor. The source (V_{source}) of this current may be in one of the two lines used for grounding the units. In this way a circuit is constituted via R_1 , Z_{cable} , R_2 . The unwanted voltage produced across the load

$$V_{\text{unwanted}} = I_{\text{unwanted}} Z_{\text{cable}} = V_{\text{source}} \frac{Z_{\text{cable}}}{R_1 + R_2 + Z_{\text{cable}}}$$

becomes the smaller, the smaller the cable impedance and the greater the two ground impedance are.

The source of this unwanted signal is frequently the voltage drop shown in Fig. 2-2 occurring between the earthed-wire contacts A and B of the two power cables.

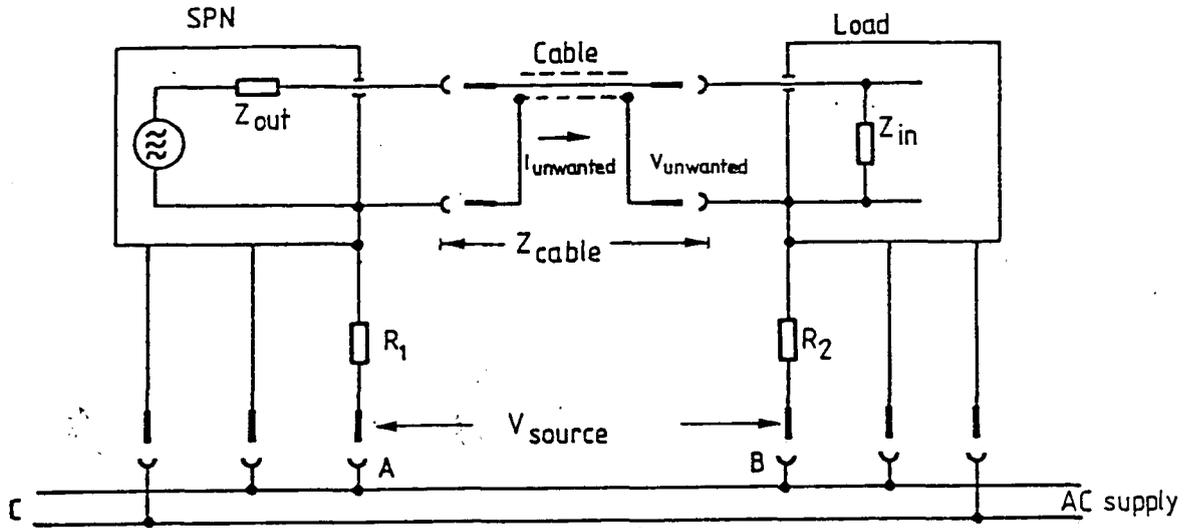


Fig. 2-2 Cause of ground loops

The voltage drop V_{source} occurring between the earthed-wire contacts A and B may be caused by other loads in addition to the consumption of the SPN, these loads being connected to the same line C.

The interference picked up from the AC supply can be reduced best by plugging the power connector of the generator and of the load into a double power outlet as is shown in Fig. 2-3; in this way, the line impedance between A and B is reduced such that $V_{source} \approx 0$ and thus also $V_{unwanted} \approx 0$.

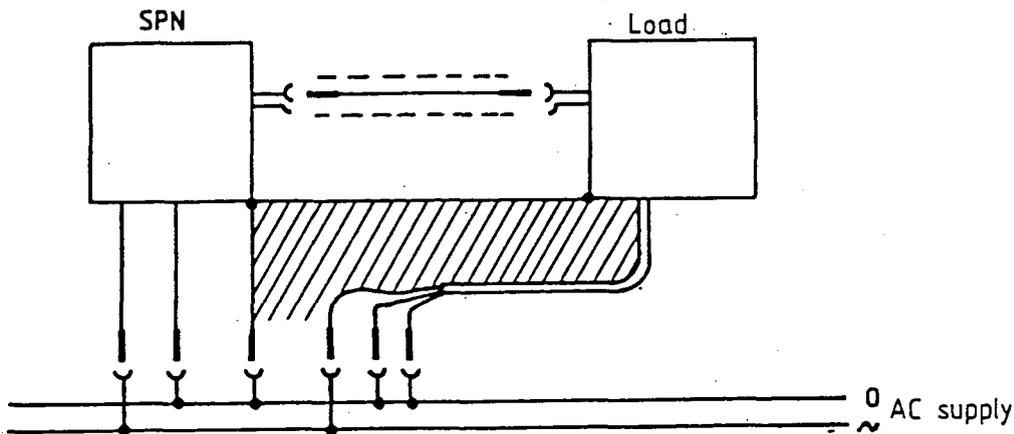


Fig. 2-3 Elimination of ground loops

2.3.3.4 Units of Level Indication

1 the entries for the output level refer to the EMF or maximum power into an ohmic termination of 600, 50 or $\approx 5 \Omega$.

dBV is a logarithmic unit of the output voltage referred to 1 V. It is calculated based on the output voltage:

$$V_{dBV} = 20 \log \frac{V_{out} (V)}{1 (V)}$$

Thus an output voltage of precisely 1 V corresponds to 0 dBV. Voltages higher than 1 V yield positive, those smaller than 1 V negative values in dBV.

The unit dBm is the logarithmic measure of the output power which an ohmic termination would handle referred to 1 mW.

It is calculated based on the power: $P_{dBm} = 10 \log \frac{P(mW)}{1(mW)}$

or based on the voltage $P_{dBm} = 10 \log \frac{V_{out}^2 (V) \cdot 20}{1(mW)}$

If the test item or the load is mismatched, the remaining power is reduced due to reflection. Depending on the VSWR, the output power is:

$$P(\text{load}) = P(\text{readout}) \frac{4 \text{ VSWR}}{(1+s)^2}$$

2.3.4 Setting the Output Impedance

Key 11 (Fig. 2-7) permits the impedance of output 9 to be selected: 600, 50 and $\approx 5 \Omega$. In this way, matched measurements are possible in different impedance systems. The accuracy of the 600- Ω and 50- Ω output impedance is $\pm 1\%$.

NOTE: The 600- Ω impedance of output 9 can be matched to a different system by exchanging resistor R13 (drawing No. 392.7522). The newly inserted resistor R13 must be 50 Ω smaller than the desired output impedance. The new output impedance is selected by pressing the 600- Ω key. The 50- Ω and the ≈ 5 - Ω output impedance remain unchanged.

Attention: The dBm indication must be converted by the corresponding factor. The EMF indication remains correct.

Example:

A balanced 600- Ω output is required. For this purpose, the Balun SPN-Z1 (see Section 2.5) is used.

The required new resistor R13 is calculated as follows:

$$Z_{out} = \frac{Z_{out \text{ SPN}}}{10} + 15 \Omega (\text{balun})$$

$$Z_{out} = 600 \Omega$$

$$Z_{out \text{ SPN}} = (Z_{out} - 15) \Omega \times 10 = (600 - 15) \Omega \times 10 = 5850 \Omega$$

$$R_{13} = Z_{out \text{ SPN}} - 50 \Omega = 5850 \Omega - 50 \Omega = 5800 \Omega.$$

2.3.5 Sweep Mode

The output frequency of the SPN can be swept by an external signal in the linear or logarithmic mode over the entire or certain subranges.

To select the mode, press key 16 (Fig. 2-7) for linear or key 15 for logarithmic operation. The level control is switched off in sweep operation.

2.3.5.1 Sweep Range

The sweep range always extends from the lower frequency limit of the SPN (≈ 1 Hz) to an upper frequency limit which can be set depending on the range. This maximum frequency obtained by an external 1.3-V signal applied to input 14 (Fig. 2-7) appears in readout 1. This is indicated by the MAX LED 2. The level control is switched off in sweep operation.

Table 2-1

Entry	Sweep range	Frequency displayed in readout <u>1</u>
<div style="display: flex; flex-direction: column; align-items: center;"> <div style="display: flex; align-items: center; gap: 10px;"> <div style="border: 1px solid black; padding: 2px 5px;">1</div> <div style="border: 1px solid black; padding: 2px 5px;">SWP</div> </div> <div style="margin: 2px 0;">or</div> <div style="display: flex; align-items: center; gap: 10px;"> <div style="border: 1px solid black; padding: 2px 5px;">1</div> <div style="border: 1px solid black; padding: 2px 5px;">LOG</div> </div> </div>	Range 1 ≈ 1 Hz to 1,3 kHz	1,3 kHz
<div style="display: flex; flex-direction: column; align-items: center;"> <div style="display: flex; align-items: center; gap: 10px;"> <div style="border: 1px solid black; padding: 2px 5px;">2</div> <div style="border: 1px solid black; padding: 2px 5px;">SWP</div> </div> <div style="margin: 2px 0;">or</div> <div style="display: flex; align-items: center; gap: 10px;"> <div style="border: 1px solid black; padding: 2px 5px;">2</div> <div style="border: 1px solid black; padding: 2px 5px;">LOG</div> </div> </div>	Range 2 ≈ 1 Hz to 13 kHz	13 kHz
<div style="display: flex; flex-direction: column; align-items: center;"> <div style="display: flex; align-items: center; gap: 10px;"> <div style="border: 1px solid black; padding: 2px 5px;">3</div> <div style="border: 1px solid black; padding: 2px 5px;">SWP</div> </div> <div style="margin: 2px 0;">or</div> <div style="display: flex; align-items: center; gap: 10px;"> <div style="border: 1px solid black; padding: 2px 5px;">3</div> <div style="border: 1px solid black; padding: 2px 5px;">LOG</div> </div> </div>	Range 3 ≈ 1 Hz to 130 kHz	130 kHz
<div style="display: flex; flex-direction: column; align-items: center;"> <div style="display: flex; align-items: center; gap: 10px;"> <div style="border: 1px solid black; padding: 2px 5px;">4</div> <div style="border: 1px solid black; padding: 2px 5px;">SWP</div> </div> <div style="margin: 2px 0;">or</div> <div style="display: flex; align-items: center; gap: 10px;"> <div style="border: 1px solid black; padding: 2px 5px;">4</div> <div style="border: 1px solid black; padding: 2px 5px;">LOG</div> </div> </div>	Range 4 ≈ 1 Hz to 1300 kHz	1300 kHz

Example:

Keyboard 6

Key 16 (15)

Readout 1

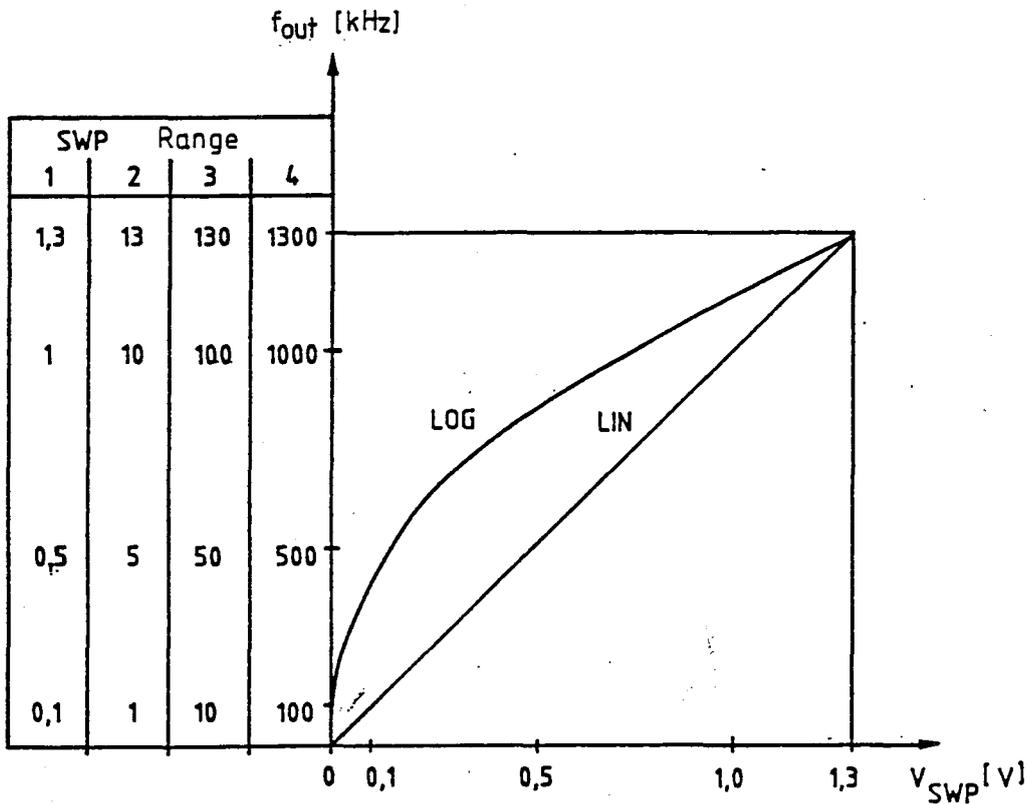
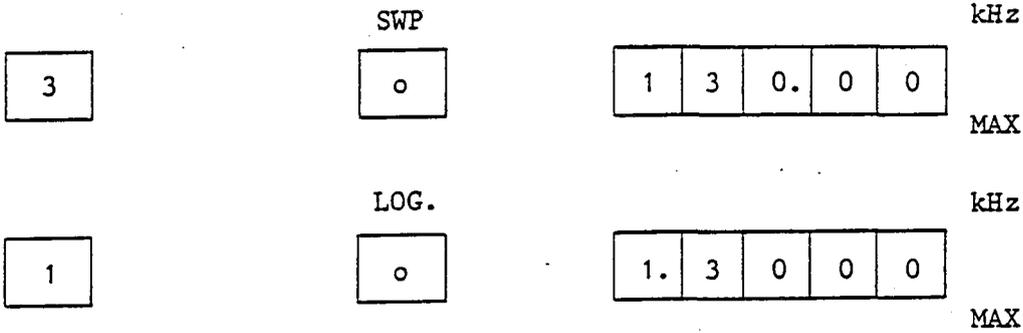


Fig. 2-4 Sweep range limits, depending on control voltage.
LOG / LIN diagram

To switch the sweep mode off, press the SWP key 16 again; the previously selected frequency appears again in readout 1. With the sweep mode enabled, the entry of a new frequency is not accepted and signalled as a wrong entry.

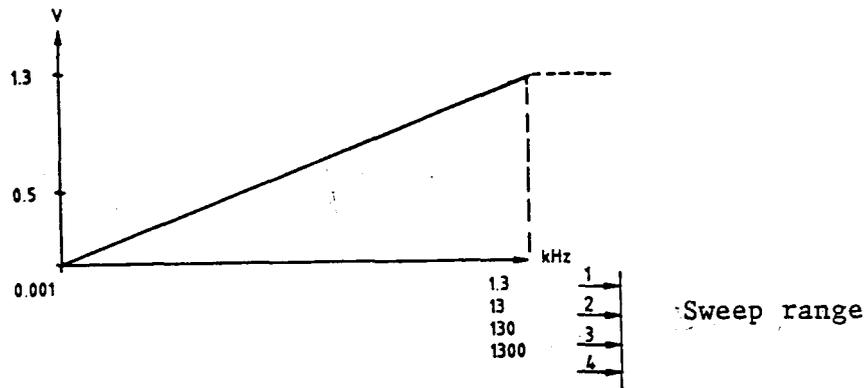
2.3.5.2 DC Output Voltage Proportional to Frequency

Connector 14 delivers a DC voltage proportional to the frequency. The voltage range always covers 0 V at 1 Hz to 1.3 V at the maximum frequency of each sweep range.

After the SPN has been switched on, sweep range 4 (1 Hz to 1300 kHz) is selected.

a) Linear frequency variation

With linear frequency variation (see Section 2.3.2.1 a, b, d) the frequency-proportional DC output voltage is a linear function of the output frequency. Select the maximum frequency to cover the full sweep range in accordance with the following diagram:

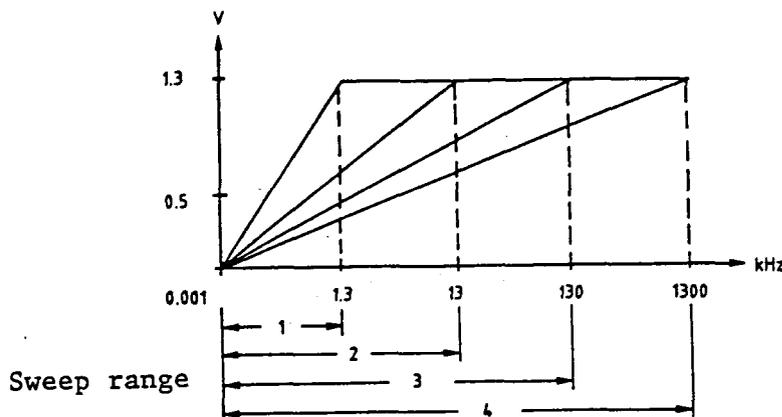


Example: Maximum DC output voltage at 13 kHz

	Keyboard <u>6</u>	Key <u>16</u>	Readout <u>1</u>	kHz
Range selection	<input type="text" value="2"/>	<input type="text" value="0"/>	<input type="text" value="1"/> <input type="text" value="3."/> <input type="text" value="0"/> <input type="text" value="0"/> <input type="text" value="0"/>	
		SWP		MAX
		<input type="text"/>		
		SWP	The previously set frequency appears in readout <u>1</u> .	

b) Logarithmic frequency variation

With logarithmic frequency variation (see Section 2.3.2.1 c) there is a logarithmic relation between the frequency-proportional DC output voltage and the output frequency. Select the maximum frequency to cover the full sweep range in accordance with the following diagram:



Example: Maximum DC output voltage at 13 kHz

	Keyboard <u>6</u>	Key <u>16</u>	Readout <u>1</u>	kHz
Range selection	<input type="text" value="2"/>	<input type="radio"/>	<input type="text" value="1"/> <input type="text" value="3."/> <input type="text" value="0"/> <input type="text" value="0"/> <input type="text" value="0"/>	
		SWP		MAX
		<input type="text"/>		
		SWP	The previously set frequency appears in readout <u>1</u> .	

2.3.5.2.1 Recording Frequency Responses with the aid of an XY Recorder

To record frequency responses with the aid of an XY recorder, proceed as follows:

1. Select the linear or the logarithmic frequency variation mode (see Section 2.3.2.1).
2. Select the limit frequency in accordance with the diagram under 2.3.5.2 a) or 2.3.5.2 b).

Example: Frequency range from 1 Hz to 130 kHz,
10% frequency variation

	Keyboard <u>6</u>	Key <u>16</u>	Key <u>8</u>	Readout <u>1</u>	
Entering the frequency variation			VAR		
	<input type="text" value="1"/> <input type="text" value="."/> <input type="text" value="1"/>		<input type="text"/>		kHz
Sweep range	<input type="text" value="3"/>	<input type="radio"/>		<input type="text" value="1"/> <input type="text" value="3"/> <input type="text" value="0."/> <input type="text" value="0"/> <input type="text" value="0"/>	
		SWP			MAX
		<input type="text"/>			
		SWP	The previously set frequency appears in readout <u>1</u> .		

The frequency displayed in readout 1 can be varied with knob 17.

3. Calibrate the X axis of the recorder with the pen lifted.
To calibrate the Y axis, use knob 17 to vary the frequency (for instance to find a maximum). The X deflection voltage is following the frequency and stops at the corresponding upper sweep limit.
4. Use knob 17 or enter a frequency value to set the lower frequency limit; lower the pen and vary the frequency with knob 17.
5. Lift the pen at the end of the sweep.

Prior to a new sweep, use knob 17 or enter a frequency value to set the lower frequency limit.

2.3.6 Storing Facility

All the settings made on the instrument can be stored and called up if required.

The instrument permits five complete instrument setups to be stored in parallel. For this purpose, press the STO key and one of the numbers 1 to 5 on keyboard 6 (Fig. 2-7).

The RCL of keyboard 6 permits all the values stored to be recalled. The syntax is the same as that of the STO instruction, the RCL key replacing the STO key. In addition to the recall of complete instrument setups, five separate frequency and five level settings out of the complete instrument setup can be fetched. For this purpose, press the number number of the desired memory on keyboard 6 after the RCL key and one of keys 10 or 13.

Examples:

Keyboard <u>6</u>	Key <u>10</u>	Keyboard <u>6</u>
RCL		1
	dBm	
RCL	□	1
	kHz	
RCL	□	1

All the data recalled are checked for correct syntax so that unpermissible settings do not occur due to errors in storing. Should such an error occur, the frequency readout 1 signals "error" for half a second and then the smallest value of the setting is output (e.g. frequency: 1 Hz; level: 1 mV).

After the instrument has been switched on, the values of 10 kHz and 1 mV are stored as the basic settings in all the five memories. These values are overwritten only if new values are entered.

2.3.6.1 Special Functions

By pressing the keys RCL, \emptyset and a further number (1 to 4) on keyboard 6 (Fig. 2-7), the standardized octave and one-third-octave sequences can be set as special functions $\emptyset 1$ to $\emptyset 4$.

RCL $\emptyset 1$	first octave sequence
RCL $\emptyset 2$	second octave sequence
RCL $\emptyset 3$	first one-third-octave sequence
RCL $\emptyset 4$	second one-third-octave sequence

The lowest frequency of the selected sequence appears in readout 1.

Knob 17 permits the frequency to be stepped up or down in accordance with the standardized sequence. Switching-off is possible by pressing the VAR. frequency key again.

When the keys RCL, \emptyset and 5 are pressed, switchover at 1.3 kHz does not take place and the output frequency of the SPN in the frequency range 1 Hz to 13 kHz is read out with a resolution of 1 Hz. The special function RCL $\emptyset 5$ can be switched off by pressing the keys RCL and twice \emptyset .

Table 2-2 Octave and one-third-octave sequences to DIN 45401

1st octave sequence	1st one-third-octave-sequence	2nd one-third-octave-sequence
1.0 Hz	1.0 Hz	1.1 Hz
2.0 Hz	1.2 Hz	1.4 Hz
4.0 Hz	1.6 Hz	1.8 Hz
8.0 Hz	2.0 Hz	2.2 Hz
16.0 Hz	2.5 Hz	2.8 Hz
31.5 Hz	3.1 Hz	3.5 Hz
63.0 Hz	4.0 Hz	4.5 Hz
125.0 Hz	5.0 Hz	5.6 Hz
250.0 Hz	6.3 Hz	7.1 Hz
500.0 Hz	8.0 Hz	9.0 Hz
1.0 kHz	10.0 Hz	11.2 Hz
2.0 kHz	12.5 Hz	14.0 Hz
4.0 kHz	16.0 Hz	18.0 Hz
8.0 kHz	20.0 Hz	22.4 Hz
16.0 kHz	25.0 Hz	28.0 Hz
31.5 kHz	31.5 Hz	35.5 Hz
63.0 kHz	40.0 Hz	45.0 Hz
125.0 kHz	50.0 Hz	56.0 Hz
250.0 kHz	63.0 Hz	71.0 Hz
500.0 kHz	80.0 Hz	90.0 Hz
1000.0 kHz	100.0 Hz	112.0 Hz
	125.0 Hz	140.0 Hz
	160.0 Hz	180.0 Hz
	200.0 Hz	224.0 Hz
	250.0 Hz	280.0 Hz
	315.0 Hz	355.0 Hz
	400.0 Hz	450.0 Hz
	500.0 Hz	560.0 Hz
	630.0 Hz	710.0 Hz
	800.0 Hz	900.0 Hz
2nd octave sequence		
1.4 Hz	1.0 kHz	1.12 kHz
2.8 Hz	1.25 kHz	1.4 kHz
5.6 Hz	1.6 kHz	1.8 kHz
11.2 Hz	2.0 kHz	2.24 kHz
22.4 Hz	2.5 kHz	2.8 kHz
45.0 Hz	3.15 kHz	3.55 kHz
90.0 Hz	4.0 kHz	4.5 kHz
180.0 Hz	5.0 kHz	5.6 kHz
355.0 Hz	6.3 kHz	7.1 kHz
710.0 Hz	8.0 kHz	9.0 kHz
1.4 kHz	10.0 kHz	11.2 kHz
2.8 kHz	12.5 kHz	14.0 kHz
5.6 kHz	16.0 kHz	18.0 kHz
11.2 kHz	20.0 kHz	22.4 kHz
22.4 kHz	.	.
45.0 kHz	.	.
90.0 kHz	.	.
180.0 kHz	.	.
355.0 kHz	400.0 kHz	355.0 kHz
710.0 kHz	500.0 kHz	450.0 kHz
	630.0 kHz	560.0 kHz
	800.0 kHz	710.0 kHz
	1000.0 kHz	900.0 kHz
	1250.0 kHz	1120.0 kHz

2.3.7 Squarewave Output

The squarewave output 12 (BNC female connector) (Fig. 2-7) is available simultaneously with the sinewave output 9. The squarewave output delivers a constant TTL level suitable for driving TTL circuits. The output is short-circuit-proof and has a fan-out of 10.

2.3.8 Reference Frequency

The reference frequency of 1 MHz with TTL level is available at BNC socket 24 for external controls.

It is also possible to apply an external reference frequency of 1 MHz 0.2 to 2 V if the SPN, for example, is to be operated from another unit or at a standard frequency. For this purpose, the BNC socket 24 must be connected in such a manner that it can be used as an input.

The SPN is supplied with the BNC socket 24 connected as an output. When the socket is to serve as a reference input, the link BR1 and the cable K7 must be changed over from ST3 to ST2 on the frequency processor board 392.7580.

2.4 Remote-controlled Operation

The Generator SPN can also be remote-controlled. The setting data are transmitted via a byte-serial bussed system using an interface which corresponds to IEC 625-1 (formerly IEC 66.22), IEEE 488-1975 and DIN 66.22. The IEC-625 Bus connector 20 on the rear panel (Fig. 2-8) is used for this purpose.

2.4.1 Interface

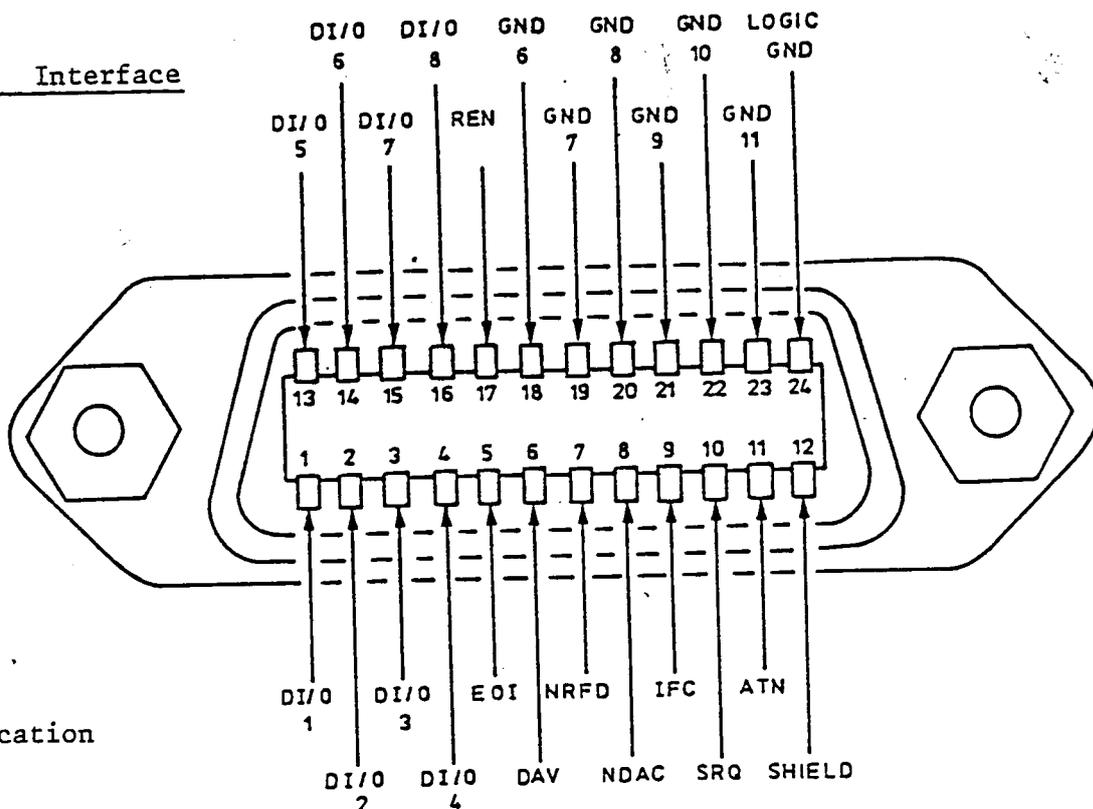


Fig. 2-5
Pin allocation

The IEEE 488-1975 standard provides for a different connector than the international IEC standard. The SPN is fitted with the most commonly used 24-way female connector to IEEE 488-1975. By using an adapter, devices fitted with a 25-way female connector to IEC can easily be connected to the SPN. The control function and data transfer are the same.

The standardized interface has three groups of bus lines.

1. Data bus, 8 lines DI/0 to DI/0 8

Data transfer is bit-parallel and byte-serial, the characters of the ISO 7-bit code (also ASCII code) being transmitted.

DI/0 1 represents the lowest-order and DI/0 8 the highest-order bit.

2. Control bus, 5 lines

These lines are used for transferring control functions.

ATN (attention) goes active LOW while an address is transferred to the devices connected.

REN (remote enable) is used for switching the Generator to the remote-controlled mode.

SRQ (service request) enables a device - by activating this line - to request a service from the controller.

IFC (interface clear) is activated to bring the devices connected to a defined initial status.

EOI (end or identify) can be used to mark the end of a data transfer and is also used for polling after a service request.

3. Handshake bus, 3 lines

It is used to control the timing of the data transfer.

NRFD (not ready for data) Active LOW on this line signals to the controller that one of the devices connected is not ready to accept data.

DVD (data valid) is activated by the controller shortly after a new data byte has been applied to the data bus.

NDAC (not data accepted) is kept active LOW by the device connected until it has accepted the data transferred on the data bus.

2.4.2 Setting the Address

Table 2-3 gives the setting of the address switches. The decimal address 11 is factory-set on the SPN.

The address is transferred only when the SPN is switched on and in the case of DCL (device clear).

Table 2-3 Setting the device address

ASCII character		Binary address					Decimal equivalent
Listen address	Talk address	Address switches A5 A4 A3 A2 A1					
(SPACE)	@	0	0	0	0	0	0
!	A	0	0	0	0	1	1
"	B	0	0	0	1	0	2
#	C	0	0	0	1	1	3
\$	D	0	0	1	0	0	4
%	E	0	0	1	0	1	5
&	F	0	0	1	1	0	6
'	G	0	0	1	1	1	7
(	H	0	1	0	0	0	8
)	I	0	1	0	0	1	9
*	J	0	1	0	1	0	10
+	K	0	1	0	1	1	11
,	L	0	1	1	0	0	12
-	M	0	1	1	0	1	13
.	N	0	1	1	1	0	14
/	O	0	1	1	1	1	15
0	P	1	0	0	0	0	16
1	Q	1	0	0	0	1	17
2	R	1	0	0	1	0	18
3	S	1	0	0	1	1	19
4	T	1	0	1	0	0	20
5	U	1	0	1	0	1	21
6	V	1	0	1	1	0	22
7	W	1	0	1	1	1	23
8	X	1	1	0	0	0	24
9	Y	1	1	0	0	1	25
:	Z	1	1	0	1	0	26
;	[	1	1	0	1	1	27
<	]	1	1	1	0	0	28
=	^	1	1	1	0	1	29
>	~	1	1	1	1	0	30

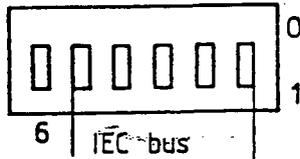


Fig. 2-6 Address switch 19 on the rear panel (see Fig. 2-8)

2.4.3 REMOTE/LOCAL/DEVICE CLEAR

When driven by a controller, the SPN automatically goes to the REMOTE mode and stays in this state even when the output is terminated. LED 5 (Fig. 2-7) indicates this status. In this case, all the front-panel controls are disabled. If a manual setting is to be made, first stop the program run of the controller. Next press the LOC key 8 to switch the SPN over to manual operation. Now the desired setting can be made.

The controller can bring the instrument to the LOCAL mode by the GTL (go-to-local) control instruction.

Switchover to the REMOTE mode is automatically performed with the next setting instruction.

The switchover to the LOCAL mode by pressing key 8 can be inhibited by sending once - if possible at the beginning of the program - the LLO (local-lockout) instruction via the IEC bus.

The instrument is brought to its basic state (frequency 10.000 kHz, output level 1 mV, output impedance 50 Ω) by a DCL (device-clear) instruction which should be entered at the beginning of a program every time the IEC bus is restarted.

Table 2-4 gives examples for outputting the above-mentioned instructions, based on the decimal address 11 of the SPN. This decimal address corresponds to the full decimal equivalent of 43 (ASCII code).

Table 2-4

	R&S PUC/PPC	Tektronix 4051/4052	hp 9825	hp 9835/9845	Commodore PET 2001/3032/4032/8032
Go to local	IECLAD11 IECGTL (for the device addressed) IECUNL	WBYTE043,1:	1c1711	LOCAL711 or LOCAL7	not possible
Local lockout	IECLLO (for all devices)	WBYTE043,17: or WBYTE017:	11o7 (for all devices)	LOCAL LOCKOUT7 (for all devices)	not possible
Remote	IECLAD11	WBYTE043:	rem711 or rem7	REMOTE711 or REMOTE7	in conjunction with an output only
Selected device clear	IECLAD11 IECSDC IECUNL	WBYTE043,4:	cl711	RESET 711	not possible

2.4.4 Remote-control Instructions

2.4.4.1 Listener

Setting instructions consist of data (optional) and an easy-to-remember combination of two characters designating the unit or the function while being the delimiter at the same time.

Storage instructions and special functions are terminated by numbers. The separator can be any character with the exception of numbers, decimal points and the letters included in the instructions.

Table 2-5 Remote-control instructions of SPN

Function	Data	Instruction (delimiter)
Setting the frequency in kHz in Hz	Max. 5 decimal digits with or without decimal point	KH HZ
Setting the frequency with short transient period (time saving about 5 ms) in kHz in Hz	Max. 5 decimal digits with or without decimal point	KS HS
Setting the level in V in mV in dBV in dBm	Max. 3 decimal digits with or without decimal point	V MV DV DM
Switching the level off	None	RØ
Switching on the linear sweep: range 1 range 2 range 3 range 4	None None None None	S1 S2 S3 S4
Switching on the logarithmic sweep: range 1 range 2 range 3 range 4 Switching off	None None None None None	L1 L2 L3 L4 LØ

Function	Data	Instruction (delimiter)
Switching the sweep off	None	S \emptyset
Output impedance 600 Ω 50 Ω = 5 Ω	None None None	R 6 R 5 R 1
Storing the complete setup	n = number 1 to 5 for the last digit	ST n
Recalling the frequency	Same as for storing	RC KH n RC HZ n
Recalling the level	Same as for storing	RC V n RC MV n RC DV n RC DM n
Recalling the complete setup	Same as for storing	RC n
Switching on the special functions	n = number 0 to 5	RC \emptyset n
After switching on the special functions: stepping up stepping down	None None	N 1 N \emptyset
Enabling service request	None	SR

For data entry the limits of the setting range must be observed. If they are exceeded, SRQ is signalled if the controller had previously sent the SR IEC-bus instruction. If the data entered have a finer resolution than the SPN can accept, the extra digits are ignored.

2.4.4.2 Service Request

If the controller allows the service request by sending the SR instruction, the SPN signals different entry errors by activating the SRQ line. The status byte output during the subsequent serial poll has the following meaning:

Status byte Decimal equivalent	Meaning
65	Syntax error
66	Entered frequency exceeds the range or frequency has been entered with the sweep mode on
67	Entered level exceeds the range
68	Instruction not recognized

After the instrument has been switched on, the service request is always inhibited. It is enabled by the SR instruction.

2.4.5 Programming Examples for Process Controllers PPC/PUC

Frequency setting

- a) for 1.2343 kHz
Entry: IECOUT11,"1.2343 KH"
- b) for 432.5 Hz
Entry: IECOUT11,"432.5 HZ"

Frequency setting for short transient periods
(without display)

- a) for 1.2343 kHz
Entry: IECOUT11,"1.2343 KS"
- b) for 432.5 Hz
Entry: IECOUT11,"432.5 HS"

Level setting

- a) for 4.32 V
Entry: IECOUT11,"4.32 V"
- b) for 185 mV
Entry: IECOUT11,"185 MV"
- c) for 14.2 dBm
Entry: IECOUT11,"14.2 DM"
- d) for 15.2 dBV
Entry: IECOUT11,"15.2 DV"

Switch on range 1:	IECOUT11,"S1"
Switch off linear sweep:	IECOUT11,"S0"
Switch on logarithmic sweep range 1:	IECOUT11,"L1"
Switch off logarithmic sweep only:	IECOUT11,"L0"
Switch off sweep:	IECOUT11,"S0"

Output impedance

- a) Switch on 600 Ω : IECOUT11,"R6"
- b) Switch on 50 Ω : IECOUT11,"R5"
- c) Switch on \approx 5 Ω : IECOUT11,"R1"

Store the complete setup,
for instance in memory 1 IECOUT11,"ST 1"

Recall the values stored as in the case of storing
(replace ST by RC)

Switch on the special function

- a) first octave sequence: IECOUT11,"RC Ø1"
- b) second octave sequence: IECOUT11,"RC Ø2"
- c) first one-third-octave sequence: IECOUT11,"RC Ø3"
- d) second one-third-octave sequence: IECOUT11,"RC Ø4"

After recalling the special function, the sequence selected is

- a) stepped up once IECOUT11,"N1"
- b) stepped down once IECOUT11,"NØ"

Recall the second one-third-octave sequence and step up ten times

```

1Ø IECOUT 11, "RC Ø4"
2Ø FOR I = 1 TO 1Ø STEP 1
3Ø IECOUT 11, "N1"
4Ø NEXT I

```

Switch the level off and on again with 50- Ω output impedance

```

1Ø IECOUT 11, "RØ"
2Ø IECOUT 11, "R5"

```

Frequency response measurement in the range from 16 Hz to 13.0 kHz when using the voltage proportional to frequency

```

SPN setting                1Ø IECOUT11,"5VR5"
Upper and lower limit frequency 2Ø IECOUT11,"S1SØ"
Frequency range and step width 3Ø FORI=16TO13ØØØSTEP1
Frequency output           4Ø IECOUT11,STRS(I)+"HZ"
                           5Ø NEXT I
                           6Ø END

```

Complete setup of instrument

```

Frequency:                1.2343 kHz
Level:                    4.32 V
Output impedance:        50  $\Omega$ 

```

Entry: IECOUT11,"1.2343KH4.32VR5"

For better reading, the instruction can also be provided with separators and space characters. These are ignored by the SPN.

IECOUT11,"1.2343 KH,4.32V,R5"

The instructions required for data output differ slightly for computers of different make. Examples are given in Table 2-6 for the most commonly used desktop models.

Table 2-6

	R&S PUC/PPC	Tektronix* 4051/4052	hp 85	hp 9825	hp 9835/9845	Commodore PET 2001/3032/4032/8032
Initialization Listener	---	---	---	---	---	OPEN1,11
Frequency 1.2343 kHz	IECOUT11,"1.2343KH"	PRINT#11:"1.2343KH"	OUTPUT711;"1.2343KH"	wrt711,"1.2343KH"	OUTPUT711,"1.2343KH"	PRINT#1,"1.2343KH"
Frequency as a variable	LET F=1.2343 IECOUT11,STR\$(F)+"KH"	LET F=1.2343 PRINT#11:F;"KH"	F=1.2343 OUTPUT711;VAL\$(F)&"KH"	1.2343 F wrt711,str(F),"KH"	LET F=1.2343 OUTPUT711:F;"KH"	LET F=1.2343 PRINT#1,STR\$;"KH"
Level 4.32 V	IECOUT11,"4.32V"	PRINT#11:"4.32V"	OUTPUT711;"4.32V"	wrt711,"4.32V"	OUTPUT711;"4.32V"	PRINT#1,"4.32V"
Switch on linear sweep, range 1 Switch off	IECOUT11,"S1" IECOUT11,"S0"	PRINT#11:"S1" PRINT#11:"S0"	OUTPUT711;"S1" OUTPUT711;"S0"	wrt711,"S1" wrt711,"S0"	OUTPUT711;"S1" OUTPUT711;"S0"	PRINT#1,"S1" PRINT#1,"S0"
Switch on logarithmic sweep, range 1 Switch off	IECOUT11,"L1" IECOUT11,"L0"	PRINT#11:"L1" PRINT#11:"L0"	OUTPUT711;"L1" OUTPUT711;"L0"	wrt711,"L1" wrt711,"L0"	OUTPUT711;"L1" OUTPUT711;"L0"	PRINT#1,"L1" PRINT#1,"L0"
Output impedance R = 50Ω	IECOUT11 " R5 "	PRINT#11, " R5 "	OUTPUT711; " R5 "	wrt711, " R5 "	OUTPUT711; " R5 "	PRINT#1, " R5 "

*)When using the graphic Computing System 4051, connect the bus line (pin 17) to ground (pin 18). This can be done with a shortcircuit connector.

2.5 Balun SPN-Z1

The Balun SPN-Z1 265.4319.02 is part of the recommended extras. It permits a voltage balanced to earth to be drawn from the SPN or any other unbalanced voltage source and is used for feeding balanced line systems and amplifiers requiring a push-pull or floating input voltage. It is also suitable for transmitting stereo multiplex signals. Moreover, the use of such a balun is of advantage in many test setups to interrupt hum loops, for instance when measuring the stopband of filters. To ensure that the balun does not pick up any hum voltage, it is inserted into a μ metal shielding can.

Due to the step-down transformation, the balun, including the transformed current source, has a small output impedance (see Section 4.9.1). Thus with the usual secondary load of 600 Ω , practically the full, transformed EMF of the SPN is available.

As the frequency response of the balun stays very flat over the entire frequency range at loads between 150 Ω and open circuit, it is sufficient to measure the primary in order to determine the secondary voltage.

The secondary voltage is symmetrical about the centre tap. An asymmetry occurs only in the vicinity of the upper frequency limit.

Make sure that the permissible primary voltage (5 to 32 V) in the lower frequency range is not exceeded since otherwise the harmonic distortion will increase excessively.

3. Maintenance3.1 Required Measuring Equipment and Accessories

No.	Instrument	Required specifications	R & S type	See section
1	Frequency counter	Range 1 Hz to 1.3 MHz		3.2.2 3.2.10
2	AC-DC voltmeter	Range 1 mV to 10 V	UDS 6 346.9210... URE 342.1214...	3.2.3 3.2.4 3.2.8 3.2.11
3	AF spectrum	Range 1 Hz to 1300 kHz, dynamic range > 70 dB		3.2.5 3.2.6
4	Distortion meter	Range 1 Hz to 1300 kHz		3.2.7
5	50- Ω feed-through termination	Z = 50 Ω , 0.5 W	RAD 289.8966.00	3.2.8
6	Oscilloscope			3.2.9 3.2.10
7	Controller	Interface to IEEE 488 or IEC 625.1	Process Controller PUC 344.9800...	3.2.12
8	Power meter	Range 1 Hz to 1.3 MHz Z = 50 Ω error < 0.1 dB		3.2.4
9	10-dB attenuator	Z = 50 Ω /0.5 W, 10 dB	DSF 289.8866.00	3.2.4

3.2 Checking Rated Specifications

3.2.1 Checking Readouts, Indicators and Keyboard

After the SPN has been switched on, all the LEDs should stay on for 5 seconds. During this period, readouts 1 and 3 (Fig. 2-7) display . To check the keyboard, perform the entries listed in section 2.3 and check the figures displayed in the readouts.

3.2.2 Checking Frequency Setting and Accuracy

Test setup: Connect a frequency meter to the squarewave output 12 (Fig. 2-7).

Checking: Set the following frequencies on the SPN and check with the frequency meter.

1300 kHz	63.7 Hz
130 kHz	32.8 Hz
13 kHz	1 Hz
1.3 kHz	

A relative frequency error may be due to aging or a temperature variation.

In the steady state, the relative frequency error must stay constant for all the frequencies selected. Check this error against the specifications.

3.2.2.1 Checking the Reference Frequency

Test setup: Connect a frequency meter to the reference output 24 (Fig. 2-8).

Checking: Check the 1-MHz reference frequency with the frequency meter.

A relative frequency error may occur due to aging or a temperature variation.

3.2.3 Checking Level Setting

Setting on the SPN: Frequency = 1 kHz; $Z_{out} = 50 \Omega$.

Connect a high-impedance voltmeter to the sinewave output.

Checking: Use knob 17 to reduce the level from 20 dBV to 10.1 dBV in steps of 0.1 dBV. Check the level steps on the voltmeter. At the maximum error, reduce the error by 10/20/30/40/50/60 and 70 dB and check on the voltmeter.

Example: Maximum error at 12.1 dBV

Entry: 2.1 dBV (12.1 dBV - 10 dB)
 -7.9 dBV (12.1 dBV - 20 dB)

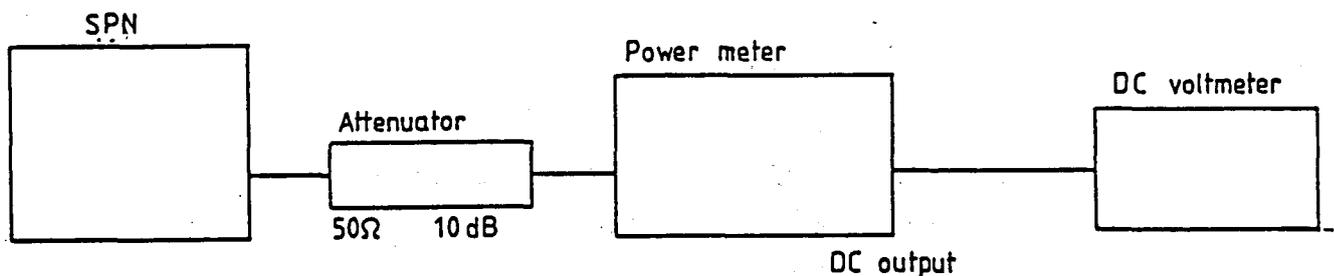
Check the error of the output voltage against the specifications.

Repeat the measurement at 50 kHz.

3.2.4 Checking Frequency Response

Setting on the SPN: Level = 10 V, frequency = 1 Hz to 1300 kHz,
 output impedance = 50 Ω

Test setup:



Checking:

Vary the frequency on the SPN and check the level on the DC voltmeter. The permissible frequency response (difference between the highest and the lowest level) is to be checked against the specifications.

3.2.5 Checking Spurious Signal Rejection

Setting on the SPN: Level = 10 V, frequency = 1 Hz to 1300 kHz,
 output impedance = 50 Ω

Test setup:

Connect the AF analyzer to the sinewave of the SPN. Check the spurious signal suppression against the specifications.

3.2.6 Checking Harmonic Content

Setting on the SPN: Level = 10 V, frequency 1 Hz to 1300 kHz.

Test setup: Connect the AF analyzer to the sinewave output of the SPN.
Check the harmonic content against the specifications.

3.2.7 Checking Harmonic Distortion

Setting on the SPN: Level = 10 V, frequency = 1 Hz to 1300 kHz

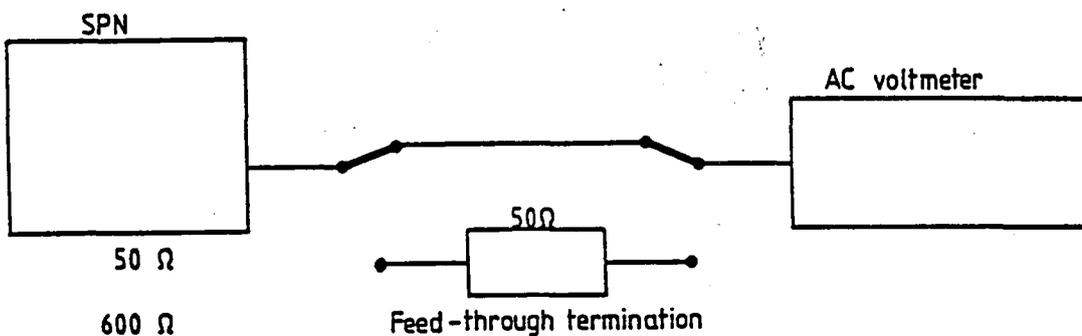
Test setup: Connect a distortion meter to the sinewave output of the SPN. Check the harmonic distortion against the specifications.

3.2.8 Checking Output Impedance

Setting on the SPN: Level = 10 V, frequency = 50 kHz,
output impedance = 50 Ω /600 Ω

Checking: Connect the AC voltmeter to the sinewave output and measure the open-circuit voltage.

Connect a 50- Ω feed-through termination to the output and measure the values for the two output impedances mentioned.



$$V_{\text{nom}} = \frac{V_{\text{open}}}{Z_{\text{out}} + 50} \quad 50$$

$$\text{Error } \% = \frac{V_{\text{nom}} \cdot V_{\text{act.}}}{V_{\text{nom}}} \quad 100$$

Check the maximum error against the specifications.

3.2.9 Checking Squarewave Output

Setting on the SPN: Level = 3.17 V, frequency = 1 Hz to 1300 kHz

Test setup: Connect the oscilloscope via a high-impedance probe to the squarewave output.

Checking: The duty cycle should be ≈ 0.5 over the entire frequency range.

3.2.10 Checking Sweep Operation

Setting on the SPN: Level = 10 V; select SWP range 4 (max. frequency 1300 kHz)

Test setup: Connect the counter and the oscilloscope to the squarewave output.

Checking: Apply a voltage of 0 V to the sweep input.

f_{out} should be ≈ 0 Hz.

Apply a voltage of 1.3 V to the sweep input.

f_{out} should be ≈ 1300 kHz.

3.2.11 Checking DC Output Voltage Proportional to Frequency

Setting on the SPN: Select SWP range 1.
Switch off the SWP mode.

Test setup: Connect a DC voltmeter to the sweep output.

Checking: The DC voltage measured at the sweep output should be proportional to frequency:

1 Hz corresponding to 0 V

1.300 kHz corresponding to 1.3 V

3.2.12 Checking Interface Functions

Test setup: Use the controller (e.g. PUC from R&S) for remote control of the SPN. Program all the setting instructions listed in Section 2.4.4.1 and check the correct execution on the front-panel display.

3.3 Performance Test Protokoll

R&S

Date:

Generator SPN

Name:

Order No.: 336.3019.02

Serial-No.:

No.	Check	See section	Min	Actual	Max	Unit
1	Performance check of readouts, indicators and keyboards	3.2.1				
2	Frequency error due to aging and temperature variation (measured at $23 \pm 1^\circ\text{C}$ and max. 1 month after calibration)					
	1300 kHz		1299984.4	.....	1300015.6	Hz
	130 kHz		129998.44	.....	130001.56	Hz
	13 kHz	3.2.2	12999.844	.....	13000.156	Hz
	1.3 kHz		1299.9844	.....	1300.0156	Hz
	63.7 Hz		63.6992356	.....	63.7007644	Hz
	32.8 Hz		32.799016	.....	32.800984	Hz
	1 Hz		0.999979	.....	1.000021	Hz
3	Error of output level, EMF	3.2.3				
	300 mV to 10 V		-2	.....	+2	%
	10 mV to 300 mV		-3	.....	+3	%
	1 mV to 10 mV		-5	.....	+5	%

No.	Check	See section	Min	Actual	Max	Unit
4	Frequency response	3.2.4				
	1 Hz to 9.99 kHz		-0.5	.....	+0.5	%
	10 kHz to 1300 kHz		-0.5	.....	+0.5	%
	1 Hz to 1300 kHz		-1	.....	+1	%
5	Spurious signal rejection	3.2.5				
	1 Hz to 700 kHz		70	.....	-	dB
	700 kHz to 1300 kHz		65	.....	-	dB
6	Harmonic content	3.2.6				
	1 Hz to 100 kHz		70	.....	-	dB
	100 kHz to 1300 kHz		54	.....	-	dB
7	Harmonic distortion	3.2.7				
	1 Hz to 50 Hz			.....	0.05	%
	50 Hz to 100 kHz			.....	0.03	%
	100 kHz to 1300 kHz		.....	0.2	%	
8	Output impedance	3.2.8				
	600 Ω		594	.....	606	Ω
	50 Ω		49.5	.....	50.5	Ω
9	Checking the squarewave output	3.2.9	-		-	
10	Checking the sweep mode	3.2.10				
	SWP		-		-	
	LOG SWP		-		-	
11	Checking the DC output voltage proportional to frequency	3.2.11				
	1 Hz		-0.005	.....	0.005	V
	1.300 kHz		1.295	.....	1.305	V
12	Checking the interface functions	3.2.12	-		-	

3.4 Regular Maintenance Work

The only maintenance required is the adjustment of the frequency, the variation of which is caused by crystal aging.

For the adjustment see Section 4.2.2.1.

4. Servicing4.1 Required Measuring Equipment and Accessories

No.	Instrument	Required specifications	R&S type	See section
1	Frequency counter	Range \geq 135 MHz		4.2.2.1 4.2.2.6 4.5.2.1 4.5.3 4.6.2.1 4.6.3
2	AC-DC voltmeter	Range 1 mV to 10 V	UDS6 346.9210... URE 342.1214...	4.2.2.2 4.2.2.5 4.2.2.7 4.4.2 4.5.2.1 4.5.3 4.6.3 4.7.3
3	Distortion meter	Range 1 Hz to 100 kHz		4.2.2.3 4.4.2 4.7.2 4.9.3
4	50- Ω feed-through	50 Ω /0.5 W	RAD 289.8966.00	4.2.2.3
5	AF spectrum analyzer	Range 1 Hz to 1300 kHz, dynamic range \geq 76 dB		4.2.2.4 4.4.2 4.5.2.2 4.5.3 4.6.3 4.7.3

No.	Instrument	Required specifications	R&S type	See section
6	20-dB/50- Ω attenuator	Z = 50 Ω , 20 dB, 0.5 W, error \pm 1 dB	DSF 591.4338.00	4.2.2.4
7	Oscilloscope			4.2.2.6 4.4.2 4.5.3
8	DC power supply	> 5 V, < 100 mA	NGM 117.7110 NGR 100.5084	4.2.2.6 4.4.2 4.5.3 4.7.3
9	Psophometer	min. input voltage < 0.3 mV	UPGR 248.1915	4.4.2
10	Signature analyzer			4.4.2
11	RF voltmeter	1 mV to 10 V	UVM 110.2994...	4.5.2.2 4.5.3 4.7.3 4.9.2

4.2 Overall Description

4.2.1 Circuit Description and Construction

(See Fig. 4-2)

(For block diagram see Fig. 4-1)

The SPN output signal is produced by mixing a 2-MHz fixed-frequency signal with the signal derived from a phase-controlled oscillator. The output of this oscillator is derived from a stable 18-MHz control frequency by frequency synthesis.

There are three frequency decades ahead of the output mixer in order to ensure high resolution and little spurious FM at low frequencies. In the first frequency decade, the divided oscillator frequency (2.13 to 3.3 MHz) is mixed with a fixed frequency of 18 MHz to obtain 20.13 to 21.3 MHz and then divided by ten. The 2.013 to 2.13 MHz signal thus produced has a resolution which is ten times finer while the spurious FM is reduced by the factor 10. Thus the first decade covers the range from 13.0 to 130 kHz, the second decade that from 1.3 to 13 kHz and the third decade from 1 Hz to 1.3 kHz.

The active high-quality output mixer which delivers a low-distortion signal ensures a small distortion factor and an excellent spurious frequency rejection for the output signal.

A preamplifier and an output amplifier boost the signal to the required high output level.

Because of the low frequency of the output, the output amplifier is DC-coupled throughout. An offset control is provided to keep the DC offset as small as possible.

Two independent control loops are provided for level control in order to obtain a short transient level response time even for low frequency outputs. The RF mixer frequency alone is regulated up to 9.999 kHz whereas between 10 kHz and 1.3 MHz control is extended to the complete output signal.

The output attenuator can be mechanically switched in 10-dB steps up to a maximum attenuation of 70 dB. The 0.1-dB steps are electronically set by a D/A converter by way of the level control.

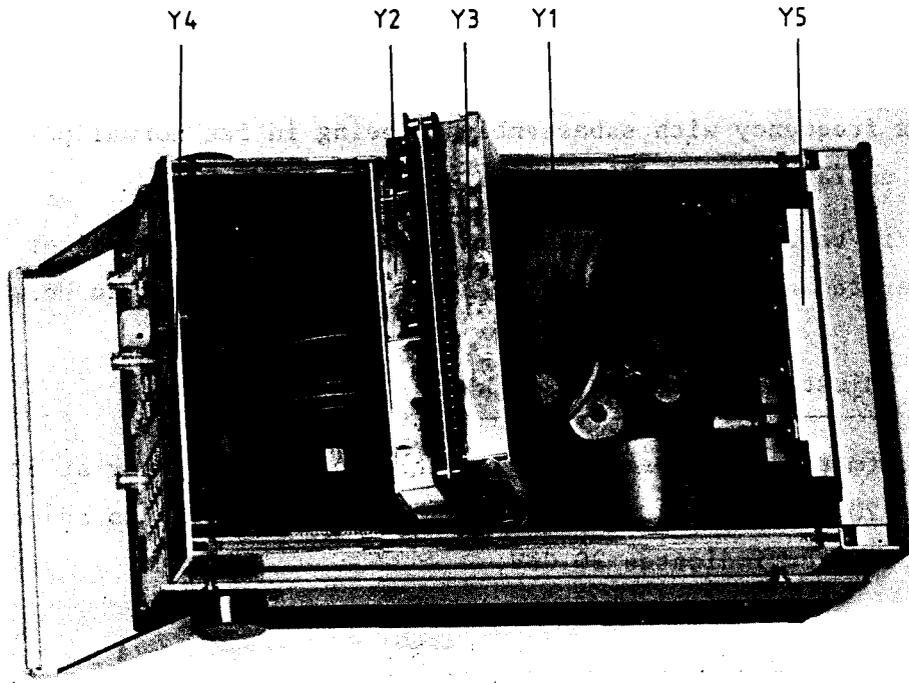
All functions are controlled by a microprocessor which continuously polls the keyboard and the IEC bus. Based on the key entries, the microprocessor calculates the required settings and performs them. Moreover, the microprocessor also drives the display.

In spite of its comprehensive circuitry, the SPN is of small size and has a clear, compact design. Extruded aluminium profiles are used for the side panels which rigidly connect the front panel to the rear junction panel. The top and bottom panelling fixed by lateral screws can be removed after undoing these screws. The front and the rear panels can be removed after undoing four screws per panel. However, the two panels should not be removed at the same time since the SPN would lose its mechanical stability.

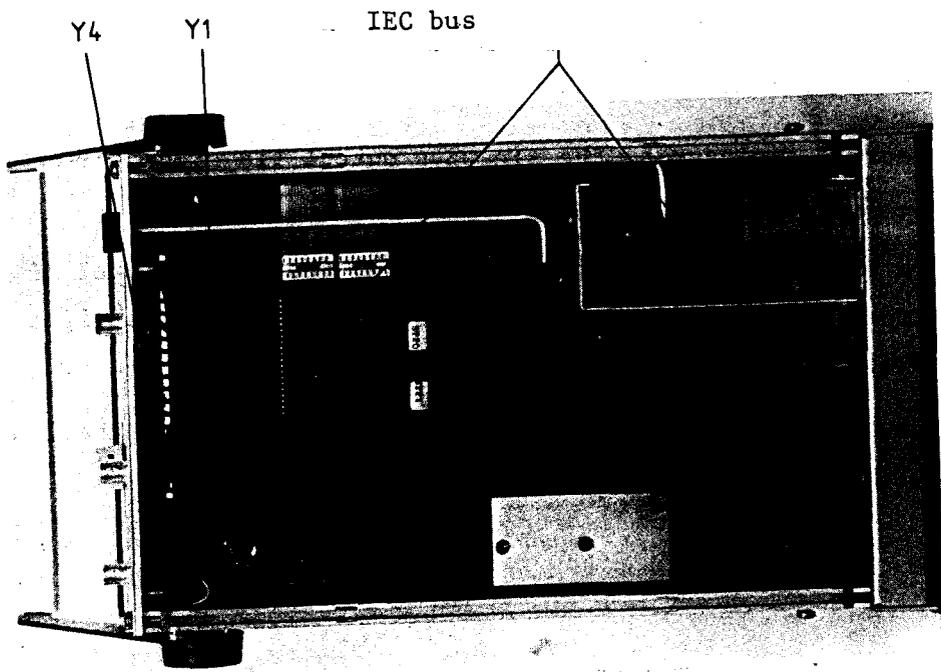
Board Y1 (control circuit and attenuator) is used as the motherboard and fixed to the bottom of the instrument.

Boards Y2 (frequency generator) and Y3 (frequency processor) are plugged together. Having undone the two front screws, the boards can easily be swung up and horizontally displaced. This ensures excellent access for servicing.

Boards Y2 and Y3 as well as part of board Y1 are designed as RF-leakage-proof subassemblies with a view to eliminating crosstalk.



Top with Y2 and Y3 swung out



Bottom

Fig. 4-2 Interior views

4.2.2.1 Reference Frequency Adjustment

Connect a frequency counter to the reference frequency output and use C4 to adjust the 1-MHz frequency with subassembly Y3 being in its normal position. The permissible deviation is ± 1 Hz.

This adjustment is to be performed at normal ambient temperature after the SPN has been operated at this temperature for a period of about an hour.

4.2.2.2 Level Adjustment for $f_{out} > 10$ kHz

Connect an AC voltmeter to the sinewave output. Set the frequency at 50 kHz and the level at 20 dBV on the SPN. Use potentiometer R99 (Y2) to adjust such that the voltmeter indicates 20 dBV.

4.2.2.3 Operating Point of 10-V Output Stage

Connect a distortion meter to the sinewave output via a 50- Ω feed-through termination.

Select the output frequency of 100 kHz, the level of 1 V and the output impedance of $\approx 5 \Omega$ on the SPN.

Turn potentiometer R21 (Y5) from the righthand stop slowly anti-clockwise until a distortion factor of 0.03% is reached.

4.2.2.4 Spurious Frequency Adjustment

Connect an AF spectrum analyzer to the sinewave output via a 20-dB/50- Ω attenuator.

Select on the SPN the output frequency of 1300 kHz, the output level of 10 V and the output impedance of 50 Ω . With these settings, a spurious signal is present at 700 kHz.

Use potentiometer R111 (Y2) to adjust this spurious frequency to the lowest value possible without affecting the distortion factor.

4.2.2.5 Level Adjustment for $f_{out} < 10$ kHz

Connect an AC voltmeter to the sinewave output. Select on the SPN the output frequency of 50 kHz and the level of 20 dBV.

Measure the output voltage. Without changing the frequency setting, set 10.1 dBV on the SPN and measure again.

Switch the frequency over to 1 kHz and the level to 20 dBV. Adjust to the same values as with an output frequency of 50 kHz using potentiometers R34 (Y2) at 20 dBV and R112 (Y2) at 10.1 dBV.

Repeat the adjustment several times since the two adjustments affect each other.

4.2.2.6 Sweep Adjustment

Connect a frequency counter and an oscilloscope in parallel to the square-wave output.

Select SWP range 4 on the SPN. 1300.0 kHz MAX appears on the display.

Connect a DC power supply to the sweep input and set the voltage to 0 V.

Use potentiometer R84 (Y2) to adjust an output frequency of ≈ 0 Hz.

Increase the voltage applied to the sweep input to 1.3 V. Use potentiometer R110 (Y2) to adjust the frequency to ≈ 1300 kHz.

Repeat the adjustment several times since the adjustments affect each other.

Select the LOG SWP range 4 with the same settings as above.

Adjust the voltage applied to the sweep input to 0 V. Use potentiometer R71 (Y2) to set a frequency of ≈ 0 Hz. Increase the voltage at the sweep input to 1.3 V and use potentiometer R87 (Y2) to adjust the frequency to ≈ 1300 kHz.

4.2.2.7 Adjustment of Frequency-proportional DC Output Voltage

Connect a DC voltmeter to the sweep output.

Enter the frequency of 1.300 kHz on the SPN.

Select sweep range 1 so that display shows 1.300 kHz MAX.

Switch off the sweep mode.

Use potentiometer R82 to adjust a DC voltage of 1.3 V.

4.2.3 Troubleshooting

4.2.3.1 General Instructions

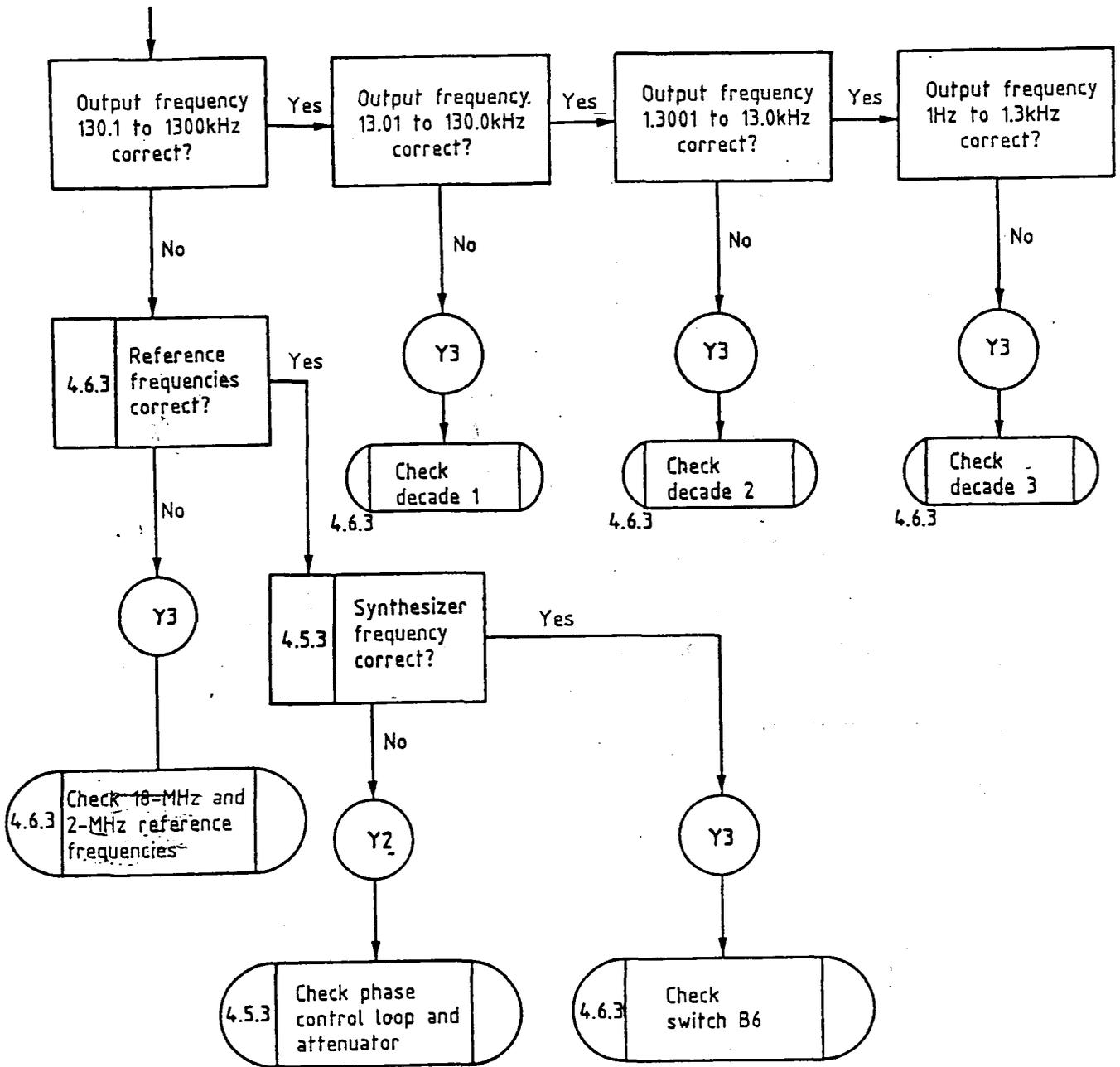
The following flow charts are to be used for determining the faulty board. The numbers to the left in the box refer to the section in which the performance test is described. The symbol in the circle gives the number of the circuit board on which the fault is to be traced. Levels and switching states are to be checked against those of relevant circuit diagrams. Prior to troubleshooting make sure that all supply voltages have the correct value (see Section 4.4).

 Make sure that the circuit boards are exchanged only when the  instrument is switched off.

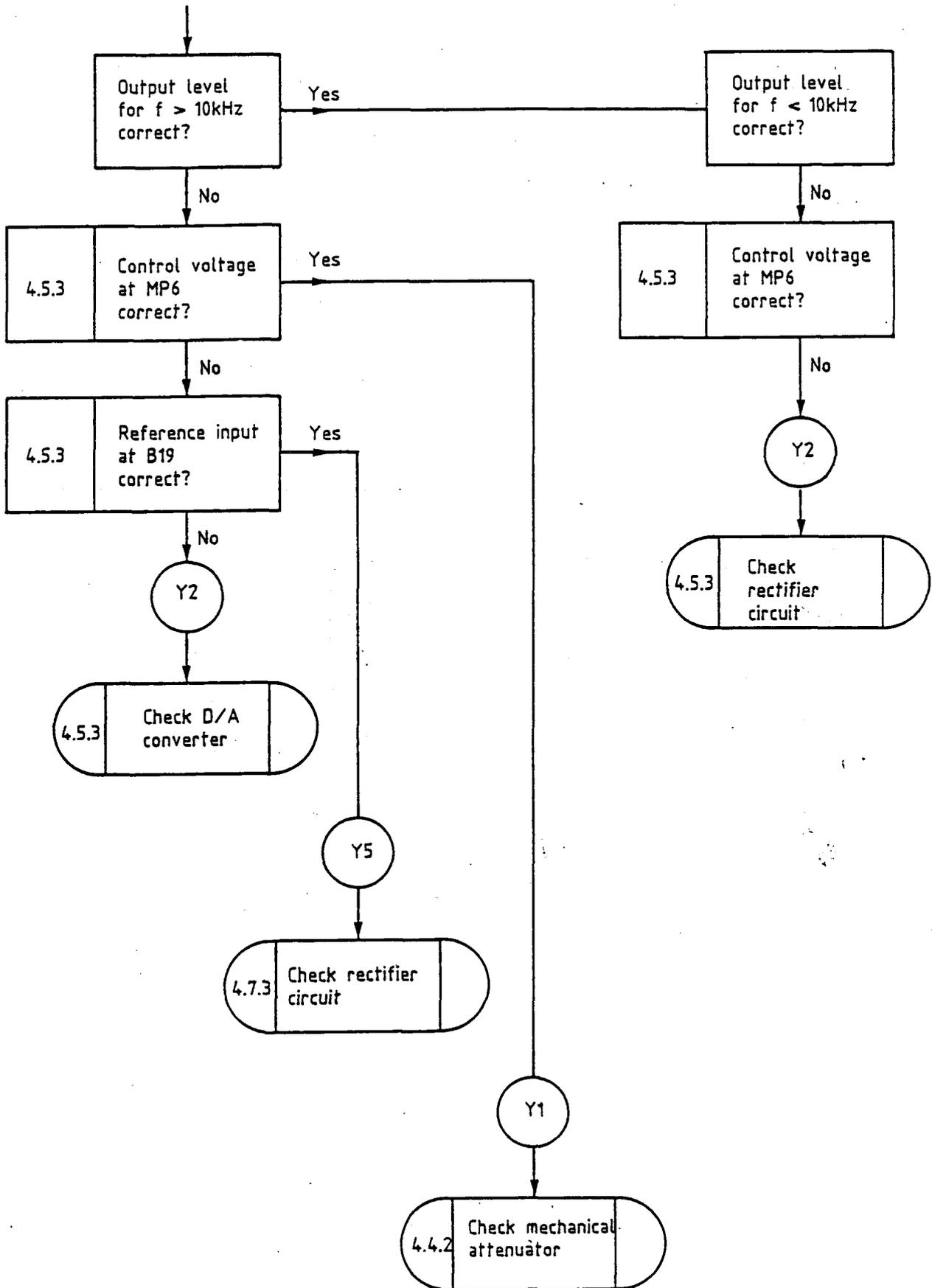
Table 4-1 Circuit boards

No.	Designation	Order No.
Y1	Control circuit and attenuator	392.7522
Y2	Frequency generator	392.7545
Y3	Frequency processor	392.7580
Y4	Display and keyboard	336.4015
Y5	10-V output stage	336.4038

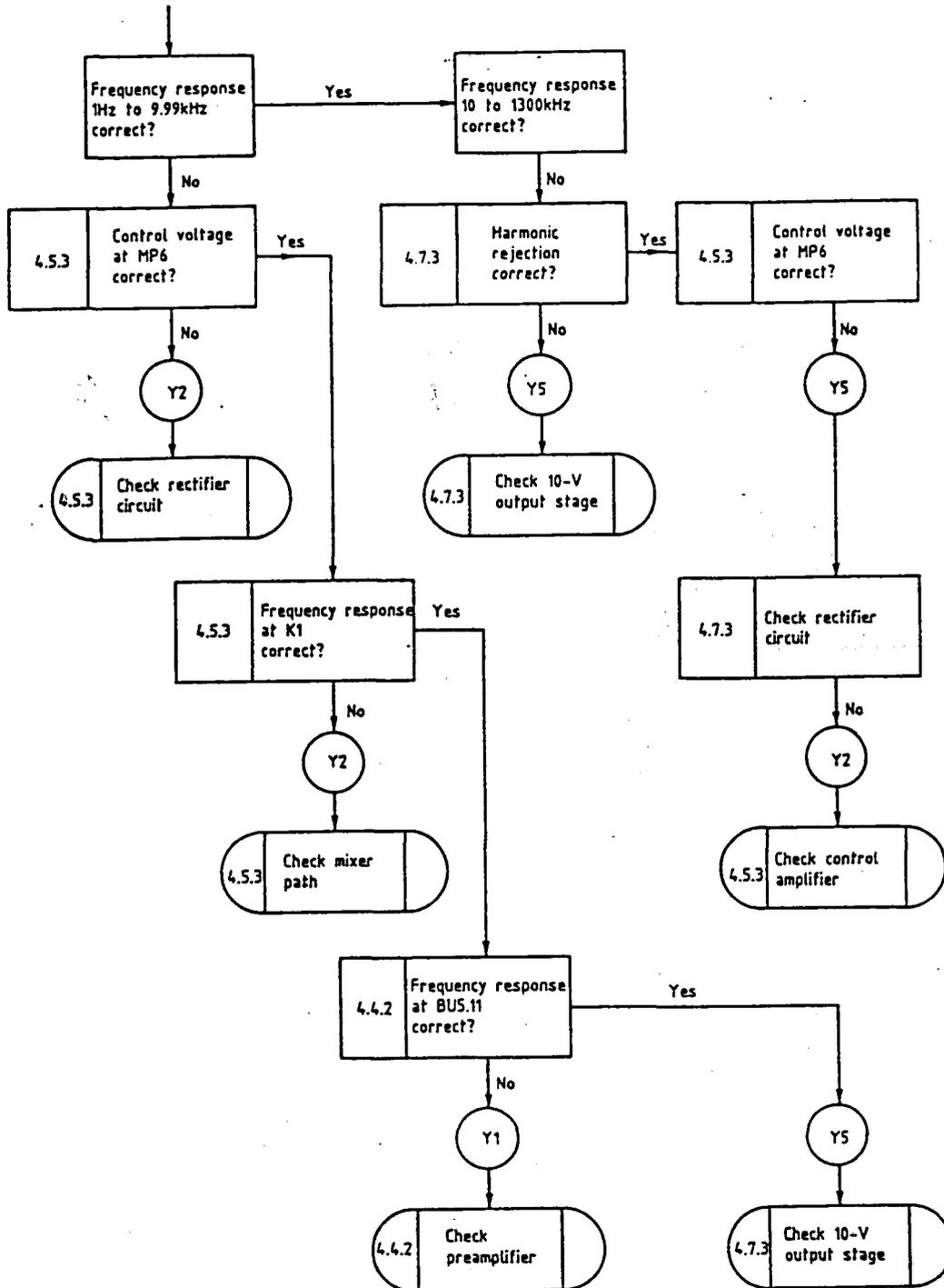
4.2.3.2 Wrong Output Frequency



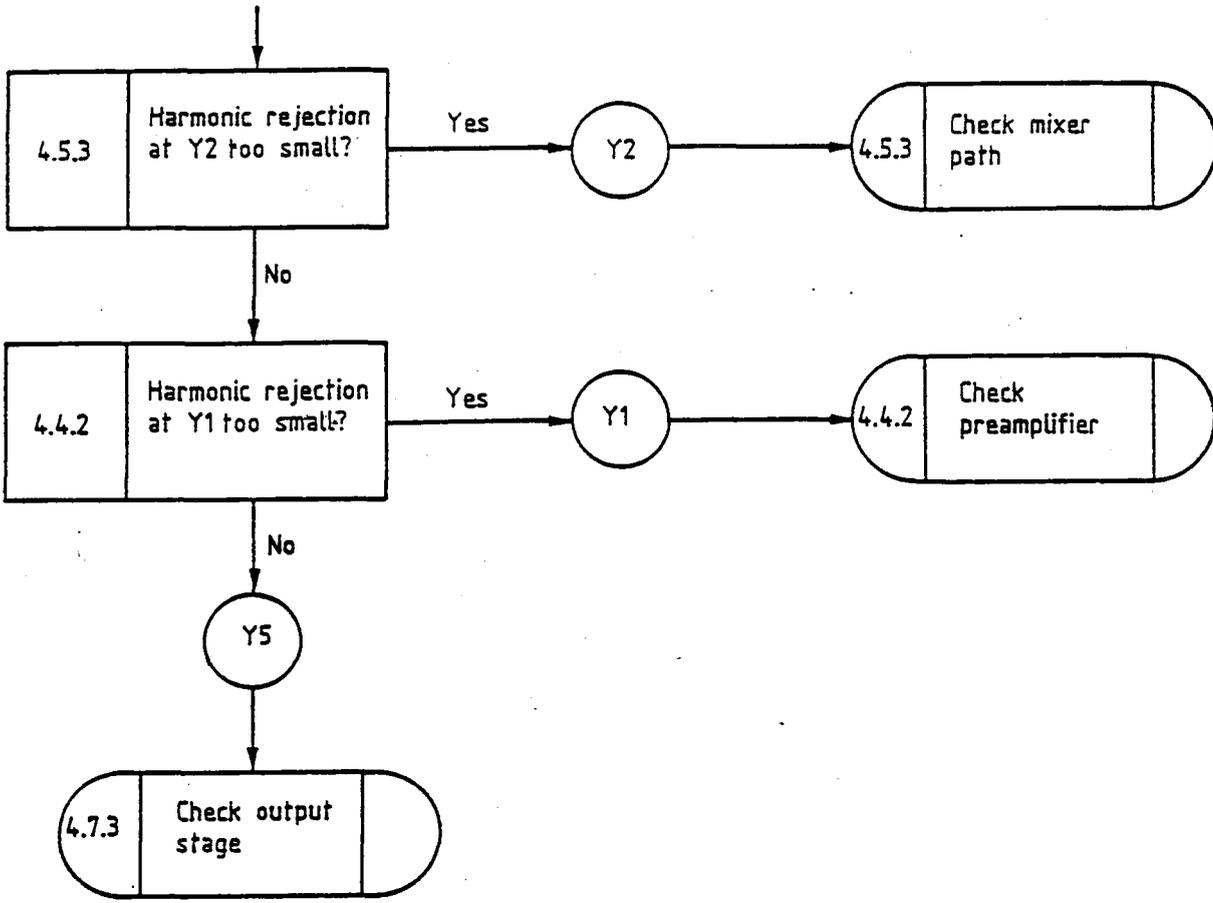
4.2.3.3 Wrong Output Level



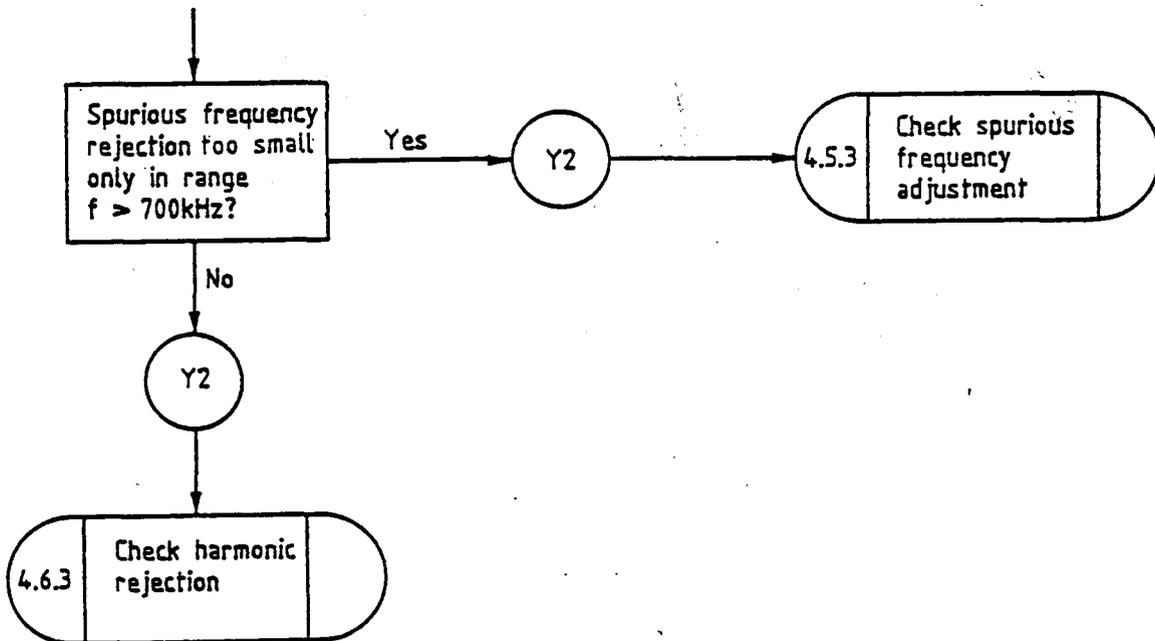
4.2.3.4 Excessive Frequency Response



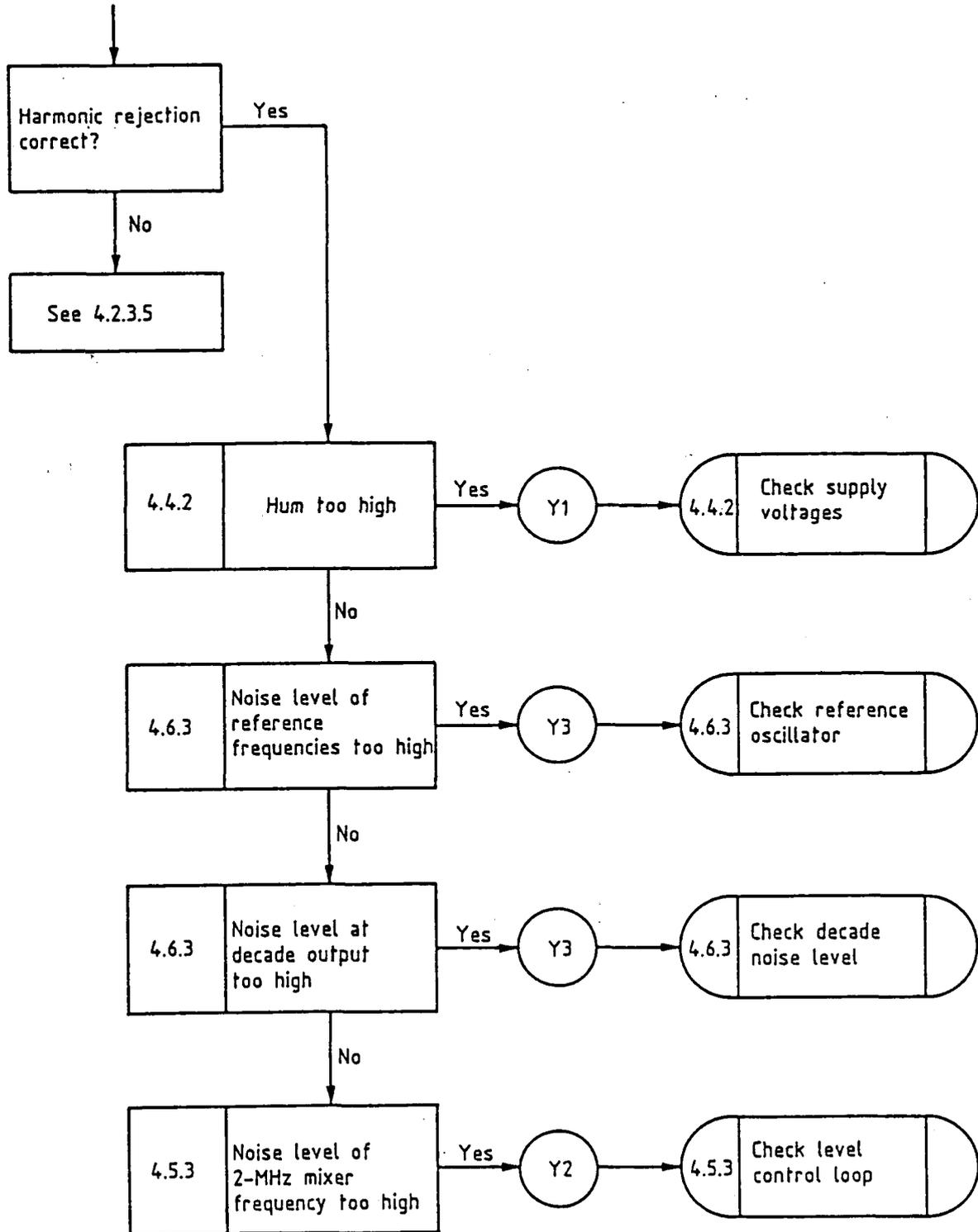
4.2.3.5 Insufficient Harmonic Rejection



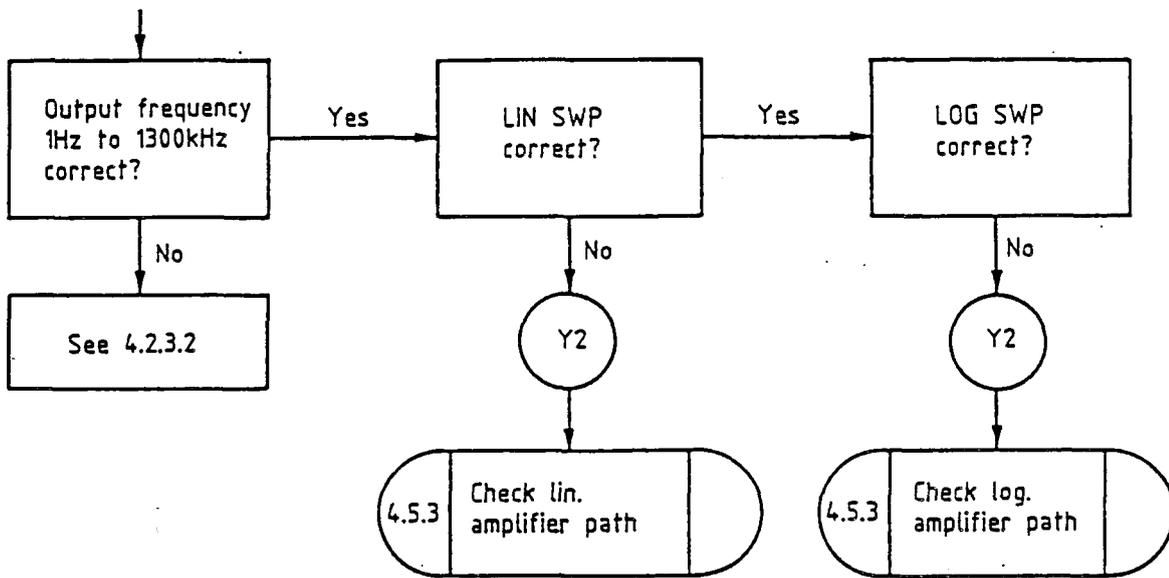
4.2.3.6 Insufficient Spurious Frequency Rejection



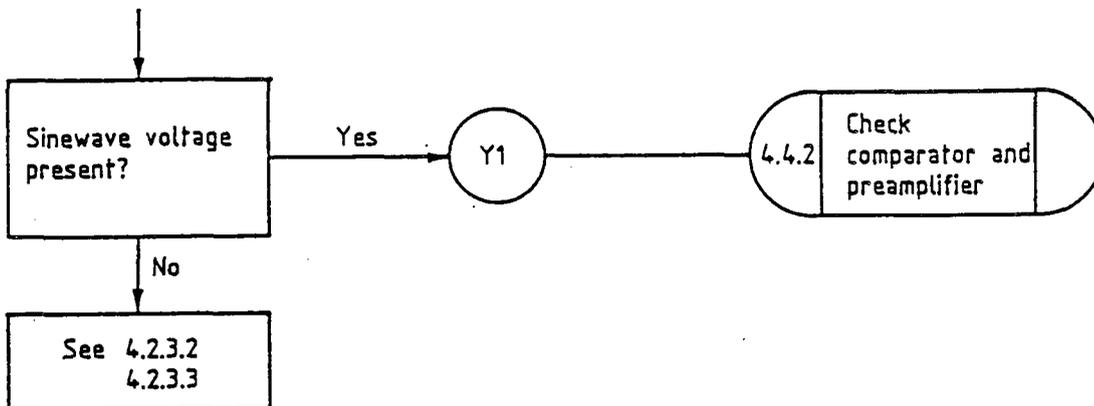
4.2.3.7 Excessive Distortion Factor



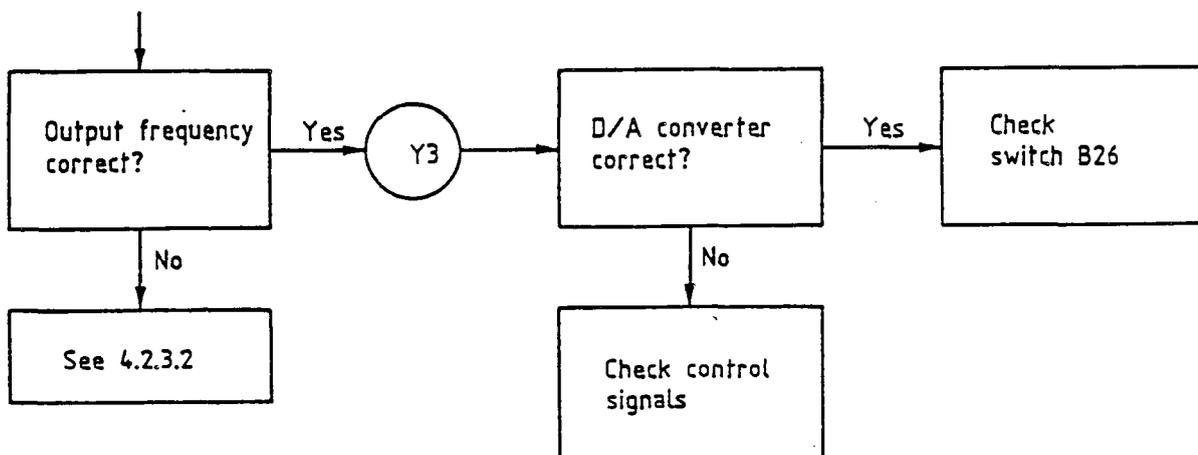
4.2.3.8 Faulty Sweep Operation



4.2.3.9 Faulty Squarewave Signal



4.2.3.10 Faulty Frequency-proportional DC Output Voltage



4.3 Display and Keyboard Y4 336.4015

4.3.1 Circuit Description

Board Y4 has the circuitry for the keys and the control knob for operation and adjustment, the associated LEDs indicating the selected mode as well as

- the 5-digit seven-segment readout indicating the selected frequency
- the 3-digit seven-segment readout indicating the selected level.

The keys and the drivers B10 and B11 as well as the transistors T1 to T9 driving the readouts and the LEDs are connected via ST1 and ST2 to the keyboard and display chip B25 on board Y1. The lines are driven and multiplexed by B25.

The quasi-continuous frequency and level adjustment is made with the aid of a control knob whose magnetic-detent disk is sampled by two Hall-effect chips (B14 and B15). The output signals are shifted 7.5° by phase and are taken via ST1 and ST2 to board Y1.

4.3.2 Troubleshooting and Checking

For checking see Section 3.2.1.

4.4 Control-circuit and Attenuator Board Y1 392.7522

4.4.1 Circuit Description

The control circuit and attenuator board Y1 accommodates the following sections:

- a) power supply
- b) sinewave preamplifier
- c) mechanical attenuator
- d) squarewave amplifier
- e) difference current sink for display and keyboard
- f) front-panel driving circuit
- g) microprocessor

a) Power supply

The power supply produces five DC voltages: three regulated voltages (+5 V, +15 V, -15 V) and two unregulated voltages (+32 V, -32 V) for the 10-V output stage Y5.

The +15-V and -15-V lines are regulated with the aid of fixed-voltage regulators, I.C.'s B7 and B8. The +5-V voltage source consists of the precision voltage regulator, IC B10, driver transistor T13 for current amplification and setting circuit T14. The voltage regulator (μ A 723) contains a reference source. The +5-V voltage is set by voltage divider R45 and R46.

All regulated voltages are protected against prolonged shortcircuit. The fixed-voltage regulators contain a constant-current limiter and a circuit protecting against thermal overload.

b) Sinewave preamplifier

The preamplifier is designed as a DC-coupled cascode amplifier. To avoid a temperature-dependent drift in the differential amplifier, the thermally coupled FETs T3 and transistors B4I, B4II and B4III are used. In this way potential shifts which might be caused by direct coupling can be avoided. Due to variations of the drain-gate potential in T3, distortions may occur from changes in impedance. This is avoided by using a combined cascode-bootstrap circuit ensuring a constant drain-gate potential and thus distortion-free gain independent of impedance variations.

The output of the preamplifier is designed as a low-impedance push-pull class A stage using transistors T7 to T10. The output offset voltage is measured across the 10-V output stage Y5 and applied, via connector ST3a and lowpass filter R14/C4, to control amplifier B3. The control voltage obtained is superimposed onto the push-pull signal of the preamplifier and thus becomes effective at the input of the preamplifier.

c) Mechanical attenuator

The mechanical attenuator is connected between the 10-V output stage and the output of the instrument. It permits the output-stage signal to be attenuated by 70 dB in 10-dB steps.

The attenuator contains three sections 10 dB, 20 dB and 40 dB respectively, which are switched with relays RS1, RS2 and RS3. The output impedance and the level is switched at the attenuator output by means of RS4 and RS5. The relays are driven by power driver B1.

d) Squarewave amplifier

The squarewave amplifier consists of comparator B5 coupled with high-impedance to the sinewave preamplifier output and of the output stage T11, T12.

The output is shortcircuit-proof.

e) Difference current sink for display and keyboard Y4

The difference current sink B12 drives via transistor T15 the shunt transistor T16 which compensates via R50 to R55 load variations occurring by display multiplexing thus avoiding any disturbance of the +5-V supply.

f) Front-panel driving circuit

The IC B25 constitutes the interface between the microprocessor and the display and keyboard subassembly Y4. The display information is written into the RAM of B25. The interface automatically controls the output of the RAM content to the display in multiplex mode.

B26 decodes the three control outputs SLO to SL2 delivering periodical scan pulses for interrogating the keys. When a key is pressed, one of the scan pulses is through-connected on one of the return lines RLO to 5. The data sent on the return line by the pressed key is stored in B25 as well as status data of the SL outputs. The two values stored yield the position code of the key which is read in to the microprocessor by an interrupt raised from a keystroke.

Turning the variation knob raises an interrupt. The phase-shifted pulses present at the input of B32 are evaluated in the ICs B32, B24, B33 and applied to microprocessor B14 via the output of B33. A HIGH signal at the output of B33 causes the displayed value to be increased and a LOW signal causes it to be reduced.

g) Microprocessor

The microprocessor B14 constitutes the heart of the digital control of Generator SPN. The data bus, the address bus and the control lines of the processor are buffered via ICs B15, B16, B19, B23 and B31. The reset input is connected to the +5-V supply via R63, R64 and C33 to ensure that the SPN starts from a defined state.

B18 performs the address decoding for RAM B22 and EPROMs B20, B21 and B35.

Data transfer via the keyboard/display interface IC B25 is driven by the \overline{WR} , \overline{RD} , \overline{CS} , CD control lines. The data present at the output of B31 are transferred to subassemblies Y1, Y2 and Y3 with the strobe signals STR1 to STR7 enabled by B19. An interrupt causes microprocessor B14 to read data in via the bus. If the data are entered from the keyboard, the interrupt is sent by the keyboard/display interface IC B25. For IEC-bus data the interrupt is generated from D1 and B33.

4.4.2 Troubleshooting and Checking

a) Power supply

Measure the voltages at the test points listed under operating conditions and compare measured values to those of Table 4-2.

Table 4-2

Test point	Voltage
ST/BU 8	+5.15 V \pm 0.15 V
ST/BU 7	+15 V \pm 0.75 V
ST/BU 9	-15 V \pm 0.75 V
ST 5.17	+32 V \pm 3.0 V
ST 5.20	-32 V \pm 3.0 V

Measure the noise levels with the differential input of a floating oscilloscope or with a floating millivoltmeter and compare the values to Table 4-3.

Table 4-3

Voltage	Noise voltage (mV _{rms})
+5.15 V	\leq 3
+15 V	\leq 0.4
-15 V	\leq 0.4

b) Sinewave preamplifier

- Open link BU16.
- Apply a DC voltage to connector ST16 such that a DC voltage of 0 V is measured at ST5.11.
- Apply a 110-mV_{rms} sinewave signal of 1 Hz to 1300 kHz to input ST12.
- Measure the gain, distortion factor and harmonic rejection at ST5.11.

Gain \approx 10 dB

Distortion factor 1 Hz to 50 Hz \leq 0.045%
 50 Hz to 100 kHz \leq 0.025%
 100 kHz to 1300 kHz \leq 0.195%

Harmonic rejection 1 Hz to 100 kHz \geq 73 dB
 100 kHz to 1300 kHz \geq 57 dB

If these values are not obtained, check the DC values given in the circuit diagram.

c) Mechanical attenuator

Apply a sinewave voltage to ST5.8: $f_{out} = 1 \text{ kHz}$
 $V_{in} = 20 \text{ dBV} = 10 \text{ V}$
 $Z_{out} = 50 \Omega$

Check the attenuator with the control signals applied to port B2 in accordance with Table 4-4.

Table 4-4

Control signals at B2						Attenuation	Level at ST14
D5	D4	D3	D2	D1	D0		
X	0	1	0	0	0	0 dB	20 dBV = 10 V
X	0	1	0	0	1	-10 dB	10 dBV = 3.16 V
X	0	1	0	1	0	-20 dBV	0 dBV = 1 V
X	0	1	1	0	0	-40 dB	-20 dBV = 100 mV

Permissible error $\leq \pm 1\%$

For checking the output impedance see Section 3.2.8.

Table 4-5

Control signals at B2						Output impedance
D5	D4	D3	D2	D1	D0	
X	1	0	0	0	0	600 Ω
X	1	1	0	0	0	50 Ω
X	0	1	0	0	0	\approx 5 Ω

d) Squarewave amplifier

Setting up:

- Open link BU16.
- Apply a DC voltage to connector ST16 such that a DC voltage of 0 V is measured at ST5.11.
- Apply a 40-mV sinewave signal of 1 Hz to 1300 kHz to input ST12.

Checking: Connect an oscilloscope to ST15.

The duty cycle should be about 0.5.

Troubleshooting: - Check the DC voltages in accordance with circuit diagram
 - Check squarewave signal at pin 11 of B5.

e) Difference current sink for display and keyboard

Display on board Y4

8.888 kHz 8.88 V

$Z_{out} = 50 \Omega$

Measure the noise voltage at connector ST/BU10 using a floating micro-voltmeter. Permissible value: ≤ 3 mV.

f) Microprocessor

When checking the microprocessor which constitutes a complex digital system, the signature analysis in the free-running mode is available as an aid for troubleshooting. In the free-running mode, the processor is made to cyclically scan its complete addressing range, the start/stop signals for the signature analyzer coming directly from the address bus.

Setting up:

- Set bridge BU31 such that contacts 1 and 2 are closed. Press any key on the keyboard. B16, B23 and B22 are inhibited. All the data lines are cyclically set to 0 via B17.
- Checking the CLOCK output B14, pin 37.
3-MHz clock signal with TTL level.
- Connect the signature analyzer to ST6.
- Set bridge BU32 such that contacts 1 and 2 are closed.

Setting the signature analyzer:

START  STOP  CLOCK 

Compare the signatures on the address bus to those given in Table 4-6.

- Set bridge BU32 such that contacts 2 and 3 are closed.

Setting the signature analyzer:

START  STOP  CLOCK 

Compare the signatures on the data bus to those given in Table 4-7.

At the end of the test, set bridge BU31 such that contacts 2 and 3 are closed.

Table 4-6

Address signatures

MP2.	Signature	B18 Pin	Signature
1	0455	1	C5FU
2	C713	2	772F
3	5AP1	3	704U
4	CHF1	7	AF00
5	A591	9	PHP7
6	UH9C	10	0630
7	1594	11	3798
8	CA42	13	6CP4
9	U8U8	14	42H0
10	7777	15	0455
11	AAAA		
12	UUUP		
B15		B14	
PIN		PIN	
2	UUUU	28	PACP
5	5555		
6	CCCC		
9	7F7F		
12	5H21		
15	OAF A		
16	UPFH		
19	52F8		

Table 4-7

Data signatures

B16 Pin	Signature
11	U094
12	FF7H
13	U243
14	HC7U
15	24H0
16	H083
17	CCH2
18	U85C
B19	
7	9256
9	24AU
10	495H
11	92C8
12	2572
13	4AP7
14	95FH
15	2C98

4.5 Frequency Generator Y2 392.7545

4.5.1 Circuit Description

The frequency generator board accommodates the following sections:

- a) synthesizer
- b) output mixer
- c) level control circuit with electronic attenuator
- d) LOG / LIN sweep amplifier

a) Synthesizer

The oscillator consists of transistor T102 with the tuned circuit L102, L103 and G1 101 to G1 104 plus G1 108, G1 109 and can be adjusted from 80.04 to 132 MHz. The oscillator frequency is divided in the programmable divider (B6, B7, B8, B9, B10, B11 and B12) by $M = 20010$ to 33000 and compared with the 4-kHz crystal-oscillator reference frequency (B15, B16) in the phase discriminator (B1). The derived voltage controls the oscillator, via the control amplifier (B2) and the lowpass filter, with crystal accuracy to the frequency determined by the division factor M and the reference frequency ($f_{oscill} = M \cdot f_{ref}$). The oscillator frequency is divided by 40 (B4, B5) and brought out at ST15.

b) Output mixer

The output mixer is designed as an active mixer (B21). After the lowpass filter (C41 to C45, L8 to L11), the low-distortion 2-MHz mixer frequency is applied to pin 3 of the mixer. The squarewave signal of 2.001 to 3.3 MHz is the oscillator signal for the mixer and is added at pins 2 and 9.

After the buffer amplifier (T2), the wanted signal is filtered from the mixture product and brought out at pin 8 of the lowpass filter (C60 to C73, L12 to L15); it is then taken to output K1 via buffer amplifier T3.

c) Level control circuit with electronic attenuator

Level control is performed by two independent control loops in order to obtain short transient responses even at low frequencies of output.

For output frequencies of up to 9.999 kHz, only the 2-MHz mixer frequency is controlled. A detector (R25, G1 6, C54, R26) is provided at the lowpass filter output for level measurement. The rectified voltage produced is compared

In the control amplifier (B19, B20) with a reference input (B22). The control voltage required to drive the setting circuit (B18) is thus obtained by switching B25 depending whether $f < 9.999$ kHz or $f > 10$ kHz.

For frequencies above 10 kHz the output signal is directly controlled. The detector is located at the output of the 10-V output stage Y5. After the voltage divider (R44, R45), the rectified signal is applied to the control amplifier (B19) and compared with the reference input (B22).

The reference input is the output signal of a D/A converter (B22) which permits level adjustment in 0.1-dB steps over 10 dB.

d) LOG / LIN sweep amplifier

The external sweep voltage applied to the input of the buffer amplifier (B26) is taken to switch B27 either directly for LIN SWP operation or via the LOG amplifier (B26) for LOG SWP operation and then amplified (B26).

The sweep voltage obtained controls the oscillator frequency via the varactors. Diodes (G1 10 to G1 12) are used for logarithmic conversion of the sweep voltage.

4.5.2 Adjustment

4.5.2.1 Synthesizer

- Apply a 2-MHz TTL signal to ST16.
- Set the oscillator frequency of 80040 000 Hz (MP3) by applying the control signals to ports B13 and B14 in accordance with Table 4-8.
- Connect a DC voltmeter to ST4.
- Withdraw the core from oscillator coil L103 by rotating it.
- Rotate the core of coil L102 to adjust a DC voltage of 2.0 V at ST4.

Table 4-8

SPN setting	Port	Control byte								Division factor
		D7	D6	D5	D4	D3	D2	D1	D0	
1 Hz	B13	0	0	0	1	0	0	0	0	20010
	B14	0	1	1	1	1	1	0	1	

4.5.2.2 Output Mixer

- Open link BU5.
- Apply a 2-MHz TTL signal to ST16.
- Apply a 3.3-MHz TTL signal to ST17.
- Connect an AF spectrum analyzer and an RF voltmeter to output K1.
- By varying the DC voltage at MP5.1, adjust the level of the 2-MHz signal such that a voltage of 300 mV_{rms} is indicated on the RF voltmeter.
- Use potentiometer R111 to adjust the spurious signal at 700 kHz to minimum.

4.5.3 Troubleshooting and Checking

a) Synthesizer

- Apply a 2-MHz TTL signal to ST16.
- Connect a frequency counter to ST15 and check the frequency with the control byte applied to ports B13 and B14 in accordance with Table 4-9.

Table 4-9

SPN setting	Port	Control byte								Division factor	Frequency Hz
		D7	D6	D5	D4	D3	D2	D1	D0		
1300 kHz	B13	0	1	0	0	0	0	0	0	33000	3300000
	B14	1	1	0	0	1	1	1	0		
63.7 Hz	B13	1	1	1	1	0	1	1	1	20637	2063700
	B14	1	0	0	0	0	0	0	0		
32.8 Hz	B13	0	0	0	0	1	0	0	0	20328	2032800
	B14	0	1	1	1	1	1	1	1		
1 Hz	B13	0	0	0	1	0	0	0	0	20010	2001000
	B14	0	1	1	1	1	1	0	1		

The frequency accuracy is determined by the 2-MHz signal at ST16. If the values specified are not obtained, check DC voltages given in the circuit diagram and the division factor M of the programmable divider.

b) Output mixer

- Open link BU5.
- Apply a 2-MHz TTL signal to ST16.
- Connect an AF spectrum analyzer and an RF voltmeter to output K1.
- By varying the DC voltage at MP5.1, adjust the level of the 2-MHz signal for every frequency variation of the TTL signal such that a voltage of 300 mV is indicated on the RF voltmeter.
- Check the harmonic and spurious-frequency rejection using the AF spectrum analyzer.

Nominal values:

Harmonics	1 Hz to 100 kHz	down \geq 73 dB
	100 kHz to 1300 kHz	down \geq 57 dB
Spurious frequencies up to	700 kHz	down \geq 70 dB
	700 kHz to 1300 kHz	down \geq 65 dB

If the values specified are not obtained:

- Check the attenuation of the lowpass filter (C60 to C73, L12 to L15).
Maximum attenuation \leq 10 dB.
- Compare DC voltage values with those given in the circuit diagram.
- Check the adjustment of potentiometer R111.

c) Level control circuit with electronic attenuator

- Apply a 2-MHz TTL signal to ST16.
- Apply a 2.001-MHz TTL signal to ST17.
- Connect an RF voltmeter to output K1.
- Adjust R112 to mid-position.
- Use R99 to adjust a DC voltage of 10.2 V at MP9 using control byte at ports B23 and B24 in accordance with Table 4-10.
- With the control byte applied in accordance with Table 4-11, check the voltage at MP9 and pin 14 of B19. The two voltages must have the same value.
- Check the variation of the output level at output K1.

Table 4-10

SPN setting	Port	Control byte								Voltage at MP 9
		D7	D6	D5	D4	D3	D2	D1	D0	
10 V	B23	X	1	X	1	1	1	1	1	10.2 V
	B24	1	1	1	1	1	1	1	1	

Table 4-11

SPN setting	Port	Control byte								Voltage at MP 9 and pin 14/B19
		D7	D6	D5	D4	D3	D2	D1	D0	
3.8 mV	B23	X	1	X	0	0	1	0	0	3.88 mV
	B24	0	1	1	0	0	0	0	1	
6.2 mV	B23	X	1	X	0	1	0	1	1	6.33 mV
	B24	1	0	0	1	1	1	1	0	

d) LOG / LIN sweep amplifier

LIN

- Connect a frequency counter to ST15.
 - Select LIN SWP and apply the control byte in accordance with Table 4-12 to port B23.
 - Apply a signal of 0 V to ST12.13.
 - Use potentiometer R84 to adjust a frequency of about 2 MHz.
 - Increase voltage at ST12.13 to 1.3 V.
 - Use potentiometer R110 to adjust a frequency of about 3.3 MHz.
 - Repeat this adjustment several times since the adjustments affect each other.
 - Vary the voltage at ST12.13 and make sure that the frequency varies linearly.
- Nominal value: linearity $\pm 5\%$.

LOG

- Select LOG SWP and apply the control signal in accordance with Table 4-12 to port B23.
 - Apply a signal of 0 V to ST12.13.
 - Use potentiometer R71 to adjust a frequency of about 2 MHz.
 - Increase the voltage at ST12.12 to 1.3 V and use potentiometer R87 to adjust a frequency of 3.3 MHz.
 - Vary the voltage at ST12.13 and make sure that the frequency varies logarithmically.
- Nominal value: deviation $\pm 8\%$.

Table 4-12

SPN setting	Port	Control byte								SWP mode
		D7	D6	D5	D4	D3	D2	D1	D0	
SWP LOG	B23	X	0	0	X	X	X	X	X	LIN
		X	0	1	X	X	X	X	X	LOG

If errors occur, compare DC values with those given in the circuit diagram.

4.6 Frequency Processor Y3 392.7580

4.6.1 Circuit Description

The frequency processor board accommodates the following sections:

- a) crystal oscillator
- b) frequency decades
- c) D/A converter
- d) Reference frequency

a) Crystal oscillator

The crystal oscillator (B1) operates at the frequency of 18 MHz. The accurate frequency value can be set with C4 and R99.

The reference frequencies of 18 MHz and 2 MHz are derived from the oscillator frequency.

A hex inverter (B2) used as a buffer amplifier at the output of the crystal oscillator routes the 18-MHz reference frequency to the frequency decades. The 2-MHz reference frequency is obtained in B3 and B4 by division and is taken to BU16.

b) Frequency decades

Three practically identical frequency decades are used. These decades are switched on and off by B6, B11, B16 and B21 depending on the frequency selected and the signal is then applied via amplifier T7 to output BU17.

Depending on the decade (control line D1), the signal is divided at the output by voltage divider R80, R111. This ensures level matching of the switching voltage for the output mixer (Y2).

The frequency decades ensure a high resolution and low spurious FM.

In the first decade, the signal of 2.13 to 3.3 MHz is taken from BU15 via switch B6 and lowpass filter C14 to C17, L5 to L7 to the mixer input (B8). The 18-MHz reference frequency is applied as the local frequency via switch B7 to the second mixer input.

After the 4-section bandpass filter (C26 to C36, L8 to L11), the mixed signal of 20.13 to 21.3 MHz is boosted to TTL level by comparator (B9) and its frequency is divided by 10 (B10).

The resolution of the frequency obtained (2.013 to 2.13 MHz) is 10 times finer and the spurious FM is reduced by the factor of 10.

Depending on the frequency range, the same processing is repeated in the other two frequency decades.

c) D/A converter

The D/A converter (B24) delivers a frequency-proportional DC output voltage.

The frequency data is stored in the two latches (B22, B23) and taken to the D/A converter (B24).

The analog switch B26 disconnects the frequency-proportional voltage at the output when the sweep mode is in use.

4.6.2 Adjustment

4.6.2.1 Crystal Oscillator

The adjustment is to be made at normal ambient temperature after the oscillator has been operated at this temperature for a period of about half an hour.

Connect a DC voltmeter to BR1 INT. Adjust potentiometer R96 for a voltage of 1.8 V.

Connect a frequency counter to test point MP4 and use C4 to adjust the 18-MHz frequency with the subassembly being in its normal position.

The permissible deviation is ± 18 Hz.

4.6.3 Troubleshooting and Checking

a) Crystal oscillator

BR1 must be in position INT.

Use a frequency counter to check the reference frequencies at MP4 (18 MHz), BU16 (2 MHz) and ST3 (1 MHz).

Change BR1 to position EXT.

Feed to ST2 a 1-MHz signal with 0.2 to 2 V.

Measure the frequency at ST3 using a frequency counter.

The frequency accuracy must correspond to that of the signal applied.

Vary the frequency at ST2 by $\pm 5 \times 10^{-5}$.

The voltage at ST1 must be between 0.2 and 4.2 V.

Change BR1 over to position INT.

b) Frequency decades

- Apply a 3.3-MHz TTL signal to BU15.
- Connect a frequency counter to BU17.
- Apply the control data to port B5 in accordance with Table 4-13 and check the frequency.

Table 4-13

SPN setting	Port	Control data				Frequency kHz
		D4	D3	D2	D1	
1300 kHz	B5	0	0	0	0	3300
130 kHz		0	0	0	1	2130
13 kHz		0	0	1	1	2013
1.3 kHz		0	1	1	1	2001.3

- Apply a TTL signal in accordance with Table 4-14 to BU15.
- Apply the control data to port B5 in accordance with Table 4-14 and check the frequency.

Table 4-14

SPN setting	Port	Control data				Frequency kHz
		D4	D3	D2	D1	
130.10 kHz	B5	0	0	0	0	2130100
13.01 Hz		0	0	0	1	2130100
1.301 Hz		0	0	1	1	2130100
1 Hz		0	1	1	1	2001000

Apply an AF spectrum analyzer to output BU17.

- Apply a TTL signal of 2 to 3.3 MHz to BU15.
- Apply the control data to port B5 in accordance with Table 4-15 and check the spurious frequency rejection using the AF spectrum analyzer.
Spurious frequency rejection: down \geq 70 dB.

Table 4-15

SPN setting	Port	Control data				Frequency kHz
		D4	D3	D2	D1	
130.1 kHz to 1300 kHz	B5	0	0	0	0	130.1 to 1300
13.01 kHz to 130 kHz		0	0	0	1	13.01 to 130
1.301 kHz to 13 kHz		0	0	1	1	1.301 to 13
1 Hz to 1.3 kHz		0	1	1	1	0.001 to 1.3

If the values given are not obtained, check switches and levels at the comparator inputs.

c) D/A converter

- Apply the control byte to ports B22 and B23 in accordance with Table 4-16.
- Connect a DC voltmeter to pins 3, 4 of B26.
- Use potentiometer R82 to adjust a voltage of 1.3 V.

Table 4-16

SPN setting	Port	Control byte								Voltage at pins 3, 4 of B26
		D7	D6	D5	D4	D3	D2	D1	D0	
1 SWP SWP OFF LOG OFF	B22	1	1	1	1	1	1	1	1	
1.300 kHz	B23	1	1	1	X	X	X	X	1	1.3 V

- With the control byte applied to ports B22 and B23 in accordance with Table 4-17 check the voltage at pins 3, 4 of B26.

Table 4-17

SPN setting at SPN	Port	Control byte								Voltage at pins 3, 4 of B26
		D7	D6	D5	D4	D3	D2	D1	D0	
1 SWP SWP OFF LOG OFF	B22	0	1	0	0	1	1	1	0	1.0 V
1.000 kHz	B23	1	1	0	X	X	X	X	0	
1 Hz	B22	0	0	0	0	0	0	0	0	0 V
	B23	0	0	0	X	X	X	X	0	

4.7 10-V Output Stage Y5 336.4038

4.7.1 Circuit Description

On the 10-V output stage board, the signal from the control circuit and attenuator is boosted by about 20 dB to the maximum level of 10 V to be made available at the SPN output. The amplifier consists of a differential pre-amplifier (B1), a current mirror (T22, T24, T25, T44, B20) for the output stage and the output stage (T40 to T43).

R21 is used to adjust the quiescent current of the VMOS transistors (T42, T43) such that the harmonic rejection is of a sufficient level (> 70 dB at 100 kHz). The power dissipation thus produced is so great that cooling via the rear junction panel is necessary. A good harmonic rejection is obtained for the output signal by the feedback loop (R6, R5) covering the entire amplifier stage. Ahead of the resistors (R24, R25, R47, R48) constituting the 50- Ω output impedance, the diode (G1 50) measures the output signal. The lowpass filter (R55; C52) is provided to determine the DC offset.

The rectified voltages produced are applied to the positive inputs of the double amplifier (B50I, B50II) and are routed to Y1 and Y2 via BU5.3 and BU5.4.

The fixed-voltage regulators (B60, B61) provide for the regulation of the +24-V and -24-V supplies for the 10-V output stage.

4.7.2 Adjustment

- Apply a low-distortion 100-kHz signal of 1 V to input BU5.11 (distortion $< 0.02\%$).
- Connect a distortion meter to output BU5.8.
- Starting from the righthand stop, turn potentiometer R21 slowly anticlockwise until the minimum distortion factor is obtained.

4.7.3 Troubleshooting and Checking

- Apply a 1-V signal between 1 Hz and 1300 kHz to BU5.11.
- Connect an RF millivoltmeter to BU5.8 and check the gain.
Gain ≈ 20 dB
- Connect an AF spectrum analyzer to BU5.8 and check the harmonic rejection.
Harmonics 1 Hz to 100 kHz down ≥ 70 dB
 100 kHz to 1300 kHz down ≥ 54 dB
- Apply a 100-kHz signal to BU5.11 and vary the level between 300 mV and 1 V.

- Connect a DC voltmeter to BU5.4 and check whether the DC voltage follows the level of the input signal.
- Apply a DC voltage between 0 and 500 mV to BU5.11 and check with a DC voltmeter connected to BU5.3 whether the DC voltage follows the level of the input signal.

If the values specified are not obtained, compare DC values with those given in the circuit diagram.

4.8 IEC-Bus

4.8.1 Circuit Description

The SPN has the following interface functions complying with IEC 625-1/IEEE 488:

- T6 talker (basic talker version with serial poll; unaddressing if MLA)
- L4 listener (basic listener version; unaddressing if MTA)
- RL1 remote/local
- DC1 device clear
- SR1 service request

The IEC interface 8291A (D1) controls all the functions via bidirectional drivers (D2 to D5).

The complex peripheral (D1) connects the microprocessor data bus to the IEC-625 interface mounted on the rear panel of the instrument. Data transfer in both directions is interrupt-controlled via the 16 internal write and read registers of the IEC-bus IC. The 8 data lines, 5 control lines and 3 handshake lines are connected by means of drivers D2 to D5 to the standard IEC-bus connector on the rear panel with the aid of cables K3 and K4.

The IEC-bus address is set with switch S20 and read in from port B22 (on Y1) when the SPN is switched on.

4.8.2 Troubleshooting and Checking

First check the functioning of the display and keyboard subassembly in accordance with 3.2.1. Set the correct device address (11).

Functioning of remote control and data output via the IEC bus:

- Connect the IEC-bus controller to the IEC-bus connector of the SPN.

Check all the functions of the instrument with the aid of the setting instruction in accordance with Table 2-5 (Section 2.4.4.).

Checking the indication of the remote mode:

LISTEN, TALK, REMOTE LEDs

Checking the LOCAL mode:

- Set the SPN to the REMOTE mode by addressing it as listener via the IEC-bus controller (without sending the instruction LLO = LOCAL LOCKOUT).
- Check that REMOTE and LISTEN LEDs light up.
After the LOCAL key has been pressed, the SPN should return to the LOCAL mode, i.e. manual operation.
- Check that the REMOTE indicator extinguishes.
- Set the SPN to the REMOTE mode by addressing it as listener via the IEC-bus controller.
- Send the LLO (LOCAL LOCKOUT) instruction.
After the LOCAL key has been pressed, the SPN must not return to the LOCAL mode.

4.9 Balun SPN-Z1 265.4319.02

4.9.1 Circuit Description

The Balun makes it possible to obtain a balanced-to-ground output voltage from the SPN. Depending on the transformation ratio, the output impedance is reduced as follows:

$$Z_{\text{out}} = \frac{Z_{\text{SPN}}}{10} + 15 \text{ } [\Omega]$$

The Balun is protected against stray magnetic field by a μ -metal shielding can. All the connectors are located on the front panel.

4.9.2 Troubleshooting and Checking

Symmetry of the secondary winding:

- Apply a 0.9-V signal at 30 Hz, 1 kHz, 20 kHz, 30 kHz, 100 kHz (output impedance of Generator 50 Ω).
- Ground the centre tap (open at 100 kHz).
- Terminate the output of the balun with 150 Ω , 1 k Ω , no load in turn. At 100 kHz, 2 x 300 Ω \pm 0.5% grounding the centre of the resistors.
- Use an AF millivoltmeter to measure the potential at both ends of the secondary with respect to ground.

Potential difference at:

30 Hz	< 0.1 dB
1 kHz	< 0.1 dB
20 kHz	< 0.2 dB
30 kHz	< 0.3 dB
100 kHz	< 0.5 dB

Distortion factor:

- Apply a signal at 30 Hz, 10 V/50 Ω .
- Ground the centre tap.
- Terminate the output of the balun with 150 Ω .
- Connect a distortion meter to the output and check the distortion factor.
Nominal value: < 0.2%.

Check the frequency response of the output voltage with all permissible loads, referred to 1 kHz.

Frequency response flatness up to 30 kHz < \pm 0.2 dB
100 kHz < \pm 1 dB

- Check the crosstalk of stereo multiplex signals using a stereocoder.

Crosstalk

for L or R signal	< 0.5 %
at "100 Hz to 15 kHz"	
for L or R signal	\approx 1 %
at "40 Hz"	



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Bilder
Figures

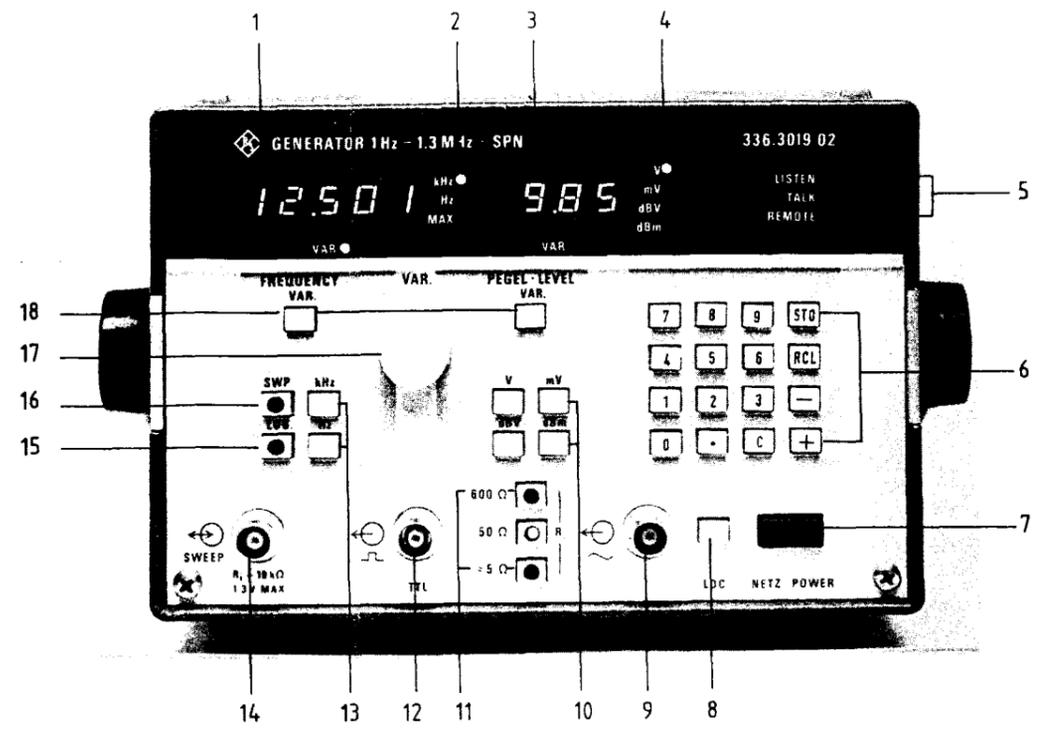


Bild 2-7 Frontansicht
Fig. 2-7 Front panel

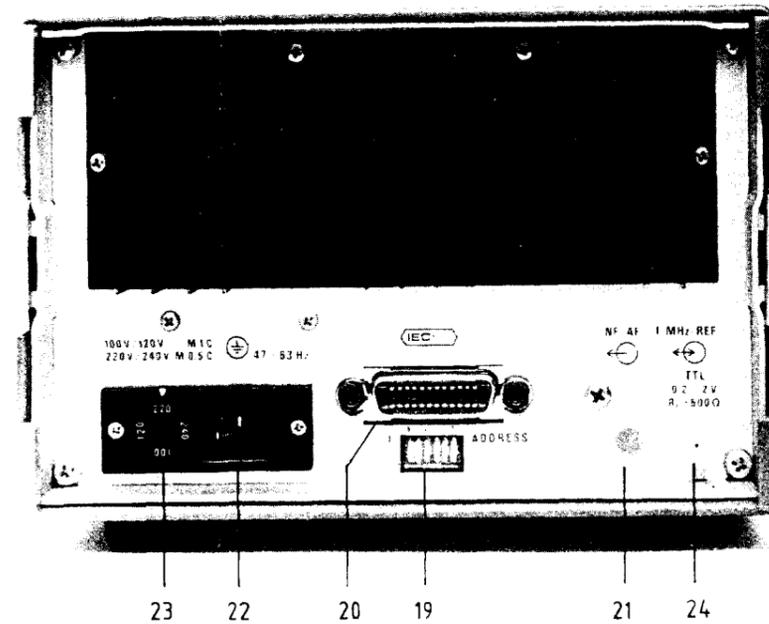


Bild 2-8 Rückansicht
Fig. 2-8 Rear panel

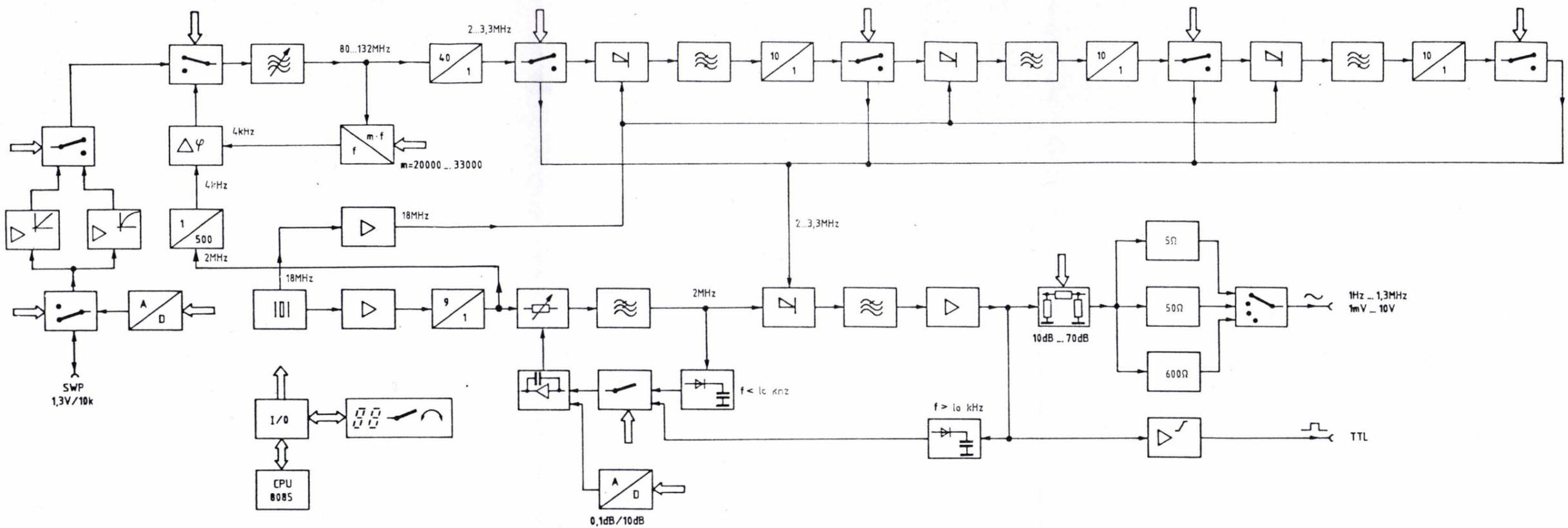


Bild 4-1 Blockschaltbild des Generators SPN
 Fig. 4-1 Block diagram of the Generator SPN



ROHDE & SCHWARZ

MÜNCHEN

Schaltteillisten
numerisch geordnet
Parts lists
in numerical order

R&S-Schlüsselliste

Die R&S-Schaltteillisten nennen in der Spalte "Benennung/Beschreibung" die technischen Daten der Bauelemente in Kurzform. Die Art des Bauelements (z. B. Schicht-, Draht-Widerstand usw.) beschreiben die 2 Kennbuchstaben vor der "Benennung" (evtl. auch vor der "Sachnummer"), die nachfolgend erklärt werden. In Ersatzteil-Bestellungen an R&S ist stets die Angabe der vollständigen Sachnummer erforderlich.

R&S key list

The R&S Parts Lists give the technical data of the components in short form in the column "Benennung/Beschreibung" (designation). The type of component (e.g. depos.-carbon resistor, wire-wound resistor etc.) is indicated by 2 identification letters before the designation, possibly also before the "Sachnummer" (order number), which are explained below. When ordering spare parts from R&S, the complete order number must always be specified.

Liste des symboles de référence R&S

La colonne « Désignation/description » des listes de pièces de R&S indique les caractéristiques des éléments sous forme abrégée. Le type d'élément (p. ex. résistance à couche, résistance bobinée etc...) est décrit par les deux lettres précédant la désignation (et éventuellement le numéro de référence), dont voici l'explication. Prière d'indiquer le numéro de référence (« Sachnummer ») complet dans toute commande de pièces de rechange.

Kennbuchst	Art des Bauelementes	Identif.-letter	Type of component	Symbole	Type d'élément
A	Aktive Bauelemente, Halbleiter	A	Active components, semiconductors	A	Composants actifs, semiconducteurs
AD	Universaldiode, z.B. Gleichrichter, Sperrdiode	AD	General-purpose diode, e.g. rectifier, high-resistance diode	AD	Diode d'usage général, p.ex. redresseur, diode à haute résistance
AE	Spezialdiode, z.B. Tunnel-, Kapazitäts-, Zener-Diode	AE	Diode (special), e.g. tunnel diode, varactor, Zener diode	AE	Diode spéciale, p.ex. diode tunnel, varactor, diode Zener
AF	Fotoelement, z.B. Foto-Diode, -Transistor, -Widerstand, Leuchtdiode	AF	Light-sensitive component, e.g. resistor, diode, transistor; LED	AF	Composant photoélectrique, p.ex. diode, transistor, résistance photoél., D.E.L.
AG	Leistungs-Gleichrichter, z.B. Thyristor, Triac, Selengleichrichter	AG	Power rectifier, e.g. thyristor, triac, selenium rectifier	AG	Redresseur de puissance, p.ex. thyristor, triac, redresseur au sélénium
AK	Kleinsignal-Transistor	AK	Low-power transistor	AK	Transistor faible puissance
AL	Leistungs-Transistor	AL	High-power transistor	AL	Transistor grande puissance
AM	Spezial-Transistor, z.B. FET, MOSFET	AM	Transistor (special), e.g. FET, MOS-FET	AM	Transistor spécial, p.ex. TEC, MOSTEC
AP	Peltier-, Hall-Element	AP	Peltier element, Hall element	AP	Element Peltier, élément Hall
AR	Röhre für Empfänger, Verstärker, Gleichrichter	AR	Valve for receiver, amplifier, rectifier	AR	Tube pour récepteur, amplificateur, redresseur
AS	Spezialröhre, z.B. Senderöhre, EW-Widerstand, Stabilisator	AS	Valve (special), e.g. for transmitter, baretter, ballast valve	AS	Tube (spécial), p.ex. pour émetteur, résistance fer-hydrogène, ballast
AT	Katodenstrahlröhre, z.B. Bildröhre, Ziffern-Anzeigeröhre	AT	Cathode ray tube, e.g. picture tube, digital indicator tube	AT	Tube à rayon cathodique, p.ex. tube à image, tube à affichage numérique
AW	Spannungs- oder temperaturabhängiger Widerstand	AW	Voltage- or temperature-dependent resistor	AW	Varistance ou thermistance
B	Bausteine	B	PC boards, chips	B	Cartes imprimées, puces
BC	Integr. Schaltkreis (Microcomp.)	BC	Integrated circuit (interface, A/D)	BC	Circuit intégré (microprocesseur)
BD	R&S-Dünnschichtschaltung	BD	R&S thinfilm circuit	BD	Circuit à couche mince R&S
BG	Gerätebaugruppe	BG	Subassembly	BG	Sous-ensemble
BJ	Integr. Schaltkreis (Interface, A/D-Wandler)	BJ	Integrated circuit (interface, A/D converter)	BJ	Circuit intégré (interface, convertisseur A/N)
BK	Kernspeicher, Magnetspeicher	BK	Core memory, magnetic memory	BK	Mémoire à tores, mémoire magnétique
BL	Log. Schaltkreis z.B. DTL, TTL, HTL, ECL, C-MOS	BL	Logic circuit, e.g. DTL, TTL, HTL, ECL, C-MOS	BL	Circuit logique, p.ex. DTL, TTL, HTL, ECL, C-MOS
BM	Hybridbaustein, z.B. Mischer, Tuner, Modulator	BM	Hybrid chip, e.g. mixer, tuner, modulator	BM	Puce hybride, p.ex. mélangeur, tuner, modulateur
BO	Analogschaltkreis, z.B. Operationsverstärker	BO	Analog circuit, e.g. operational amplifier	BO	Circuit analogique, p.ex. amplificateur opérationnel
BP	Optobaustein, z.B. Anzeigeeinheit, Koppler	BP	Optoelement, e.g. display, coupler	BP	Élément optique, p.ex. afficheur, coupleur
BS	Schalt- und Steuerbaustein, elektronischer Sensor	BS	Switching and control modul, electronic sensor	BS	Modul de commutation et de commande, sonde électronique
BV	Stromversorgung, Übersp.-Schutz	BV	Power pack, protective circuit	BV	Alimentation, protection surcharge



Kennbuchst.	Art des Bauelementes	Identif.-letter	Type of component	Symbole	Type d'élément
C	Kondensatoren	C	Capacitors	C	Condensateurs
CB	Bypass-, Durchf.-Kondensator	CB	Bypass capacitor, feed-through capacitor	CB	Condensateur bypass, condensateur de traversée
CC	Keramischer Kondensator	CC	Ceramic capacitor	CC	Condensateur céramique
CD	Drehkondensator	CD	Variable capacitor	CD	Condensateur variable
CE	Elektrolytkondensator	CE	Electrolytic capacitor	CE	Condensateur électrolytique
CG	Glimmerkondensator	CG	Mica capacitor	CG	Condensateur au mica
CH	Sperrschichtkondensator	CH	Semiconductor capacitor	CH	Condensateur semiconducteur
CK	Kunstfolienkondensator	CK	Synthetic-foil capacitor	CK	Condensateur à feuille synthétique
CL	Ker. Hochsp.-Kondensator	CL	HV capacitor (ceramic)	CL	Condensateur HT céramique
CM	Metallpapier-Kondensator	CM	MP capacitor	CM	Condensateur à papier métallisé
CN	Kondensatornetzwerk	CN	Capacitor network	CN	Réseau capacitif
CP	Papierkondensator	CP	Paper capacitor	CP	Condensateur au papier
CS	Störschutzkondensator	CS	Interference-suppression capacitor	CS	Condensateur anti-parasite
CT	Trimmkondensator	CT	Trimmer capacitor	CT	Condensateur ajustable
CV	Vakuum-Kondensator	CV	Vacuum capacitor	CV	Condensateur à vide
D	Drähte, Leitungen	D	Wires, lines	D	Fils, lignes
DD	Schalt- und Wickeldraht	DD	Hook-up or winding wire	DD	Fil de câblage, fil de bobinage
DF	Flachleitung, Litze	DF	Flat multiple line, stranded wire	DF	Ligne plate, ligne torsadée
DG	Abgeschirmte Leitung	DG	Shielded line	DG	Ligne blindé
DH	Koaxialkabel	DH	Coaxial line	DH	Ligne coaxiale
DN	Antenne	DN	Antenna	DN	Antenne
DS	Anschlußkabel (mehradrig)	DS	Connecting cable, multicore	DS	Câble de connexion (multiconducteur)
E	Elektrische Teile	E	Electric parts	E	Organes électriques
EB	Blei-, NC-Akku, Batterie	EB	Lead or alkaline accumulator, battery	EB	Accumulateur Pb/NC, batterie
EF	Glühlampe, Leuchte	EF	Incandescent lamp, pilot lamp	EF	Lampe à incandescence, voyant
EG	Glimmlampe, Entladungslampe	EG	Glow lamp, discharge lamp	EG	Lampe à luminescence, lampe à décharge
EK	Kontakt-Streifen, -Feder	FK	Contact clip, contact spring	EK	Lame de contact, ressort de contact
EL	Lautspr., Kopfhörer, Mikrofon	EL	Loudspeaker, headphones, microphone	EL	Haut-parleur, casque, microphone
EM	Motor, Hubmagnet, Drehfeldsystem	EM	Motor, lifting magnet, synchro system	EM	Moteur, électro-aimant de levage, système synchro
EO	Oszillator, z.B. Quarzoszillator	EO	Oscillator, e.g. crystal oscillator	EO	Oscillateur, p.ex. oscillateur à quartz
EP	Tief-, Band-, Hochpaß, Bandsperre, Diskriminator	EP	Lowpass, bandpass, highpass filter, band-stop filter, discriminator	EP	Filtre passe-bas, passe-bande, passe-haut, suppression de bande, discriminateur
EQ	Schwing-, Filter-Quarz	EQ	Oscillator or filter crystal	EQ	Quartz oscillateur, quartz de filtre
ER	Resonator, piezoelekt./magnetostruktiv	ER	Resonator, piezoelectric/magnetostrictive	ER	Résonateur piézo-électrique/magneto-strictif
ES	Passive SHF-Bauteile	ES	Passive SHF-components	ES	Composant SHF passif
ET	Thermostat	ET	Thermostat	ET	Thermostat
EV	Lüfter, Gebläse	EV	Ventilator, blower	EV	Ventilateur, soufflerie
F	Fassungen, Steckverbindungen	F	Sockets, connectors	F	Douilles, connecteurs
FA	Dezifix/Prezifix A	FA	R&S coaxial connector Dezifix/Precifix A	FA	Dezifix, Prezifix A
FB	Dezifix B	FB	R&S coaxial connector Dezifix B	FB	Dezifix B
FC	Dezifix C	FC	R&S coaxial connector Dezifix C	FC	Dezifix C
FD	Dezifix D	FD	R&S coaxial connector Dezifix D	FD	Dezifix D
FE	Dezifix E/J	FE	R&S coaxial connector Dezifix E/J	FE	Dezifix E/J
FF	Dezifix F	FF	R&S coaxial connector Dezifix F	FF	Dezifix F



Kenn- buchst.	Art des Bauelementes	Identif- letter	Type of component	Sym- bole	Type d'élément
FG	Koax-Umrüstsatz	FG	Coaxial screw-in assembly	FG	Ensemble vissable coaxial
FH	Koax-Übergang auf Fremdsystem	FH	Coaxial adapter	FH	Adaptateur coaxial
FJ	BNC-Systemteil	FJ	BNC screw-in assembly	FJ	Ensemble vissable BNC
FK	Koaxial-UHF-Systemteil	FK	Coaxial UHF screw-in assembly	FK	Ensemble vissable coaxial UHF
FM	Mehrfachstecker, Buchsenleiste	FM	Multipoint connector	FM	Connecteur multiple
FN	Netz-Steckverbindung	FN	AC-supply connector	FN	Connecteur secteur
FO	Runde Mehrfach-Steckverbindung	FO	Round multipoint connector	FO	Connecteur multipoles rond
FP	Druckschalt.-Steckverbindung	FP	Multipoint connector for PC boards	FP	Connecteur multipoles pour cartes imprimées
FR	Fassung für Lampe, Sicherung, usw.	FR	Socket for lamp, fuse, etc.	FR	Douille pour lampe, fusible etc.
FT	Schwachstrom-Steckverbindung	FT	LV plug and socket	FT	Connecteur pour faible courant
FU	Hochsp.-Steckverbindung	FU	HV plug and socket	FU	Connecteur pour haute tension
FV	Verbinder (z.B. AMP)	FV	Push-on connector	FV	Connecteur à enfichage
J	Meßinstrumente	J	Indicators	J	Indicateurs
JD	Drehspul-Anzeigeeinstrument	JD	Moving-coil meter	JD	Galvanomètre à cadre mobile
JE	Dreheisen-Anzeigeeinstrument	JE	Moving-iron meter	JE	Galvanomètre à fer mobile
JF	Frequenzmesser	JF	Frequency meter	JF	Fréquence-mètre
JG	Drehspulinstrument mit Gleichrichter	JG	Moving-coil meter with rectifier	JG	Galvanomètre à cadre mobile avec redresseur
JH	Betriebstundenzähler	JH	Operating-hours counter	JH	Compteur d'heures de fonctionnement
JJ	Impulszähler	JJ	Pulse counter	JJ	Compteur d'impulsions
JK	Kleinst-Instrument, z.B. Abstimmanzeiger	JK	Mini-instrument, e.g. tuning indicator	JK	Petit indicateur, p.ex. indicateur d'accord
JM	Mechanisches Zählwerk	JM	Mechanical counter	JM	Compteur mécanique
JP	Projektions-Instrument (Leuchtziffer)	JP	Digital display	JP	Afficheur numérique
JQ	Quotientenmesser (Kreuzspul-instrument)	JQ	Ratiometer (cross coil)	JQ	Quotientmètre (à cadres croisés)
JS	Spiegelgalvanometer	JS	Reflecting galvanometer	JS	Galvanomètre à miroir
JU	Uhrwerk	JU	Clockwork	JU	Mouvement d'horlogerie
JW	Elektrodyn. Anzeigeeinstrument	JW	Electrodynamic meter	JW	Instrument électrodynamique
L	Induktivitäten, Magnetik	L	Inductors, magnetic components	L	Composants inductifs et magnétiques
LC	Keramische Spule	LC	Ceramic coil	LC	Bobine céramique
LD	Netz-, HF-Drossel, Df-Filter	LD	Choke, lead-through filter	LD	Self de choc, filtre de traversée
LE	Einzelkreis, Bandfilter	LE	Single tuned circuit, bandpass filter	LE	Circuit accordé, filtre passe-bande
LP	Permanentmagnet	LP	Permanent magnet	LP	Aimant permanent
LT	Netztransformator	LT	Power transformer	LT	Transformateur secteur
LU	NF-Übertrager	LU	AF transformer	LU	Transformateur BF
LV	Variometer	LV	Variometer	LV	Variomètre
R	Widerstände	R	Resistors	R	Résistances
RD	Drahtwiderstand	RD	Wire-wound resistor	RD	Résistance bobinée
RF	Kohleschicht-Widerstand	RF	Carbon-film resistor	RF	Résistance à couche de carbone
RG	Metallglasur-Widerstand	RG	Metal-coated resistor	RG	Résistance à couche métallique
RJ	Metalloxyd-Widerstand	RJ	Metal-oxide resistor	RJ	Résistance à oxyde métallique
RL	Metallfilm-Widerstand	RL	Metal-film resistor	RL	Résistance à film métallique
RM	Widerstandsdraht	RM	Resistance wire	RM	Fil de résistance
RN	Widerstandsnetzwerk	RN	Resistor network	RN	Réseau de résistance
RR	Draht-Potentiometer	RR	Wire-wound potentiometer	RR	Potentiomètre bobiné
RS	Schicht-Potentiometer	RS	Carbon-film potentiometer	RS	Potentiomètre à couche



Kennbuchst.	Art des Bauelementes	Identif.-letter	Type of component	Symbole	Type d'élément
RT	Dämpfungsglied, Abschlußwiderstand	RT	Attenuator, termination	RT	Atténuateur, charge
RV	Drahtwiderstand mit Abgriff	RV	Wire-wound resistor, tapped	RV	Résistance bobinée à prise
RW	Wendelpotentiometer	RW	Helical potentiometer	RW	Potentiomètre hélicoïdal
S	Schalter, Relais, Sicherungen	S	Switches, relays, fuses	S	Commutateurs, relais, fusibles
SB	Drucktastenschalter	SB	Pushbutton switch	SB	Commutateur à touche
SD	Drehschalter	SD	Rotary switch	SD	Commutateur rotatif
SF	Kontaktfedersatz	SF	Spring contact assembly	SF	Jeu de ressorts de contact
SH	HF-Koaxialschalter, -Relais, -Teiler	SH	Coaxial RF switch, RF relay, RF attenuator	SH	Commutateur RF coaxial, relais RF, atténuateur RF
SK	Kipp-, Wipp- und Schiebeschalter	SK	Toggle switch, slide switch	SK	Commutateur à bascule, à glissière
SL	Leistungsschalter Netz/HF	SL	AC supply switch, high-power RF switch	SL	Commutateur secteur, de puissance RF
SM	Mikroschalter	SM	Microswitch	SM	Microrupteur
SN	Elektromagnet, Relais	SN	Electromagnetic relay	SN	Relais électromagnétique
SP	Leistungsrelais, Luftschtüt	SP	Power relay, air-type contactor	SP	Relais de puissance, contacteur à air
SR	Reedrelais	SR	Reed relay	SR	Relais reed
SS	Sicherung, Schutzschalter	SS	Fuse, automatic cut-out	SS	Fusible, coupe-circuit automatique
ST	Thermoschalter	ST	Thermal circuit breaker	ST	Disjoncteur thermique
SU	Überspannungs-Ableiter	SU	Arrester	SU	Eclateur
SW	Wechselrichter, Näherungsschalter	SW	Inverter (DC-AC), proximity switch	SW	Inverseur (DC-AC), commutateur de proximité
SZ	Zeitschalter	SZ	Time switch	SZ	Interrupteur horaire
V	Verbindungselemente	V	Connecting elements	V	Éléments de raccordement
VK	Klemme, Klemmleiste	VK	Clamp, terminal strip	VK	Pince, réglette à bornes
VL	Lötöse, Stützpunkt	VL	Soldering lug	VL	Cosse à souder
VS	Schraube, Mutter, Scheibe	VS	Screw, nut, washer	VS	Vis, écrou, disque

Farbcode für Widerstände und Kondensatoren / Colour code for resistors and capacitors / Code couleur pour résistances et condensateurs

Anmerkung:
Die Wertangabe der weitgehend miniaturisierten Bauelemente erfolgt überwiegend durch Farbkennzeichnungen, deren Bedeutung der nachfolgenden Tabelle entnommen werden kann.

Note:
The electrical values of the largely miniaturized components are mainly identified by a colour code, the meaning of which can be taken from the table below.

Remarque:
Les valeurs électriques des composants fort miniaturisés sont indiquées dans la plupart des cas par un code couleur dont voici l'explication.

HINWEIS:
Im Zuge des technischen Fortschrittes setzt R&S zunehmend Metallschichtwiderstände mit 1% Toleranz anstelle von Kohleschichtwiderständen mit 5% Toleranz ein. Metallschichtwiderstände können sich dabei an Stellen befinden, an denen gemäß Schaltteilliste Kohleschichtwiderstände vorgesehen sind. Etwaige geringfügige Differenzen der Nennwerte zwischen Stromlaufplan, Schaltteilliste und Gerät liegen im zulässigen Toleranzbereich.

N. B.:
Following the state of the art R&S makes increasing use of metal-film resistors (1% tolerance) instead of carbon-film resistors (5% tolerance). Metal-film resistors may have been employed where carbon-film resistors are specified in the parts list. Any slight differences of nominal values between circuit diagram, parts list and equipment are within tolerance.

N. B.:
Suivant le progrès technique R&S utilise de plus en plus des résistances à film métallique (tolérance 1%) au lieu des résistances à couche de carbone (tolérance 5%). Des résistances à film métallique peuvent se trouver en des points où des types à couche de carbone figurent dans la liste des composants. Les différences minimales des valeurs nominales existant éventuellement entre le schéma de circuit, la liste des composants et l'appareil sont dans la marge de tolérance.

Farbe/Colour/Couleur	A	B	C	D	Anordnungsbeispiele für Examples for Exemple pour	Definition* / Définition*
Schwarz/Black/Noir	-	0			Widerstände (R) Kondensat. (C) Resistors (R) Capacitors (C) Résistance (R) Condensateur (C)	Kennzeichen A (Bauteilfarbe/1. Farbring) = 1. Zahl: Marking A (body colour or first coloured ring) = 1st digit; Repérage A (couleur du corps ou 1er anneau) = 1er chiffre:
Braun/Brown/Marron	1	1	0	± 1%		Kennzeichen B (Bauteilende/2. Farbring) = 2. Zahl: Marking B (body end or second coloured ring) = 2nd digit; Repérage B (bout du corps ou 2e anneau) = 2e chiffre:
Rot/Red/Rouge	2	2	00	± 2%		Kennzeichen C (Punkt/3. Farbring) = 3. Zahl = Zahl der Nullen: Marking C (dot or third coloured ring) = number of zeroes; Repérage C (point ou 3e anneau) = nombre de zéros:
Orange/Orangé	3	3	000			Kennzeichen D (Punkt/4. Farbring) = Toleranz des Nennwerts in % Marking D (dot or fourth coloured ring) + tolerance on nominal value in % Repérage D (point ou 4e anneau) = tolérance en % de la valeur nominale. (with no D marking: tolerance ± 20%) (L'absence du repérage D signifie ± 20%)
Gelb/Yellow/Jaune	4	4	0000	± 0.5%		
Grün/Green/Vert	5	5	00000	± 0.1%		
Blau/Blue/Bleu	6	6	000000			
Violett/Violet	7	7	-			
Grau/Gray/Gris	8	8	-			
Weiß/White/Blanc	9	9	-			
Gold/Doré	-	-	-	± 5%		
Silber/Silver/Argenté	-	-	-	± 10%		
Ohne Farbe/No colour/ Pas de couleur	-	-	-	± 20%		

1) Toleranzring, hier nicht spezifiziert.
1) Tolerance ring, here not specified.
1) Anneau de tolérance, ne pas spécifié ici.

*Siehe auch DIN 41 429 und DIN 40 825
see also IEC publication 62-1952 and 62-1968
Voir aussi DIN 41 429 et DIN 40 825.



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Kennzeichen Component No.	Benennung/Beschreibung Designation	Sachnummer Stock No.	enthalten in contained in
.	ZUGEH. STROML./CIRC. DIAGR. 336.3019 S		
BU11	BUCHSE SOCKET	336.3477	336.3460
BU40	FJ EINBAUBUCHSE SYST. BNC SOCKET	FJ 017.6636	336.4238
BU41	SPINNER BN 942403 FJ EINBAUBUCHSE SYST. BNC	FJ 017.6607	336.3519.01
BU42	FIXED BNC SOCKET, 50 OHM SPINNER BN292700 FJ EINBAUBUCHSE SYST. BNC	FJ 017.6607	336.3519.01
BU43	FIXED BNC SOCKET, 50 OHM SPINNER BN292700 FJ EINBAUBUCHSE SYST. BNC	FJ 017.6636	392.7739
	SOCKET SPINNER BN 942403		
D1	ENTHALTEN IN/INCLUDED IN ST1		
K4	KABEL CABLE	336.4238	336.3519.01
K5	KABEL CABLE	336.4244	336.3519.01
K6	KABEL CABLE	336.4150	336.3519.01
K7	KABEL CABLE	392.7739	
M01	LUEFTEREINHEIT BLOWER UNIT	336.3460	
S1	SB SCHALT NETZ 2A 0.KNOPF POWER SWITCH	SB 020.5495	
S2	ENTHALTEN IN/INCLUDED IN ST1		
S3	ST OEFFNER 110GRDC+-5GRD. THERMAL SWITCH	ST 063.6941	336.3590
SI1	TEXAS TYPE 9700L-36-11 SS SCHMELZT 0,5 BDIN 41571 FUSE	SS 020.7352	
	FUER 220V UND 240V SCHMELZS. M1C DIN 41571 FUER 110V UND 120V		
ST1	SS 020.7446 FN NETZFILT. M.SPANNUNGSW. FILTER	FN 099.3313	
	SCHAFFNER FN 369-2/01		
TR1	NETZTRAFO POWER TRANSFORMER	336.3590	336.4767
Y1	ED STEUERUNG U.EICHLITG. CONTR. CIRCUIT ATTENUATOR FUER VAR/FOR MOD.02	392.7522.02	
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Anzeichen Component No.	Benennung/Beschreibung Designation	Sachnummer Stock No.	enthalten in contained in
Y2	***** 392.7522.32 FUER VAR/FOR MOD.32 ED FREQUENZERZEUGUNG FREQUENCY GENERATOR FUER VAR/FOR MOD.02 *****	392.7545.02	336.4009.01
Y3	***** 392.7545.32 FUER VAR/FOR MOD.32 ED FREQUENZAUFBEREITUNG FREQUENCY PROCESSOR FUER VAR/FOR MOD.02 *****	392.7580.02	336.4009.01
Y4	***** 392.7580.32 FUER VAR/FOR MOD.32 ED ANZEIGE-U.TASTENFELD INDIC.FIELD A.KEYBOARD FUER VAR/FOR MOD.02 *****	336.4015.02	336.3519.01
Y5	***** 336.4015.32 FUER VAR/FOR MOD.32 ED 10V ENDSTUFE FINAL STAGE FUER VAR/FOR MOD.02 *****	336.4038.02	
Y7	***** 336.4038.32 FUER VAR/FOR MOD.32 ED IEC-BUS-STEUERUNG IEC-BUS-CONTROL FUER VAR/FOR MOD.02 *****	392.7700.02	
Y8	***** 392.7700.32 FUER VAR/FOR MOD.32 IEC-625-ANSCHLUSSPLATTE IEC-BUS-BOARD FUER VAR/FOR MOD.02 *****	392.7722.02	
	***** 392.7722.32 FUER VAR/FOR MOD.32 *****		- ENDE -

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Kennzeichen Component No.	Benennung/Beschreibung Designation	Sachnummer Stock No.	enthalten in contained in
B1	BP 5082-7610 7SEGM. ANZ. RT IC SEGMENT INDICATION HEWLETT QDSP-4331	BP 293.6241	
BIS/TO			
B8			
B9	BP 5082-7616 +-ANZEIGE RT IC +- INDICATING 5082-761 HEWLETT QDSP4333	BP 302.7934	
B10	BJ SN75492AN LED DRIV LED DRIVER TEXAS SN75492AN	BJ 257.4720	
B11	BJ SN75492AN LED DRIV LED DRIVER TEXAS SN75492AN	BJ 257.4720	
B12	BL SN74LS42N 4/10DECODER IC DECODER SN74LS42N TEXAS SN74LS42N	BL 290.8620	
B14	BS UGS3030T HALL-EFF. SW. HALL-EFFECT-SWITCH SPRAGUE UGS-3030T	650.9342	
B15	BS UGS3030T HALL-EFF. SW. HALL-EFFECT-SWITCH SPRAGUE UGS-3030T	650.9342	
C10	CC 10NF-20+50X7X8R6000 CAPACITOR	CC 087.7525	
C11	VALVO 2222 63051 64051103 CC 10NF-20+50X7X8R6000 CAPACITOR	CC 087.7525	
C12	VALVO 2222 63051 64051103 CC 10NF-20+50X7X8R6000 CAPACITOR	CC 087.7525	
C17	VALVO 2222 63051 64051103 CE 47UF-20+50% 16V 6,5X20 ELECTROLYTIC CAPACITOR ROEDERST ELKOEBS-IS47/16	CE 022.7720	
GL1	AF HLMP1301 LED RT RD3 LED HEWLETT-P. 5082-4684	AF 257.4736	
GL2	AF HLMP1301 LED RT RD3 LED HEWLETT-P. 5082-4684	AF 257.4736	
GL3	ENTHALTEN IN/INCLUDED IN S25		
GL4	AF HLMP1301 LED RT RD3 LED HEWLETT-P. 5082-4684	AF 257.4736	
GL5	ENTHALTEN IN/INCLUDED IN S8		
GL6	ENTHALTEN IN/INCLUDED IN S24		
GL7	ENTHALTEN IN/INCLUDED IN S19		

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Kennzeichen Component No.	Benennung/Beschreibung Designation	Sachnummer Stock No.	enthalten in contained in
GL8	ENTHALTEN IN/INCLUDED IN S20		
GL9	AF HLMP1301 LED RT RD3 LED HEWLETT-P. 5082-4684	AF 257.4736	
GL10	AF HLMP1301 LED RT RD3 LED HEWLETT-P. 5082-4684	AF 257.4736	
GL11	AF HLMP1301 LED RT RD3 LED HEWLETT-P. 5082-4684	AF 257.4736	
GL12	AF HLMP1301 LED RT RD3 LED HEWLETT-P. 5082-4684	AF 257.4736	
GL13	AF HLMP1301 LED RT RD3 LED HEWLETT-P. 5082-4684	AF 257.4736	
GL14	AF HLMP1301 LED RT RD3 LED HEWLETT-P. 5082-4684	AF 257.4736	
GL15	AF HLMP1301 LED RT RD3 LED HEWLETT-P. 5082-4684	AF 257.4736	
GL16	AF HLMP1301 LED RT RD3 LED HEWLETT-P. 5082-4684	AF 257.4736	
GL17	AF HLMP1301 LED RT RD3 LED HEWLETT-P. 5082-4684	AF 257.4736	
R1	RL 0,35W22,10 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/22,10HM-F-D	RL 082.9188	
BIS/TO R16 R22	RL 0,35W 121 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/1210HM-F-D	RL 082.9859	
BIS/TO R32 R33	RL 0,35W 1KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/1K-F-C	RL 082.2160	
BIS/TO R43 R44	RL 0,35W22,10 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/22,10HM-F-D	RL 082.9188	
R45	RL 0,35W 2,21KOHM+-1%TK50 RESISTOR DRALORIC SMA 0207/2,21K-F-C	RL 082.2477	
R46	RL 0,35W 2,21KOHM+-1%TK50 RESISTOR DRALORIC SMA 0207/2,21K-F-C	RL 082.2477	
S1	TASTER "7" PUSHBUTTON	336.4421	336.4315



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Kennzeichen Component No.	Benennung/Beschreibung Designation	Sachnummer Stock No.	enthalten in contained in
S2	TASTER "1" PUSHBUTTON	336.4367	336.4315
S3	TASTER "0" PUSHBUTTON	336.4350	336.4315
S4	SB TASTER 1POL.DOPPELKONT PUSHBUTTON SWITCH PREH 75 120-001	292.0340	
S5	SB TASTER 1POL.DOPPELKONT PUSHBUTTON SWITCH PREH 75 120-001	292.0340	
S6	TASTER "8" PUSHBUTTON	336.4438	336.4315
S7	TASTER "4" PUSHBUTTON	336.4396	336.4315
S8	SB TASTER GRAU MIT LED RT PUSHBUTTON PREH 75120-051	332.5200	
S9	SB TASTER 1POL.DOPPELKONT PUSHBUTTON SWITCH PREH 75 120-001	292.0340	
S10	SB TASTER 1POL.DOPPELKONT PUSHBUTTON SWITCH PREH 75 120-001	292.0340	
S11	TASTER "9" PUSHBUTTON	336.4444	336.4315
S12	TASTER "5" PUSHBUTTON	336.4409	336.4315
S13	SB TASTER 1POL.DOPPELKONT PUSHBUTTON SWITCH PREH 75 120-001	292.0340	
S14	SB TASTER 1POL.DOPPELKONT PUSHBUTTON SWITCH PREH 75 120-001	292.0340	
S15	SB TASTER 1POL.DOPPELKONT PUSHBUTTON SWITCH PREH 75 120-001	292.0340	
S16	TASTER "STO" PUSHBUTTON	336.4450	336.4315
S17	TASTER "-" PUSHBUTTON	336.4496	336.4315
S18	TASTER "+" PUSHBUTTON	336.4509	336.4315
S19	SB TASTER GRAU MIT LED RT PUSHBUTTON PREH 75120-051	332.5200	
S20	SB TASTER GRAU MIT LED RT PUSHBUTTON PREH 75120-051	332.5200	
S21	TASTER "RCL" PUSHBUTTON	336.4467	336.4315
S22	TASTER "2" PUSHBUTTON	336.4373	336.4315
S23	TASTER "C" PUSHBUTTON	336.4473	336.4315
S24	SB TASTER GRAU MIT LED RT PUSHBUTTON PREH 75120-051	332.5200	

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Kennzeichen Component No.	Benennung/Beschreibung Designation	Sachnummer Stock No.	enthalten in contained in
S25	SB TASTER GRAU MIT LED RT PUSHBUTTON PREH 75120-051	332.5200	
S26	TASTER "6" PUSHBUTTON	336.4415	336.4315
S27	TASTER "3" PUSHBUTTON	336.4380	336.4315
S28	TASTER "-" PUSHBUTTON	336.4480	336.4315
S29	SB TASTER 1POL. DOPPELKONT PUSHBUTTON SWITCH PREH 75 120-001	292.0340	
S30	SB TASTER 1POL. DOPPELKONT PUSHBUTTON SWITCH PREH 75 120-001	292.0340	
ST1	STECKEREINHEIT	336.4321	
ST2	STECKEREINHEIT	336.4338	
T1	AK 2N2907A PNP 60V 600MA TRANSISTOR VALVO 2N2907A	AK 010.3583	
BIS/TO T10 T11	AK 2N2907A PNP 60V 600MA TRANSISTOR VALVO 2N2907A	AK 010.3583	



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Kennzeichen Component No.	Benennung/Beschreibung Designation	Sachnummer Stock No.	enthalten in contained in
B1	BO CA3146E NPN-TR.ARRAY IC TRANSISTOR ARRAY CA314 RCA CA3146E	BO 249.6633	
B20	BO MPQ2369 NPN-TR.-ARRAY IC TRANS.ARRAY MPQ2369 MOTOROLA MPQ2369	BO 336.4673	
B50	BO CA3240AE 2XMOS OPAMP OPERATIONAL AMPLIFIER RCA CA3240AE	BO 302.7040	
B60	BO UA7824UC +24V1A0 VREGL VOLTAGE REGULATOR FAIRCHILD UA7824UC	BO 336.4621	
B61	BO UA7924UC -24V1A0 VREGL VOLTAGE REGULATOR FAIRCHILD UA7924UC	BO 336.4638	
BU1	FP KURZSCHL.BUCHSE OFFEN SHORTING PLUG BERG 76264-101	FP 342.1895	
BU2	FP KURZSCHL.BUCHSE OFFEN SHORTING PLUG BERG 76264-101	FP 342.1895	
BU3	FP KURZSCHL.BUCHSE OFFEN SHORTING PLUG BERG 76264-101	FP 342.1895	
BU5	FP BUCHSENLEISTE 40POL. ANGLE SOCKET CONNECTOR BERG 67231-020	FP 279.2236	
C1	CC 27PF+-2%4X5NPO CAPACITOR VALVO 2222 678 10279	CC 087.6470	
C2	CC 27PF+-2%4X5NPO CAPACITOR VALVO 2222 678 10279	CC 087.6470	
C3	CC 12PF+-2%3X4NPO CAPACITOR VALVO 2222 678 10129	CC 087.6435	
C4	CC 10NF-20+50%7X8R6000 CAPACITOR VALVO 2222 63051 64051103	CC 087.7525	
C5	CC 10NF-20+50%7X8R6000 CAPACITOR VALVO 2222 63051 64051103	CC 087.7525	
C6	CE 10UF -10+50% 63V 9X13 ELECTROLYTIC CAPACITOR ROEDERST ELKOEK10/63	CE 022.7650	
C7	CE 10UF -10+50% 63V 9X13 ELECTROLYTIC CAPACITOR ROEDERST ELKOEK10/63	CE 022.7650	
C22	CC 2,7NF+-10%5X6R2000 CAPACITOR VALVO 2222 63051 272	CC 087.7077	
C23	CE 10UF -10+50% 63V 9X13 ELECTROLYTIC CAPACITOR ROEDERST ELKOEK10/63	CE 022.7650	

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Kennzeichen Component No.	Benennung/Beschreibung Designation	Sachnummer Stock No.	enthalten in contained in
C24	CC 10NF-20+50%7X8R6000 CAPACITOR VALVO 2222 63051 64051103	CC 087.7525	
C25	CE 10UF -10+50% 63V 9X13 ELECTROLYTIC CAPACITOR ROEDERST ELK0EK10/63	CE 022.7650	
C40	CC 18PF+-2%3X4NPO CAPACITOR VALVO 2222 678 10189	CC 087.6458	
C41	CC 10NF-20+50%7X8R6000 CAPACITOR VALVO 2222 63051 64051103	CC 087.7525	
C43	CC 100PF+-2%6X9NPO CAPACITOR VALVO 2222 678 10101	CC 087.6541	
C45	CC 10NF-20+50%7X8R6000 CAPACITOR VALVO 2222 63051 64051103	CC 087.7525	
C50	CK 680NF+-20%100V QUADER PLASTIC-FOIL CAPACITOR ROEDERST MKT1822-468/0	CK 006.5085	
C51	CG 6,8NF+-0,5% 250V TKG MICA CAPACITOR JAHRE 53-2/6,9NF/0,5/250	CG 023.1726	
C52	CK 4,7UF+-10% 63V QUADER CAPACITOR ROEDERST MKT1822-547/06/10%	CK 024.7005	
C53	CE 1UF -10+50% 63V 9X13 ELECTROLYTIC CAPACITOR ROEDERST ELKO EK 1/63	CE 022.7620	
C54	CC 10NF-20+50%7X8R6000 CAPACITOR VALVO 2222 63051 64051103	CC 087.7525	
C55	CC 10PF+-0,25PF5X6P100 CAPACITOR VALVO 2222 678 03109	CC 087.6293	
C60	CK 470NF+-20% 63V QUADER CAPACITOR ROEDERST MKT1822-447/06	CK 024.6950	
C61	CK 470NF+-20% 63V QUADER CAPACITOR ROEDERST MKT1822-447/06	CK 024.6950	
C63	CE 470UF-10+50% 40V 15X30 ELECTROLYTIC CAPACITOR ROEDERST ELKO EK470/40	CE 087.0572	
C64	CE 470UF-10+50% 40V 15X30 ELECTROLYTIC CAPACITOR ROEDERST ELKO EK470/40	CE 087.0572	
C65	CE 1000UF 40V 16RDX30 ELECTROLYTIC CAPACITOR SIEMENS B 41293-B7108-T	573.9931	
C66	CE 1000UF 40V 16RDX30 ELECTROLYTIC CAPACITOR SIEMENS B 41293-B7108-T	573.9931	
C68	CC 4,7PF+-0,25PF3X4NPO CAPACITOR VALVO 2222 678 09478	CC 087.6387	



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Kennzeichen Component No.	Benennung/Beschreibung Designation	Sachnummer Stock No.	enthalten in contained in
C69	CC 12PF+-2%3X4NP0 CAPACITOR VALVO 2222 678 10129	CC 087.6435	
C160	TRIMMWERT / SELECTED		
C161	TRIMMWERT / SELECTED		
GL20	AD 1N4448 75V 0,15A UDI DIODE VALVO 1N4448	AD 012.0700	
GL21	AD 1N4448 75V 0,15A UDI DIODE VALVO 1N4448	AD 012.0700	
GL50	AE 5082-2800 SCHOTTKYDI DIODE HEWLETT-P. 5082-2800	AE 012.9066	
GL51	AE 5082-2800 SCHOTTKYDI DIODE HEWLETT-P. 5082-2800	AE 012.9066	
GL52	AE BZX79/C20 0,5W Z-DI ZENER DIODE VALVO BZX79/C20	AE 012.2584	
MP1	FP INDIREKT.STECKERL.36P. PIN CONNECTOR BERG 75160-102-36 1-POLIG	FP 242.3600	
BIS/TO MP6	1-POLIG		
R1	RL 0,35W 4,99KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/4,99K-F-D	RL 083.1116	
R2	RL 0,35W 23,2KOHM+-1%TK50 RESISTOR DRALORIC SMA/207/23,2K-F-C	RL 083.1551	
R3	RL 0,35W 221 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/221OHM-F-D	RL 083.0084	
R4	RL 0,35W 23,2KOHM+-1%TK50 RESISTOR DRALORIC SMA/207/23,2K-F-C	RL 083.1551	
R5	RL 0,35W 1KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/1K-F-C	RL 082.2160	
R6	RL 0,35W 10,5KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/10,5K-F-D	RL 083.1300	
R7	RL 0,35W 3,92KOHM+-1%TK50 RESISTOR	RL 083.1039	
R8	RL 0,35W 8,25KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/8,25K-F-D	RL 083.1239	
R9	RL 0,35W 8,25KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/8,25K-F-D	RL 083.1239	

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Zeichen Component No.	Benennung/Beschreibung Designation	Sachnummer Stock No.	enthalten in contained in
R10	RL 0,35W 2,21KOHM+-1%TK50 RESISTOR DRALORIC SMA 0207/2,21K-F-C	RL 082.2477	
R11	RL 0,35W 2,21KOHM+-1%TK50 RESISTOR DRALORIC SMA 0207/2,21K-F-C	RL 082.2477	
R12	RL 0,35W 10,0 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/100HM-F-D	RL 082.8852	
R13	RL 0,35W 10,0 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/100HM-F-D	RL 082.8852	
R20	RL 0,35W 182 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/182OHM-F-D	RL 083.0010	
R21	RS 0,5W100 OHM+-10%10X10X CERMET POTENTIOMETER T BOURNS 3386F-1-101	RS 247.7984	
R22	RL 0,35W 332 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/332OHM-F-D	RL 083.0255	
R23	RL 0,35W 332 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/332OHM-F-D	RL 083.0255	
R24	RL 0,5W 200 OHM+-1%TK50 RESISTOR SFERNICE RCMS1 200 OHM 1%K3	067.5662	
R25	RL 0,5W 200 OHM+-1%TK50 RESISTOR SFERNICE RCMS1 200 OHM 1%K3	067.5662	
R26	RL 0,35W 10,0 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/100HM-F-D	RL 082.8852	
R27	RF 0,25W 1 OHM +-5% RESISTOR DRALORIC LCA0207/+-5%1	RF 073.9872	
R28	RL 0,35W 22,1KOHM+-1%TK50 RESISTOR DRALORIC SMA/207/22,1K-F-C	RL 083.1545	
R29	RF 0,25W 1 OHM +-5% RESISTOR DRALORIC LCA0207/+-5%1	RF 073.9872	
R30	RL 0,35W 10,0 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/100HM-F-D	RL 082.8852	
R40	RL 0,35W 3,48KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/3,48K-F-D	RL 083.1016	
R41	RL 0,35W100 OHM+-0,1%TK25 RESISTOR DRALORIC SMA0207/1000HM-B-E	RL 083.7220	
R42	RL 0,35W1,52KOHM+-0,1%T25 RESISTOR	RL 083.9498	
R43	RL 0,35W 3,48KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/3,48K-F-D	RL 083.1016	

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Kennzeichen Component No.	Benennung/Beschreibung Designation	Sachnummer Stock No.	enthalten in contained in
R44	RL 0,35W100 OHM+-0,1%TK25 RESISTOR DRALORIC SMA0207/100OHM-B-E	RL 083.7220	
R45	RL 0,35W1,52KOHM+-0,1%T25 RESISTOR	RL 083.9498	
R46	RL 0,35W 1,50KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/1,50K-F-D	RL 083.0732	
R47	RL 0,5W 200 OHM+-1%TK50 RESISTOR SFERNICE RCMS1 200 OHM 1%K3	067.5662	
R48	RL 0,5W 200 OHM+-1%TK50 RESISTOR SFERNICE RCMS1 200 OHM 1%K3	067.5662	
R50	RL 0,35W 2,74KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/2,74K-F-D	RL 083.0926	
R51	RL 0,35W 1,13KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/1,13K-F-C	RL 082.2383	
R52	RL 0,35W 1MOHM+-1%TK50 RESISTOR DRALORIC SMA0207/1M-F-D	RL 082.7862	
R53	RL 0,35W 1,13KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/1,13K-F-C	RL 082.2383	
R54	RL 0,35W 26,7KOHM+-1%TK50 RESISTOR DRALORIC SMA/207/26,7K-F-C	RL 083.1597	
R55	RL 0,35W4,75MOHM+-1%TK50 METALFILMRESISTOR RESISTA MK2 4,75MOHM 1% TK50	RL 099.8250	
R56	RL 0,35W 392 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/392K-F-C	RL 082.2183	
R57	RL 0,35W 1KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/1K-F-C	RL 082.2160	
R58	RL 0,35W 22,1KOHM+-1%TK50 RESISTOR DRALORIC SMA/207/22,1K-F-C	RL 083.1545	
R59	RL 0,35W 10,0 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/100HM-F-D	RL 082.8852	
R60	RL 0,35W 10,0 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/100HM-F-D	RL 082.8852	
ST1	FP INDIREKT.STECKERL.36P. PIN CONNECTOR BERG 75160-102-36	FP 242.3600	
ST2	FP INDIREKT.STECKERL.36P. PIN CONNECTOR BERG 75160-102-36	FP 242.3600	
ST3	FP INDIREKT.STECKERL.36P. PIN CONNECTOR BERG 75160-102-36	FP 242.3600	

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Kennzeichen Component No.	Benennung/Beschreibung Designation	Sachnummer Stock No.	enthalten in contained in
T22	AK 2N3349 PNP 45V DUAL DUAL-TRANSISTOR TEXAS 2N3349	AK 082.3750	
T24	AK BC107B NPN 45V 100MA TRANSISTOR VALVO BC107B	AK 010.5157	
T25	AK BC107B NPN 45V 100MA TRANSISTOR VALVO BC107B	AK 010.5157	
T40	AK BC107B NPN 45V 100MA TRANSISTOR VALVO BC107B	AK 010.5157	
T41	AK BC107B NPN 45V 100MA TRANSISTOR VALVO BC107B	AK 010.5157	
T42	AM VN66AF NKAN POW.MOSF MOS-FET SILICONIX VN66AF	AM 336.4680	
T43	AM VN66AF NKAN POW.MOSF MOS-FET SILICONIX VN66AF	AM 336.4680	
T44	AK BCY79IX PNP 45V 200MA TRANSISTOR SIEMENS BCY79IX	AK 010.3777	

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Kennzeichen Component No.	Benennung/Beschreibung Designation	Sachnummer Stock No.	enthalten in contained in
B1	BJ SN75492AN LED DRIV LED DRIVER TEXAS SN75492AN	BJ 257.4720	
B2	BL SN74LS273N 8BIT-D-REG. 8BIT-D-REGISTER TEXAS SN74LS273N	BL 214.8998	
B3	BO LF351N BIFET OPAMP OPERATIONAL AMPLIFIER NSC LF351N	BO 301.6105	
B4	BO CA3146E NPN-TR.ARRAY IC TRANSISTOR ARRAY CA314 RCA CA3146E	BO 249.6633	
B5	BO LM361N DIFF.KOMPARATOR IC DIFF.COMP.LM361N NSC LM361N	BO 336.4644	
B7	BO UA7815UC +15V1A0 VREGL VOLTAGE REGULATOR FAIRCHILD UA7815UC	BO 282.5403	
B8	BO UA7915UC -15V1A0 VREGL VOLTAGE REGULATOR FAIRCHILD UA7915UC	BO 282.5432	
B10	BO UA723C ADJOA1 VREGL VOLTAGE REGULATOR FAIRCHILD UA 723PC	BO 009.0190	
B11	BO LF351N BIFET OPAMP OPERATIONAL AMPLIFIER NSC LF351N	BO 301.6105	
B12	BO LF351N BIFET OPAMP OPERATIONAL AMPLIFIER NSC LF351N	BO 301.6105	
B13	BL SN74LS74AN 2/D-FLIPFL. IC FLIP-FLOP SN74LS74N TEXAS SN74LS74N	BL 266.7934	
B14	BC P8085A 8B.CPU CPU INTEL P8085A	335.8930	
B15	BL SN74LS273N 8BIT-D-REG. 8BIT-D-REGISTER TEXAS SN74LS273N	BL 214.8998	
B16	BL SN74LS245N 8XBUS-TRSCV IC 8XBUS TRSCV SN74LS245N TEXAS SN74LS245N	BL 300.8833	
B17	BL SN74LS244N 8XBUS-TREIB IC 8XBUS DRIVER TEXAS SN74LS244N	BL 092.8984	
B18	BL SN74LS138N DEMUX 1:8 DEMULTIPLEXER 1:8 TEXAS SN74LS138N	BL 510.1379	
B19	BL SN74LS138N DEMUX 1:8 DEMULTIPLEXER 1:8 TEXAS SN74LS138N	BL 510.1379	
B20	BC 2732 PROGR.2 B20 ENTHALTEN IN PROM-SATZ INCLUDED IN SET OF PROM	392.7816	

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Anzeichen Component No.	Benennung/Beschreibung Designation	Sachnummer Stock No.	enthalten in contained in
B21	392.7845.02 BC 2732 PROGR.2 B21 ENTHALTEN IN PROM-SATZ INCLUDED IN SET OF PROM 392.7845.02	392.7822	
B22	BC RICHTIGE SNR 335.8952 RAM I/O AND TIMER INTEL 08155	092.8078	
B23	BL SN74LS245N 8XBUS-TRSCV IC 8XBUS TRSCV SN74LS245N TEXAS SN74LS245N	BL 300.8833	
B24	BL SN74LS74AN 2/D-FLIPFL. IC FLIP-FLOP SN74LS74N TEXAS SN74LS74N	BL 266.7934	
B25	BC P8279-5 KEYB/DISPL.I/O I/O KEYBOARD DISPLAY INTEL P8279-5	BC 334.2496	
B26	BL SN74154N 1AUF16-DECOD. IC DECODER SN74154N TEXAS SN74154N	BL 244.8509	
B27	BL SN74LS04N 6/INVERTER HEXINVERTER TEXAS SN74LS04N	BL 266.2010	
B28	BL SN74LS32N 4/2INP.OR IC OR GATE SN74LS32N TEXAS SN74LS32N	BL 266.4687	
B29	BL SN74LS00N 4/2INP.NAND IC NAND GATE SN74LS00N TEXAS SN74LS00N	BL 266.4641	
B30	BL SN74LS08N 4/2INP.AND IC AND GATE SN74LS08N TEXAS SN74LS08N	BL 266.4664	
B31	BL SN74LS244N 8XBUS-TREIB IC 8XBUS DRIVER TEXAS SN74LS244N	BL 092.8984	
B32	BL SN74LS74AN 2/D-FLIPFL. IC FLIP-FLOP SN74LS74N TEXAS SN74LS74N	BL 266.7934	
B33	BL SN74LS76AN 2/JK-MS-FLP IC FLIP FLOP SN74LS76N TEXAS SN74LS76AN	BL 266.2026	
B34	EL SN74LS32N 4/2INP.OR IC OR GATE SN74LS32N TEXAS SN74LS32N	BL 266.4687	
B35	BC 2732 PROGR.2 B35 ENTHALTEN IN PROM-SATZ INCLUDED IN SET OF PROM 392.7845.02	392.7839	
BU1	FR JC-FASSUNG 16 POLIG 16-PIN IC-SOCKET PRECICONT US016T	FR 249.6091	
BU2	FR JC-FASSUNG 16 POLIG 16-PIN IC-SOCKET PRECICONT US016T	FR 249.6091	
BU3	FR JC-FASSUNG 16 POLIG 16-PIN IC-SOCKET PRECICONT US016T	FR 249.6091	



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BU4	FR JC-FASSUNG 16 POLIG 16-PIN IC-SOCKET PRECICONT US016T	FR 249.6091	
BU7	FP KURZSCHL. BUCHSE OFFEN SHORTING PLUG BERG 76264-101	FP 342.1895	
BIS/TO			
BU10			
BU11	FR JC-FASSUNG 16 POLIG 16-PIN IC-SOCKET PRECICONT US016T	FR 249.6091	
BU12	FR JC-FASSUNG 16 POLIG 16-PIN IC-SOCKET PRECICONT US016T	FR 249.6091	
BU16	FP KURZSCHL. BUCHSE OFFEN SHORTING PLUG BERG 76264-101	FP 342.1895	
BU31	FP KURZSCHLUSSBUCHSE SHORTING PLUG PK 452-70302	FP 491.7042	
BU32	FP KURZSCHLUSSBUCHSE SHORTING PLUG PK 452-70302	FP 491.7042	
BU33	FP KURZSCHLUSSBUCHSE SHORTING PLUG PK 452-70302	FP 491.7042	
BU34	FP KURZSCHLUSSBUCHSE SHORTING PLUG PK 452-70302	FP 491.7042	
C1	CE 100UF-10+100% 6V 9X13 ELECTROLYTIC CAPACITOR SIEMENS B41316-A2107-Z	022.7514	
C2	CC 10NF-20+50% 7X8R6000 CAPACITOR VALVO 2222 63051 64051103	CC 087.7525	
C3	CC 1NF+-10% 63V K2000 CERAMIC CAPACITOR VALVO 2222 63051 102	CC 022.0784	
C4	CK 2,2UF+-10% 63V QUADER CAPACITOR ROEDERST MKT1822-522/06/10%	CK 024.6996	
C5	CK 2,2UF+-10% 63V QUADER CAPACITOR ROEDERST MKT1822-522/06/10%	CK 024.6996	
C6	CC 10NF-20+50% 7X8R6000 CAPACITOR VALVO 2222 63051 64051103	CC 087.7525	
C7	CC 10NF-20+50% 7X8R6000 CAPACITOR VALVO 2222 63051 64051103	CC 087.7525	
C8	CC 3,3PF+-0,25PF 3X4NPO CAPACITOR VALVO 2222 678 09338	CC 087.6364	
C9	CC 100PF+-2% 6X9NPO CAPACITOR VALVO 2222 678 10101	CC 087.6541	

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Zeichen Component No.	Benennung/Beschreibung Designation	Sachnummer Stock No.	enthalten in contained in
C10	CK 330NF+-5%63V5RM MKT CAPACITOR	CK 099.2969	
C11	WIMA MKS2/63/0,33UF/5% CC 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
C12	VALVO 2222 63051 64051103 CE 220UF-10+50% 16V 13X17 ELECTROLYTIC CAPACITOR	CE 022.7566	
C13	SIEMENS B41316-A4227-Z CE 220UF-10+50% 16V 13X17 ELECTROLYTIC CAPACITOR	CE 022.7566	
C17	SIEMENS B41316-A4227-Z CC 10PF+-0,25PF3X4NPO CAPACITOR	CC 087.6429	
C18	VALVO 2222 678 09109 CE 22UF-10+50% 16V 9X13B ELECTROLYTIC CAPACITOR	CE 086.4368	
C19	ROEDERST ELKO 22/16 CC 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
C20	VALVO 2222 63051 64051103 CC 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
C21	VALVO 2222 63051 64051103 CE 220UF-10+50% 16V 13X17 ELECTROLYTIC CAPACITOR	CE 022.7566	
C22	SIEMENS B41316-A4227-Z CC 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
C23	VALVO 2222 63051 64051103 CE 2200UF-10+50%25V 25X45 ELECTROLYTIC CAPACITOR	CE 334.6333	
C24	SIEMENS B41306-A5228-T CE 2200UF-10+50%25V 25X45 ELECTROLYTIC CAPACITOR	CE 334.6333	
C25	SIEMENS B41306-A5228-T CK 330NF+-5%63V5RM MKT CAPACITOR	CK 099.2969	
C26	WIMA MKS2/63/0,33UF/5% CK 1UF+-10%50V5RM MKT CAPACITOR	CK 099.2998	
C27	WIMA MKS2/50/1UF/10% CK 150NF+-5%63V5RM MKT CAPACITOR	CK 099.2946	
C28	WIMA MKS2/63/0,15UF/5% CK 1UF+-10%50V5RM MKT CAPACITOR	CK 099.2998	
C29	WIMA MKS2/50/1UF/10% CE 10000UF-10+50%16V30X50 ELECTROLYTIC CAPACITOR	CE 219.3459	
C30	ROEDERST EYV00BB510D CC 560PF+-10%3X4R2000 CAPACITOR	CC 087.7002	
C31	VALVO 2222 63051 561 CE 100UF-10+100% 6V 9X13 ELECTROLYTIC CAPACITOR	022.7514	
	SIEMENS B41316-A2107-Z		

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C32	CE 470UF-10+50% 6V 13X17 ELECTROLYTIC CAPACITOR SIEMENS B41316-A2477-Z	CE 022.7537	
C33	CE 4,7UF-10+50% 63V 9X13 ELECTROLYTIC CAPACITOR ROEDERST ELKOEK4/63	CE 022.7643	
C34	CC 6,8PF+-0,25PF3X4NPO CAPACITOR VALVO 2222 678 09688	CC 087.6406	
C35	CK 150NF+-5%63V5RM MKT CAPACITOR WIMA MKS2/63/0,15UF/5%	CK 099.2946	
C36	CC 10NF-20+50%7X8R6000 CAPACITOR VALVO 2222 63051 64051103	CC 087.7525	
BIS/TO			
C41			
C42	CE 1000UF 40V 16RDX30 ELECTROLYTIC CAPACITOR SIEMENS B 41293-B7108-T	573.9931	
C43	CE 1000UF 40V 16RDX30 ELECTROLYTIC CAPACITOR SIEMENS B 41293-B7108-T	573.9931	
C44	CK 6,8UF+-10% 63V QUADER CAPACITOR ROEDERST MKC1862-568/06+10%	CK 087.4010	
C45	CC 10NF-20+50%7X8R6000 CAPACITOR VALVO 2222 63051 64051103	CC 087.7525	
C46	CC 10NF-20+50%7X8R6000 CAPACITOR VALVO 2222 63051 64051103	CC 087.7525	
C47	CK 100NF+-5%63V5RM MKT CAPACITOR WIMA MKS/2/63/0,1UF/5%	CK 099.2930	
GL1	AD 1N4448 75V 0,15A UDI DIODE VALVO 1N4448	AD 012.0700	
BIS/TO			
GL14			
GL16	AD 1N4448 75V 0,15A UDI DIODE VALVO 1N4448	AD 012.0700	
GL17	AG KBFO2 140V 2A5 BRGL RECTIFIER GEN-INSTR KBFO2	006.9722	
GL18	AG B40C500C/3300 BRGL RECTIFIER SIEMENS B40C5000/3300	AG 084.5115	
GL23	AG 1N4004 GL 400V 1A0 RECTIFIER INTERMETAL 1N4004	AG 013.0291	
BIS/TO			
GL26			

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L1	LD 12UH BEI 0,62A 1,1 OHM CHOKE JAHRE 74.11-12ROK	LD 026.3259	
MP2	FP INDIREKT STECKERL.36P. PIN CONNECTOR BERG 75160-102-36	FP 242.3600	
Q1	EQ 6,000 MHZ CL30PF HC43U CRYSTAL 6,000MHZ	EQ 302.7186	
R1	RL 0-WIDERSTAND DIN 0204 0-OHM RESISTOR DRALORIC 0MA 0204	RL 069.0000	
R2	RF 0,5 W 71,15 OHM +-1% RESISTOR RESISTA SK4/71,15OHM1%	037.5564	
R3	RL 0-WIDERSTAND DIN 0204 0-OHM RESISTOR DRALORIC 0MA 0204	RL 069.0000	
R4	RF 0,5 W 61,11OHM +-1% RESISTOR RESISTA SK4/61,11OHM1%	037.5558	
R5	RL 0,35W493 OHM+-0,1%TK25 RESISTOR	RL 083.8556	
R6	RL 0,35W493 OHM+-0,1%TK25 RESISTOR	RL 083.8556	
R7	RF 0,5 W 61,11OHM +-1% RESISTOR RESISTA SK4/61,11OHM1%	037.5558	
R8	RL 0,5W 25,5 OHM+-1%TK50 RESISTOR	084.7776	
R9	RL 0,5W 25,5 OHM+-1%TK50 RESISTOR	084.7776	
R10	RL 0,35W 10,0 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/100HM-F-D	RL 082.8852	
R11	RL 0,35W 2,49KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/2,49K-F-D	RL 083.0890	
R12	RL 0,35W 51,1 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/51,1OHM-F-D	RL 082.9536	
R13	RF 0,5W 550 OHM +-1% RESISTA SK4/550OHM1%	028.8312	
R15	RL 0,35W4,75MOHM+-1%TK50 METALFILMRESISTOR RESISTA MK2 4,75MOHM 1% TK50	RL 099.8250	
R16	RL 0,35W4,75MOHM+-1%TK50 METALFILMRESISTOR RESISTA MK2 4,75MOHM 1% TK50	RL 099.8250	
R17	RF 0,5W 5,6 OHM +-1% RESISTOR RESISTA SK4/5,6OHM1%	028.7074	

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Kennzeichen Component No.	Benennung/Beschreibung Designation	Sachnummer Stock No.	enthalten in contained in
R18	RL 0,35W 1MOHM+-1%TK50 RESISTOR DRALORIC SMA0207/1M-F-D	RL 082.7862	
R19	RL 0,35W 47,5 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/47,5OHM-F-D	RL 082.9507	
R20	RL 0,35W 18,2KOHM+-1%TK50 RESISTOR DRALORIC SMA/207/18,2K-F-C	RL 083.1480	
R21	RL 0,35W 2,74KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/2,74K-F-D	RL 083.0926	
R22	RL 0,35W 8,25KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/8,25K-F-D	RL 083.1239	
R23	RL 0,35W 47,5 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/47,5OHM-F-D	RL 082.9507	
R24	RL 0,35W 82,5 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/82,5OHM-F-D	RL 082.9707	
R25	RL 0,35W 22,1KOHM+-1%TK50 RESISTOR DRALORIC SMA/207/22,1K-F-C	RL 083.1545	
R26	RL 0,35W 6,19KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/6,19K-F-C	RL 082.2283	
R27	RL 0,35W 2,00KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/2,00K-F-D	RL 083.0826	
R28	RL 0,35W 365 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/365OHM-F-D	RL 083.0290	
R29	RF 0,25 W 3,32KOHM+-2% RESISTOR DRALORIC LCA0207/2X3,32K	073.0552	
R30	RL 0,35W 1,50KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/1,50K-F-D	RL 083.0732	
R31	RL 0,35W 100 OHM+-1%TK50 DEPOS.-CARBON RESISTOR DRALORIC SMA0207/100/HM-F-D	RL 082.6543	
R32	RF 0,25W 5,6 OHM +-5% RESISTOR DRALORIC LCA0207/+5%5,6	RF 074.0056	
R33	RF 0,25W 5,6 OHM +-5% RESISTOR DRALORIC LCA0207/+5%5,6	RF 074.0056	
R34	RL 0,35W 10,0 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/100HM-F-D	RL 082.8852	
R35	RL 0,35W 100 OHM+-1%TK50 DEPOS.-CARBON RESISTOR DRALORIC SMA0207/100/HM-F-D	RL 082.6543	
R36	RL 0,35W 47,5KOHM+-1%TK50 RESISTOR DRALORIC SMA/207/47,5K-F-C	RL 083.1800	

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R37	RL 0,35W 22,1KOHM+-1%TK50 RESISTOR DRALORIC SMA/207/22,1K-F-C	RL 083.1545	
R38	RL 0,35W 27,4KOHM+-1%TK50 RESISTOR DRALORIC SMA 0207/27,4K-F-C	RL 082.2583	
R39	RL 0,35W 1MOHM+-1%TK50 RESISTOR DRALORIC SMA0207/1M-F-D	RL 082.7862	
R40	RL 0,35W 475 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/475OHM-F-D	RL 083.0390	
R41	RL 0,35W 2,21KOHM+-1%TK50 RESISTOR DRALORIC SMA 0207/2,21K-F-C	RL 082.2477	
R42	RL 0,35W 475 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/475OHM-F-D	RL 083.0390	
R43	RL 0,35W 10,0 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/100OHM-F-D	RL 082.8852	
R44	RL 0,35W 825 OHM+-1%TK50 RESISTOR DRALORIC SMA 0207/825OHM-F-C	RL 082.2502	
R45	RL 0,35W 1KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/1K-F-C	RL 082.2160	
R46	RL 0,35W 1,50KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/1,50K-F-D	RL 083.0732	
R47	RL 0,35W 1,50KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/1,50K-F-D	RL 083.0732	
R48	RL 0,35W 1KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/1K-F-C	RL 082.2160	
R49	RD 1,2W68MIOHM+-3% WIRE-WOUND RESISTOR SAGE 1000S/0,0680HM/3%	RD 451.4920	
R50	RF 0,25W 1 OHM +-5% RESISTOR DRALORIC LCA0207/+5%1	RF 073.9872	
BIS/TO			
R55			
R56	RL 0,35W 150 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/150OHM-F-D	RL 082.9942	
R57	RL 0,35W 8,25KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/8,25K-F-D	RL 083.1239	
R58	RS 0,5W 2KOHM+-20%KURVE1 DEPOS.-CARBON POTENTIOMET BOURNS 3329H-1-202	RS 069.8046	
R58	RS 0,5W 2KOHM+-20%KURVE1 DEPOS.-CARBON POTENTIOMET BOURNS 3329H-1-202	RS 069.8046	



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R59	RL 0,35W 221 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/2210HM-F-D	RL 083.0084	
R63	RL 0,35W 22,1KOHM+-1%TK50 RESISTOR DRALORIC SMA/207/22,1K-F-C	RL 083.1545	
R64	RL 0,35W 221 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/2210HM-F-D	RL 083.0084	
R65	RL 0,35W 3,32KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/3,32K-F-D	RL 083.0990	
BIS/TO R73 R74	RL 0,35W 2,21KOHM+-1%TK50 RESISTOR DRALORIC SMA 0207/2,21K-F-C	RL 082.2477	
R201	RL 0,5W 47,5 OHM+-1%TK50 RESISTOR SFERNICE RCMS1 47 OHM 1% K3	067.5510	
R202	RL 0,5W 48,7 OHM+-1%TK50 RESISTOR VALVO MR54C 48,7 OHM1%T50	084.7960	
R203	RL 0,35W 47,5 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/47,5OHM-F-D	RL 082.9507	
R204	RL 0,35W 48,73 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/48,7OHM-F-D	RL 082.9513	
R205	RL 0,35W 10,0 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/100HM-F-D	RL 082.8852	
R206	RL 0,35W 27,4KOHM+-1%TK50 RESISTOR DRALORIC SMA 0207/27,4K-F-C	RL 082.2583	
R207	RL 0,35W 27,4KOHM+-1%TK50 RESISTOR DRALORIC SMA 0207/27,4K-F-C	RL 082.2583	
RS1	SN 5V 2XU AU GEDR.SCH. RELAY FUJITSU FBR221D005-P	336.4744	
RS2	SN 5V 2XU AU GEDR.SCH. RELAY FUJITSU FBR221D005-P	336.4744	
RS3	SN 5V 2XU AU GEDR.SCH. RELAY FUJITSU FBR221D005-P	336.4744	
RS4	SN 5V 1XU AU GEDR.SCH. RELAY OMRON G 2 E ,5V	336.4738	
RS5	SN 5V 2XU AU GEDR.SCH. RELAY FUJITSU FBR221D005-P	336.4744	
ST6	FP INDIREKT.STECKERL.36P. PIN CONNECTOR BERG 75160-102-36	FP 242.3600	

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ST7	FP INDIREKT. STECKERL. 36P. PIN CONNECTOR BERG 75160-102-36	FP 242.3600	
BIS/TO ST9 ST10	FP INDIREKT. STECKERL. 36P. PIN CONNECTOR BERG 75160-102-36	FP 242.3600	
ST11	FP INDIREKT. STECKERL. 36P. PIN CONNECTOR BERG 75160-102-36	FP 242.3600	
ST12	FP INDIREKT. STECKERL. 36P. PIN CONNECTOR BERG 75160-102-36	FP 242.3600	
ST13	FP INDIREKT. STECKERL. 36P. PIN CONNECTOR BERG 75160-102-36	FP 242.3600	
ST14	FP WINKELSTECKERLEIST. 36P ANGLE PIN CONNECTOR BERG 75168-113-36	FP 243.3578	
ST15	FP WINKELSTECKERLEIST. 36P ANGLE PIN CONNECTOR BERG 75168-113-36	FP 243.3578	
ST16	FP INDIREKT. STECKERL. 36P. PIN CONNECTOR BERG 75160-102-36	FP 242.3600	
ST19	FV STECKSTIFT GR. 2,8 PIN 112619700 3775A/0,5MS-S18	FV 495.9462	
BIS/TO ST27 ST31	FP INDIREKT. STECKERL. 36P. PIN CONNECTOR BERG 75160-102-36	FP 242.3600	
ST32	FP INDIREKT. STECKERL. 36P. PIN CONNECTOR BERG 75160-102-36	FP 242.3600	
ST33	FP INDIREKT. STECKERL. 36P. PIN CONNECTOR BERG 75160-102-36	FP 242.3600	
ST34	FP INDIREKT. STECKERL. 36P. PIN CONNECTOR BERG 75160-102-36	FP 242.3600	
ST5A	FP INDIREKT. STECKERL. 36P. PIN CONNECTOR BERG 75160-102-36	FP 242.3600	
ST5B	FP INDIREKT. STECKERL. 36P. PIN CONNECTOR BERG 75160-102-36	FP 242.3600	
T1	AK 2N3209 PNP 20V 200MA TRANSISTOR SGS 2N3209	AK 010.3590	
T3	AM U440 NKAN-DUAL-FET FET SILICONIX U440	AM 336.4696	

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T4	AK 2N3209 PNP 20V 200MA TRANSISTOR SGS 2N3209	AK 010.3590	
T7	AK 2N3209 PNP 20V 200MA TRANSISTOR SGS 2N3209	AK 010.3590	
T8	AK BCY59IX NPN 45V 200MA TRANSISTOR SIEMENS BCY59IX	AK 010.5163	
T9	AK BCY59IX NPN 45V 200MA TRANSISTOR SIEMENS BCY59IX	AK 010.5163	
T10	AK 2N2907A PNP 60V 600MA TRANSISTOR VALVO 2N2907A	AK 010.3583	
T11	AK 2N3209 PNP 20V 200MA TRANSISTOR SGS 2N3209	AK 010.3590	
T12	AK 2N2369A NPN 40V 200MA TRANSISTOR VALVO 2N2369A	AK 010.4680	
T13	AL BD140 PNP 80V 1A0 TRANSISTOR VALVO BD140	AL 335.9642	
T14	AL BDX77 NPN 80V 8A0 TRANSISTOR VALVO BDX77	AL 300.6318	
T15	AK BCY59IX NPN 45V 200MA TRANSISTOR SIEMENS BCY59IX	AK 010.5163	
T16	AL BD439 NPN 60V 4A0 TRANSISTOR AEG-TELEF. BD439	AL 010.1645	

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B1	BL 11C44DC PHASE/FREQ.DET IC PHASE FREQU.DET.11C44D FAIRCHILD 11C44PC	BL 300.9481	
B2	BO LF351N IFET-INPUT-OPA IC INPUT-OP.LF351N NSC LF351N	BO 301.6105	
B4	BL SP8647BDG10:1DIVID UHF DIVIDER PLESSEY SP8647BDG	BL 300.6747	
B5	BL SN74LS73N 2/JK-FLIPFL. IC FLIP-FLOP SN74LS73N TEXAS SN74LS73N	BL 266.7928	
B6	BL MC12014L CONTR.LOGIC CONTROL LOGIC MOTOROLA MC12014L	BL 300.6753	
B7	BL SP8647BDG10:1DIVID UHF DIVIDER PLESSEY SP8647BDG	BL 300.6747	
B8	BL SN74LS00N 4/2INP.NAND IC NAND GATE SN74LS00N TEXAS SN74LS00N	BL 266.4641	
B9	BL SN74LS191N ZAEHLER IC COUNTER TEXAS SN74LS191N	BL 250.2721	
B10	BL SN74LS191N ZAEHLER IC COUNTER TEXAS SN74LS191N	BL 250.2721	
B11	BL SN74LS191N ZAEHLER IC COUNTER TEXAS SN74LS191N	BL 250.2721	
B12	BL SN74LS191N ZAEHLER IC COUNTER TEXAS SN74LS191N	BL 250.2721	
B13	BL SN74LS273N 8BIT-D-REG. 8BIT-D-REGISTER TEXAS SN74LS273N	BL 214.8998	
B14	BL SN74LS273N 8BIT-D-REG. 8BIT-D-REGISTER TEXAS SN74LS273N	BL 214.8998	
B15	BL SN74LS390N 2XDEC.COUNT IC DECADE COUNTER SN74LS3 TEXAS SN74LS390N	BL 300.6760	
B16	BL SN74LS290N DEC.COUNTER IC DECADE COUNTER SN74LS2 TEXAS SN74LS290N	BL 300.6447	
B17	BL SN74LS04N 6/INVERTER HEXINVERTER TEXAS SN74LS04N	BL 266.2010	
B18	BO CA3146E NPN-TR.ARRAY IC TRANSISTOR ARRAY CA314 RCA CA3146E	BO 249.6633	
B19	BO LM124J 4XOPER.AMPLIF. IC OPERATION AMPLIFIER LM NSC LM124J	BO 300.6353	
B20	BO MA741SCM OP-AMP IC OPERATION AMPLIFIER	BO 239.0655	

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B21	SILICON-GE SG741SC EO CA3054 TRANSISTORARRAY IC TRANSISTOR ARRAY CA305 RCA CA3054	BO 009.1474	
B22	BJ AD7531 12B.D/A-CONV D/A-CONVERTER ANALOG-DEV AD7531KN	BJ 300.6324	
B23	BL SN74LS273N 8BIT-D-REG. 8BIT-D-REGISTER TEXAS SN74LS273N	BL 214.8998	
B24	BL SN74LS273N 8BIT-D-REG. 8BIT-D-REGISTER TEXAS SN74LS273N	BL 214.8998	
B25	BJ TL604CP 2X ANALOGSCH ANALOG SWITCH TEXAS TL604CP	BJ 300.6199	
B26	BO LM124J 4XOPER.AMPLIF. IC OPERATION AMPLIFIER LM NSC LM124J	BO 300.6353	
B27	BJ TL604CP 2X ANALOGSCH ANALOG SWITCH TEXAS TL604CP	BJ 300.6199	
BU4	FP KURZSCHL.BUCHSE OFFEN SHORTING PLUG BERG 76264-101	FP 342.1895	
BU5	FP KURZSCHL.BUCHSE OFFEN SHORTING PLUG BERG 76264-101	FP 342.1895	
BU8	FP KURZSCHL.BUCHSE OFFEN SHORTING PLUG BERG 76264-101	FP 342.1895	
C3	CK 100NF+-5%63V5RM MKT CAPACITOR WIMA MKS2/63/0,1UF/5%	CK 099.2930	
C4	CK 1UF+-10%50V5RM MKT CAPACITOR WIMA MKS2/50/1UF/10%	CK 099.2998	
C6	CK 10NF+-5%63V5RM MKT CAPACITOR WIMA FKS 2/100/0,01UF/5%	CK 099.2869	
C7	CC 4,7UF+-20%50VK6000VIEL CAPACITOR ERIE 8157-050-Z5U-4,7M-M	060.0113	
C9	CK 330NF+-5%63V5RM MKT CAPACITOR WIMA MKS2/63/0,33UF/5%	CK 099.2969	
C14	CC 10NF-20+50%7X8R6000 CAPACITOR VALVO 2222 63051 64051103	CC 087.7525	
C15	CC 10NF-20+50%7X8R6000 CAPACITOR VALVO 2222 63051 64051103	CC 087.7525	
C19	CK 150NF+-5%63V5RM MKT CAPACITOR WIMA MKS2/63/0,15UF/5%	CK 099.2946	
C20	CK 100NF+-5%63V5RM MKT	CK 099.2930	

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C22	CAPACITOR WIMA MKS2/63/0,1UF/5% CE 100UF-10+100% 6V 9X13	022.7514	
C23	ELECTROLYTIC CAPACITOR SIEMENS B41316-A2107-Z CC 10NF-20+50%7X8R6000	CC 087.7525	
C24	CAPACITOR VALVO 2222 63051 64051103 CC 10NF-20+50%7X8R6000	CC 087.7525	
C25	CAPACITOR VALVO 2222 63051 64051103 CK 680NF+-10%50VRM MKT	CK 099.2981	
C26	CAPACITOR WIMA MKS2/50/0,68UF/10% CC 10NF-20+50%7X8R6000	CC 087.7525	
C27	CAPACITOR VALVO 2222 63051 64051103 CC 120PF+-2%5X6N750	CC 087.6912	
C29	CAPACITOR VALVO 2222 678 58121 CC 10NF-20+50%7X8R6000	CC 087.7525	
C30	CAPACITOR VALVO 2222 63051 64051103 CC 10NF-20+50%7X8R6000	CC 087.7525	
C33	CAPACITOR VALVO 2222 63051 64051103 CK 150NF+-5%63V5RM MKT	CK 099.2946	
C34	CAPACITOR WIMA MKS2/63/0,15UF/5% CC 10NF-20+50%7X8R6000	CC 087.7525	
C35	CAPACITOR VALVO 2222 63051 64051103 CC 1NF+-10%63V K2000	CC 022.0784	
C36	CERAMIC CAPACITOR VALVO 2222 63051 102 CC 10NF-20+50%7X8R6000	CC 087.7525	
C37	CAPACITOR VALVO 2222 63051 64051103 CE 100UF-10+50% 25V 13X13	CE 208.4007	
C38	ELECTROLYTIC CAPACITOR ROEDERST ELKOEK100/25 CE 100UF-10+50% 25V 13X13	CE 208.4007	
C39	ELECTROLYTIC CAPACITOR ROEDERST ELKOEK100/25 CC 10NF-20+50%7X8R6000	CC 087.7525	
C40	CAPACITOR VALVO 2222 63051 64051103 CC 10NF-20+50%7X8R6000	CC 087.7525	
C41	CAPACITOR VALVO 2222 63051 64051103 CK 1,8NF+-1%63V6,3X11 KP	CK 283.1699	
C42	PLASTIC-FOIL CAPACITOR SIEMENS B33531-A5182-F CK 3,3NF+-1%63V6,3QUX11KP	CK 340.9030	
C43	CAPACITOR SIEMENS B33531-A5332-F CK 3,3NF+-1%63V6,3QUX11KP	CK 340.9030	

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C44	CAPACITOR SIEMENS B33531-A5332-F CK 3,3NF+-1%63V6,3QUX11KP	CK 340.9030	
C45	CAPACITOR SIEMENS B33531-A5332-F CK 2,2NF+-1%63V 6,3QUAD.	CK 099.1304	
C46	CAPACITOR SIEMENS B33531-A5222-F CC 10NF-20+50%7X8R6000	CC 087.7525	
	VALVO 2222 63051 64051103		
BIS/TO			
C49			
C50	CK 100NF+-5%63V5RM MKT CAPACITOR	CK 099.2930	
	WIMA MKS/2/63/0, 1UF/5%		
C51	CC 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
	VALVO 2222 63051 64051103		
C52	CC 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
	VALVO 2222 63051 64051103		
C53	CC 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
	VALVO 2222 63051 64051103		
C54	CC 1NF+-10%63V K2000 CERAMIC CAPACITOR	CC 022.0784	
	VALVO 2222 63051 102		
C56	CE 470UF-10+50% 25V 15X25 ELECTROLYTIC CAPACITOR	CE 087.0608	
	ROEDERST ELKO EK470/25		
C57	CC 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
	VALVO 2222 63051 64051103		
C58	CK 100NF+-5%63V5RM MKT CAPACITOR	CK 099.2930	
	WIMA MKS/2/63/0, 1UF/5%		
C59	CE 47UF -10+100%16V 9X13 ELECTROLYTIC CAPACITOR	022.7543	
	ROEDERST ELKO EK47/16		
C60	CC 82PF+-2%6X7NPO CAPACITOR	CC 087.6535	
	VALVO 2222 678 10829		
C61	CC 10PF+-0,25PF3X4NPO CAPACITOR	CC 087.6429	
	VALVO 2222 678 09109		
C62	CC 100PF+-2%6X9NPO CAPACITOR	CC 087.6541	
	VALVO 2222 678 10101		
C63	CC 120PF+-2%6X9NPO CAPACITOR	CC 087.6558	
	VALVO 2222 678 10121		
C64	CC 33PF+-2%4X5NPO CAPACITOR	CC 087.6487	
	VALVO 2222 678 10339		
C65	CC 82PF+-2%6X7NPO CAPACITOR	CC 087.6535	

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C66	VALVO 2222 678 10829 CC 100PF+-2%6X9NPO CAPACITOR	CC 087.6541	
C67	VALVO 2222 678 10101 CC 10PF+-0,25PF3X4NPO CAPACITOR	CC 087.6429	
C68	VALVO 2222 678 09109 CC 33PF+-2%4X5NPO CAPACITOR	CC 087.6487	
C69	VALVO 2222 678 10339 CC 15PF+-2%3X4NPO CAPACITOR	CC 087.6441	
C70	VALVO 2222 678 10159 CC 15PF+-2%3X4NPO CAPACITOR	CC 087.6441	
C71	VALVO 2222 678 10159 CC 82PF+-2%6X7NPO CAPACITOR	CC 087.6535	
C72	VALVO 2222 678 10829 CC 100PF+-2%6X9NPO CAPACITOR	CC 087.6541	
C73	VALVO 2222 678 10101 CC 68PF+-2%6X7NPO CAPACITOR	CC 087.6529	
C74	VALVO 2222 678 10689 CE 47UF -10+100%16V 9X13 ELECTROLYTIC CAPACITOR	022.7543	
C75	ROEDERST ELKO EK47/16 CE 47UF -10+100%16V 9X13 ELECTROLYTIC CAPACITOR	022.7543	
C76	ROEDERST ELKO EK47/16 CC 330NF+-10% 50V8K1200LR CAPACITOR	CC 092.0954	
C77	AEROVOX CKR06BX334KLEVELR CK 47NF+-5%63V5RM MKT CAPACITOR	CK 099.2917	
C78	WIMA MKS2/63/0,047UF/5% CC 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
C79	VALVO 2222 63051 64051103 CC 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
C80	VALVO 2222 63051 64051103 CC 4,7PF+-0,25PF3X4NPO CAPACITOR	CC 087.6387	
C81	VALVO 2222 678 09478 CE 220UF-10+50% 25V 13X20 ELECTROLYTIC CAPACITOR	CE 087.0595	
C82	ROEDERST ELKO EK220/25 CC 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
C83	VALVO 2222 63051 64051103 CC 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
C84	VALVO 2222 63051 64051103 CC 1NF+-10%63V K2000 CERAMIC CAPACITOR	CC 022.0784	

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Kennzeichen Component No.	Benennung/Beschreibung Designation	Sachnummer Stock No.	enthalten in contained in
C85	VALVO 2222 63051 102 CE 220UF-10+50% 25V 13X20 ELECTROLYTIC CAPACITOR	CE 087.0595	
C86	ROEDERST ELKO EK220/25 CC 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
C88	VALVO 2222 63051 64051103 CE 100UF-10+50% 25V 13X13 ELECTROLYTIC CAPACITOR	CE 208.4007	
C89	ROEDERST ELKOEK100/25 CE 100UF-10+50% 25V 13X13 ELECTROLYTIC CAPACITOR	CE 208.4007	
C90	ROEDERST ELKOEK100/25 CC 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
BIS/TO C93 C99	VALVO 2222 63051 64051103 CC 68PF+-2%6X7NPO CAPACITOR	CC 087.6529	
C100	VALVO 2222 678 10689 CC 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
C101	VALVO 2222 63051 64051103 CE 100UF-10+100%16V 11X13 ELECTROLYTIC CAPACITOR	022.7550	
C102	SIEMENS B41316-A4107-Z CC 1NF+-10%63V K2000 CERAMIC CAPACITOR	CC 022.0784	
C103	VALVO 2222 63051 102 CE 220UF-10+50% 6V 11X13 ELEKTROLYTIC CAPACITOR	CE 022.7520	
C104	ROEDERST EK 00 CB 322 B CC 1NF+-10%63V K2000 CERAMIC CAPACITOR	CC 022.0784	
BIS/TO C109 C110	VALVO 2222 63051 102 CE 470UF-10+50% 6V 13X17 ELECTROLYTIC CAPACITOR	CE 022.7537	
C111	SIEMENS B41316-A2477-Z CE 100UF-10+100%16V 11X13 ELECTROLYTIC CAPACITOR	022.7550	
C112	SIEMENS B41316-A4107-Z CC 1NF+-10%63V K2000 CERAMIC CAPACITOR	CC 022.0784	
C113	VALVO 2222 63051 102 CC 1NF+-10%63V K2000 CERAMIC CAPACITOR	CC 022.0784	
C114	VALVO 2222 63051 102 CC 1NF+-10%63V K2000 CERAMIC CAPACITOR	CC 022.0784	
GL1	VALVO 2222 63051 102 AD 1N4448 75V 0,15A UDI DIODE	AD 012.0700	
	VALVO 1N4448		

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GL3	AD 1N4448 75V 0,15A UDI DIODE VALVO 1N4448	AD 012.0700	
GL4	AD 1N4448 75V 0,15A UDI DIODE VALVO 1N4448	AD 012.0700	
GL5	AE BZX79/C8V2 0,5W Z-DI ZENER DIODE VALVO BZX79/C8V2	AE 012.2490	
GL6	AE 5082-2800 SCHOTTKYDI DIODE HEWLETT-P. 5082-2800	AE 012.9066	
GL7	AE 5082-2800 SCHOTTKYDI DIODE HEWLETT-P. 5082-2800	AE 012.9066	
GL8	AD 1N4448 75V 0,15A UDI DIODE VALVO 1N4448	AD 012.0700	
BIS/TO GL12 GL13	AE BZX79/C10 0,5W Z-DI ZENER DIODE VALVO BZX79/C10	AE 012.2510	
GL14	AF HLMP1301 LED RT RD3 LED HEWLETT-P. 5082-4684	AF 257.4736	
GL15	AD 1N4448 75V 0,15A UDI DIODE VALVO 1N4448	AD 012.0700	
GL20	AD 1N4448 75V 0,15A UDI DIODE VALVO 1N4448	AD 012.0700	
GL100	AE BZX79/B5V6 0,5W Z-DI ZENER DIODE VALVO BZX79/B5V6	AE 012.5254	
GL101	AE BB909B 33/ 3PF CDI TUNING DIODE VALVO BB909B	AE 092.9600	
BIS/TO GL104 GL105	AE BZX79/B5V6 0,5W Z-DI ZENER DIODE VALVO BZX79/B5V6	AE 012.5254	
GL106	AD 1N4448 75V 0,15A UDI DIODE VALVO 1N4448	AD 012.0700	
GL107	AD 1N4448 75V 0,15A UDI DIODE VALVO 1N4448	AD 012.0700	
GL108	AE BB909B 33/ 3PF CDI TUNING DIODE VALVO BB909B	AE 092.9600	
GL109	AE BB909B 33/ 3PF CDI TUNING DIODE VALVO BB909B	AE 092.9600	
K1	KABEL	336.4250	

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L2	LD 100 UH10%8,000HMO,084A CHOKE DELEVAN DROSSEL1025-68	LD 067.3101	
L3	LD 100 UH10%8,000HMO,084A CHOKE DELEVAN DROSSEL1025-68	LD 067.3101	
L6	LD 100 UH10%8,000HMO,084A CHOKE DELEVAN DROSSEL1025-68	LD 067.3101	
L8	LD 6,8UH5% 2,00HM 0,185A MOLDED COIL DELEVAN 1025-40 +-5%	336.4209	
L9	LD 6,8UH5% 2,00HM 0,185A MOLDED COIL DELEVAN 1025-40 +-5%	336.4209	
L10	LD 6,8UH5% 2,00HM 0,185A MOLDED COIL DELEVAN 1025-40 +-5%	336.4209	
L11	LD 6,8UH5% 2,00HM 0,185A MOLDED COIL DELEVAN 1025-40 +-5%	336.4209	
L12	LD 150UH5% 150HM 0,068A MOLDED COIL DELEVAN 1025-72 +-5%	336.4309	
L13	LD 150UH5% 150HM 0,068A MOLDED COIL DELEVAN 1025-72 +-5%	336.4309	
L14	LD 150UH5% 150HM 0,068A MOLDED COIL DELEVAN 1025-72 +-5%	336.4309	
L15	LD 120UH5% 13 OHM 0,073A MOLDED COIL DELEVAN 1025-70 +-5%	336.4196	
L101	LD 10,0UH10%3,300HMO,144A CHOKE DELEVAN DROSSEL1025-44	LD 026.4184	
L102	SPULE / COIL	392.7800	
L103	SPULE / COIL	392.7797	
L104	LD 1,00UH10%1,000HMO,390A CHOKE DELEVAN 1025-20	LD 067.2863	
L105	LD 1,00UH10%1,000HMO,390A CHOKE DELEVAN 1025-20	LD 067.2863	
L106	LD 2,20UH10%0,400HMO,415A CHOKE DELEVAN DROSSEL1025-28	LD 067.2905	
MP1	VL WIRE-WRAP PIN BERG NR. 75 403-003	VL 088.4542	
MP2	VL WIRE-WRAP PIN BERG NR. 75 403-003	VL 088.4542	
MP3	VL WIRE-WRAP PIN BERG NR. 75 403-003	VL 088.4542	
MP4	FP INDIREKT-STECKERL.36P. PIN CONNECTOR	FP 242.3600	
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MP5	BERG 75160-102-36 FP INDIREKT. STECKERL. 36P. PIN CONNECTOR	FP 242.3600	
MP6	BERG 75160-102-36 VL WIRE-WRAP PIN	VL 088.4542	
MP7	BERG NR. 75 403-003 VL WIRE-WRAP PIN	VL 088.4542	
MP8	BERG NR. 75 403-003 FP INDIREKT. STECKERL. 36P. PIN CONNECTOR	FP 242.3600	
MP9	BERG 75160-102-36 VL WIRE-WRAP PIN	VL 088.4542	
R1	BERG NR. 75 403-003 RL 0,35W 332 OHM+-1%TK50 RESISTOR	RL 083.0255	
R2	DRALORIC SMA0207/3320HM-F-D RL 0,35W 9,09KOHM+-1%TK50 RESISTOR	RL 082.2177	
R3	DRALORIC SMA0207/9,09K-F-C RL 0,35W 1,02KOHM+-1%TK50 RESISTOR	RL 083.0610	
R4	DRALORIC SMA0207/1,02K-F-D RL 0,35W 10,0KOHM+-1%TK50 RESISTOR	RL 083.1297	
R5	DRALORIC SMA0207/10K-F-D RL 0,35W 3,32MOHM+-1%TK50 METALFILMRESISTOR	RL 099.8215	
R7	RESISTA MK2 3,32MOHM 1% TK50 RL 0,35W 1MOHM+-1%TK50 RESISTOR	RL 082.7862	
R8	DRALORIC SMA0207/1M-F-D RL 0,35W 2,21KOHM+-1%TK50 RESISTOR	RL 082.2477	
R9	DRALORIC SMA 0207/2,21K-F-C RL 0,35W 22,1KOHM+-1%TK50 RESISTOR	RL 083.1545	
R10	DRALORIC SMA/207/22,1K-F-C RL 0,35W 392 OHM+-1%TK50 RESISTOR	RL 082.2183	
R11	DRALORIC SMA0207/392K-F-C RL 0,35W 1KOHM+-1%TK50 RESISTOR	RL 082.2160	
R12	DRALORIC SMA0207/1K-F-C RL 0,35W 392 OHM+-1%TK50 RESISTOR	RL 082.2183	
R13	DRALORIC SMA0207/392K-F-C RL 0,35W 1,50KOHM+-1%TK50 RESISTOR	RL 083.0732	
R14	DRALORIC SMA0207/1,50K-F-D RL 0,35W 1KOHM+-1%TK50 RESISTOR	RL 082.2160	
R17	DRALORIC SMA0207/1K-F-C RL 0,35W 1,50KOHM+-1%TK50 RESISTOR	RL 083.0732	
R18	DRALORIC SMA0207/1,50K-F-D RL 0,35W 1,50KOHM+-1%TK50	RL 083.0732	



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R19	RESISTOR DRALORIC SMA0207/1,50K-F-D RL 0,25W 1,21KOHM+-1%TK50	RL 083.0655	
R20	RESISTOR DRALORIC SMA0207/1,21K-F-D RL 0,35W 681 OHM+-1%TK50	RL 083.0490	
R21	RESISTOR DRALORIC SMA0207/681OHM-F-D RL 0,35W 10,0 OHM+-1%TK50	RL 082.8852	
R22	RESISTOR DRALORIC SMA0207/100OHM-F-D RL 0,35W 392 OHM+-1%TK50	RL 082.2183	
R23	RESISTOR DRALORIC SMA0207/392K-F-C RL 0,35W 100 OHM+-1%TK50	RL 082.6543	
R24	DEPOS.-CARBON RESISTOR DRALORIC SMA0207/100/HM-F-D RL 0,35W 150 OHM+-1%TK50	RL 082.9942	
R25	RESISTOR DRALORIC SMA0207/150OHM-F-D RL 0,35W 1KOHM+-1%TK50	RL 082.2160	
R26	RESISTOR DRALORIC SMA0207/1K-F-C RL 0,35W 100KOHM+-1%TK50	RL 082.1764	
R27	RESISTOR DRALORIC SMA0207/100K-F-C RL 0,35W 1,1KOHM+-1%TK50	RL 082.2483	
R28	RESISTOR DRALORIC SMA 0207/1,10K-F-C RL 0,35W 2,21KOHM+-1%TK50	RL 082.2477	
R29	RESISTOR DRALORIC SMA 0207/2,21K-F-C RL 0,35W 274 OHM+-1%TK50	RL 083.0178	
R30	RESISTOR DRALORIC SMA0207/274OHM-F-D RL 0,35W 1KOHM+-1%TK50	RL 082.2160	
R31	RESISTOR DRALORIC SMA0207/1K-F-C RL 0,35W 1KOHM+-1%TK50	RL 082.2160	
R32	RESISTOR DRALORIC SMA0207/1K-F-C RL 0,35W 27,4KOHM+-1%TK50	RL 082.2583	
R33	RESISTOR DRALORIC SMA 0207/27,4K-F-C RL 0,35W 332 OHM+-1%TK50	RL 083.0255	
R34	RESISTOR DRALORIC SMA0207/332OHM-F-D RS 0,5W 500 OHM+-20%KURV1	RS 069.8023	
R35	DEPOS.-CARBON POTENTIOMET BOURNS 3329H-1-501 RL 0,35W 1,82KOHM+-1%TK50	RL 082.2277	
R36	RESISTOR DRALORIC SMA0207/1,82K-F-C RL 0,35W 4,75KOHM+-1%TK50	RL 083.1097	
R37	RESISTOR DRALORIC SMA0207/4,75K-F-D RL 0,35W 4,75KOHM+-1%TK50	RL 083.1097	

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R38	RESISTOR DRALORIC SMA0207/4,75K-F-D RL 0,35W 221 OHM+-1%TK50	RL 083.0084	
R39	RESISTOR DRALORIC SMA0207/2210HM-F-D RL 0,35W 221 OHM+-1%TK50	RL 083.0084	
R40	RESISTOR DRALORIC SMA0207/2210HM-F-D RL 0,35W 1,50KOHM+-1%TK50	RL 083.0732	
R41	RESISTOR DRALORIC SMA0207/1,50K-F-D RL 0,35W 332 OHM+-1%TK50	RL 083.0255	
R42	RESISTOR DRALORIC SMA0207/3320HM-F-D RL 0,35W 6,65KOHM+-1%TK50	RL 082.2254	
R43	RESISTOR DRALORIC SMA0207/6,65K-F-C RL 0,35W 2,74KOHM+-1%TK50	RL 083.0926	
R44	RESISTOR DRALORIC SMA0207/2,74K-F-D RL 0,25W 16,9KOHM+-1%TK50	RL 083.1451	
R45	RESISTOR DRALORIC SMA/207/16,9K-F-C RL 0,35W 41,2KOHM+-1%TK50	RL 082.2319	
R46	RESISTOR DRALORIC SMA0207/41,2K-F-C RL 0,35W 12,1KOHM+-1%TK50	RL 083.1351	
R47	RESISTOR DRALORIC SMA0207/12,1K-F-D RL 0,35W 100KOHM+-1%TK50	RL 082.1764	
R48	RESISTOR DRALORIC SMA0207/100K-F-C RL 0,35W 100KOHM+-1%TK50	RL 082.1764	
R49	RESISTOR DRALORIC SMA0207/100K-F-C RL 0,35W 1KOHM+-1%TK50	RL 082.2160	
R50	RESISTOR DRALORIC SMA0207/1K-F-C RL 0,35W 33,2KOHM+-1%TK50	RL 083.1674	
R51	RESISTOR DRALORIC SMA0207/33,2K-F-C RL 0,35W 4,75KOHM+-1%TK50	RL 083.1097	
R52	RESISTOR DRALORIC SMA0207/4,75K-F-D RL 0,25W 1,21KOHM+-1%TK50	RL 083.0655	
R53	RESISTOR DRALORIC SMA0207/1,21K-F-D RL 0,35W 10,0KOHM+-1%TK50	RL 083.1297	
R54	RESISTOR DRALORIC SMA0207/10K-F-D RL 0,35W 2,87KOHM+-1%TK50	RL 083.0949	
R55	RESISTOR DRALORIC SMA0207/2,87K-F-D RL 0,35W 1KOHM+-1%TK50	RL 082.2160	
R56	RESISTOR DRALORIC SMA0207/1K-F-C RL 0,35W 10,0KOHM+-1%TK50	RL 083.1297	

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R57	RESISTOR DRALORIC SMA0207/10K-F-D RL 0,35W 1KOHM+-1%TK50	RL 082.2160	
R58	RESISTOR DRALORIC SMA0207/1K-F-C RL 0,35W 1KOHM+-1%TK50	RL 082.2160	
R59	RESISTOR DRALORIC SMA0207/1K-F-C RL 0,35W22,10 OHM+-1%TK50	RL 082.9188	
R61	RESISTOR DRALORIC SMA0207/22,10HM-F-D RL 0,35W 100 OHM+-1%TK50	RL 082.6543	
R62	DEPOS.-CARBON RESISTOR DRALORIC SMA0207/100/HM-F-D RL 0,35W 47,5 OHM+-1%TK50	RL 082.9507	
R63	RESISTOR DRALORIC SMA0207/47,50HM-F-D RL 0,35W 4,75KOHM+-1%TK50	RL 083.1097	
R64	RESISTOR DRALORIC SMA0207/4,75K-F-D RL 0,35W 100 OHM+-1%TK50	RL 082.6543	
R67	DEPOS.-CARBON RESISTOR DRALORIC SMA0207/100/HM-F-D RL 0,35W 100 OHM+-1%TK50	RL 082.6543	
R69	DEPOS.-CARBON RESISTOR DRALORIC SMA0207/100/HM-F-D RL 0,35W 10,0KOHM+-1%TK50	RL 083.1297	
R70	RESISTOR DRALORIC SMA0207/10K-F-D RL 0,35W 15,0KOHM+-1%TK50	RL 083.1400	
R71	RESISTOR DRALORIC SMA0207/15K-F-D RS 0,5W 1KOHM+-20%KURVE1 DEPOS.-CARBON POTENTIOMET BOURNS 3329H-1-102	RS 069.8030	
R72	RESISTOR DRALORIC SMA0207/15K-F-D RL 0,35W 15,0KOHM+-1%TK50	RL 083.1400	
R73	RESISTOR DRALORIC SMA0207/15K-F-D RL 0,35W 1KOHM+-1%TK50	RL 082.2160	
R74	RESISTOR DRALORIC SMA0207/1K-F-C RL 0,35W 9,09KOHM+-1%TK50	RL 082.2177	
R75	RESISTOR DRALORIC SMA0207/9,09K-F-C RL 0,35W 10,0 OHM+-1%TK50	RL 082.8852	
R76	RESISTOR DRALORIC SMA0207/100HM-F-D RL 0,35W 10,0 OHM+-1%TK50	RL 082.8852	
R77	RESISTOR DRALORIC SMA0207/100HM-F-D RL 0,35W 2,00KOHM+-1%TK50	RL 083.0826	
R78	RESISTOR DRALORIC SMA0207/2,00K-F-D RL 0,35W 8,25KOHM+-1%TK50	RL 083.1239	
R79	RESISTOR DRALORIC SMA0207/8,25K-F-D RL 0,35W 5,49KOHM+-1%TK50	RL 083.1139	

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R80	RESISTOR DRALORIC SMA0207/5,49K-F-D RL 0,35W 3,65KOHM+-1%TK50	RL 082.2260	
R81	RESISTOR DRALORIC SMA0207/3,65K-F-C RL 0,35W 1,96KOHM+-1%TK50	RL 083.0810	
R82	RESISTOR DRALORIC SMA0207/1,96K-F-D RL 0,35W 3,32KOHM+-1%TK50	RL 083.0990	
R83	RESISTOR DRALORIC SMA0207/3,32K-F-D RL 0,35W 56,2KOHM+-1%TK50	RL 082.2231	
R84	RESISTOR DRALORIC SMA0207/56,2K-F-C RS 0,5W 2KOHM+-20%KURVE1	RS 069.8046	
R85	DEPOS.-CARBON POTENTIOMET BOURNS 3329H-1-202 RL 0,35W 8,06KOHM+-1%TK50	RL 083.1222	
R86	RESISTOR DRALORIC SMA0207/8,06K-F-D RL 0,25W 1,21KOHM+-1%TK50	RL 083.0655	
R87	RESISTOR DRALORIC SMA0207/1,21K-F-D RS 0,5W 2KOHM+-20%KURVE1	RS 069.8046	
R88	DEPOS.-CARBON POTENTIOMET BOURNS 3329H-1-202 RL 0,35W 25,5KOHM+-1%TK50	RL 083.1580	
R89	RESISTOR DRALORIC SMA0207/25,5K-F-C RL 0,35W 9,09KOHM+-1%TK50	RL 082.2177	
R90	RESISTOR DRALORIC SMA0207/9,09K-F-C RL 0,35W 3,48KOHM+-1%TK50	RL 083.1016	
R91	RESISTOR DRALORIC SMA0207/3,48K-F-D RL 0,35W 8,25KOHM+-1%TK50	RL 083.1239	
R92	RESISTOR DRALORIC SMA0207/8,25K-F-D RL 0,35W 8,25KOHM+-1%TK50	RL 083.1239	
R93	RESISTOR DRALORIC SMA0207/8,25K-F-D TRIMMWERT RL 0,35W 13,0KOHM+-1%TK50	RL 083.1368	
R94	RESISTOR DRALORIC SMA0207/13,0K-F-D RL 0,35W 9,09KOHM+-1%TK50	RL 082.2177	
R95	RESISTOR DRALORIC SMA0207/9,09K-F-C RL 0,35W 36,5KOHM+-1%TK50	RL 083.1716	
R96	RESISTOR DRALORIC SMA0207/36,5K-F-C RL 0,35W 1,50KOHM+-1%TK50	RL 083.0732	
R97	RESISTOR DRALORIC SMA0207/1,50K-F-D RL 0,35W 10,0KOHM+-1%TK50	RL 083.1297	
	RESISTOR DRALORIC SMA0207/10K-F-D		

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Kennzeichen Component No.	Benennung/Beschreibung Designation	Sachnummer Stock No.	enthalten in contained in
R99	RS 0,5W 1KOHM+-20%KURVE1 DEPOS.-CARBON POTENTIOMET BOURNS 3329H-1-102	RS 069.8030	
R100	RL 0,35W 2,21KOHM+-1%TK50 RESISTOR DRALORIC SMA 0207/2,21K-F-C	RL 082.2477	
R101	RL 0,35W 562 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/5620HM-F-D	RL 083.0461	
R102	RL 0,35W 825 OHM+-1%TK50 RESISTOR DRALORIC SMA 0207/8250HM-F-C	RL 082.2502	
R103	RL 0,35W 274 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/2740HM-F-D	RL 083.0178	
R104	RL 0,35W 332 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/3320HM-F-D	RL 083.0255	
R105	RL 0,35W 2,21KOHM+-1%TK50 RESISTOR DRALORIC SMA 0207/2,21K-F-C	RL 082.2477	
R106	RL 0,35W 274 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/2740HM-F-D	RL 083.0178	
R107	RL 0,35W 274 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/2740HM-F-D	RL 083.0178	
R108	RL 0,35W 475 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/4750HM-F-D	RL 083.0390	
R109	RL 0,35W 681 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/6810HM-F-D	RL 083.0490	
R110	RS 0,5W10KOHM+-20%KURVE1 DEPOS.-CARBON POTENTIOMET BOURNS 3329H-1-103	RS 069.8069	
R111	RS 0,5W 2KOHM+-20%KURVE1 DEPOS.-CARBON POTENTIOMET BOURNS 3329H-1-202	RS 069.8046	
R112	RS 0,5W 500 OHM+-20%KURV1 DEPOS.-CARBON POTENTIOMET BOURNS 3329H-1-501	RS 069.8023	
R113	RL 0,35W 4,75KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/4,75K-F-D	RL 083.1097	
R114	RL 0,35W 5,62KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/5,62K-F-C	RL 082.2190	
RS1	SN 5V 1XU AU GEDR.SCH. RELAY OMRON G 2 E ,5V	336.4738	
ST15	FP STECKERLEISTE 36POL. PIN CONNECTOR BERG 75160-108-36	FP 283.1847	
ST16	FP STECKERLEISTE 36POL. PIN CONNECTOR	FP 283.1847	

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ST17	BERG 75160-108-36 FP STECKERLEISTE 36POL. PIN CONNECTOR	FP 283.1847	
ST11A ST12A	BERG 75160-108-36 STECKEREINHEIT STECKEREINHEIT	336.4280 336.4296	
T1	AK BCY59IX NPN 45V 200MA TRANSISTOR	AK 010.5163	
T2	SIEMENS BCY59IX AK 2N2369A NPN 40V 200MA TRANSISTOR	AK 010.4680	
T3	VALVO 2N2369A AK 2N3209 PNP 20V 200MA TRANSISTOR	AK 010.3590	
T4	SGS 2N3209 AK BCY59IX NPN 45V 200MA TRANSISTOR	AK 010.5163	
T5	SIEMENS BCY59IX AK BCY79IX PNP 45V 200MA TRANSISTOR	AK 010.3777	
T100	SIEMENS BCY79IX AK BCY59IX NPN 45V 200MA TRANSISTOR	AK 010.5163	
T101	SIEMENS BCY59IX AK 2N2222A NPN 40V 800MA TRANSISTOR	AK 010.5405	
T102	VALVO 2N2222A AM BF247A NKAN 25V FET FET	AM 247.6536	
T103	VALVO BF247A AK BCY59IX NPN 45V 200MA TRANSISTOR	AK 010.5163	
T104	SIEMENS BCY59IX AK 2N2222A NPN 40V 800MA TRANSISTOR	AK 010.5405	
T105	VALVO 2N2222A AK 2N2222A NPN 40V 800MA TRANSISTOR	AK 010.5405	
T106	VALVO 2N2222A AK 2N2222A NPN 40V 800MA TRANSISTOR	AK 010.5405	
	VALVO 2N2222A		

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Kennzeichen Component No.	Benennung/Beschreibung Designation	Sachnummer Stock No.	enthalten in contained in
B1	BL SN74S00N 4/2INP.NANDG. IC NAND GATE SN74S00N TEXAS SN74S00N	BL 250.3734	
B2	BL SN74LS04N 6/INVERTER HEXINVERTER TEXAS SN74LS04N	BL 266.2010	
B3	BL SN74LS73N 2/JK-FLIPFL. IC FLIP-FLOP SN74LS73N TEXAS SN74LS73N	BL 266.7928	
B4	BL SN74LS73N 2/JK-FLIPFL. IC FLIP-FLOP SN74LS73N TEXAS SN74LS73N	BL 266.7928	
B6	BL SN7402N -0+75 NOR-G IC NOR GATE SN7402N TEXAS SN7402N	BL 009.3231	
B7	BJ SN75452BP 2X NAND DRIV NAND DRIVER TEXAS SN75452P	BJ 224.3424	
B8	BO S042P.MODUL./DEMOMUL. IC DEMOMUL.S042 SIEMENS S042P	BO 336.4667	
B9	BO LM361N DIFF.KOMPARATOR IC DIFF.COMP.LM361N NSC LM361N	BO 336.4644	
B10	BL SN74196N 4BIT ZAEHLER IC COUNTER SN74196N TEXAS SN74196N	BL 082.3867	
B11	BL SN7402N -0+75 NOR-G IC NOR GATE SN7402N TEXAS SN7402N	BL 009.3231	
B12	BJ SN75452BP 2X NAND DRIV NAND DRIVER TEXAS SN75452P	BJ 224.3424	
B13	BO S042P.MODUL./DEMOMUL. IC DEMOMUL.S042 SIEMENS S042P	BO 336.4667	
B14	BO LM361N DIFF.KOMPARATOR IC DIFF.COMP.LM361N NSC LM361N	BO 336.4644	
B15	BL SN74196N 4BIT ZAEHLER IC COUNTER SN74196N TEXAS SN74196N	BL 082.3867	
B16	BL SN7402N -0+75 NOR-G IC NOR GATE SN7402N TEXAS SN7402N	BL 009.3231	
B17	BJ SN75452BP 2X NAND DRIV NAND DRIVER TEXAS SN75452P	BJ 224.3424	
B18	BO S042P.MODUL./DEMOMUL. IC DEMOMUL.S042 SIEMENS S042P	BO 336.4667	
B19	BO LM361N DIFF.KOMPARATOR IC DIFF.COMP.LM361N NSC LM361N	BO 336.4644	
B20	BL SN74196N 4BIT ZAEHLER IC COUNTER SN74196N	BL 082.3867	

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B21	TEXAS SN74196N BL SN7402N -0+75 NOR-G IC NOR GATE SN7402N	BL 009.3231	
B22	TEXAS SN7402N BL SN74LS273N 8BIT-D-REG. 8BIT-D-REGISTER	BL 214.8998	
B23	TEXAS SN74LS273N BL SN74LS273N 8BIT-D-REG. 8BIT-D-REGISTER	BL 214.8998	
B24	TEXAS SN74LS273N BJ AD7531 12B-D/A -CONV D/A-CONVERTER	BJ 300.6324	
B25	ANALOG-DEV AD7531KN BO CA741G OP-AMPLIFIER IC OPERATION AMPLIFIER	BO 083.5563	
B26	RCA CA 741E BJ TL604CP 2X ANALOGSCH ANALOG SWITCH	BJ 300.6199	
B27	TEXAS TL604CP BL MC14046BCP PHASE-L-L PHASE LOCKED LOOP	BL 303.8986	
B28	MOTOROLA MC14046BCP BL SN74LS73N 2/JK-FLIPFL. IC FLIP-FLOP SN74LS73N	BL 266.7928	
BR1	TEXAS SN74LS73N FP KURZSCHL.BUCHSE OFFEN SHORTING LINK	FP 342.1895	
BU1	BERG 76264-101 FP KURZSCHL.BUCHSE OFFEN SHORTING LINK	FP 342.1895	
BU2	BERG 76264-101 FP KURZSCHL.BUCHSE OFFEN SHORTING LINK	FP 342.1895	
BU3	BERG 76264-101 FP KURZSCHL.BUCHSE OFFEN SHORTING LINK	FP 342.1895	
BU11	BERG 76264-101 FR JC-FASSUNG 16 POLIG 16-PIN IC-SOCKET	FR 249.6091	
BU12	PRECICONT US016T FR JC-FASSUNG 16 POLIG 16-PIN IC-SOCKET	FR 249.6091	
BU15A	PRECICONT US016T FP BUCHSE VERTIKAL P.V.1P SOCKET	FP 278.5577	
BU15B	BERG 75377-001 FP BUCHSE VERTIKAL P.V.1P SOCKET	FP 278.5577	
BU16A	BERG 75377-001 FP BUCHSE VERTIKAL P.V.1P SOCKET	FP 278.5577	
BU16B	BERG 75377-001 FP BUCHSE VERTIKAL P.V.1P SOCKET	FP 278.5577	
BU17A	BERG 75377-001 FP BUCHSE VERTIKAL P.V.1P SOCKET	FP 278.5577	

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Kennzeichen Component No.	Benennung/Beschreibung Designation	Sachnummer Stock No.	enthalten in contained in
BU17B	BERG 75377-001 FP BUCHSE VERTIKAL P.V.1P SOCKET BERG 75377-001	FP 278.5577	
C1	CE 100UF-10+100% 6V 9X13 ELECTROLYTIC CAPACITOR SIEMENS B41316-A2107-Z	CE 022.7514	
C2	CC 10NF-20+50%7X8R6000 CAPACITOR VALVO 2222 63051 64051103	CC 087.7525	
C3	CC 10NF-20+50%7X8R6000 CAPACITOR VALVO 2222 63051 64051103	CC 087.7525	
C4	CT 9PF250V7,2X11,7M.KAPPE TRIMMER MICROELEC MAV 03 G 10	529.5334	
C5	CC 10NF-20+50%7X8R6000 CAPACITOR VALVO 2222 63051 64051103	CC 087.7525	
C6	CC 10NF-20+50%7X8R6000 CAPACITOR VALVO 2222 63051 64051103	CC 087.7525	
C7	CE 100UF-10+100% 6V 9X13 ELECTROLYTIC CAPACITOR SIEMENS B41316-A2107-Z	CE 022.7514	
C8	CC 10NF-20+50%7X8R6000 CAPACITOR VALVO 2222 63051 64051103	CC 087.7525	
C11	CC 10NF-20+50%7X8R6000 CAPACITOR VALVO 2222 63051 64051103	CC 087.7525	
C12	CC 10NF-20+50%7X8R6000 CAPACITOR VALVO 2222 63051 64051103	CC 087.7525	
C14	CC 82PF+-2%6X7NPO CAPACITOR VALVO 2222 678 10829	CC 087.6535	
C15	CC 150PF+-2%6X9N150 CAPACITOR VALVO 2222 678 34151	CC 087.6735	
C16	CC 150PF+-2%6X9N150 CAPACITOR VALVO 2222 678 34151	CC 087.6735	
C17	CC 150PF+-2%6X9N150 CAPACITOR VALVO 2222 678 34151	CC 087.6735	
C18	CC 10NF-20+50%7X8R6000 CAPACITOR VALVO 2222 63051 64051103	CC 087.7525	
C19	CC 10NF-20+50%7X8R6000 CAPACITOR VALVO 2222 63051 64051103	CC 087.7525	
C20	CC 1NF+-10%63V K2000 CERAMIC CAPACITOR VALVO 2222 63051 102	CC 022.0784	
C21	CC 10NF-20+50%7X8R6000	CC 087.7525	

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Kennzeichen Component No.	Benennung/Beschreibung Designation	Sachnummer Stock No.	enthalten in contained in
C22	CAPACITOR VALVO 2222 63051 64051103 CC 10NF-20+50%7X8R6000	CC 087.7525	
C23	CAPACITOR VALVO 2222 63051 64051103 CC 10NF-20+50%7X8R6000	CC 087.7525	
C24	CAPACITOR VALVO 2222 63051 64051103 CC 1NF+-10%63V K2000 CERAMIC CAPACITOR	CC 022.0784	
C26	CAPACITOR VALVO 2222 63051 102 CC 100PF+-2%6X9NPO	CC 087.6541	
C27	CAPACITOR VALVO 2222 678 10101 CC 56PF+-2%5X6NPO	CC 087.6512	
C28	CAPACITOR VALVO 2222 678 10569 CC 6,8PF+-0,25PF3X4NPO	CC 087.6406	
C29	CAPACITOR VALVO 2222 678 09688 CC 120PF+-2%6X9NPO	CC 087.6558	
C30	CAPACITOR VALVO 2222 678 10121 CC 27PF+-2%4X5NPO	CC 087.6470	
C31	CAPACITOR VALVO 2222 678 10279 CC 6,8PF+-0,25PF3X4NPO	CC 087.6406	
C32	CAPACITOR VALVO 2222 678 09688 CC 120PF+-2%6X9NPO	CC 087.6558	
C33	CAPACITOR VALVO 2222 678 10121 CC 33PF+-2%4X5NPO	CC 087.6487	
C34	CAPACITOR VALVO 2222 678 10339 CC 6,8PF+-0,25PF3X4NPO	CC 087.6406	
C35	CAPACITOR VALVO 2222 678 09688 CC 33PF+-2%4X5NPO	CC 087.6487	
C36	CAPACITOR VALVO 2222 678 10339 CC 120PF+-2%6X9NPO	CC 087.6558	
C38	CAPACITOR VALVO 2222 678 10121 CC 10NF-20+50%7X8R6000	CC 087.7525	
BIS/TO	VALVO 2222 63051 64051103		
C43			
C44	CAPACITOR VALVO 2222 678 10101 CC 100PF+-2%6X9NPO	CC 087.6541	
C45	CAPACITOR VALVO 2222 678 10121 CC 27PF+-2%4X5NPO	CC 087.6470	
C46	CAPACITOR VALVO 2222 678 10279 CC 100PF+-2%6X9NPO	CC 087.6541	



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C47	ALVO 2222 678 10101 C 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
C48	ALVO 2222 63051 64051103 C 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
C49	ALVO 2222 63051 64051103 C 1NF+-10%63V K2000 RAMIC CAPACITOR	CC 022.0784	
C50	ALVO 2222 63051 102 C 2,7NF+-10%5X6R2000 CAPACITOR	CC 087.7077	
C51	ALVO 2222 63051 272 C 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
C52	ALVO 2222 63051 64051103 C 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
C53	ALVO 2222 63051 64051103 C 1NF+-10%63V K2000 RAMIC CAPACITOR	CC 022.0784	
C54	ALVO 2222 63051 102 C 56PF+-2%5X6NPO CAPACITOR	CC 087.6512	
C55	ALVO 2222 678 10569 C 120PF+-2%6X9NPO CAPACITOR	CC 087.6558	
C56	ALVO 2222 678 10121 C 3,3PF+-0,25PF3X4NPO CAPACITOR	CC 087.6364	
C57	ALVO 2222 678 09338 C 56PF+-2%5X6NPO CAPACITOR	CC 087.6512	
C58	ALVO 2222 678 10569 C 120PF+-2%6X9NPO CAPACITOR	CC 087.6558	
C59	ALVO 2222 678 10121 C 3,3PF+-0,25PF3X4NPO CAPACITOR	CC 087.6364	
C60	ALVO 2222 678 09338 C 120PF+-2%6X9NPO CAPACITOR	CC 087.6558	
C61	ALVO 2222 678 10121 C 47PF+-2%5X6NPO CAPACITOR	CC 087.6506	
C62	ALVO 2222 678 10479 C 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
C63	ALVO 2222 63051 64051103 C 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
C64	ALVO 2222 63051 64051103 C 2,7NF+-10%5X6R2000 CAPACITOR	CC 087.7077	
C65	ALVO 2222 63051 272 C 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	

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C66	VALVO 2222 63051 64051103 CC 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
C67	VALVO 2222 63051 64051103 CC 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
C68	VALVO 2222 63051 64051103 CC 100PF+-2%6X9NPO CAPACITOR	CC 087.6541	
C69	VALVO 2222 678 10101 CC 27PF+-2%4X5NPO CAPACITOR	CC 087.6470	
C70	VALVO 2222 678 10279 CC 100PF+-2%6X9NPO CAPACITOR	CC 087.6541	
C71	VALVO 2222 678 10101 CC 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
C72	VALVO 2222 63051 64051103 CC 1NF+-10%63V K2000 CERAMIC CAPACITOR	CC 022.0784	
C73	VALVO 2222 63051 102 CC 2,7NF+-10%5X6R2000 CAPACITOR	CC 087.7077	
C74	VALVO 2222 63051 272 CC 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
C75	VALVO 2222 63051 64051103 CC 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
C76	VALVO 2222 63051 64051103 CC 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
C77	VALVO 2222 63051 64051103 CC 1NF+-10%63V K2000 CERAMIC CAPACITOR	CC 022.0784	
C78	VALVO 2222 63051 102 CC 120PF+-2%6X9NPO CAPACITOR	CC 087.6558	
C79	VALVO 2222 678 10121 CC 56PF+-2%5X6NPO CAPACITOR	CC 087.6512	
C80	VALVO 2222 678 10569 CC 3,3PF+-0,25PF3X4NPO CAPACITOR	CC 087.6364	
C81	VALVO 2222 678 09338 CC 56PF+-2%5X6NPO CAPACITOR	CC 087.6512	
C82	VALVO 2222 678 10569 CC 120PF+-2%6X9NPO CAPACITOR	CC 087.6558	
C83	VALVO 2222 678 10121 CC 3,3PF+-0,25PF3X4NPO CAPACITOR	CC 087.6364	
C84	VALVO 2222 678 09338 CC 120PF+-2%6X9NPO CAPACITOR	CC 087.6558	

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C85	VALVO 2222 678 10121 CC 47PF+-2%5X6NP0 CAPACITOR	CC 087.6506	
C86	VALVO 2222 678 10479 CC 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
	VALVO 2222 63051 64051103		
BIS/T0 C90			
C120	CC 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
	VALVO 2222 63051 64051103		
C121	CC 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
	VALVO 2222 63051 64051103		
C122	CC 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
	VALVO 2222 63051 64051103		
C123	CC 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
	VALVO 2222 63051 64051103		
C124	CC 4,7UF+-20%50VK6000VIEL CAPACITOR	CC 060.0113	
	ERIE 8157-050-25U-4,7M-M		
C125	CC 27PF+-2%3X4N750 CAPACITOR	CC 087.6835	
	VALVO 2222 678 58279		
C126	CC 27PF+-2%3X4N750 CAPACITOR	CC 087.6835	
	VALVO 2222 678 58279		
C139	CE 220UF-10+100%25V 13X20 ELECTROLYTIC CAPACITOR	CE 087.0595	
	ROEDERST ELKO EK220/25		
C140	CE 220UF-10+100%25V 13X20 ELECTROLYTIC CAPACITOR	CE 087.0595	
	ROEDERST ELKO EK220/25		
C141	CE 220UF-10+100%25V 13X20 ELECTROLYTIC CAPACITOR	CE 087.0595	
	ROEDERST ELKO EK220/25		
C142	CC 1NF+-10%63V K2000 CERAMIC CAPACITOR	CC 022.0784	
	VALVO 2222 63051 102		
C143	CC 1NF+-10%63V K2000 CERAMIC CAPACITOR	CC 022.0784	
	VALVO 2222 63051 102		
C144	CC 68PF+-2%6X7NP0 CAPACITOR	CC 087.6529	
	VALVO 2222 678 10689		
C145	CC 1NF+-10%63V K2000 CERAMIC CAPACITOR	CC 022.0784	
	VALVO 2222 63051 102		
C146	CC 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
	VALVO 2222 63051 64051103		
C147	CC 10NF-20+50%7X8R6000 CAPACITOR	CC 087.7525	
	VALVO 2222 63051 64051103		

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Anzeichen Component No.	Benennung/Beschreibung Designation	Sachnummer Stock No.	enthalten in contained in
C148	CC 4,7PF+-0,25PF3X4NPO CAPACITOR VALVO 2222 678 09478	CC 087.6387	
C149	CC 10NF-20+50%7X8R6000 CAPACITOR VALVO 2222 63051 64051103	CC 087.7525	
C150	CC 10NF-20+50%7X8R6000 CAPACITOR VALVO 2222 63051 64051103	CC 087.7525	
GL1	AE BB405B 11/ 2PF CDI TUNING DIODE VALVO BB405B	AE 596.6839	
L1	LD 10,0UH10%3,300HMO,144A CHOKE DELEVAN DROSSEL1025-44	LD 026.4184	
L2	LD 100 UH10%8,000HMO,084A CHOKE DELEVAN DROSSEL1025-68	LD 067.3101	
L3	LD 100 UH10%8,000HMO,084A CHOKE DELEVAN DROSSEL1025-68	LD 067.3101	
L5	LD 56UH 5% 5,70HM 0,11CA MOLDED COIL DELEVAN 1025-62 +-5%	336.4080	
L6	LD 56UH 5% 5,70HM 0,11CA MOLDED COIL DELEVAN 1025-62 +-5%	336.4080	
L7	LD 56UH 5% 5,70HM 0,110A MOLDED COIL DELEVAN 1025-62 +-5%	336.4080	
L8	LD SPULE 30-60MHZ19PFQ155 COIL COMPONEX 301-KN-0800	336.4715	
BIS/TO			
L11			
L12	LD 56UH 5% 5,70HM 0,110A MOLDED COIL DELEVAN 1025-62 +-5%	336.4080	
L13	LD SPULE 30-60MHZ19PFQ155 COIL COMPONEX 301-KN-0800	336.4715	
L14	LD SPULE 30-60MHZ19PFQ155 COIL COMPONEX 301-KN-0800	336.4715	
L15	LD SPULE 30-60MHZ19PFQ155 COIL COMPONEX 301-KN-0800	336.4715	
L16	LD 56UH 5% 5,70HM 0,110A MOLDED COIL DELEVAN 1025-62 +-5%	336.4080	
L17	LD SPULE 30-60MHZ19PFQ155 COIL COMPONEX 301-KN-0800	336.4715	
L18	LD SPULE 30-60MHZ19PFQ155 COIL	336.4715	

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Kennzeichen Component No.	Benennung/Beschreibung Designation	Sachnummer Stock No.	enthalten in contained in
L19	COMPONEX 301-KN-0800 LD SPULE 30-60MHZ19PFQ155 COIL	336.4715	
L20	COMPONEX 301-KN-0800 LD 8,2UH BEI 0,94AG,490HM CHOKE	LD 026.4110	
L31	JAHRE 72.10-8R20K LD 100 UH10%8,000HMO,084A CHOKE	LD 067.3101	
L32	DELEVAN DROSSEL1025-68 LD 100 UH10%8,000HMC,084A CHOKE	LD 067.3101	
L33	DELEVAN DROSSEL1025-68 LD 100 UH10%8,000HMO,084A CHOKE	LD 067.3101	
L40	DELEVAN DROSSEL1025-68 LD 10,0UH10%3,300HMO,144A CHOKE	LD 026.4184	
L41	DELEVAN DROSSEL1025-44 LD 220 UH10%21,00HMO,052A CHOKE	LD 067.3147	
MP1	DELEVAN DROSSEL1025-76		
MP1	FP INDIREKT. STECKERL.36P. MALE MULTIPOINT CONNECTOR BERG 75160-102-36	FP 242.3600	
MP2	FP INDIREKT. STECKERL.36P. MALE MULTIPOINT CONNECTOR BERG 75160-102-36	FP 242.3600	
MP3	FP INDIREKT. STECKERL.36P. MALE MULTIPOINT CONNECTOR BERG 75160-102-36	FP 242.3600	
MP4	FP INDIREKT. STECKERL.36P. MALE MULTIPOINT CONNECTOR BERG 75160-102-36	FP 242.3600	
Q1	EQ 18,000MHZ CL30PF HC43U VALVO SQ 4818 18,000 MHZ	291.4887	
R1	RL 0,25W 2,21KOHM+-1%TK50 RESISTOR	RL 082.2477	
R2	DRALORIC SMA 0207/2,21K-F-C RL 0,25W 2,21KOHM+-1%TK50 RESISTOR	RL 082.2477	
R3	DRALORIC SMA 0207/2,21K-F-C RL 0,25W 2,21KOHM+-1%TK50 RESISTOR	RL 082.2477	
R4	DRALORIC SMA 0207/2,21K-F-C RL 0,25W 1,50KOHM+-1%TK50 RESISTOR	RL 083.0732	
R9	DRALORIC SMA0207/1,50K-F-D RL 0,25W 1KOHM+-1%TK50 RESISTOR	RL 082.2160	
R10	DRALORIC SMA0207/1K-F-C RL 0,25W22,10 OHM+-1%TK50 RESISTOR	RL 082.9188	
	DRALORIC SMA0207/22,10HM-F-D		

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Kenn Corr	Benennung/Beschreibung Designation	Sachnummer Stock No.	enthalten in contained in
R1	RL 0,25W 1,21KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/1,21K-F-D	RL 083.0655	
R1	RL 0,25W 121 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/121OHM-F-D	RL 082.9859	
R1	RL 0,25W 825 OHM+-1%TK50 RESISTOR DRALORIC SMA 0207/825OHM-F-C	RL 082.2502	
R14	RL 0,25W 27,40 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/27,40HM-F-D	RL 082.9271	
R15	RL 0,25W 681 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/681OHM-F-D	RL 083.0490	
R16	RL 0,25W 100 OHM+-1%TK50 DEPOS.-CARBON RESISTOR DRALORIC SMA0207/100/HM-F-D	RL 082.6543	
R17	RL 0,25W 1,21KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/1,21K-F-D	RL 083.0655	
R19	RL 0,25W 100 OHM+-1%TK50 DEPOS.-CARBON RESISTOR DRALORIC SMA0207/100/HM-F-D	RL 082.6543	
R20	RL 0,25W 2,21KOHM+-1%TK50 RESISTOR DRALORIC SMA 0207/2,21K-F-C	RL 082.2477	
R21	RL 0,25W 100 OHM+-1%TK50 DEPOS.-CARBON RESISTOR DRALORIC SMA0207/100/HM-F-D	RL 082.6543	
R23	RL 0,25W 1KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/1K-F-C	RL 082.2160	
R24	RL 0,25W 22,10 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/22,10HM-F-D	RL 082.9188	
R25	RL 0,25W 1,21KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/1,21K-F-D	RL 083.0655	
R26	RL 0,25W 150 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/150OHM-F-D	RL 082.9942	
R27	RL 0,25W 825 OHM+-1%TK50 RESISTOR DRALORIC SMA 0207/825OHM-F-C	RL 082.2502	
R28	RL 0,25W 121 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/121OHM-F-D	RL 082.9859	
R29	RL 0,25W 681 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/681OHM-F-D	RL 083.0490	
R30	RL 0,25W 100 OHM+-1%TK50 DEPOS.-CARBON RESISTOR DRALORIC SMA0207/100/HM-F-D	RL 082.6543	
R31	RL 0,25W 1,21KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/1,21K-F-D	RL 083.0655	

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Schaltteilliste für
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Kennzeichen Component No.	Benennung/Beschreibung Designation	Sachnummer Stock No.	enthalten in contained in
R33	RL 0,25W 2,21KOHM+-1%TK50 RESISTOR DRALORIC SMA 0207/2,21K-F-C	RL 082.2477	
R34	RL 0,25W 100 OHM+-1%TK50 DEPOS.-CARBON RESISTOR DRALORIC SMA0207/100/HM-F-D	RL 082.6543	
R35	RL 0,25W 100 OHM+-1%TK50 DEPOS.-CARBON RESISTOR DRALORIC SMA0207/100/HM-F-D	RL 082.6543	
R37	RL 0,25W 1KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/1K-F-C	RL 082.2160	
R38	RL 0,25W22,10 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/22,10HM-F-D	RL 082.9188	
R39	RL 0,25W 1,21KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/1,21K-F-D	RL 083.0655	
R40	RL 0,25W 150 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/150OHM-F-D	RL 082.9942	
R41	RL 0,25W 825 OHM+-1%TK50 RESISTOR DRALORIC SMA 0207/825OHM-F-C	RL 082.2502	
R42	RL 0,25W 121 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/121OHM-F-D	RL 082.9859	
R43	RL 0,25W 681 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/681OHM-F-D	RL 083.0490	
R44	RL 0,25W 100 OHM+-1%TK50 DEPOS.-CARBON RESISTOR DRALORIC SMA0207/100/HM-F-D	RL 082.6543	
R45	RL 0,25W 1,21KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/1,21K-F-D	RL 083.0655	
R47	RL 0,25W 2,21KOHM+-1%TK50 RESISTOR DRALORIC SMA 0207/2,21K-F-C	RL 082.2477	
R48	RL 0,25W 100 OHM+-1%TK50 DEPOS.-CARBON RESISTOR DRALORIC SMA0207/100/HM-F-D	RL 082.6543	
R49	RL 0,25W 100 OHM+-1%TK50 DEPOS.-CARBON RESISTOR DRALORIC SMA0207/100/HM-F-D	RL 082.6543	
R52	RL 0,25W22,10 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/22,10HM-F-D	RL 082.9188	
R64	RL 0,25W 562 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/562OHM-F-D	RL 083.0461	
R78	RL 0,25W 22,1KOHM+-1%TK50 RESISTOR DRALORIC SMA/207/22,1K-F-C	RL 083.1545	
R79	RL 0,25W 1,21KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/1,21K-F-D	RL 083.0655	

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FREQUENCY PROCESSOR

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Kennzeichen Component No.	Benennung/Beschreibung Designation	Sachnummer Stock No.	enthalten in contained in
R80	RL 0,25W 475 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/475OHM-F-D	RL 083.0390	
R81	RL 0,25W 6,81KOHM+-1%TK50 RESISTOR DRALORIC SMA 0207/6,81K-F-C	RL 082.2560	
R82	RS 0,5W 200 OHM+-20%KURV1 DEPOS.-CARBON POTENTIOMET BOURNS 3329H-1-201	RS 069.8017	
R83	RL 0,25W 562 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/562OHM-F-D	RL 083.0461	
R84	RL 0,25W 4,75KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/4,75K-F-D	RL 083.1097	
R85	RS 0,5W 500 OHM+-20%KURV1 DEPOS.-CARBON POTENTIOMET BOURNS 3329H-1-501	RS 069.8023	
R90	RL 0,25W 562 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/562OHM-F-D	RL 083.0461	
R91	RL 0,25W 1,21KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/1,21K-F-D	RL 083.0655	
R92	RL 0,25W 6,81KOHM+-1%TK50 RESISTOR DRALORIC SMA 0207/6,81K-F-C	RL 082.2560	
R93	RL 0,25W 1,50KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/1,50K-F-D	RL 083.0732	
R94	RL 0,25W 3,32KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/3,32K-F-D	RL 083.0990	
R95	RL 0,25W 1KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/1K-F-C	RL 082.2160	
R96	RS 0,5W 1KOHM+-20%KURVE1 DEPOS.-CARBON POTENTIOMET BOURNS 3329H-1-102	RS 069.8030	
R97	RL 0,25W 1KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/1K-F-C	RL 082.2160	
R98	RL 0,25W 33,2KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/33,2K-F-C	RL 083.1674	
R99	RL 0,25W 3,32KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/3,32K-F-D	RL 083.0990	
R100	RL 0,25W 33,2KOHM+-1%TK50 RESISTOR DRALORIC SMA0207/33,2K-F-C	RL 083.1674	
R110	RL 0,25W 2,21KOHM+-1%TK50 RESISTOR DRALORIC SMA 0207/2,21K-F-C	RL 082.2477	
R111	RL 0,25W 909 OHM+-1%TK50 RESISTOR DRALORIC SMA0207/909OHM-F-D	RL 083.0584	

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Kennzeichen Component No.	Benennung/Beschreibung Designation	Sachnummer Stock No.	enthalten in contained in
R120	RF O-WIDERSTAND DIN 0207 O-RESISTOR RESISTA SK2,0 OHM	RF 069.0000	
R121	RF O-WIDERSTAND DIN 0207 O-RESISTOR RESISTA SK2,0 OHM	RF 069.0000	
R122	RF O-WIDERSTAND DIN 0207 O-RESISTOR RESISTA SK2,0 OHM	RF 069.0000	
R123	RF O-WIDERSTAND DIN 0207 O-RESISTOR RESISTA SK2,0 OHM	RF 069.0000	
ST1	FP INDIREKT. STECKERL. 36P. MALE MULTIPOINT CONNECTOR BERG 75160-102-36	FP 242.3600	
ST2	FP WINKELSTECKERLEIST. 36P CONNECTOR BERG 75168-113-36	FP 243.3578	
ST3	FP WINKELSTECKERLEIST. 36P CONNECTOR BERG 75168-113-36	FP 243.3578	
T1	AK BCY59IX NPN 45V 200MA TRANSISTOR SIEMENS BCY59IX	AK 010.5163	
EIS/TO			
T4			
T5	AK BCY59IX NPN 45V 200MA TRANSISTOR SIEMENS BCY59IX	AK 010.5163	
T6	AK BCY79IX PNP 45V 200MA TRANSISTOR SIEMENS BCY79IX	AK 010.3777	
T7	AK BCY59IX NPN 45V 200MA TRANSISTOR SIEMENS BCY59IX	AK 010.5163	
T8	AK BCY59IX NPN 45V 200MA TRANSISTOR SIEMENS BCY59IX	AK 010.5163	

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ED IEC-BUS-STEUERUNG

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Kennzeichen Component No.	Benennung/Beschreibung Designation	Sachnummer Stock No.	enthalten in contained in
BU20	FR JC-FASSUNG 16 POLIG 16-PIN IC-SOCKET PRECICONT US016T	FR 249.6091	
BU21	FR JC-FASSUNG 16 POLIG 16-PIN IC-SOCKET PRECICONT US016T	FR 249.6091	
C1 BIS/TO C3	CC 10NF-20+50%7X8R6000 CAPACITOR THOMSON COX767/10000/PF-20+5	CC 087.7525	
D1	BJ P8291A IEC-BUS-INTERF. P8291A-IEC-BUS-INTERF.	BJ 099.4978	
D2 BIS/TO D5 D6	INTEL P2891A BJ MC3448AP 4XBUS-TRANSC BUS-TRANSCEIVER MOTOROLA MC3448AP	BJ 300.6247	
K3 K4	KABEL KABEL	265.4160 265.4177	
R1 BIS/TO R6	RF 0,25W2,2KOHM +-5% RESISTOR DRALORIC LCA0207/+-5%2,2K	RF 069.2225	

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IEC-625-ANSCHLUSSPLATTE

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Kennzeichen Component No.	Benennung/Beschreibung Designation	Sachnummer Stock No.	enthalten in contained in
ST20	FP STECKERLEISTE 16POL. 16-PIN INSERT ANSLEY	FP 278.4212	
ST21	FP STECKERLEISTE 16POL. 16-PIN INSERT ANSLEY	FP 278.4212	
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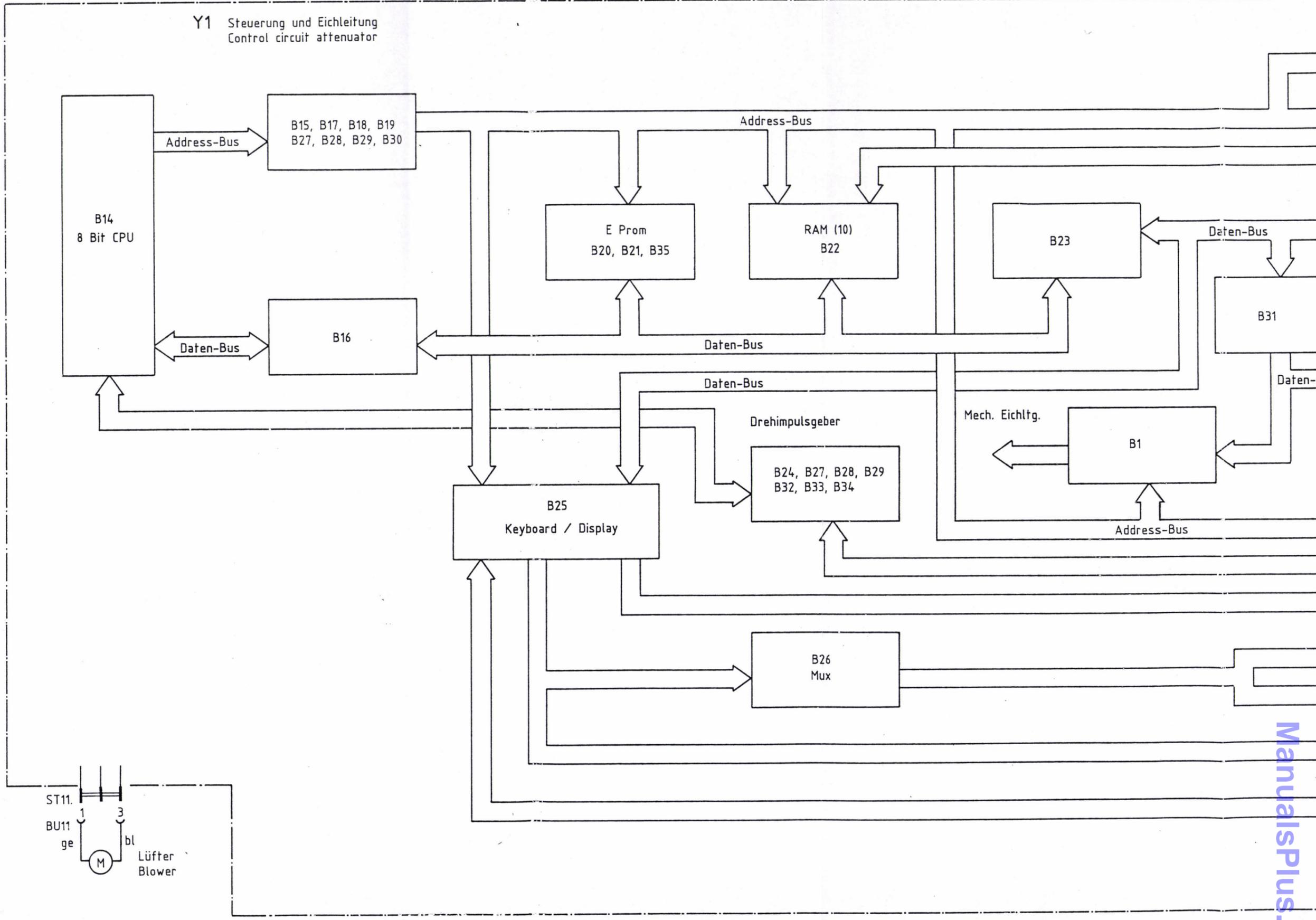
Stromläufe
Bestückungspläne
Circuit diagrams
Components plans

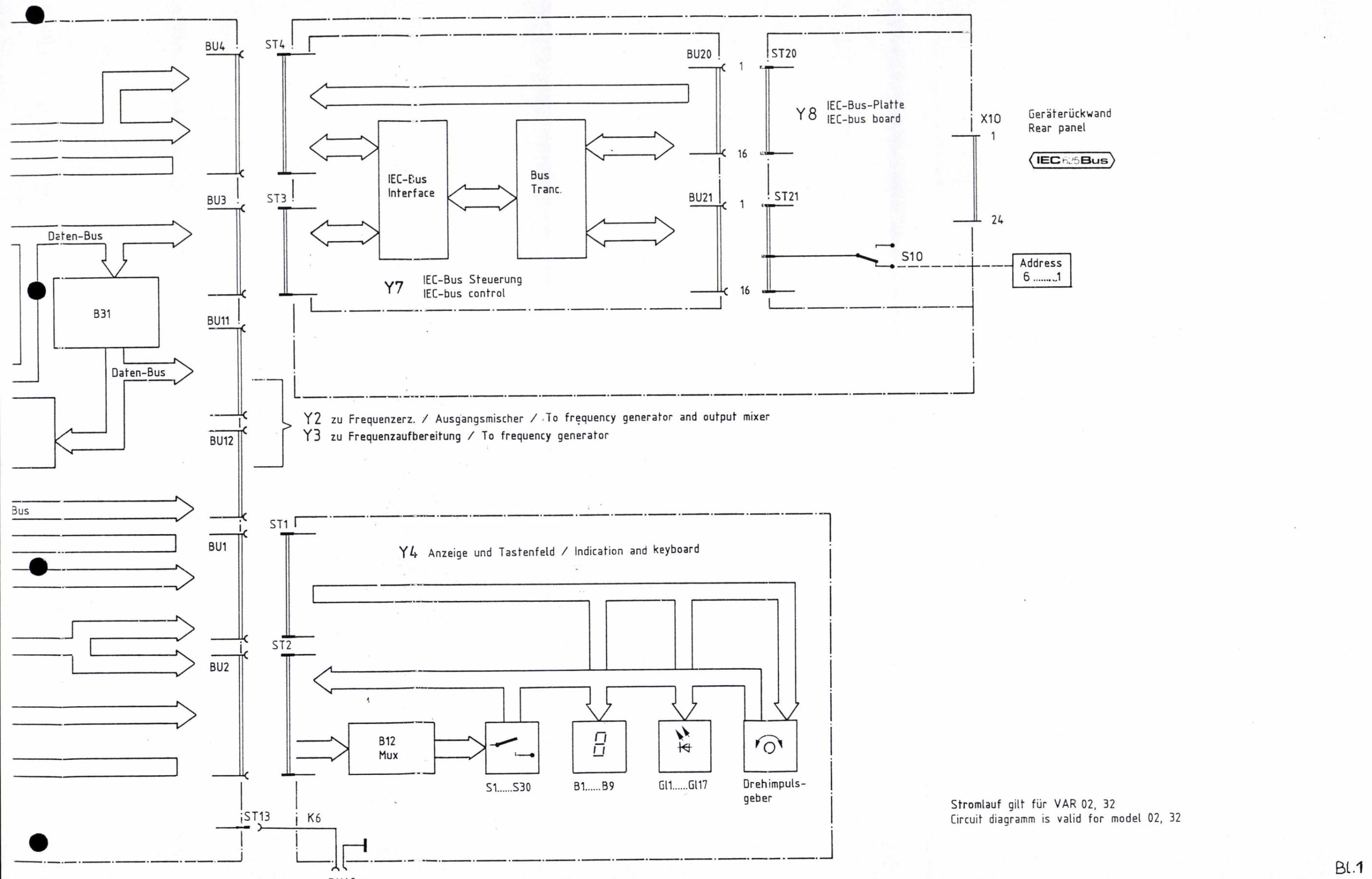
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10MA	Dz	Name	Datum	And. Mittlg. Nr.	Name
gezeichnet	22.7.81	Gu	8.82	28474	ls
bearbeitet	20.7.81	Li	3.83	29323	ls
geprüft		D	4.83	30336	gs
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Stromlauf gilt für VAR 02, 32
Circuit diagram is valid for model 02, 32

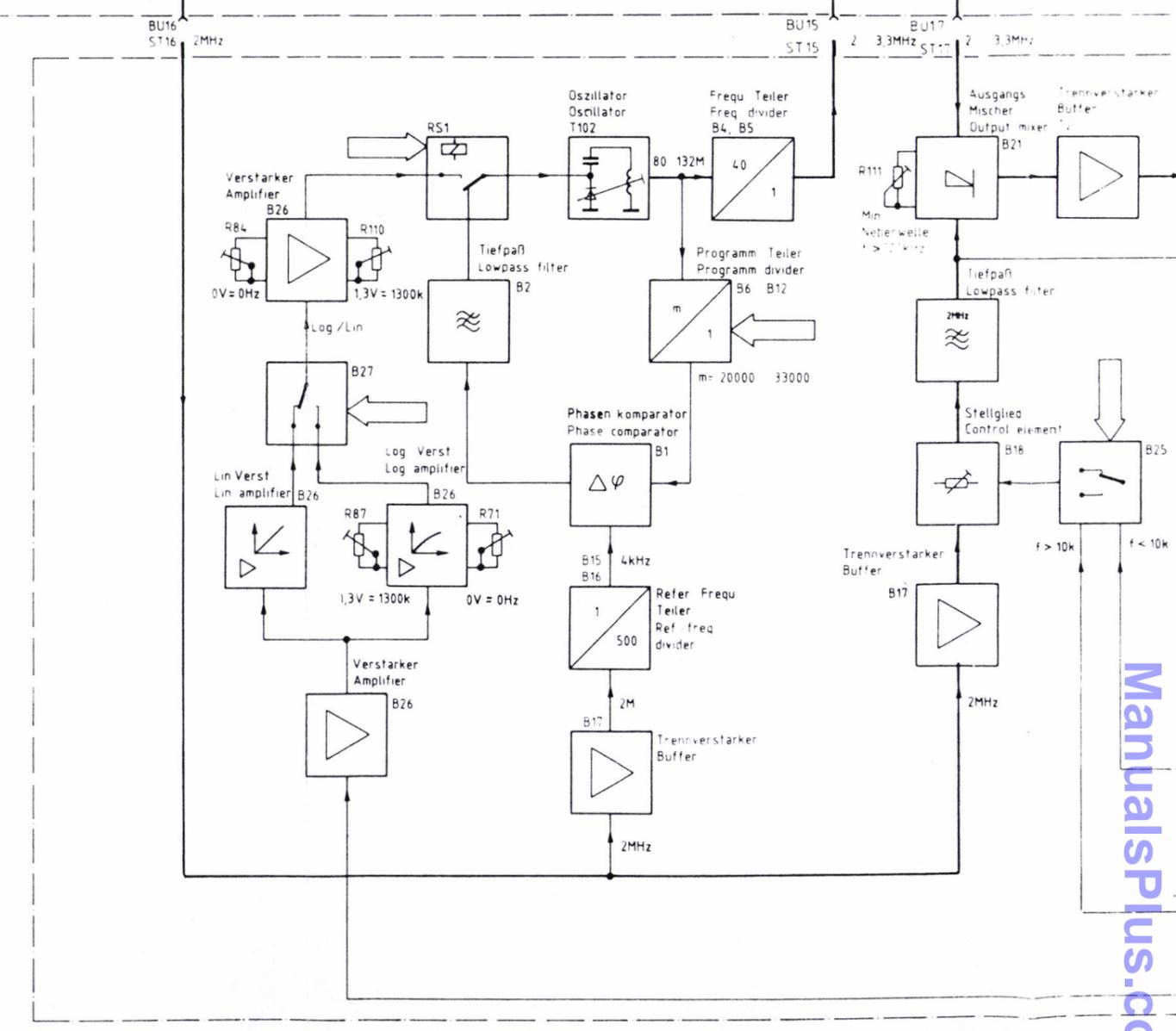
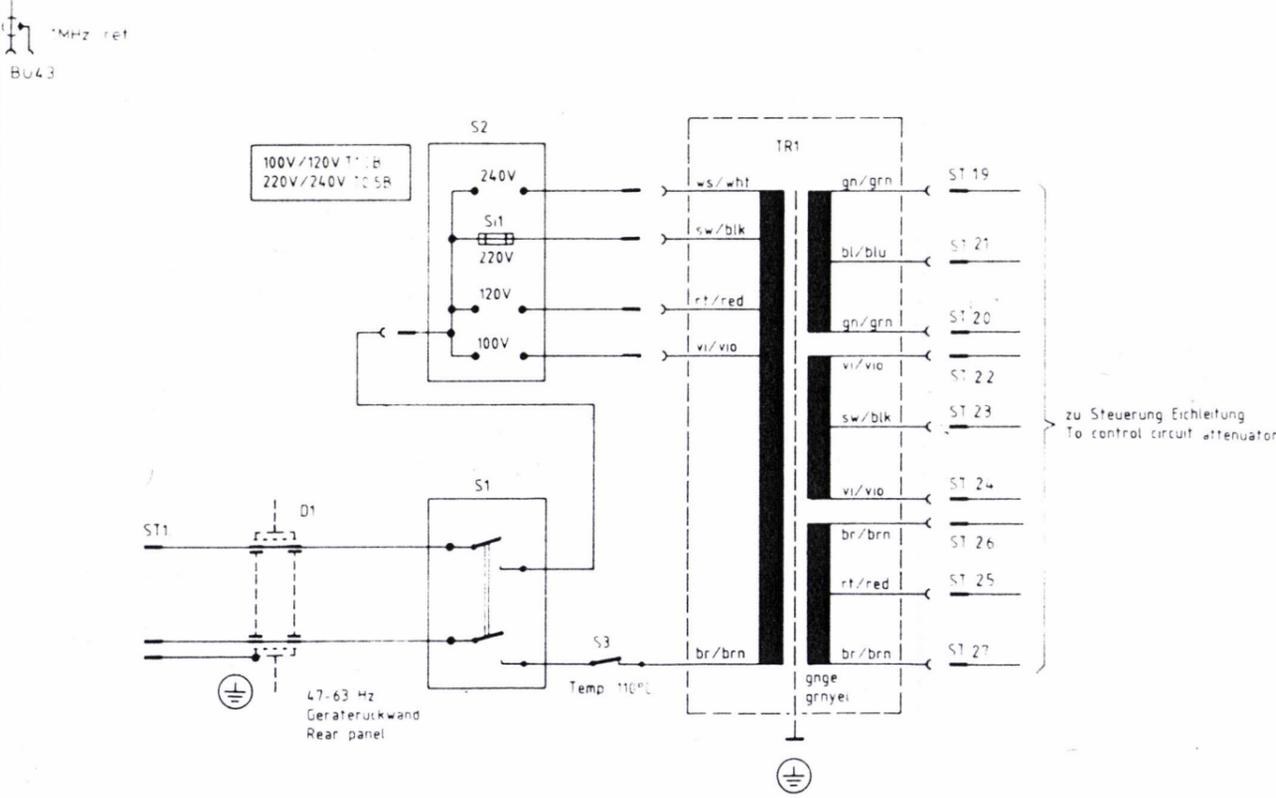
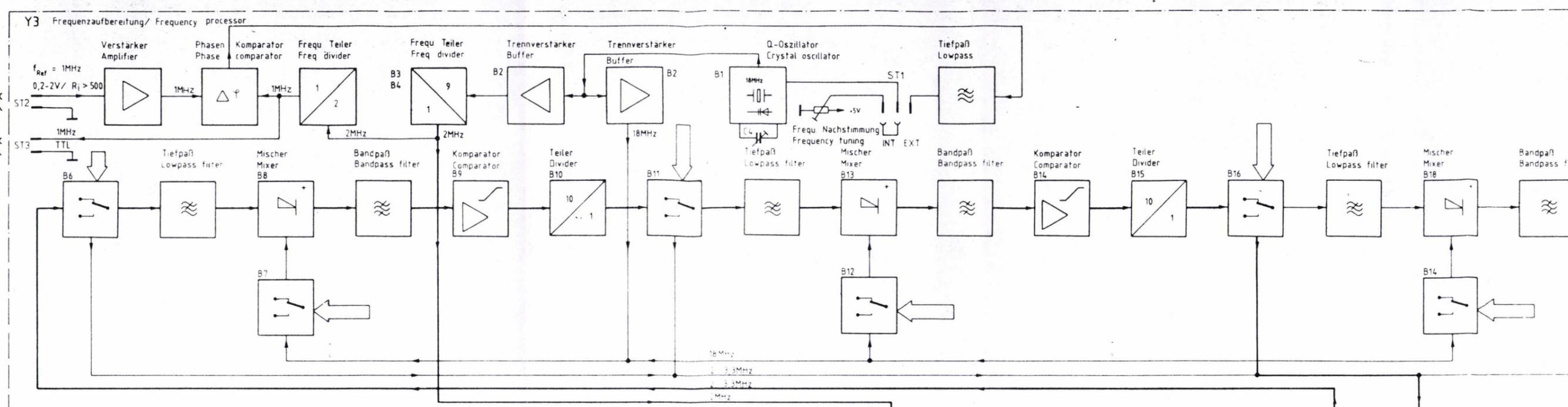
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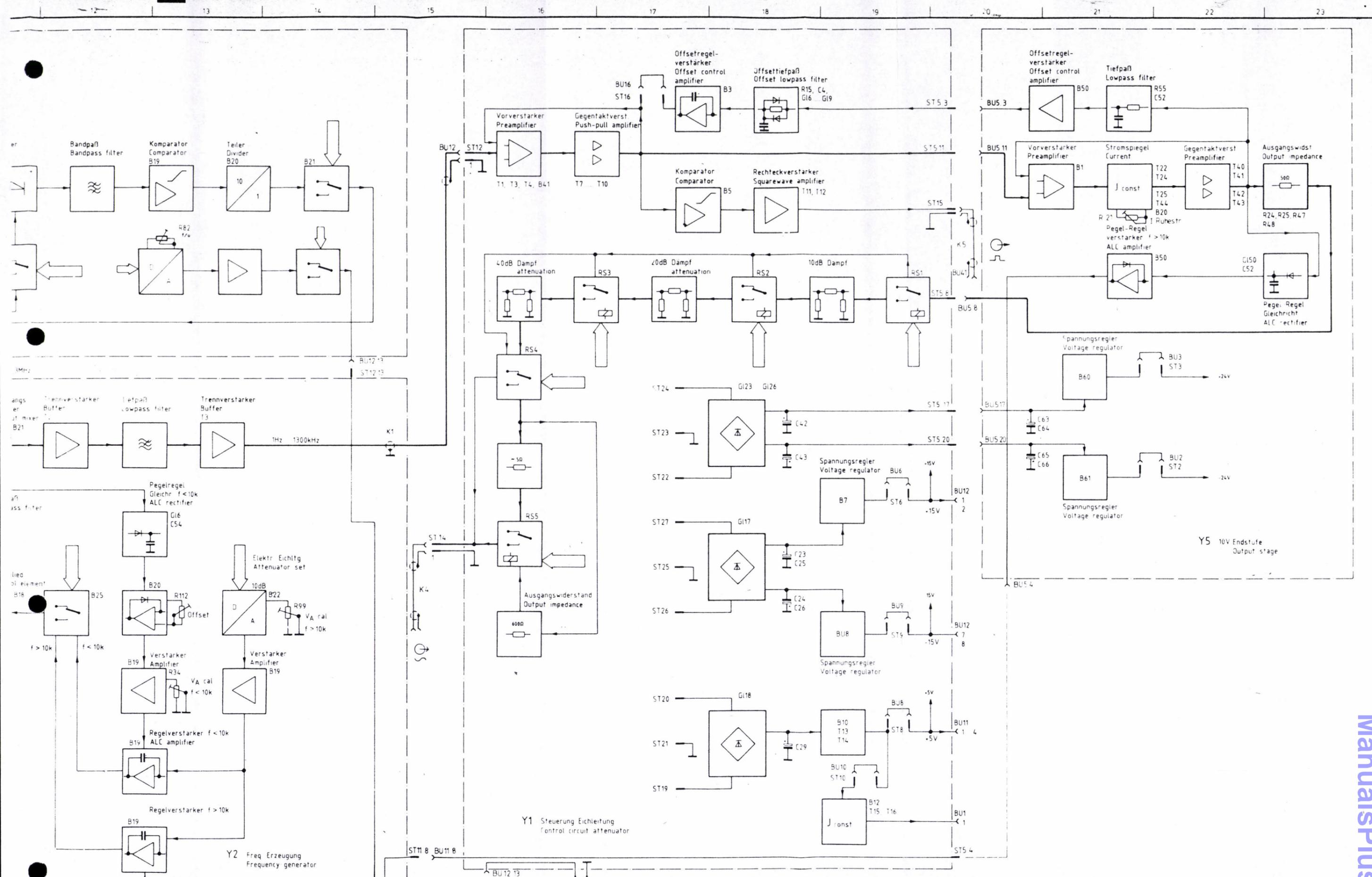
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Zeichn. Nr.	3019 S
Gezeichnet	29.7.81
Bezeichnet	26.7.81
Geprüft	
Normgepr.	
Name	GU
Name	LI
Datum	12.81
Datum	8.82
Datum	9.83
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Datum	31
And Mitglg Nr	
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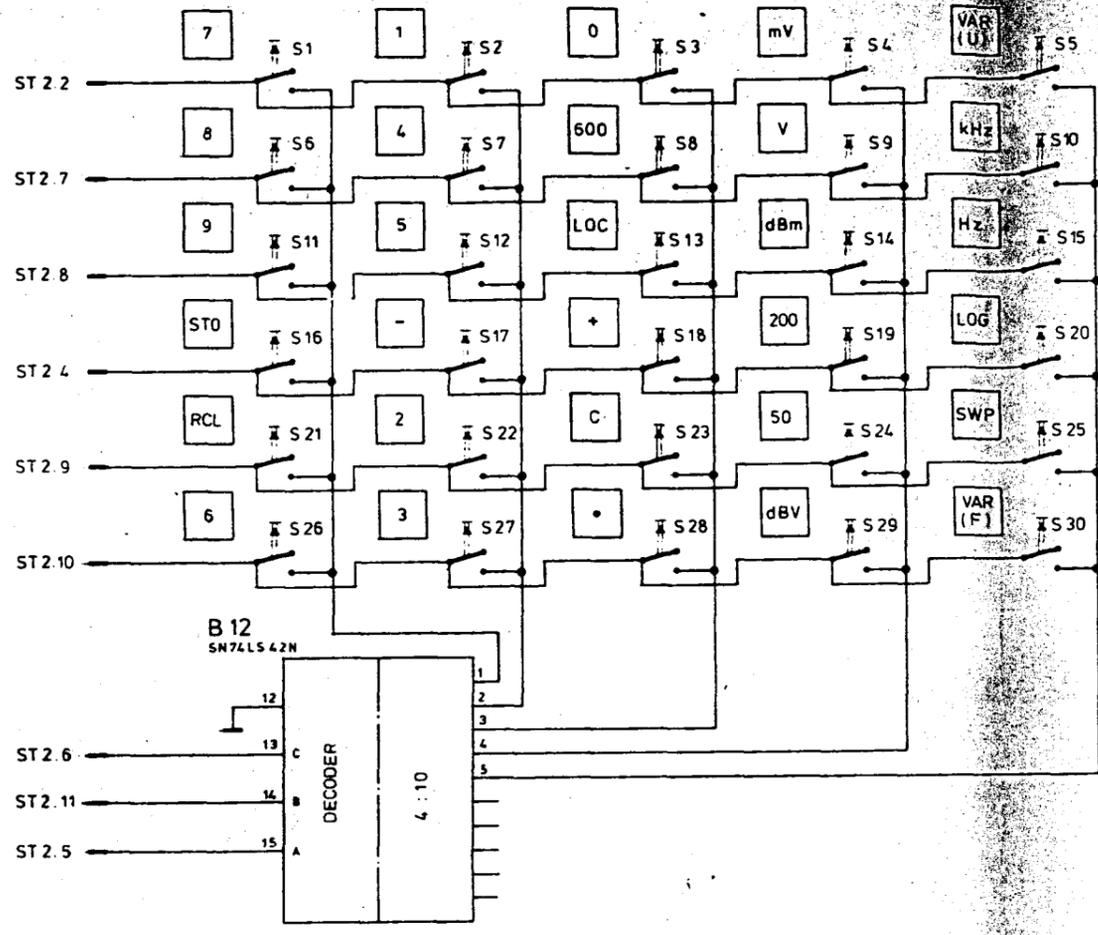
SPN Generator 1Hz - 1,3MHz		Zeichn.-Nr. 336.3019 S		Blatt 2	
SPN	Reg. v. 336.3019 V	erste Z.			

Arbeits- No.	
Proj. No.	
Rev. No.	
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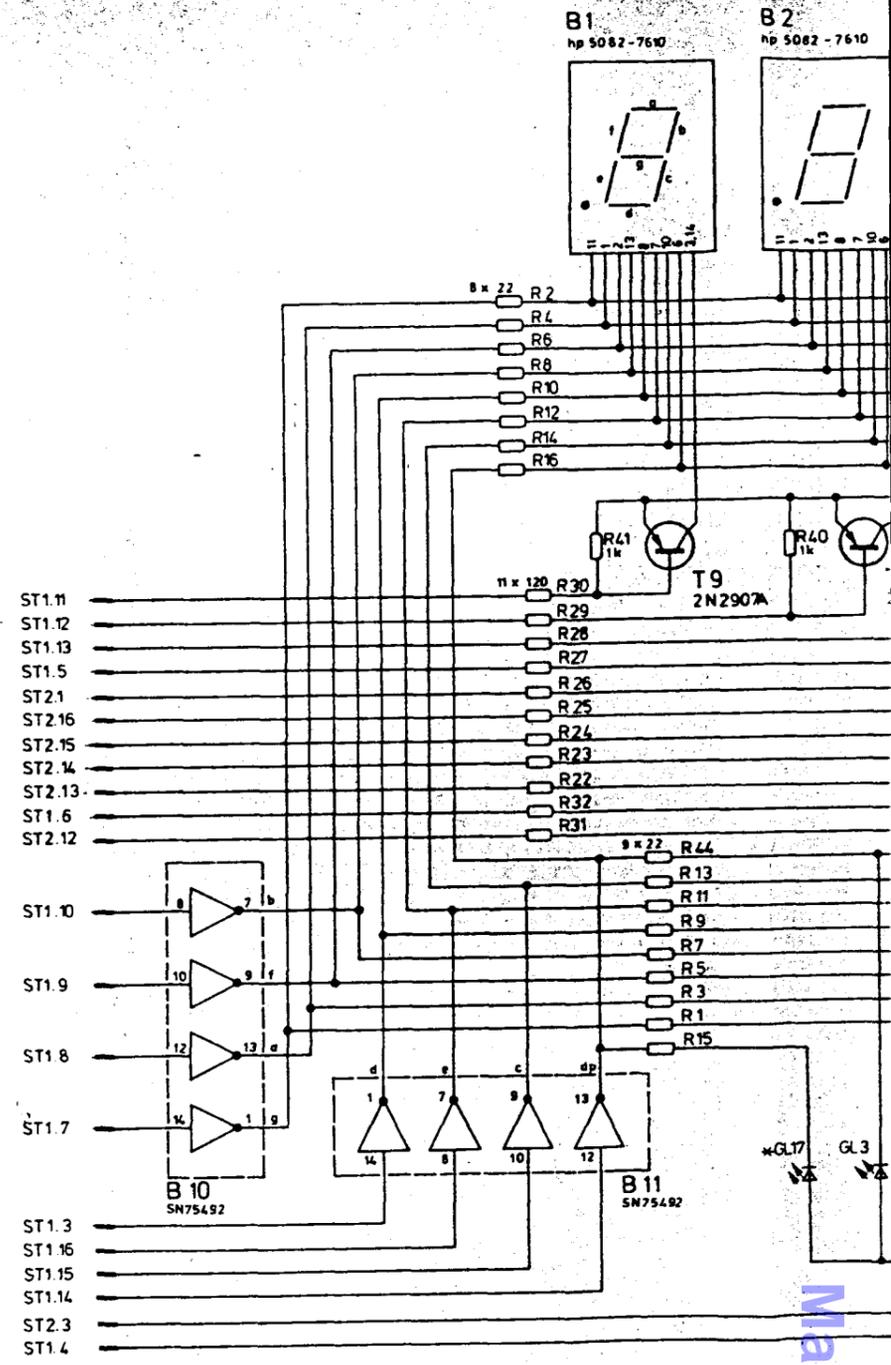
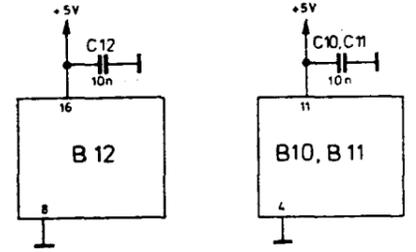
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Zusatz-Nr.	336.4015.C
1 GMA	
Arbeits- No.	107
Proj. No.	10.79
Rev. No.	La
Arbeits- No.	
Proj. No.	
Rev. No.	
Arbeits- No.	
Proj. No.	
Rev. No.	

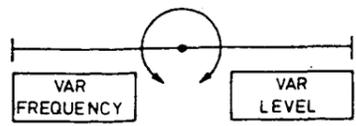
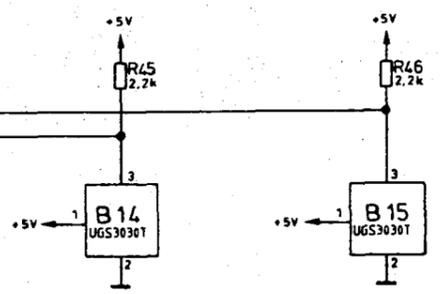
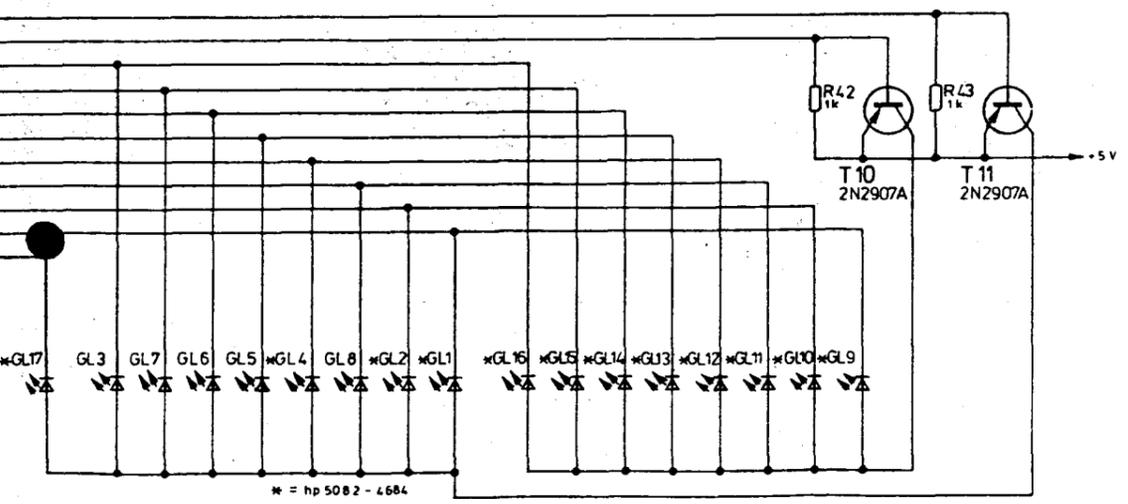
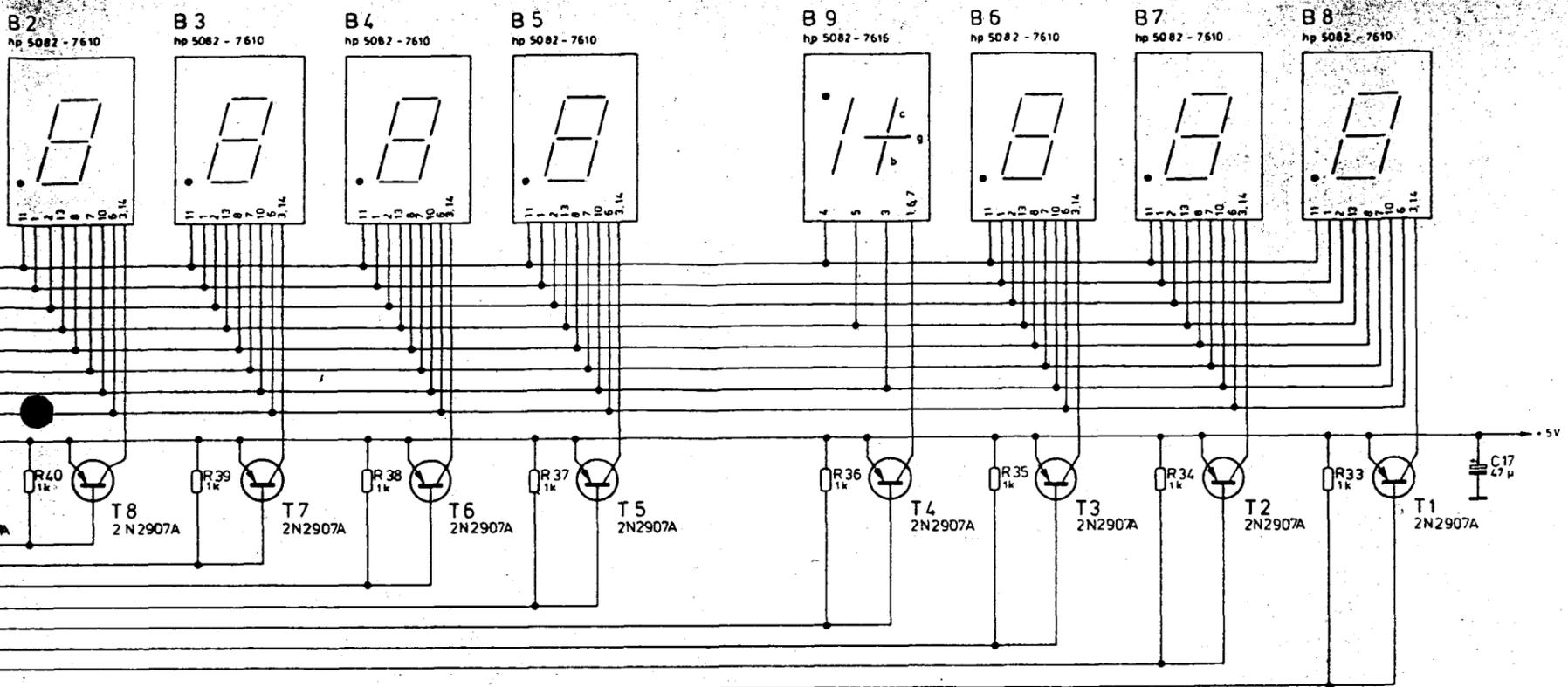
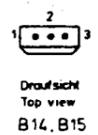
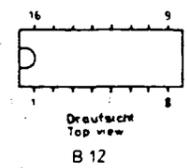
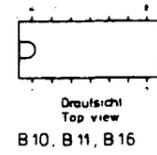
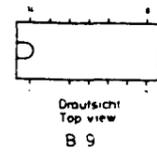
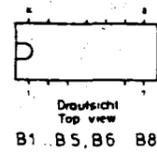
0 1 2 3
ZENTIMETER



ST 1.1 → +5V
ST 1.2 →



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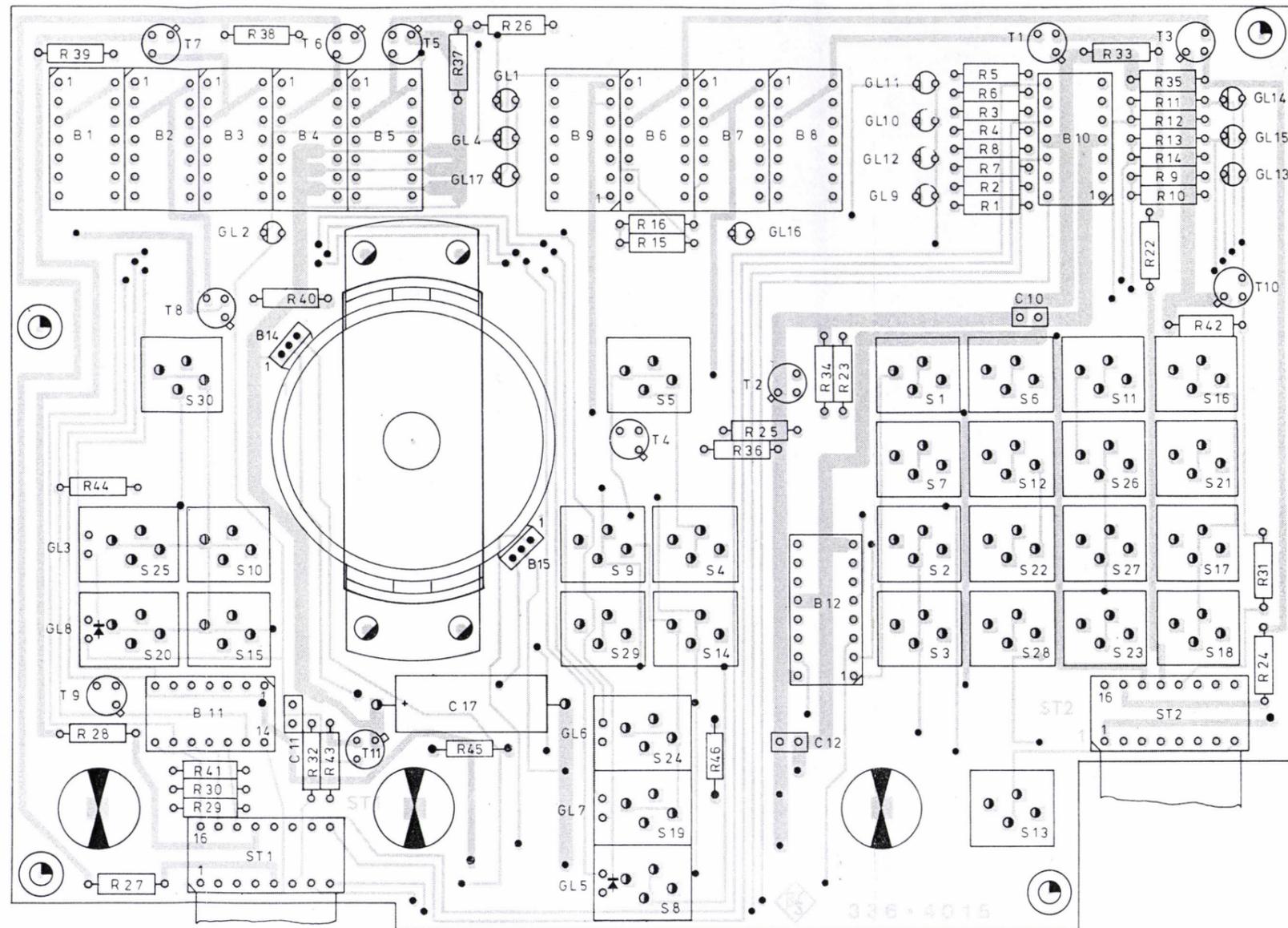


MAX	SWP	200	50	600	Hz	LOG	VAR FREQ kHz	VAR PEDEL TALK	LISTEN	REM	dBV	V	mV	dBm
-----	-----	-----	----	-----	----	-----	--------------	----------------	--------	-----	-----	---	----	-----

Stromlauf gilt für VAR 02, 32
Circuit diagram is valid for model 02,32

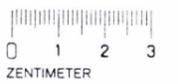
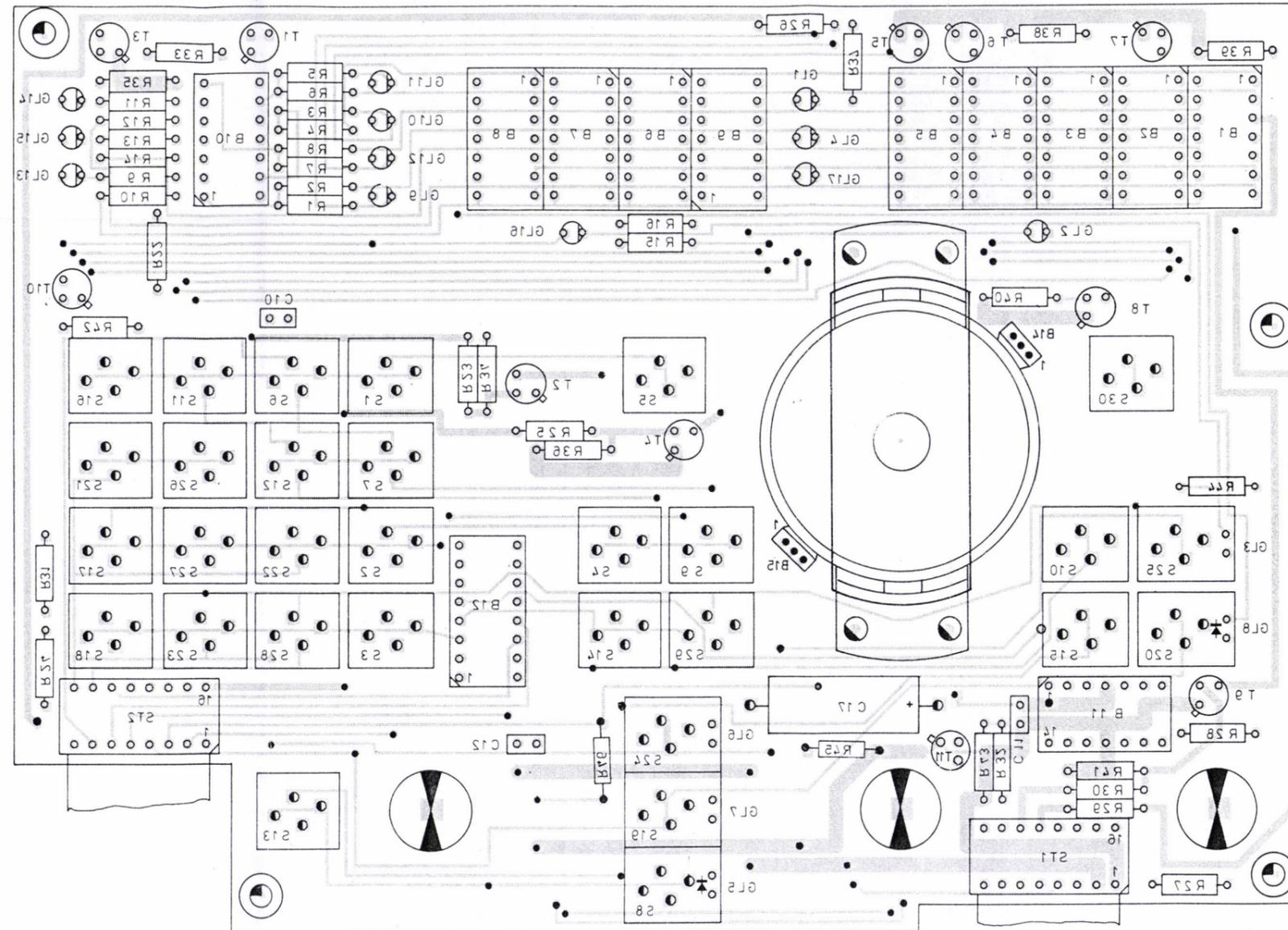
ManualsPlus.com

Ansicht und Leitungsführung Bauteilseite
View of tracks on component side



B	10.79	La	Mot. line		Maststab 2 : 1	
C	25.381	WK	Teilanzahl			
E	284.74	LS				
			1GM	Tag	Name	Benennung
			Recht	10.79	La	Anzeige- und Tastenfeld
			Leg			Indication and keyboard
			Num			
						Zeichn. Nr.
						336.4015
						Blatt Nr.
						2
						ROHDE & SCHWARZ
						SPN
						336.3019 V
						336.3519

Ansicht und Leitungsführung Lötseite
View of tracks on solder side



B	10.79	La	Masse	Maßstab	2 : 1
C	25.381	WK	Material	Maßstab	
E	284.74	LS		Maßstab	
			1 GM	Name	Benennung
			Recht	La	Anzeige-und Tastenfeld
			Herf.		Indication and keyboard
			Nr.		
			Zeichn.-Nr.		Blatt-Nr.
			336.4015		3
			RÖHDE & SCHWARZ		
			SPN	336.3019 V	erste Z. 336.3519

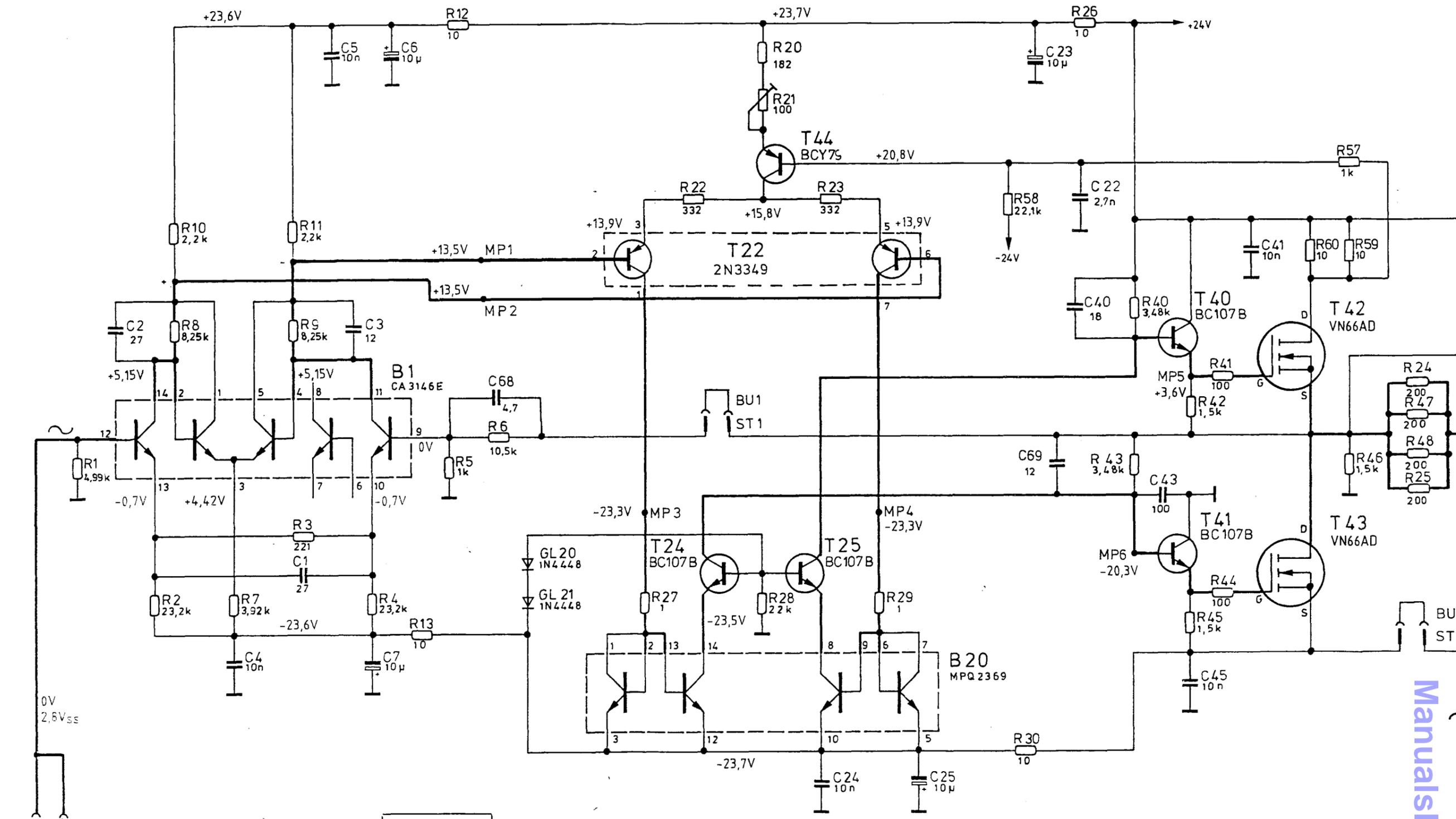
Name	
And. Mittig. Nr.	
And. zust.	
Name	
Datum	
And. Mittig. Nr.	
And. zust.	

Diese Zeichnung ist unser Eigentum. Vervielfältigung, unbefugte Verwertung, Mitteilung an andere ist strafbar und schadenersatzpflichtig.

ROHDE & SCHWARZ · MÜNCHEN

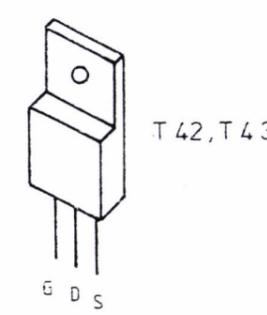
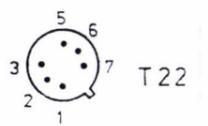
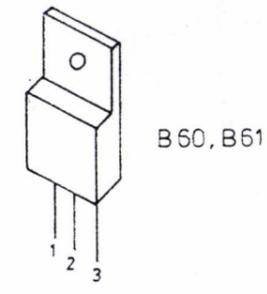
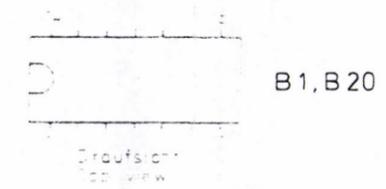
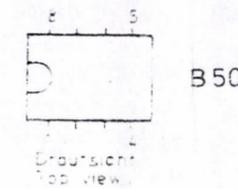
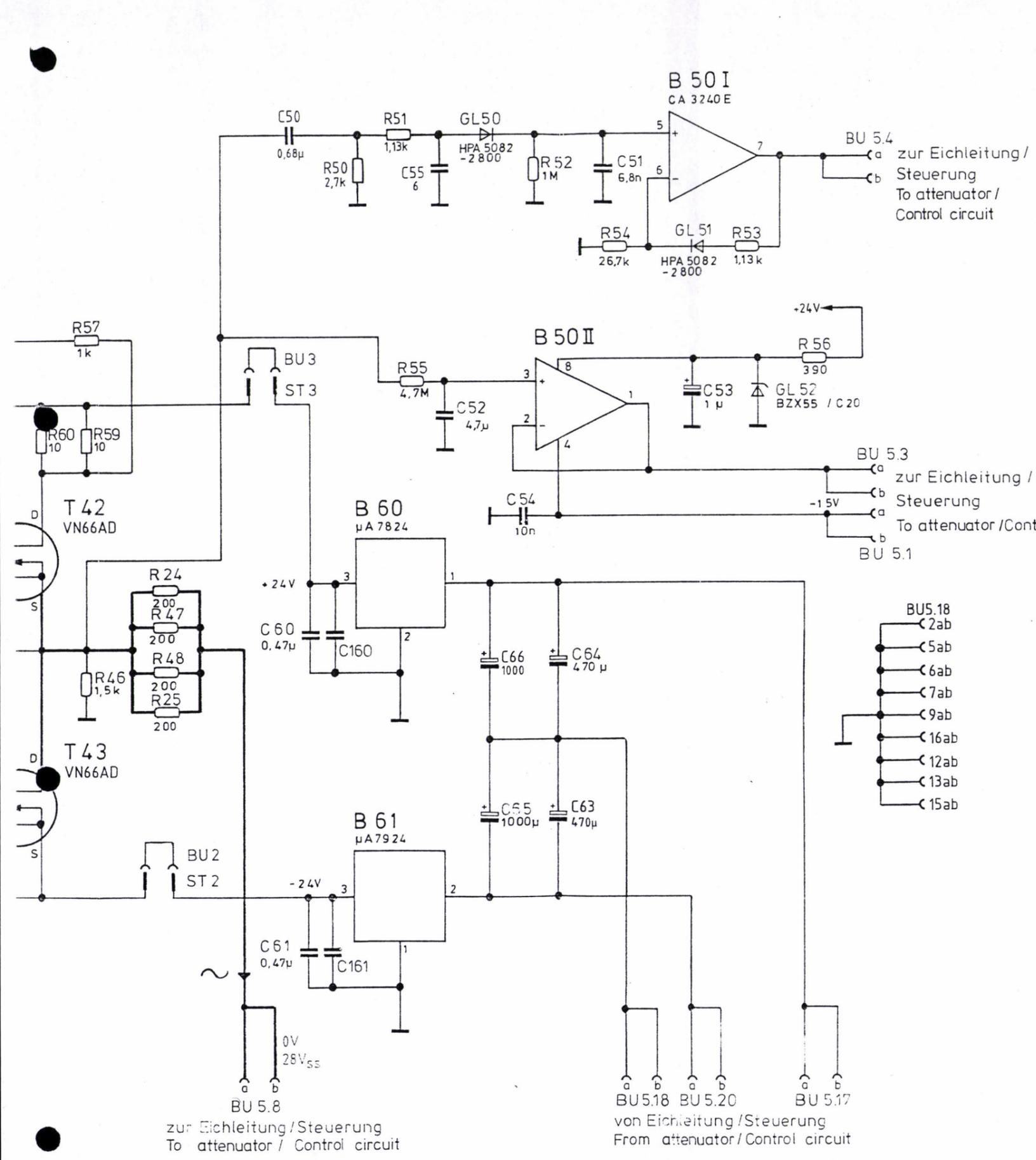
Name	
Datum	
And. Mittig. Nr.	
And. zust.	
Name	
Datum	
And. Mittig. Nr.	
And. zust.	

1 GMA	gezeichnet	11.79	GU
	beurteilt	11.79	LS
	geprüft		
	normgepr.		



von der Eichleitung/Steuerung
From attenuator / Control circuit

GEMESSEN BEI
f_A=1kHz V_A-10V



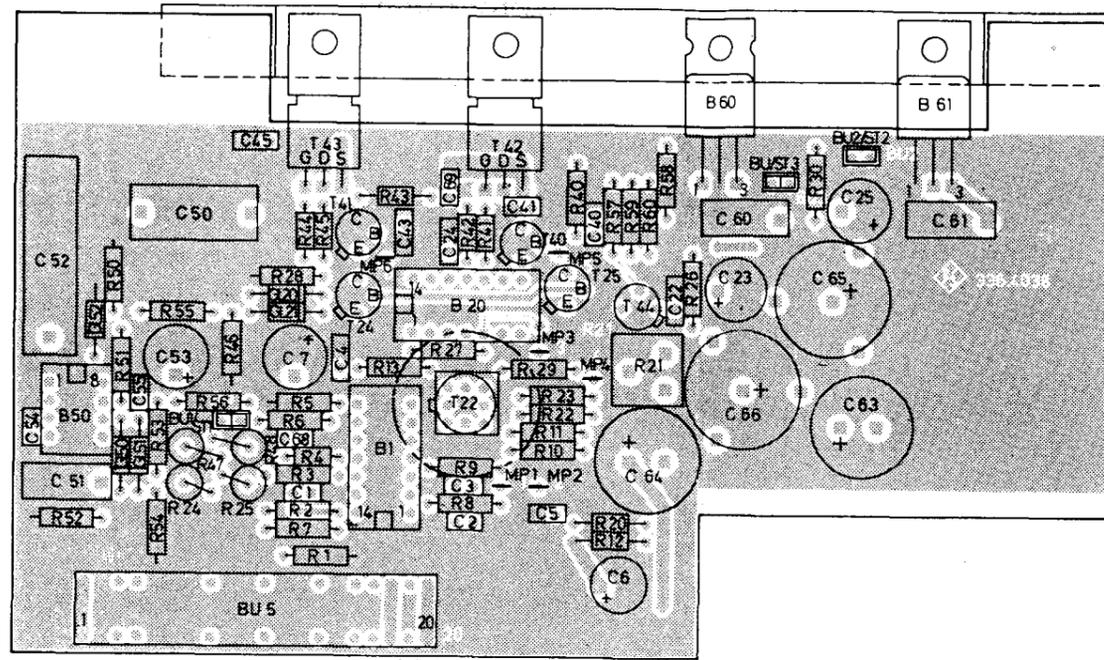
zur Eichleitung / Steuerung
To attenuator / Control circuit

von Eichleitung / Steuerung
From attenuator / Control circuit

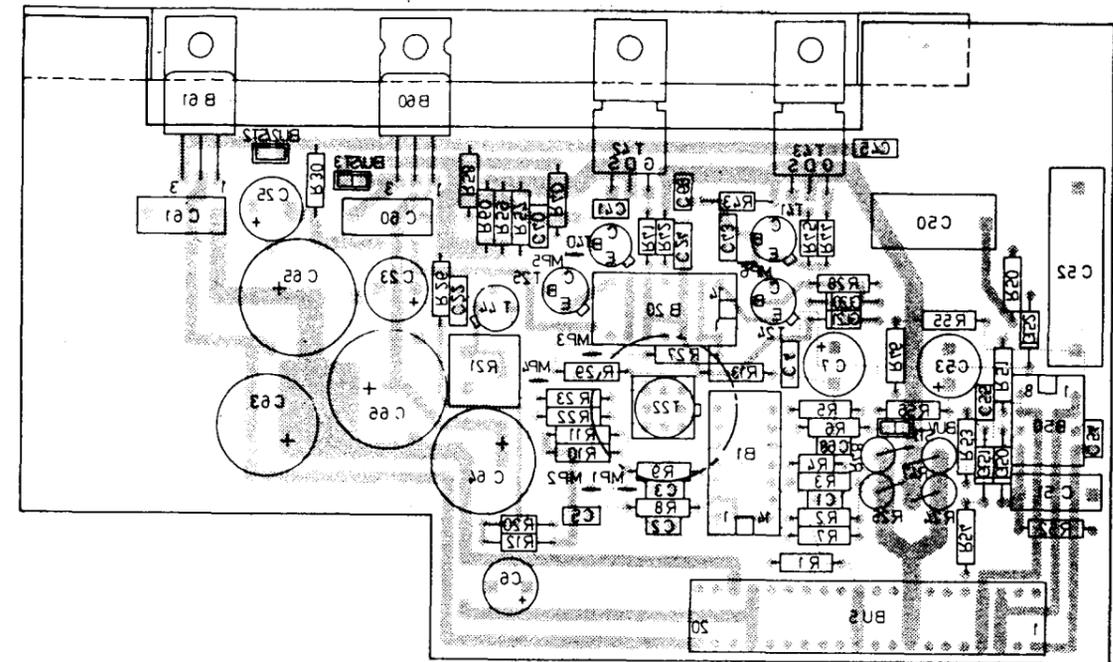
Stromlauf gilt für VAR 02, 32
Circuit diagram is valid for model 02,32

	Stromlauf zu	10V Endstufe Output stage	Zeichn. Nr. 336.4038 S
			Z 336.3019V 336.3019

Ansicht und Leitungsführung Bauteilseite
View of tracks on component side



Ansicht und Leitungsführung Lötseite
View of tracks on solder side



Für diese Unterlage behalten wir uns alle Rechte vor.

H	31000	6.84	IB	Maße ohne Toleranzangabe	Maßstab 1:1	Halbzeug, Werkstoff
J	32164	7.84	GS			
				1GMA	Tag	Name
				Bearb.	6.84	IB
				Gepr.		
				Norm		
						Benennung
						10V-Endstufe
						Zeichn.-Nr.
Änd. Zust.	Änderungs-Mitteilung	Tag	Name			Blatt-Nr.
				zu Gerät	SPN	2
				reg. i. V.	336.3019 V	v. Bl.
					erste Z.	336.3019

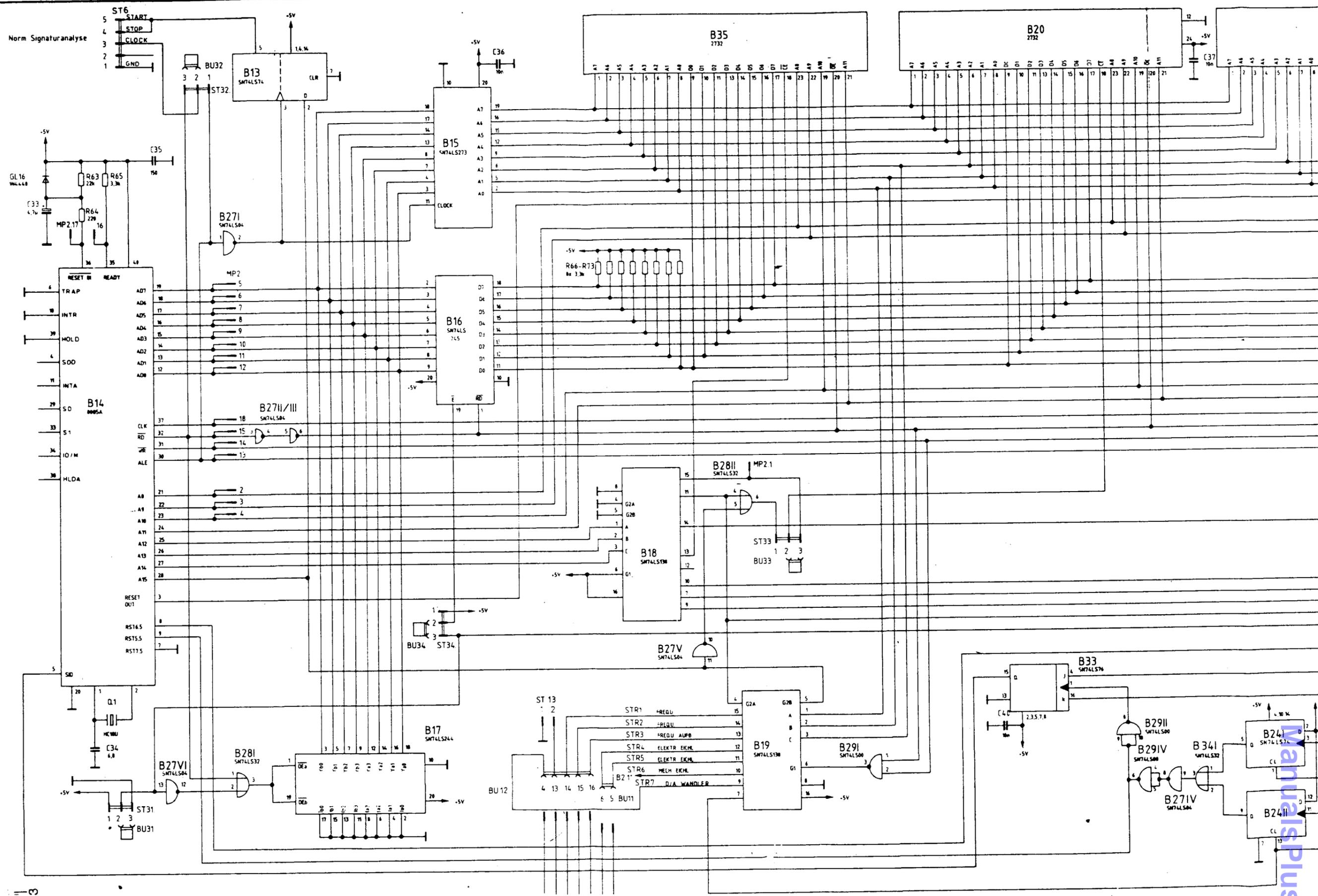
ManualsPlus.com

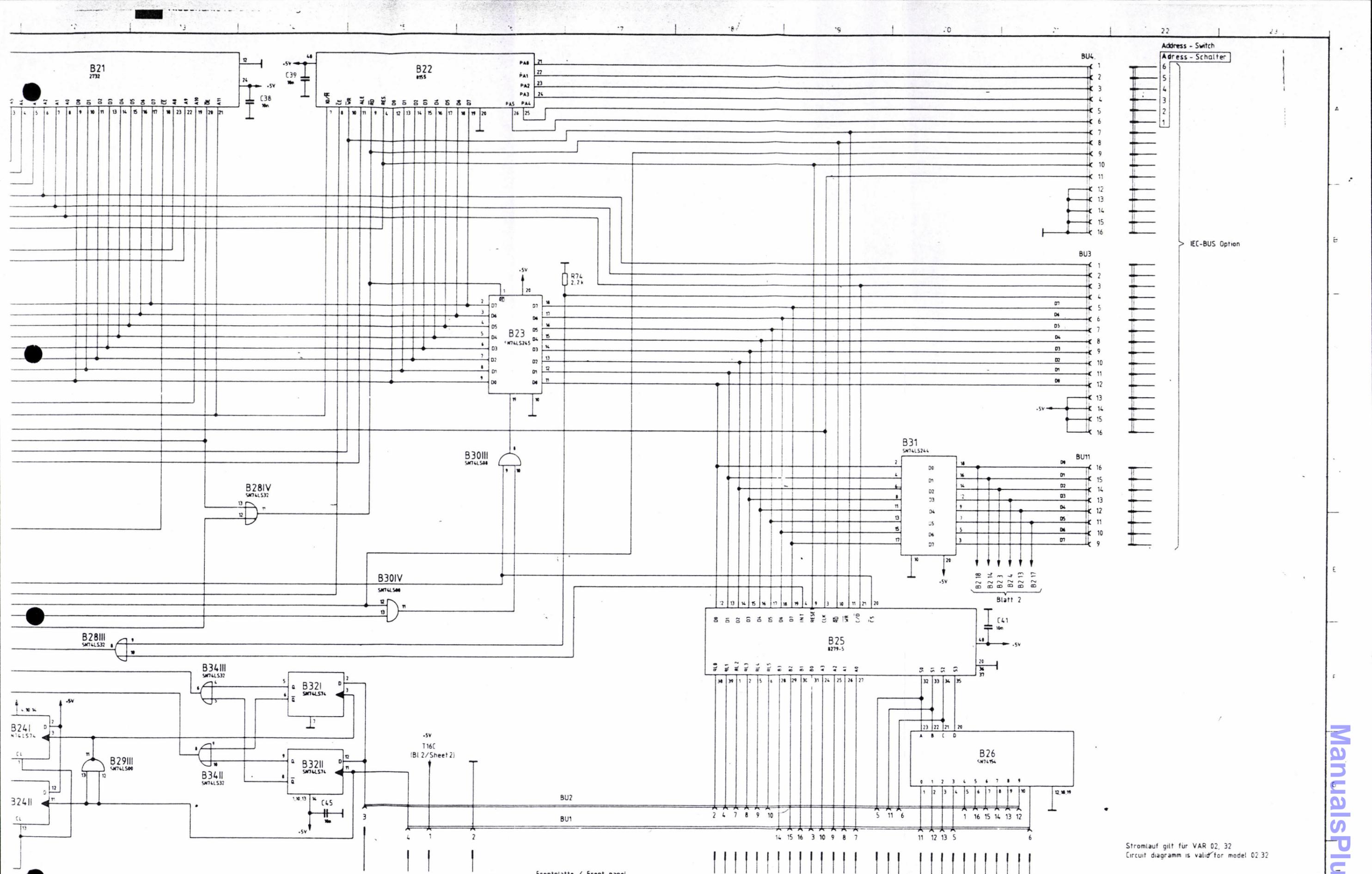
Name	
Datum	
And. Mfing. Nr.	
And. Zust.	
Name	
Datum	
And. Mfing. Nr.	
And. Zust.	

Für diese Zeichnung behalten wir uns alle Rechte vor

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Zeichn.-Nr.	392.7522 S
10HA	
gezeichnet	5.81
bearbeitet	8.52
geprüft	
normgepr.	
Name	ib
Datum	8.83
And. Mfing. Nr.	30630
And. Zust.	A
Name	Gu
Datum	8.52
geprüft	
normgepr.	





Stromlauf gilt für VAR 02, 32
 Circuit diagram is valid for model 02 32

Frontplatte / Front panel

Stromlauf zu		Steuerung Eichleitung / Control circuit attenuator		Zeichn.-Nr.		Blatt-Nr.	
				392.7522 S		1	
SPN	reg. v	392.7516 V	erste Z	336 3019	v 2 Bl		

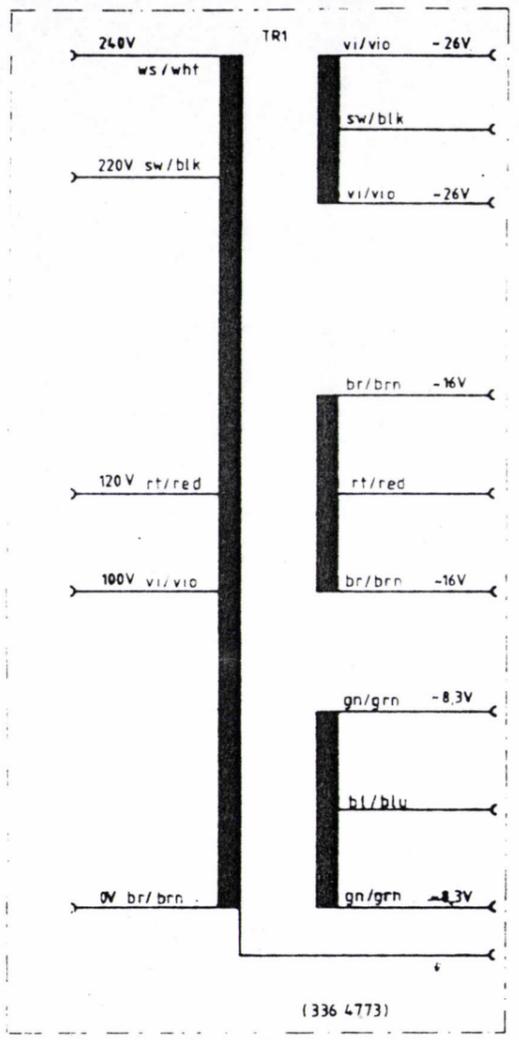
Klebekante für Druckerzeugnis, durch diese Zone möglichst nur Leitungen führen

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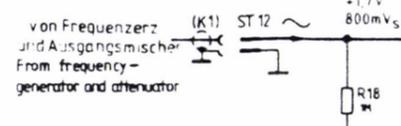
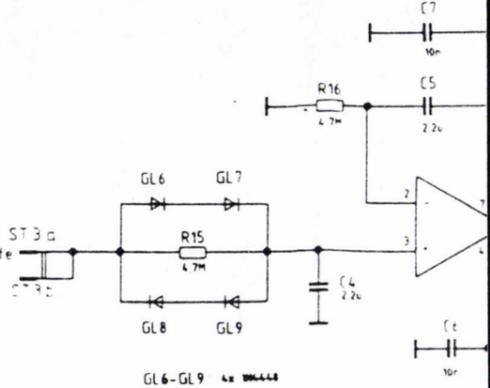
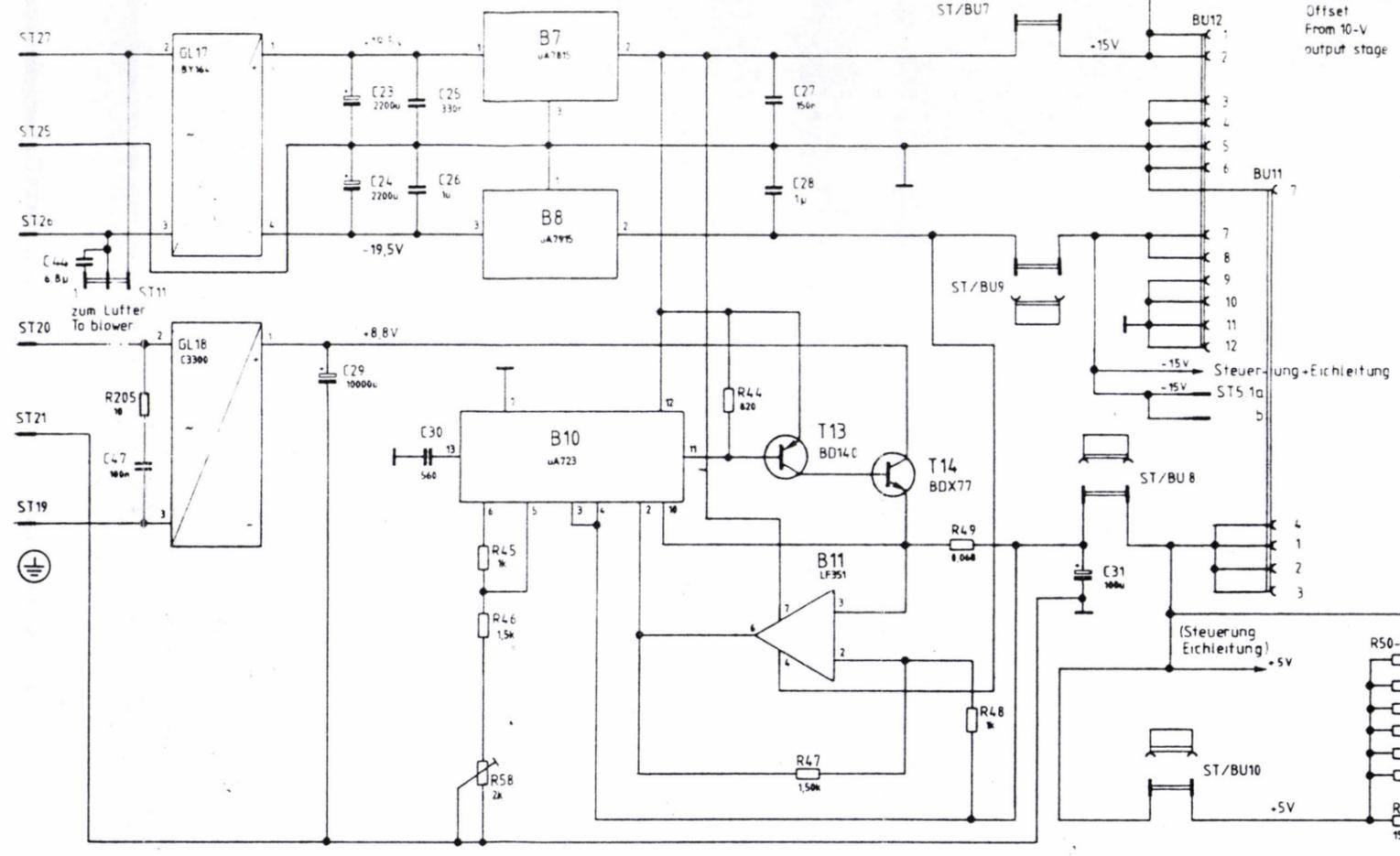
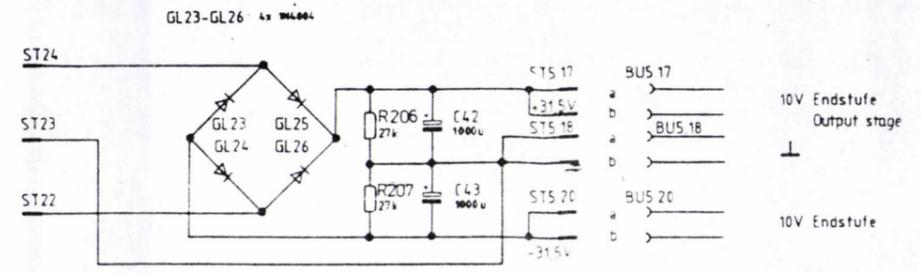
Name	
Am. Mittig	
Am. Zust.	
Name	
Datum	
Nr.	
Am. Mittig	
Am. Zust.	
Name	
Datum	
Nr.	

Zeichn.-Nr.	7522 S
1. GMA	29323
gezeichnet	30396
gezeichnet	31000
geprüft	32164
normgepr.	
Name	gs
Tag	3.83
Nr.	583
Tag	184
Nr.	1084

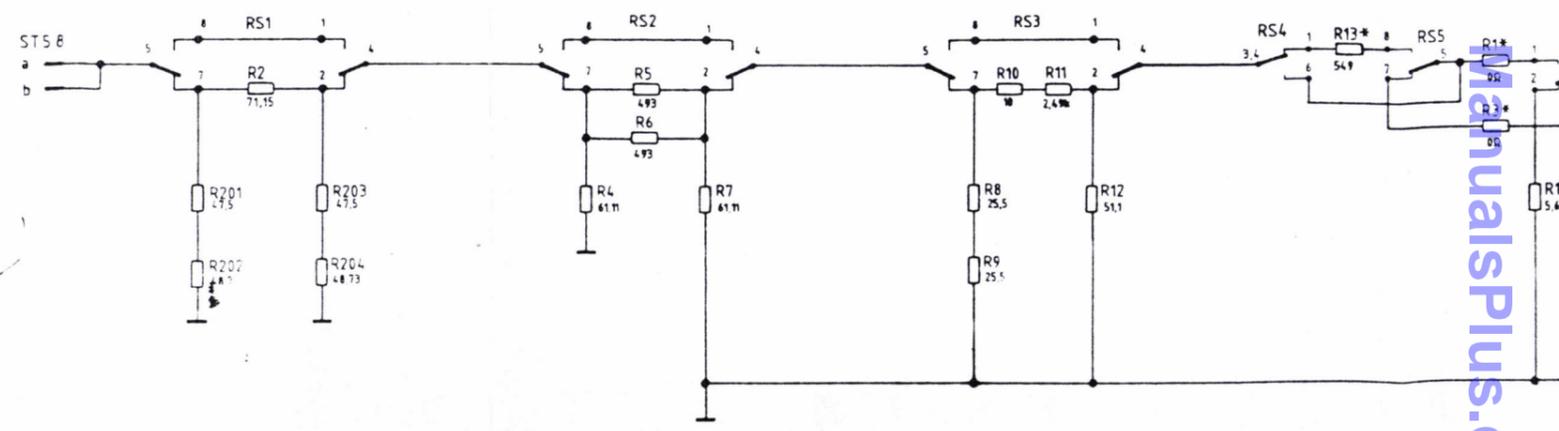
Für diese Zeichnung behalten wir uns alle Rechte vor

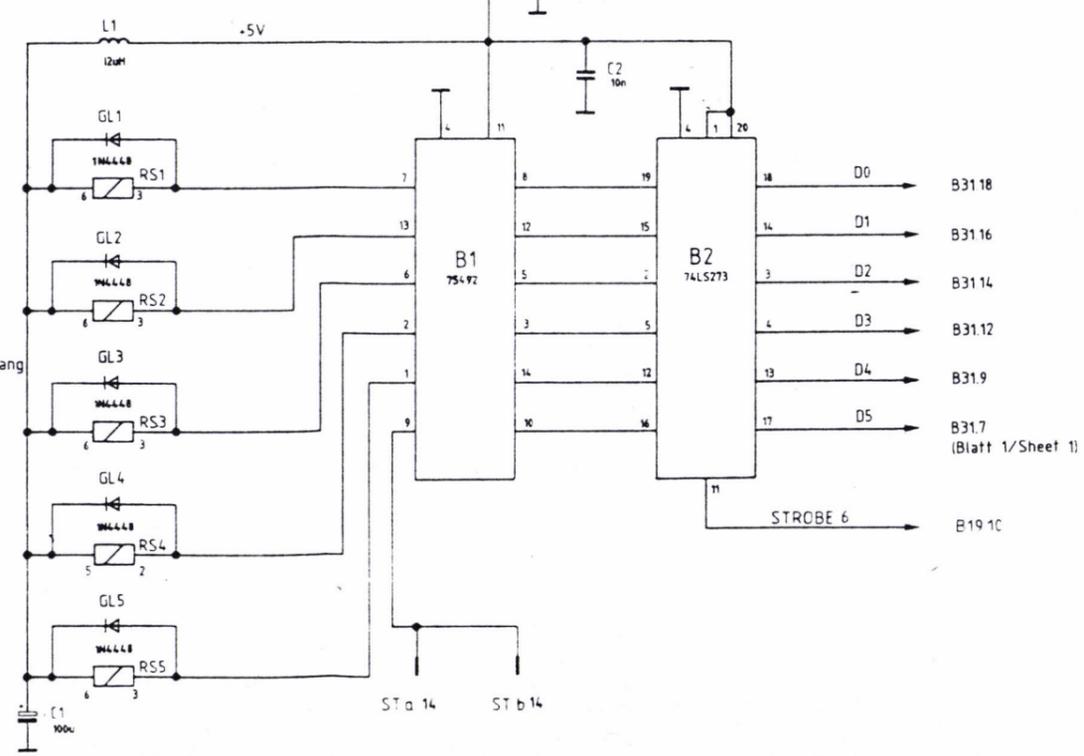
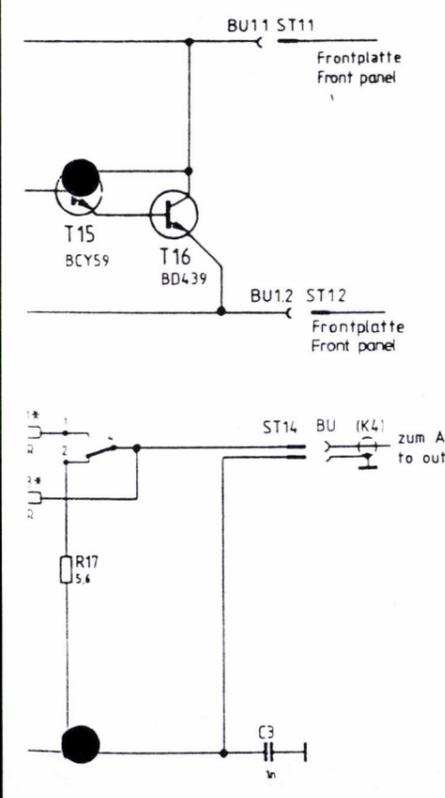
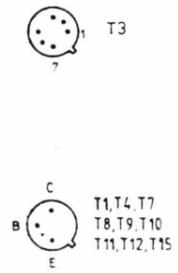
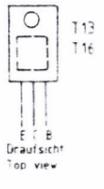
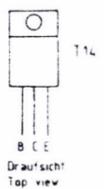
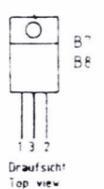
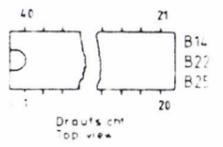
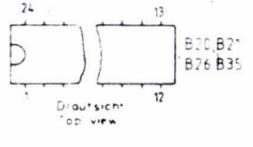
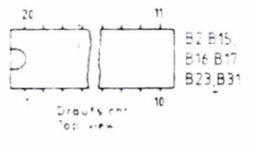
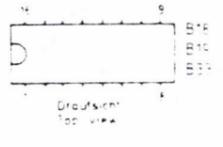
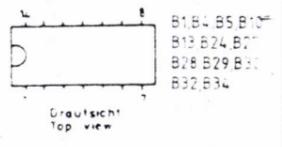
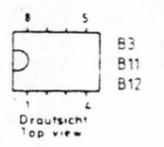
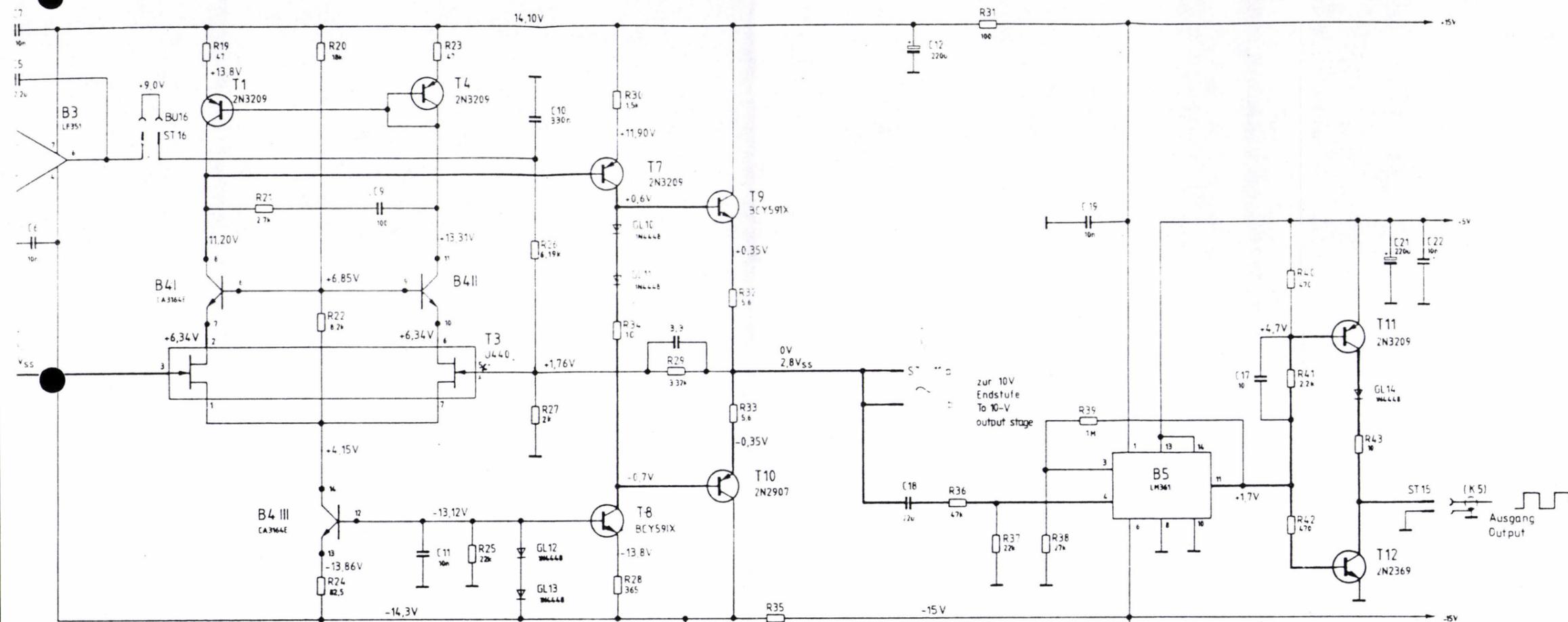


GEMESSEN BEI 220V
f_A = 1kHz U_a = 10V



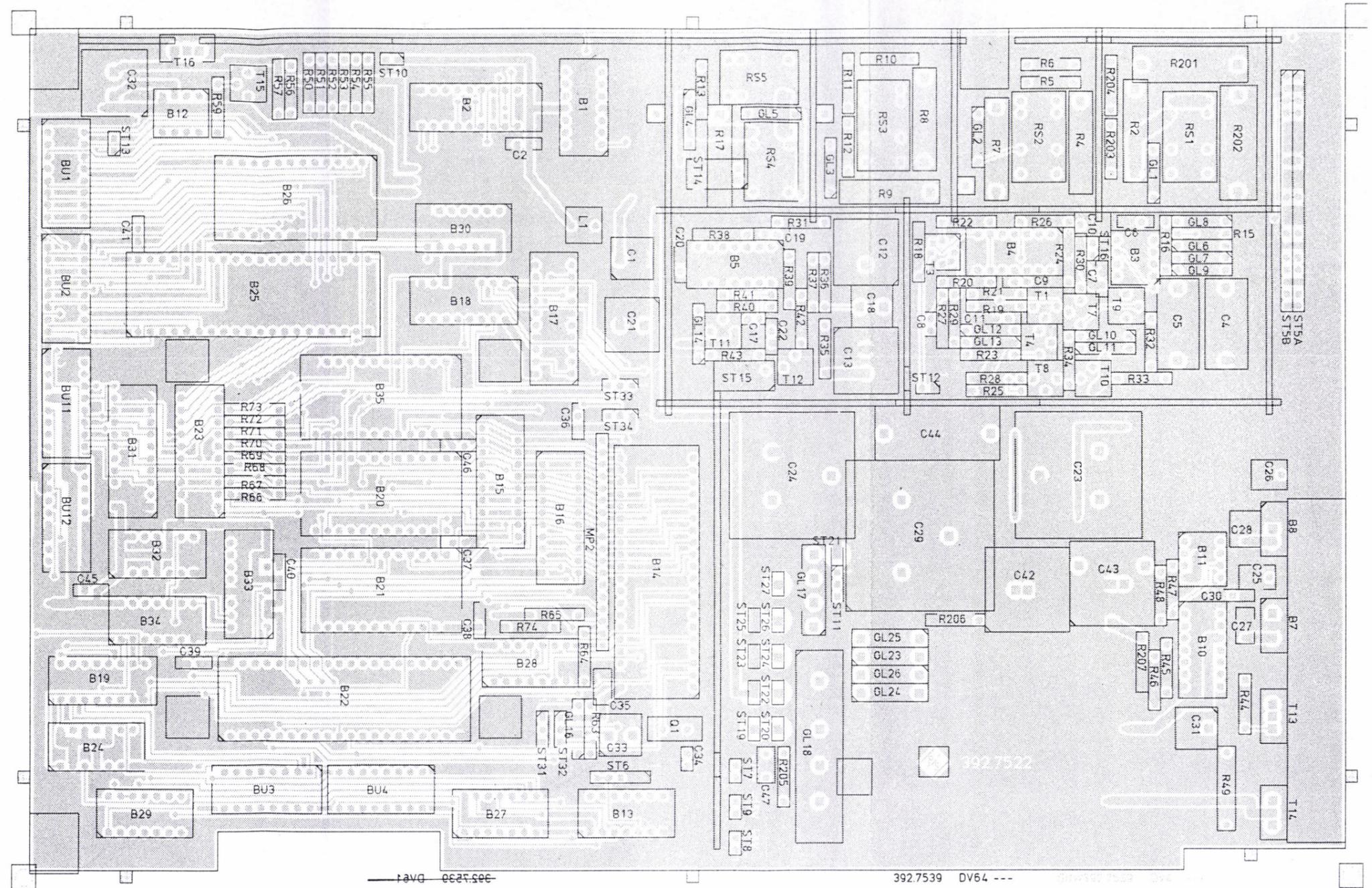
von der Endstufe
From output stage



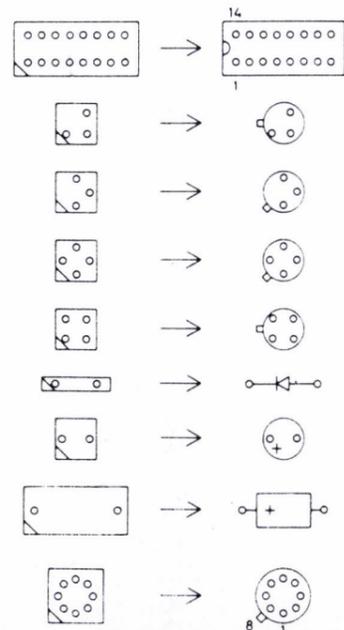


		Steuering Eichleitung / Control circuit attenuator		Zeichn.-Nr. 392.7522 S	
SPN	reg. V	392 7516 V	erste Z	336 3019	2

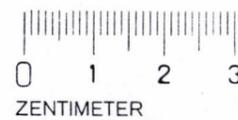
Ansicht und Leitungsführung Bauteilseite
View of tracks on component side



Symbolschlüssel



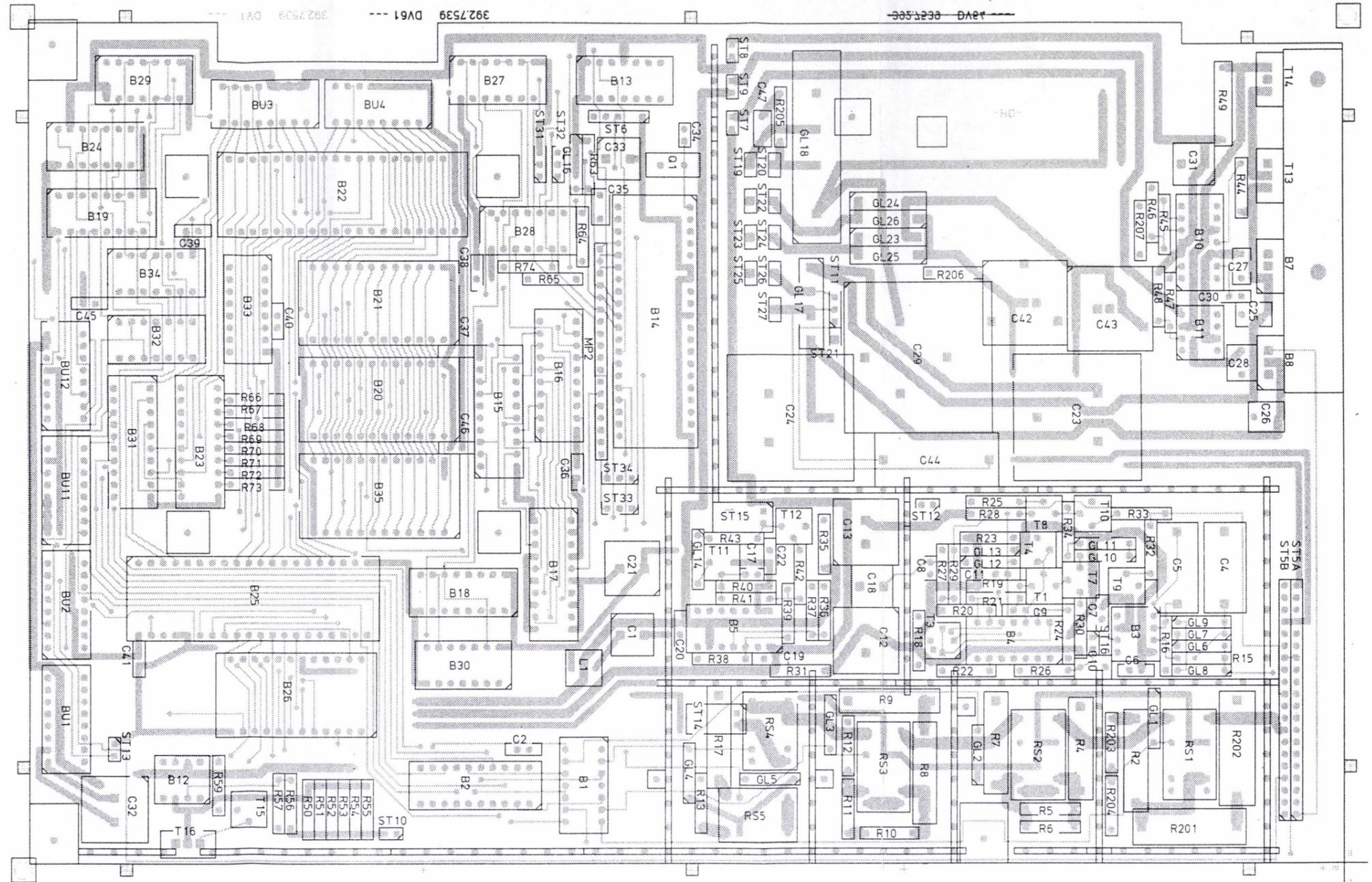
Achtung! MOS-Bauteile
Caution. MOS components



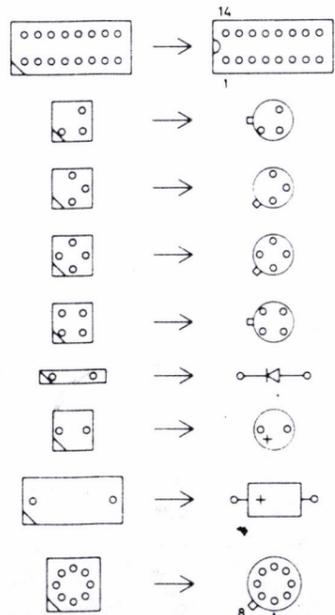
Maße ohne Toleranzangabe		Maßstab	
		Hilfzeug, Werkstoff	
Tag		Name	
Bearb.	9,82	LS	
Gepr.			
Norm			
Benennung		Steuerung und Eichleitung	
		Control and attenuator circuit	
Zeichn.-Nr.		392.7522	
Blatt-Nr.		2	
v. B.			
And. Zust.	Anderungs-Mitteilung	Tag	Name
zu Gerät SPN		reg. i. V. 392.7516 V	
		erste Z 336.3019	

ROHDE & SCHWARZ

Ansicht und Leitungsführung Lotseite
View of tracks on solder side



Symbolschlüssel



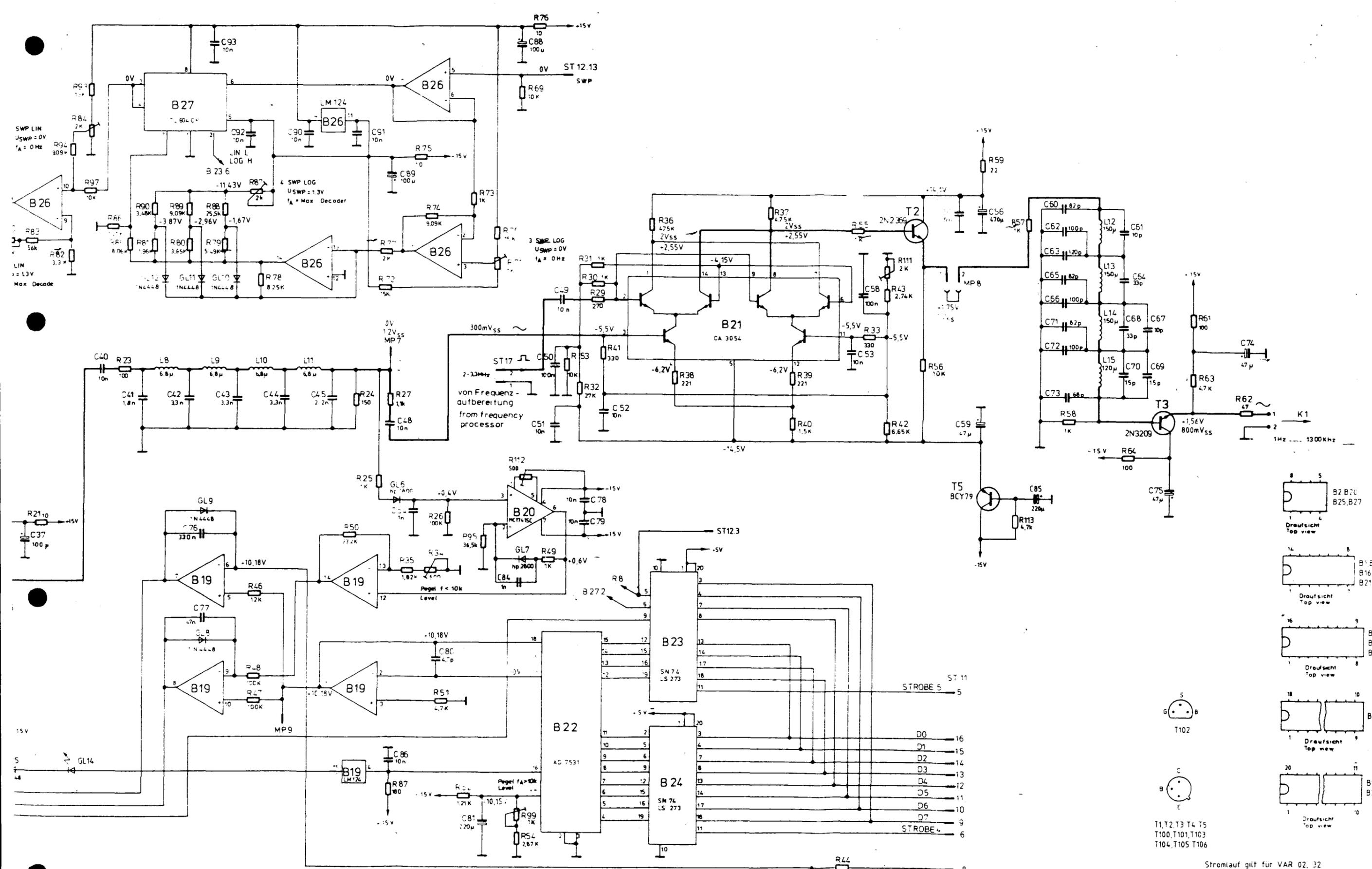
Achtung! MOS - Bauteile
Caution. MOS components

Maße ohne Toleranzangabe		Maßstab	
		Halbzeug, Werkstoff	
Tag	Name	Benennung	
Bearb. 9,82	LS	Steuerung und Eichleitung	
Gepr.		Control and attenuator circuit	
Norm		Zeichn.-Nr.	Blatt-Nr.
		392.7522	3
And. Zust.	Anderungs-Mitteilung	Tag	Name
		zu Gerät SPN	reg. i. V. 392.7516 V
			erste Z. 336.3019

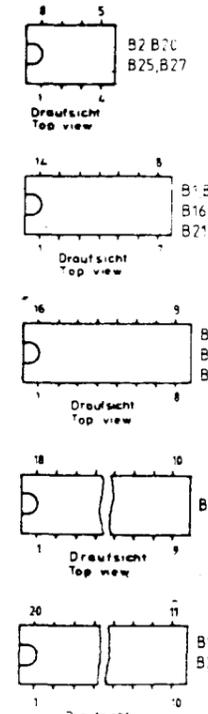
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ISU Projektion Methode E

ManualsPlus.com



ST17
2-32kHz
von Frequenz-
aufbereitung
from frequency
processor



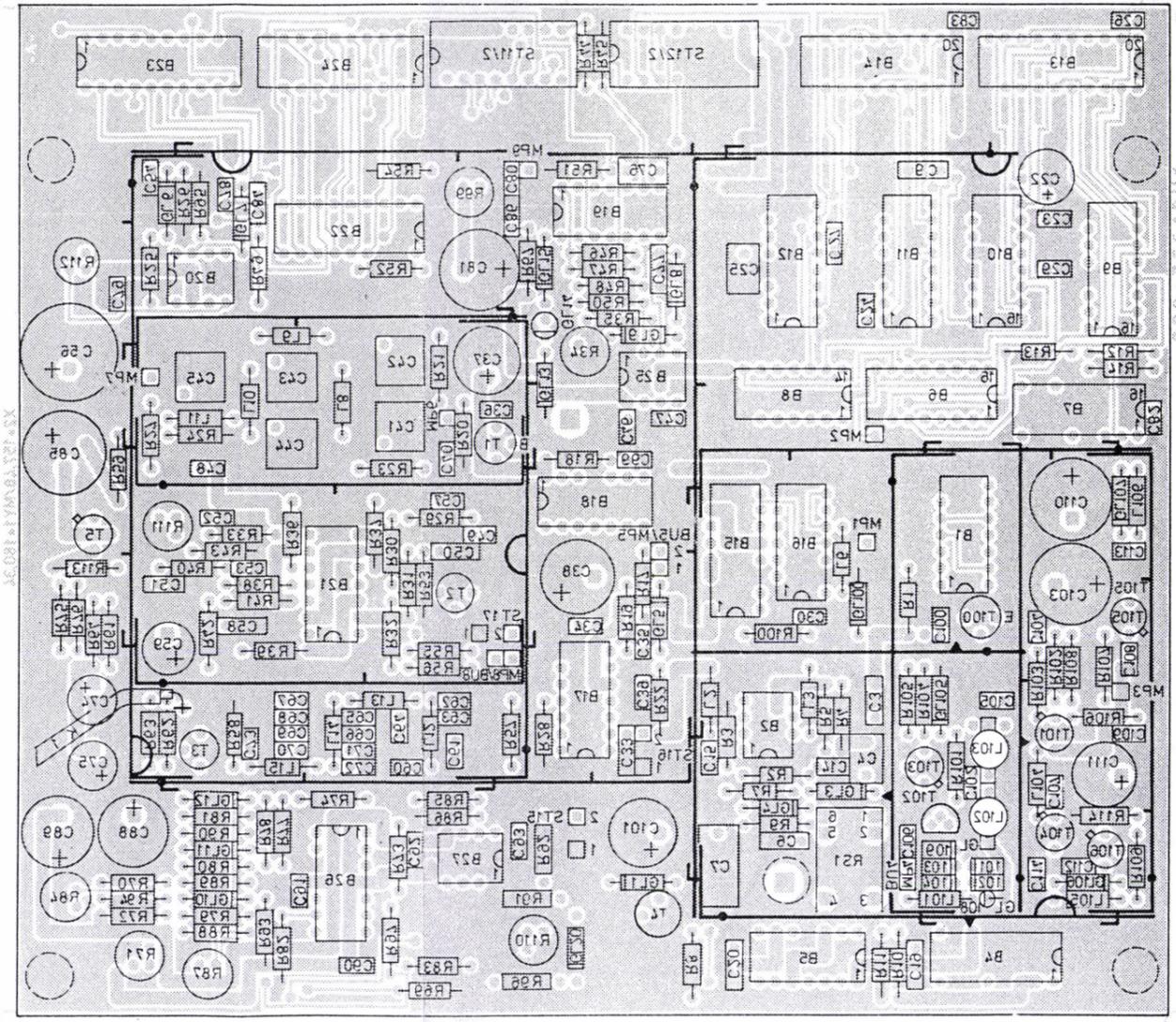
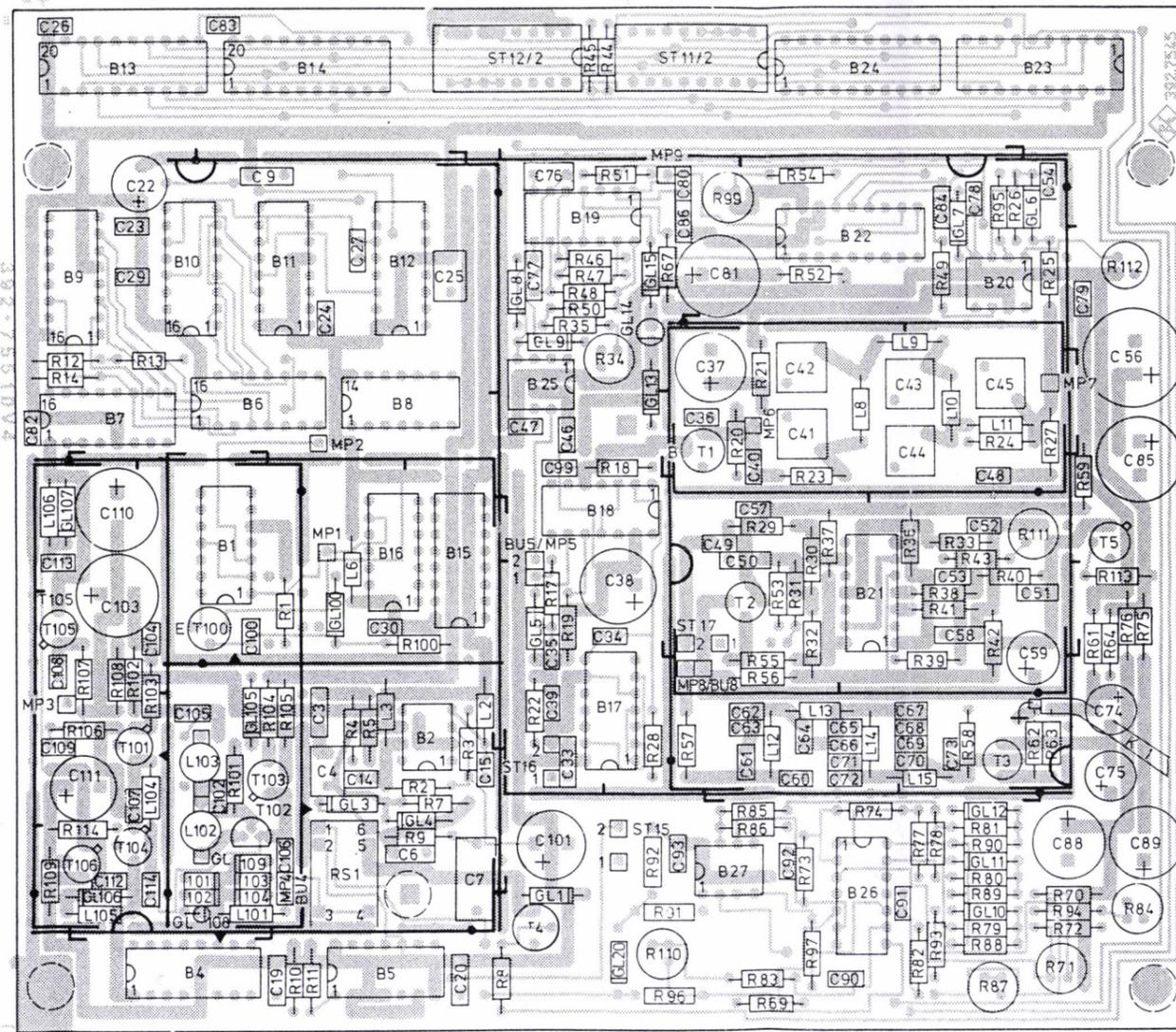
T1, T2, T3, T4, T5
T100, T101, T103
T104, T105, T106

Stromlauf gilt für VAR 02.32
Circuit diagram is valid for model 02.32

	Stromlauf zu		Frequenz Erzeugung Frequency generator		Zeichn.-Nr. 392.7545 S	Blatt Nr. 1
	SPN	reg. V	392.7516 V	erste Z			336.4.009

Ansicht und Leitungsführung Bauteilseite
View of tracks on component side

Ansicht und Leitungsführung Lotseite
View of tracks on solder side



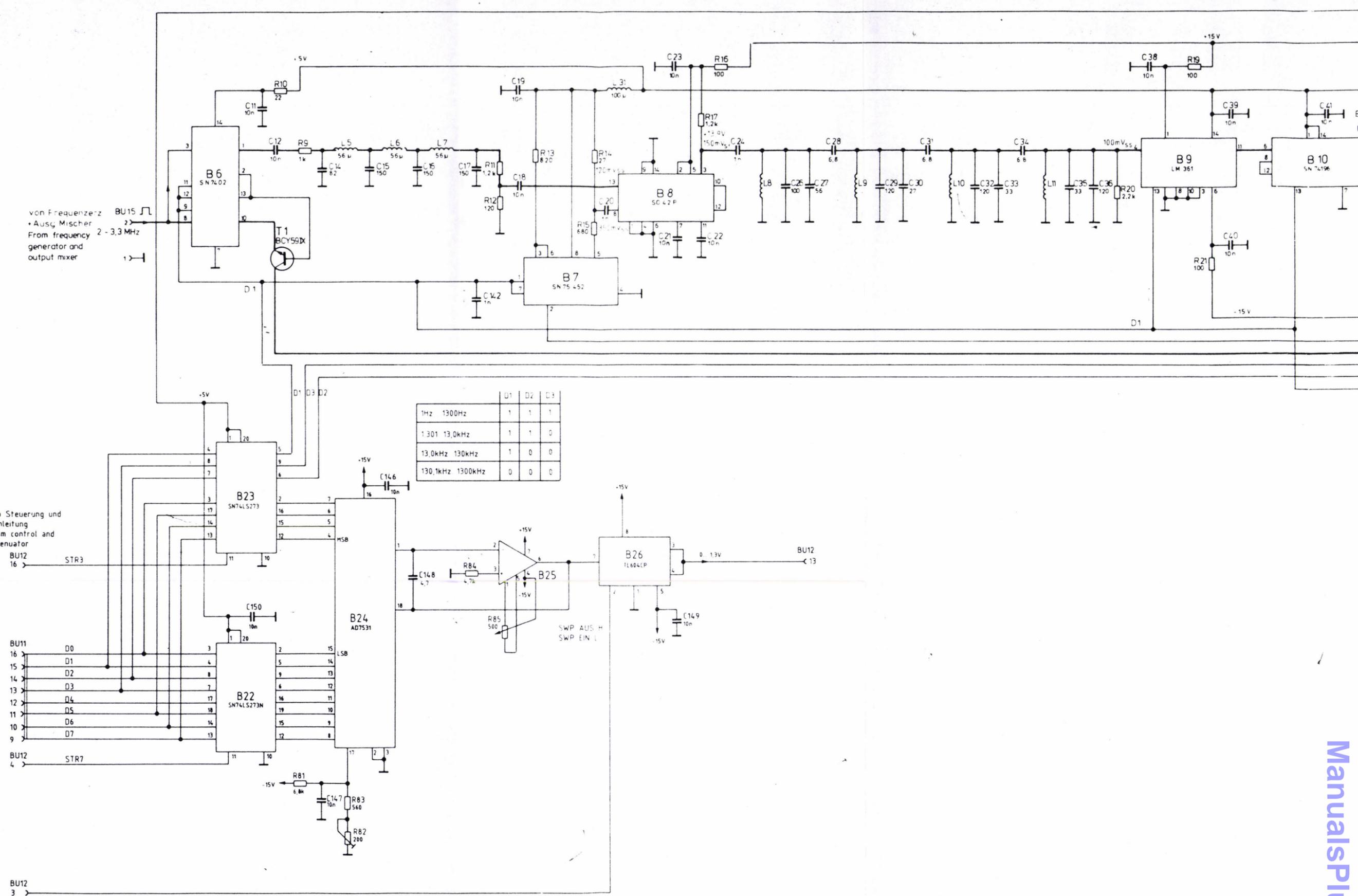
B	29323	11.82	LS	Maße ohne Toleranzangabe		Maßstab 1:1	
						Halbzeug Werkstoff	
				1KGA	Tag	Name	Benennung
				Bearb	3.9.82	LS	Frequenzerzeugung Frequency generator
				Gepr			
				Norm			
						Zeichn.-Nr.	392.7545
And Zust	Anderungs-Mitteilung	Tag	Name			reg. I. V.	
				zu Gerät	SPN		Blatt-Nr.
							2

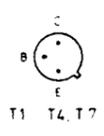
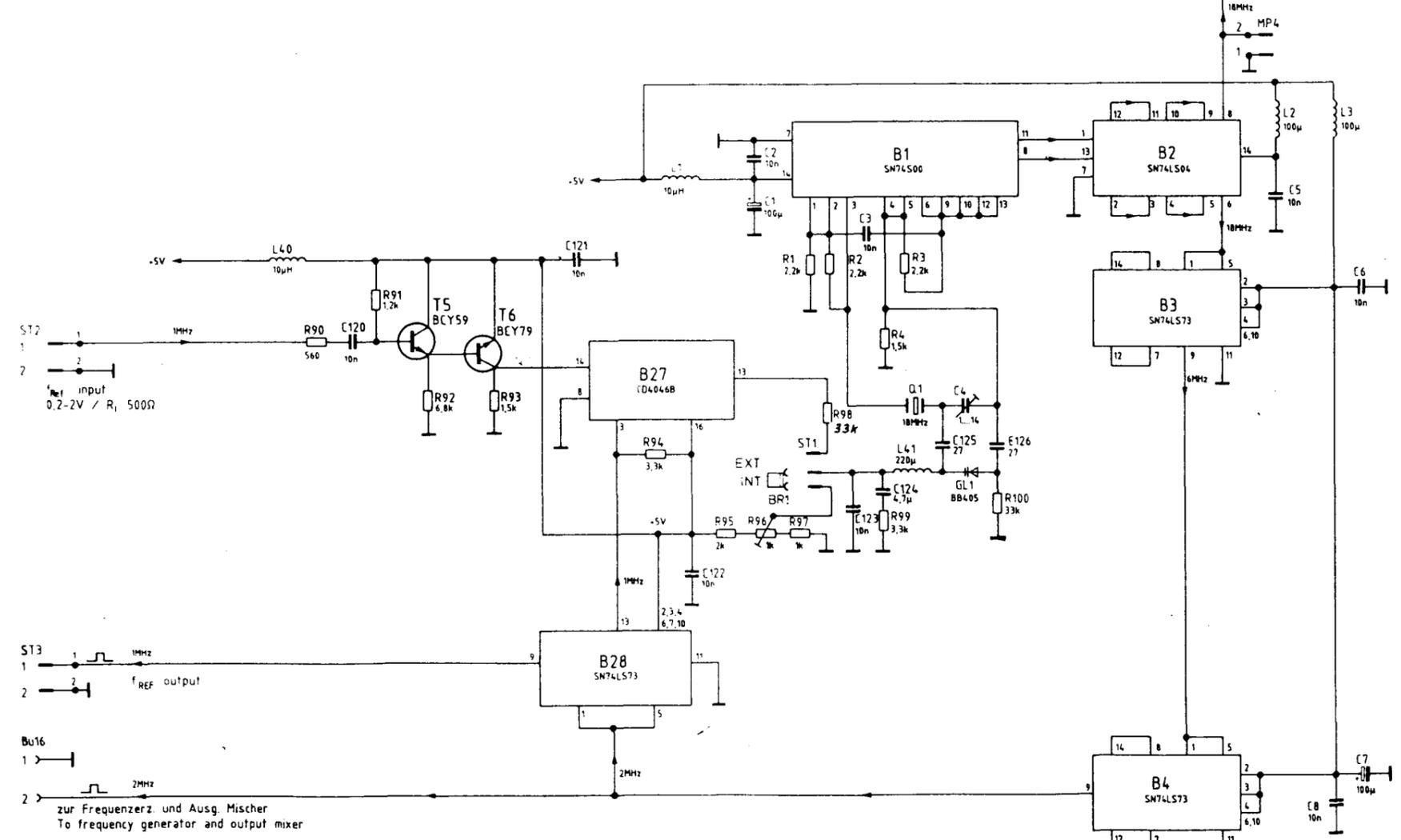
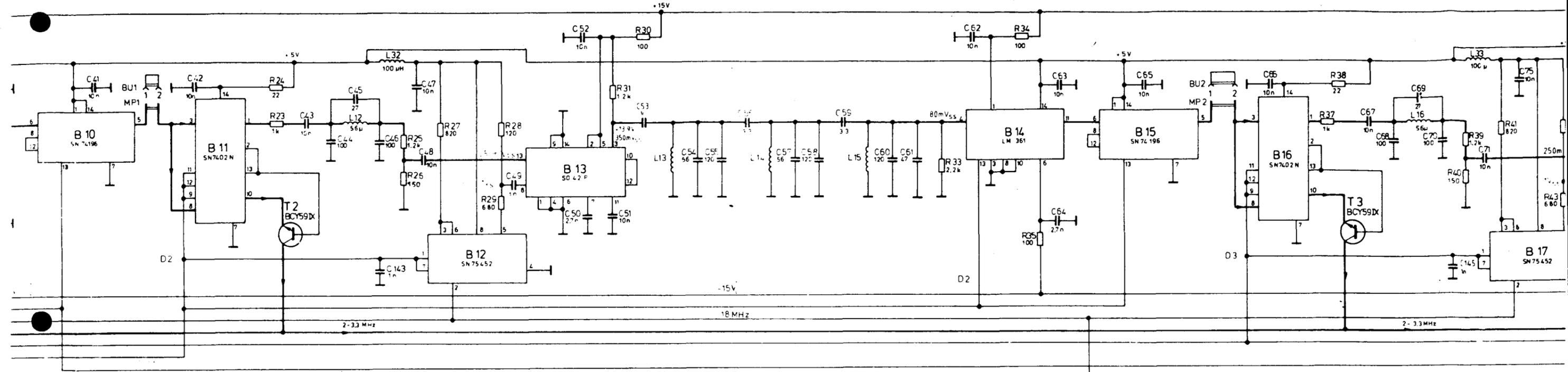
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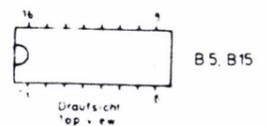
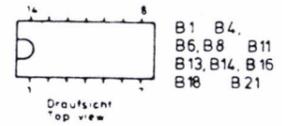
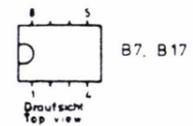
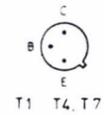
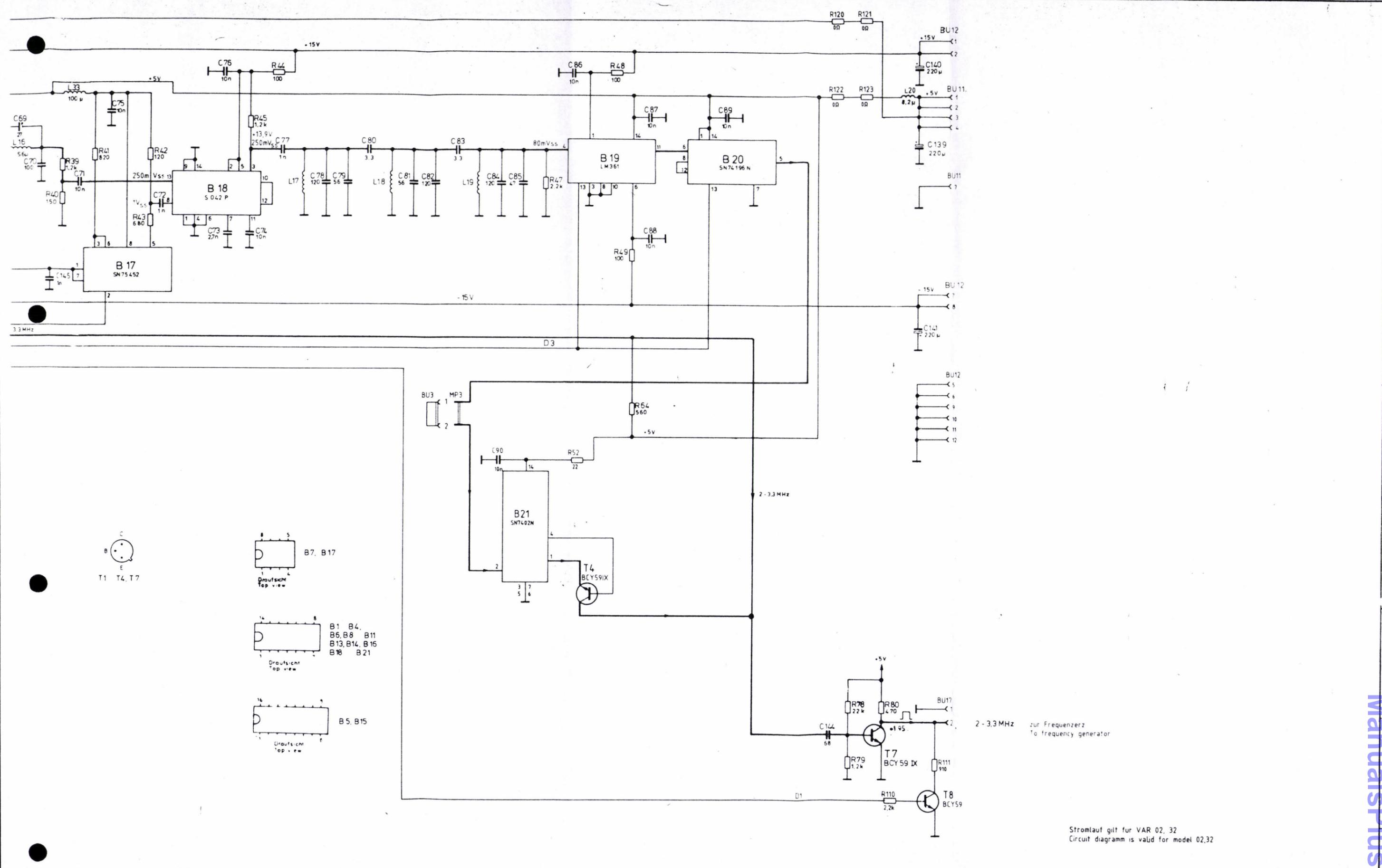
Ist-Objektion Methode E

ManualsPlus.com

1 KG
...
...
...



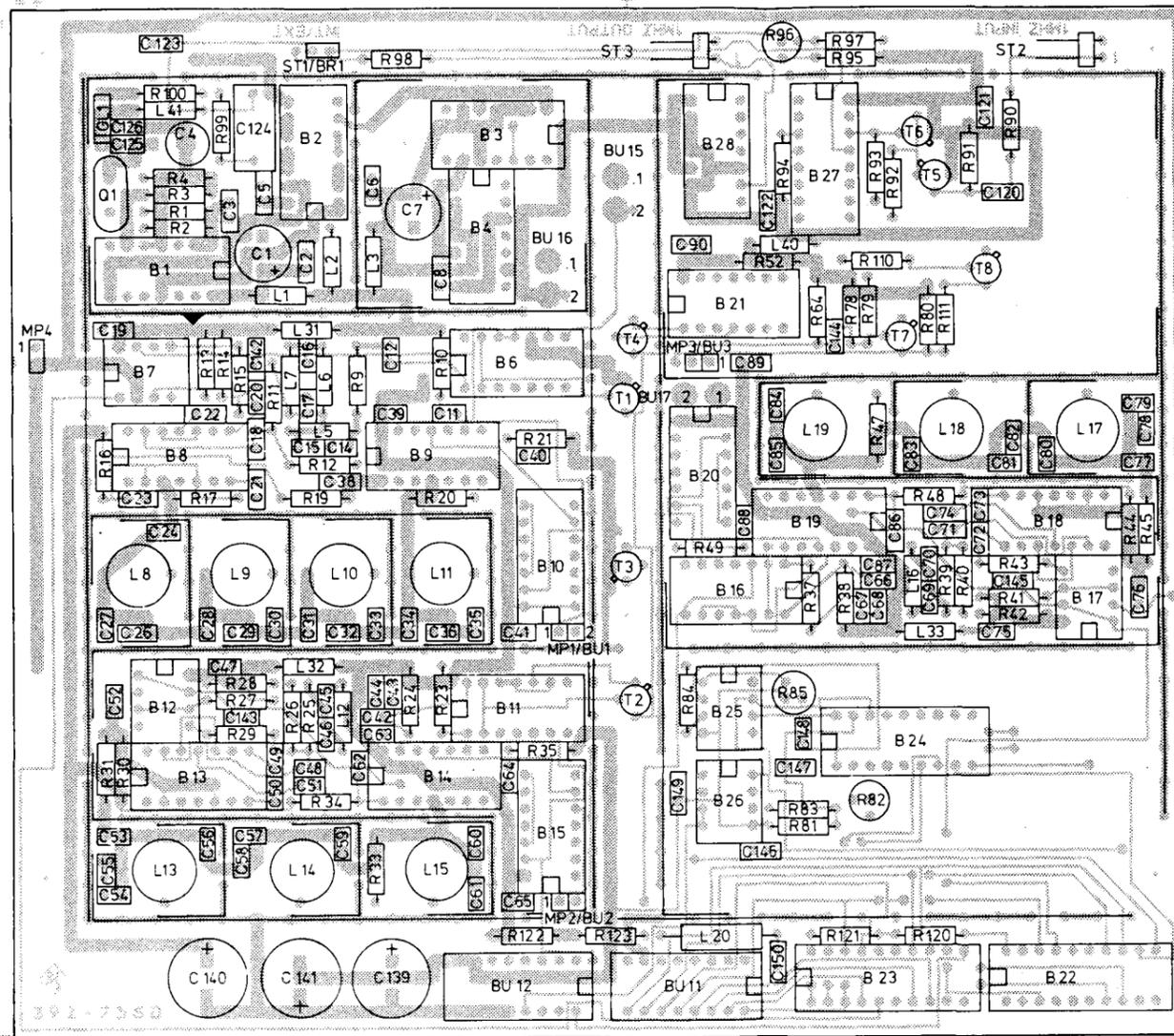




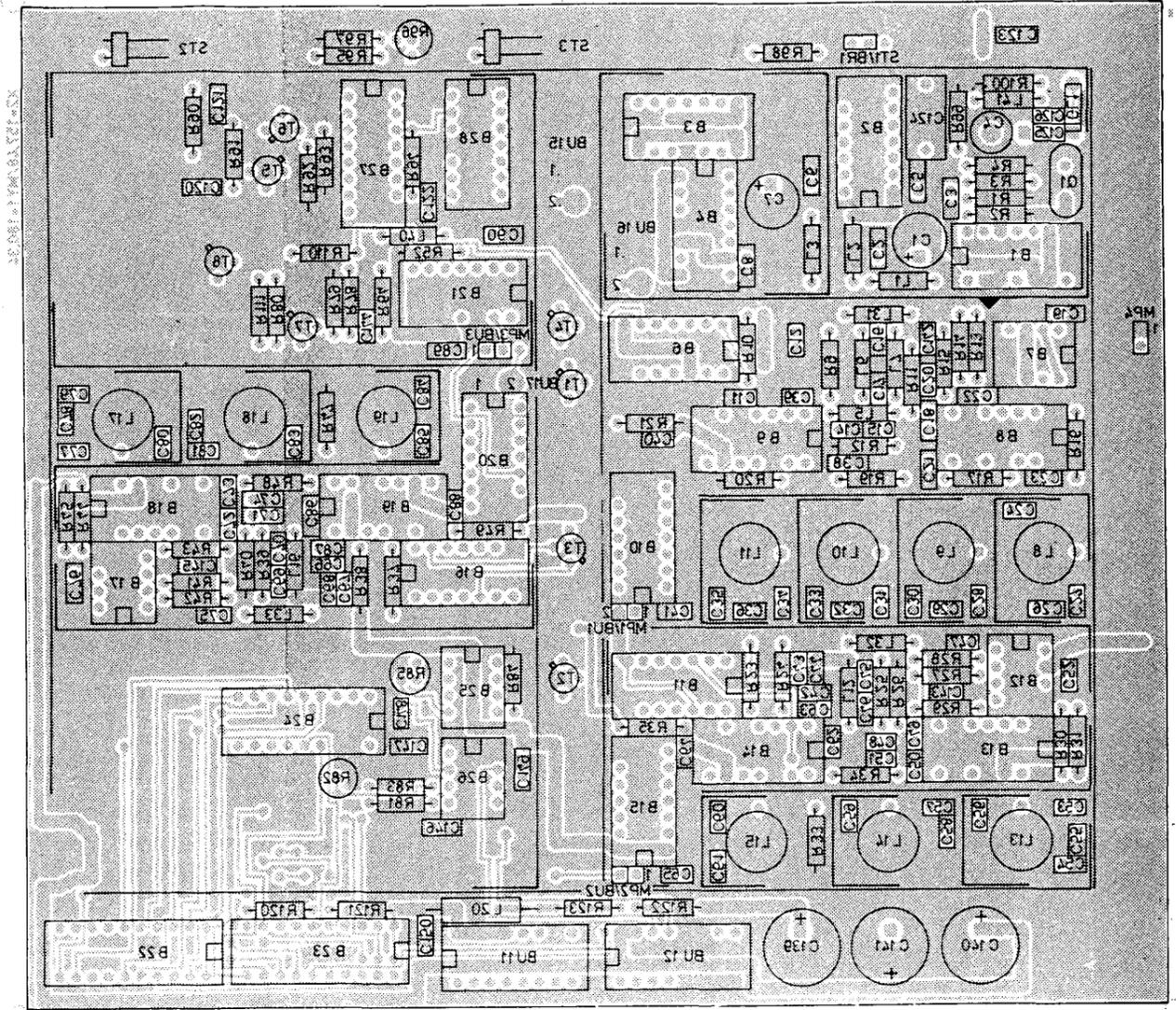
Stromlauf gilt für VAR 02, 32
Circuit diagram is valid for model 02,32

	Stromlauf zu		Zeichn. Nr. 392.7580 S	
	Frequenzaufbereitung / Frequency processor		Z	392.7516 V	336.4009

Ansicht und Leitungsführung Bauteilseite
View of tracks on component side



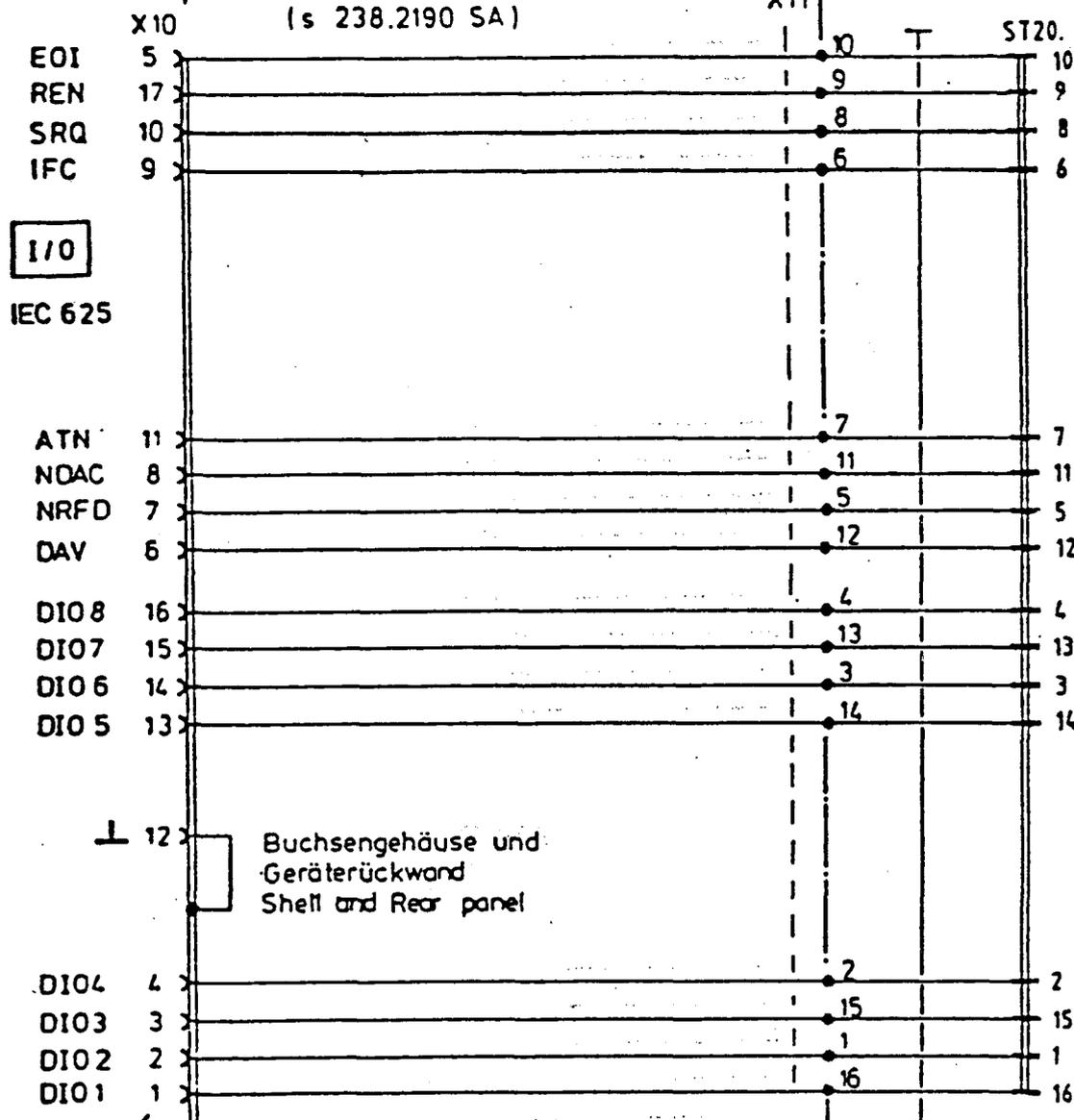
Ansicht und Leitungsführung Lötseite
View of tracks on solder side



Für diese Unterlage behalten wir uns alle Rechte vor

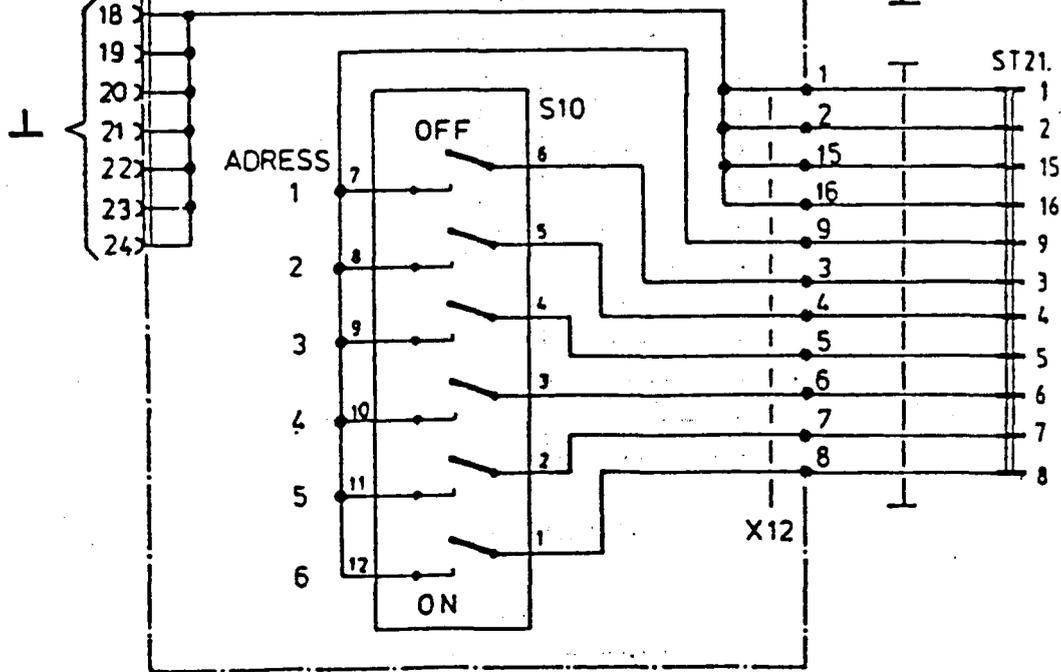
D	30396	5.83	GS	Mäße ohne Toleranzangabe	Maßstab 1 : 1	Benennung Frequenzaufbereitung FREQUENCY PROZESSOR	Blatt-Nr. 2
					Herzzeug Werkstoff		
				1KGA Tag Name		Zeichn.-Nr. 392.7580	v. Bl.
				Bearb. 5.83 GS			
				Gepr.			
				Norm			
				ROHDE & SCHWARZ			
And. Zust.	Anderungs-Mitteilung	Tag	Name	zu Gerät SPN	reg. V 392.7518V	erste Z 336.4009	

IEC-Platte 238.2190
IEC-Board
(s 238.2190 SA)



I/O
IEC 625

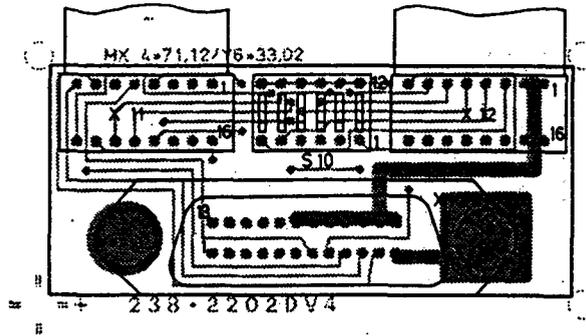
12 Buchsengehäuse und
Geräterückwand
Shell and Rear panel



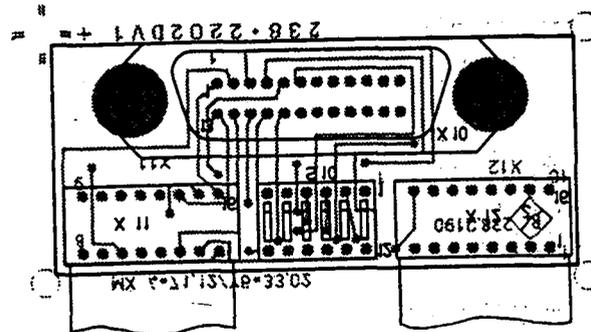
ROHDE & SCHWARZ

ib			
8.83			
30630			
A			
LS			
9.82			

Ansicht und Leitungsführung Bauteilseite
View of tracks on component side



Ansicht und Leitungsführung Lötseite
View of tracks on solder side



Für diese Unterlage behalten wir uns alle Rechte vor.

C	—	10.81	WK	Maße ohne Toleranzangabe		Maßstab 1:1	Zweitoriginal	
						Halbzeug, Werkstoff		
				1GMA	Tag	Name	Benennung	
				Bearb.	10.81	WK	IEC-625-Platte	
				Gepr.			Z	
				Norm				
				 ROHDE & SCHWARZ		Zeichn.-Nr.		Blatt-Nr.
						238.2190		2
Änd. Zust.	Änderungs-Mitteilung	Tag	Name	zu Gerät		reg. i. V.	238.2019 V	erste Z.
								v. Bl.

50-Pr. an Methode E

