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# technical notes

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## MODIFICATIONS

## BKF10/SMU401 Combination

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### Modifying the BKF10

Please refer to the list of enclosures included with these instructions.

### Opening the BKF10

Disconnect the BKF10 from the line supply.

Remove the top and bottom plates and flip the rear panel upwards as described in the BKF10 Service Manual, Section D, steps 1-4. Remove the right hand side plate (when viewed from the front of the BKF10), by pulling it backwards.

### Mounting the Modification PC-board

1. Unscrew the two upper screws which secure the Motherboard at the right hand side (behind the Input Frequency Meter).
2. Mount the modification PC-board, as shown in enclosures 3 and 4 using the screws and spacers supplied with the modification kit.
3. The modification cable should be routed together with the connection cable from J30 to the multiconnector J16 on the rear panel. Replace the three cable clamps shown in enclosure 3 with the clamps supplied in the modification kit, so that both cables pass through the clamps. To give access to the rear clamp on the side plate of the BKF10, it is necessary to remove the plate on which the line receptacle is mounted. Unscrew the six screws which secure this plate, and carefully move the plate aside. Then replace the rear cable clamps and remount the plate.
4. Mount the leads W1-5 of the modification cable to the multiconnector J16 on the rear panel as shown in enclosure 3.
5. Connect the yellow/white lead (W12) between the center pin at the BNC-connector and pin 12 on the multiconnector.
6. Cut the connection to J30/13B on the Motherboard as shown in enclosure 4. Then connect the W6 (blue) lead of the modification cable to J30/13B.
7. Connect the leads W7-11 to the Motherboard as shown in enclosure 4.

### Modifying the RMS-detector (PC-board No. 8)

1. Unplug the RMS-detector PC-board.

Note: Two different versions designated 71-PT-66-2 and 970-648S3, of the RMS-detector PC-board have been supplied. The modifications must be performed according to the component placement drawings for the version of the RMS-detector in question, see enclosures 5 or 6 as required.

2. Replace the following components with those supplied in the Modification Kit:

Replace R866 by a 270 k $\Omega$  resistor.

Replace R864 by a 270 k $\Omega$  resistor.

Replace C822 by a 0.47  $\mu$ F capacitor.

Replace CR809 by a BAV10 diode.

Mount C823 (1  $\mu$ F).

Mount CR812 (BAV10).

Connect the components as shown on the respective component placement drawings for the RMS-detector in question. See enclosures 5 or 6 as required.

3. Fasten one of the self-adhesive labels marked "SMU401 COMPATIBLE" on the PC-board. The label is metal, therefore, take care not to short circuit any component leads, etc., with the label.
4. Plug in the RMS-detector PC-board.

### Adjusting the Modification Circuit

1. Switch on the BKF10.
2. Connect Pin 7 to Pin 24 on the multiconnector J16 on the rear panel.
3. Connect a dc power supply between Pin 10 (minus) and Pin 20 on the multiconnector J16, and set the voltage to +1.000 V  $\pm$  1 mV.
4. Adjust the potentiometer on the modification PC-board until the distortion meter reads 10%.
5. Remove the connections established in items 2 and 3 above.

### Assembling the BKF10

1. Remount the side plate, the rear panel and the top and bottom plates.
2. Fasten a self-adhesive label marked "SMU401 COMPATIBLE" alongside the multiconnector on the rear panel.

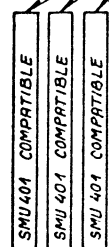
### Modifying the REA241 Distortion Interface

1. Unscrew the four screws which secure the rear and side cover, and remove the cover.
2. Unsolder the three interconnections marked 14, 17 and 18 between the two PC-boards.
3. Remount the rear and side cover.
4. Fasten a self-adhesive label marked "SMU401 COMPATIBLE" below the 25-pin multiconnector.

## LIST OF ENCLOSURES

- ENC. 1      Drawing No. 1854-A1, modification kit
- 2      Component list of the modification kit
  - 3      Drawing No. 2764-A2, mounting of the modification kit
  - 4      Motherboard pin connection drawing
  - 5      Component placement drawing showing the modified RMS detector, designated 970-428 S3
  - 6      Component placement drawing showing the modified RMS detector, designated 71-PT-66-2
  - 7      Circuit diagram No. 4739-A3, covering the modification kit
  - 8      Circuit diagram No. 2147-A2, covering the modified preamplifier, RMS detector

ENCLOSURE 1.



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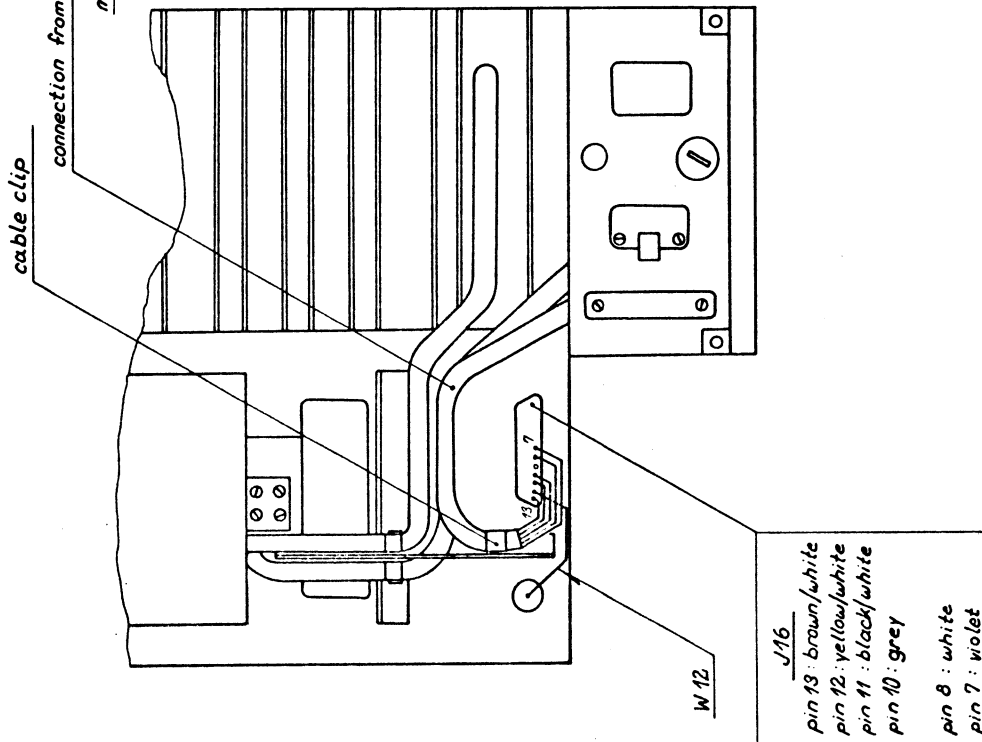
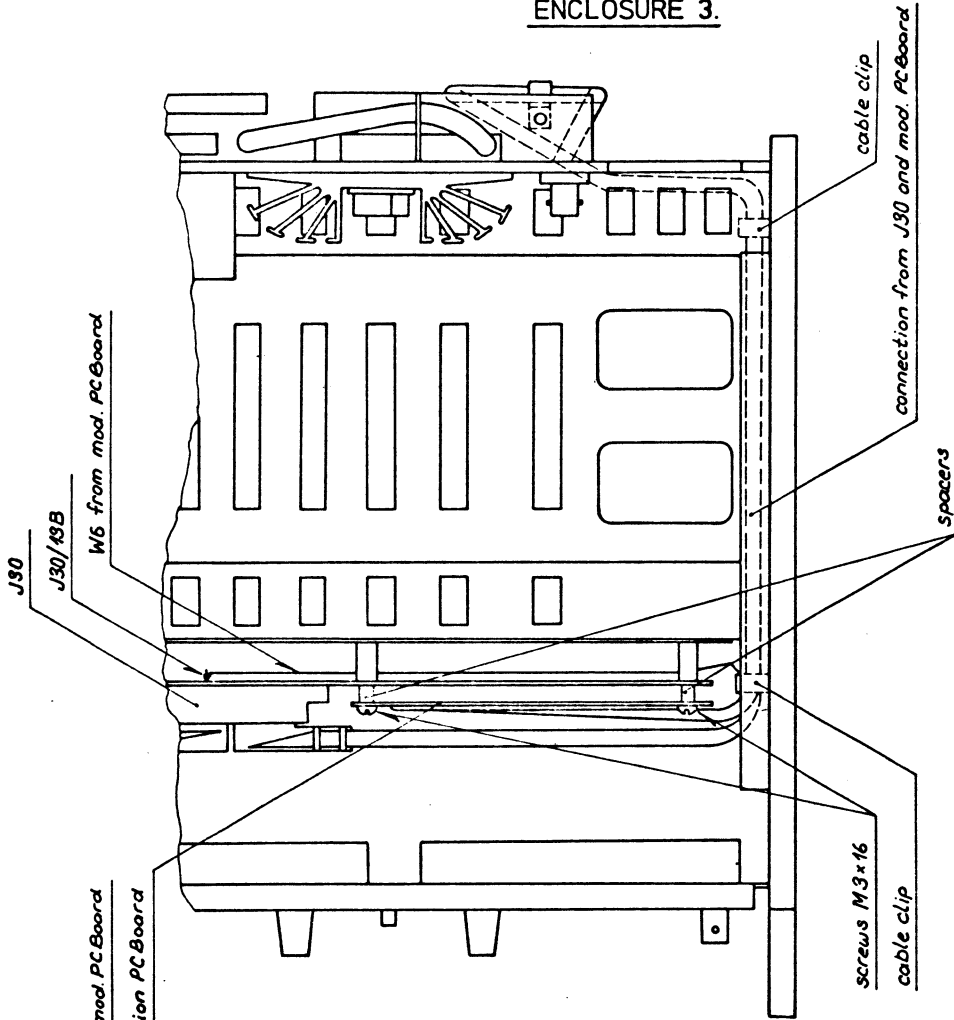
REGIONS						RADIOMETER A/S FABRIKVEJEN 10 DK-2800 LYNGBY DENMARK		ORDER BY FAX TEL. NO. 45 923 4328	
ORDER TO BE SENT BY AIR MAIL TO THE FOLLOWING ADDRESS:						Modification kit for <b>BAT 40 / SFU 40A</b> TEL. 923 4328		<b>1854-A1</b>	
NAME OF USER: _____						FROM NO. _____		TO NO. _____	

## ENCLOSURE 2.

17	Sticker		3
16	Cabelclamp 8mm	064-508	3
15	Tube 3,2/4,8x6	038-306	2
14	Screw M3x16	008-316	2
13	Resistor 270k (R866, R864)	106-627	2
12	Diode BAV10 (CR809, CR812)	350-022	2
11	Capacitor 0,47µF (C822)	241-038	1
10	Capacitor 1µF (C823)	241-027	1
W12	Mounting wire , yellow/white	L: 60mm. 634-094	1
W11	———— " ———— , brown	L: 47mm. 634-001	1
W10	———— " ———— , black	L: 37mm. 634-000	1
W9	———— " ———— , red	L: 87mm. 634-002	1
W8	———— " ———— , orange	L: 62mm. 634-003	1
W7	———— " ———— , yellow	L: 107mm. 634-004	1
W6	———— " ———— , blue	L: 323mm. 634-006	1
W5	———— " ———— , violet	L: 584mm. 634-007	1
W4	———— " ———— , grey	L: 609mm. 634-008	1
W3	———— " ———— , white	L: 615mm. 634-009	1
W2	———— " ———— , black/white	L: 687mm. 634-090	1
W1	Mounting wire , brown/white	L: 523mm. 634-091	1
9	Resistor 56k	106-556	1
8	Variable potentiometer 470Ω	182-038	1
7	Resistor 18k78	152-204	1
6	———— " ———— 6k26	152-163	1
5	Resistor 33k	106-533	1
4	Transistor J109	360-188	1
3	Resistor 680Ω	106-368	2
2	Resistor 2k7	106-427	1
1	Printet circuit board	970-784	1
P05.	DESIGNATION	DWG./CODE	No

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							EMDRUPVEJ 72 DK 2400 COPENHAGEN NV DENMARK		
							Modification kit for BKF10 / SMU 401		
							TYPE 900 - 823 FROM NO.                      TO NO.		
ISSUE    FROM NO.    DATE    DRAWN BY    CHECKED BY    APPR. BY						1854-A1			

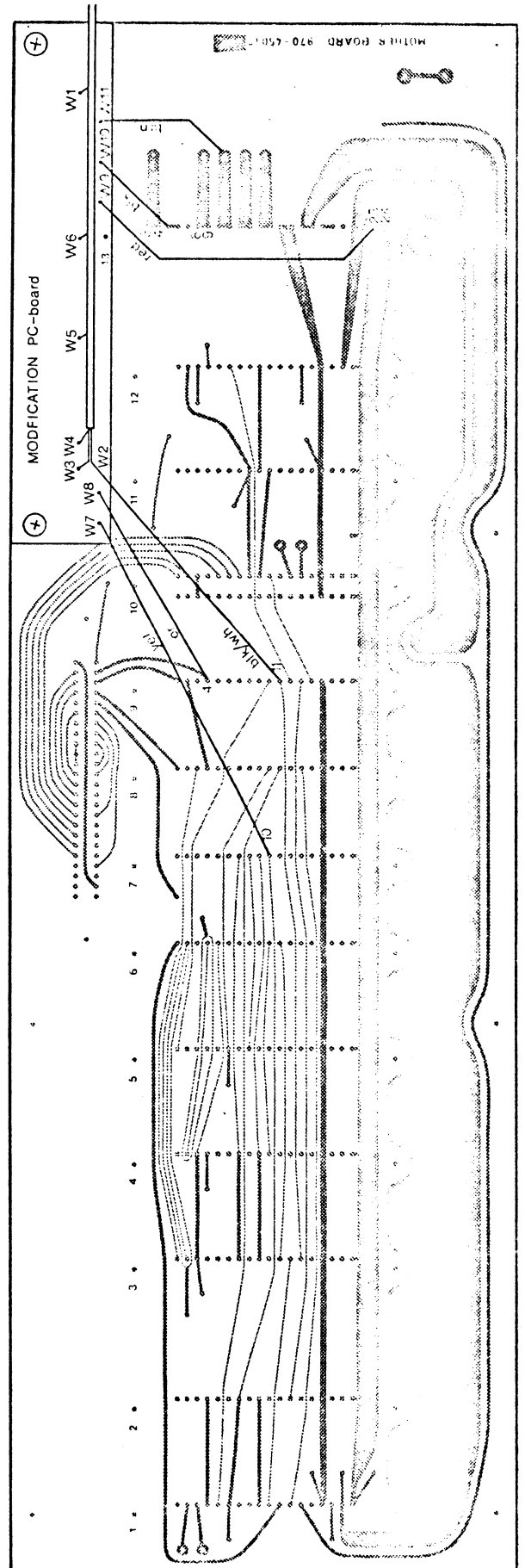
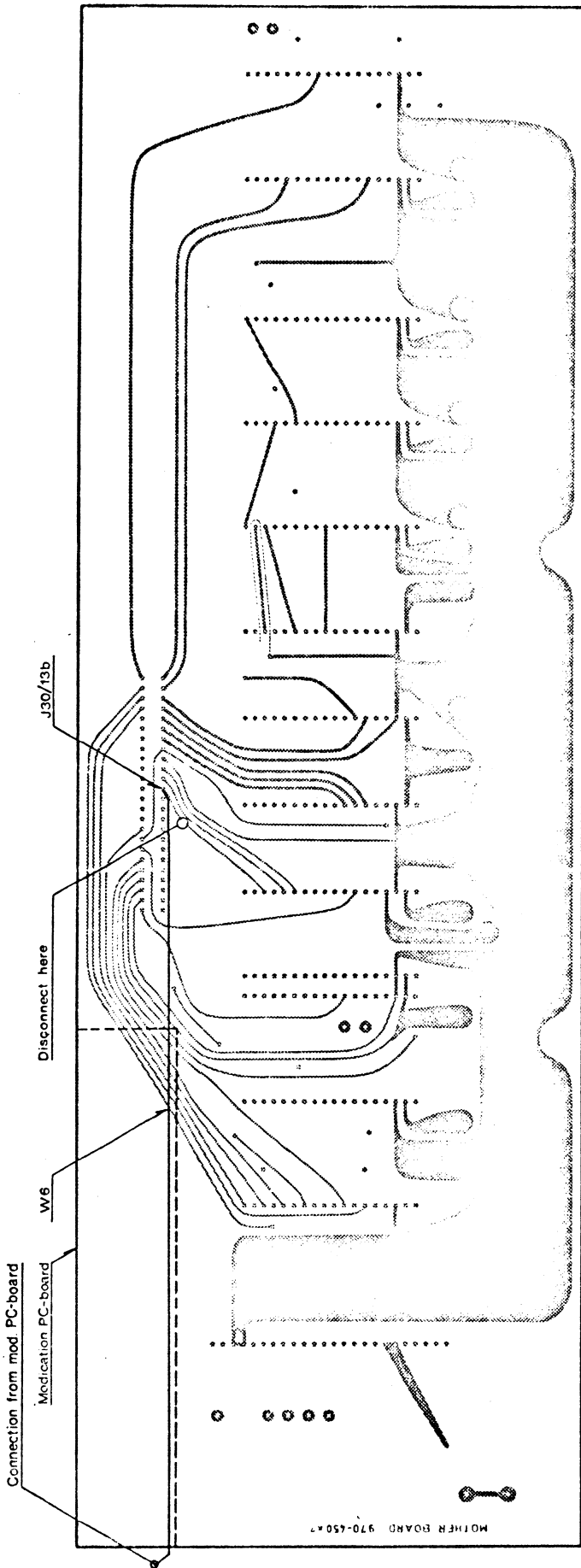
# ENCLOSURE 3.



J16  
 pin 13 : brown/white  
 pin 12 : yellow/white  
 pin 11 : black/white  
 pin 10 : grey  
 pin 8 : white  
 pin 7 : violet

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NO.	DATE	BY	APPROVED																						
RADIO METER A/S ENDRUPVEJ 72 DK 2400 COPENHAGEN NV DENMARK		Mounting of modification kit for BKF-10/SMU 401 TYPE 900-823		2764-A2 TO NO.																					
ISSUE FROM NO.		DATE		DRAWN BY																					
CHECKED BY		APPROVED		FROM NO.																					

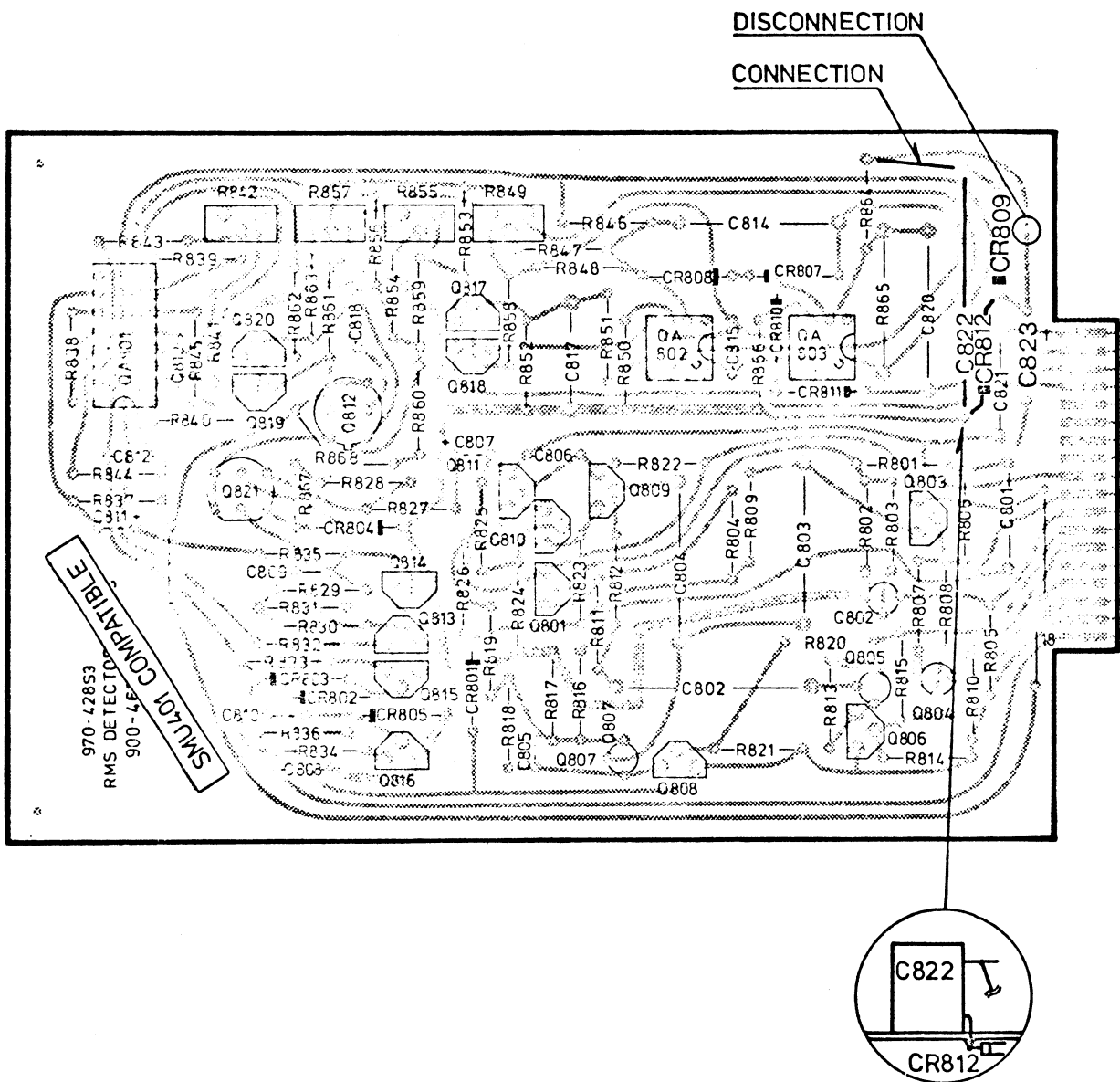
**ENCLOSURE 4.**





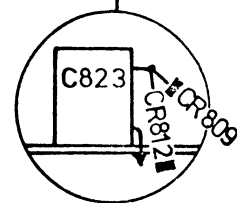
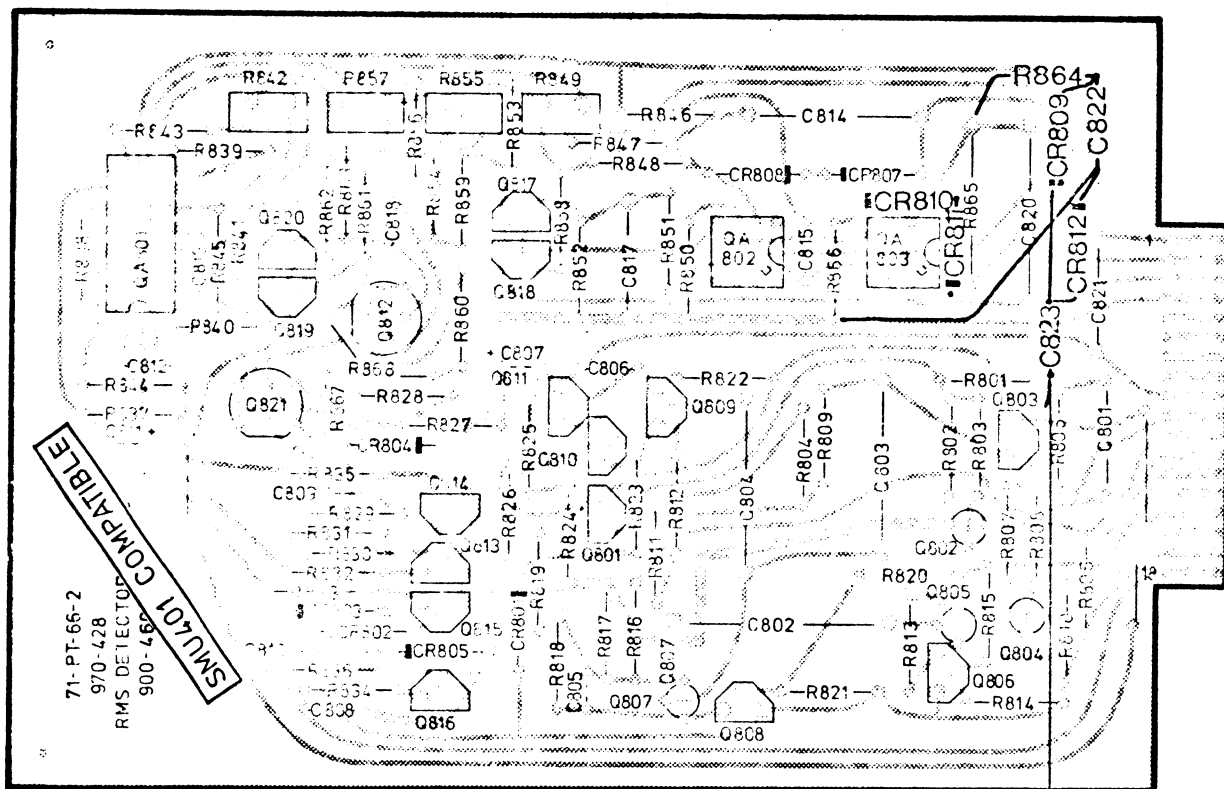
## ENCLOSURE 5.

MODIFICATIONS TO THE RMS DETECTOR, VERSION DESIGNATED 970-428S3

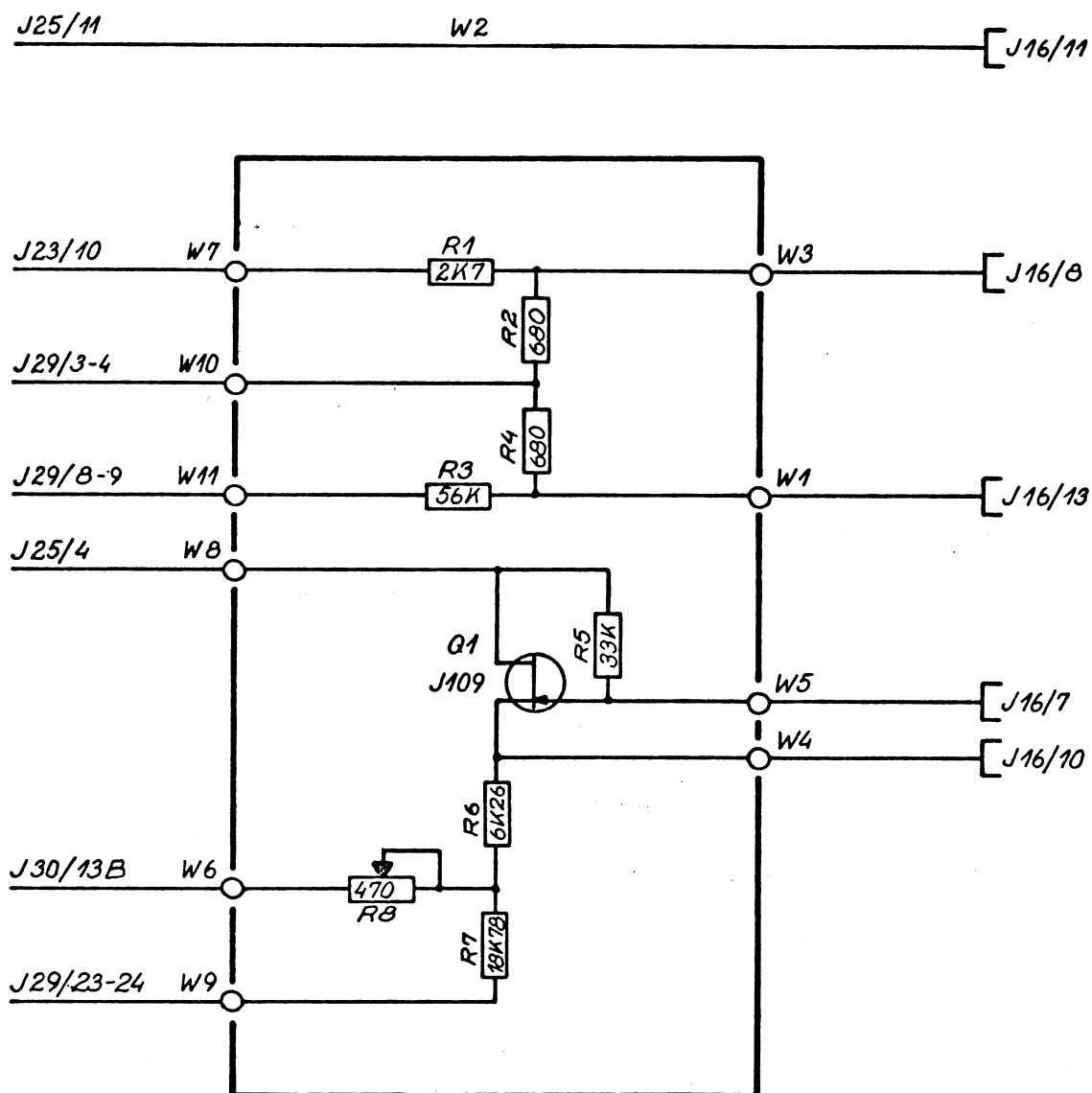


## ENCLOSURE 6.

MODIFICATIONS TO THE RMS DETECTOR, VERSION DESIGNATED 71-P-66-2



# ENCLOSURE 7.



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## REVISIONS

ISSUE	FROM NO.	DATE	DRAWN BY	CHECKED BY	APPR. BY

## RADIOMETER A/S

EMDRUPVEJ 72  
DK 2400 COPENHAGEN NV  
DENMARK



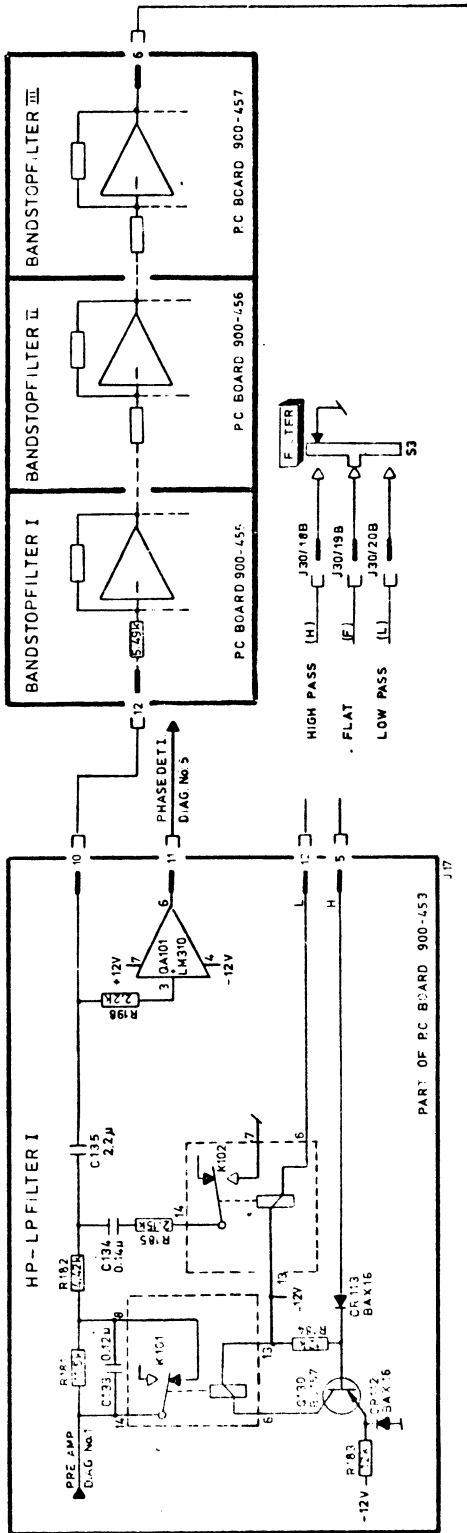
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CHECKED BY  
APPR. BY HFLV 25/2.77

Modification kit for  
BKF10/SMU401

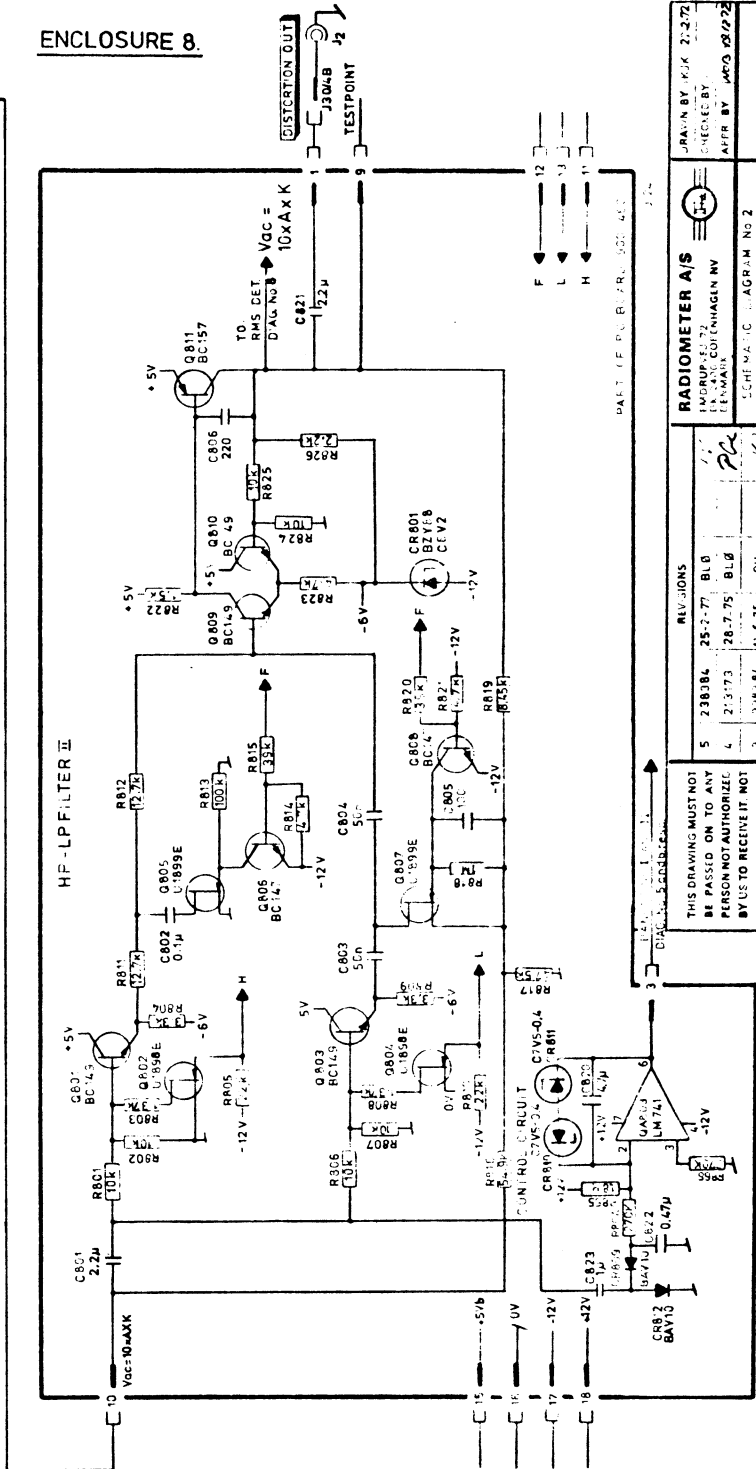
TYPE 900-823

FROM NO. TO NO.

4739-A3



# ENCLOSURE 8.



RADIOMETER A/S		JAN 1972	
INDUSTRIAL		CHECKED BY	
TELEPHONE		APPROVED BY	
SCHEMATIC DIAGRAM No 2		2147-A2	
FIRE-AMPLIFIER		TO NO.	
RMS-DETECTOR		FROM NO.	
TYPE BKF100			

VALUES IN Ω, OR pF IF NOT OTHERWISE STATED.  
J30: diag No 15

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# technical notes

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BKF10A-weighting Filter

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Some of our customers have shown interest in measuring the signal-to-noise ratio weighted in accordance with the standard A-curve, and to have a low pass filter with a cut-off at 20 kHz.

We are therefore introducing the

## BKF10S1

which is a standard version with the following changes:

The function of the LP filter has been replaced by:

an LP filter:  $f(3 \text{ dB}) = 22.5 \text{ kHz}$ . Attenuation at 40 kHz greater than 50 dB.

The function of the HP filter has been replaced by:

a filter conforming to the A-weighting requirements of:

DIN 45.500 bl. 4

DIN 45.633 bl. 1

IEC 179

The first two of a series of BKF10S1's will be delivered to Eumig through our distributor in Austria. Messrs. Drott, early in May 1977.

The delivery time for additional BKF10S1 will be approximately 4 weeks after receipt of order from June 1, 1977.

This introduction of a special version of the BKF10 should give you further possibilities for selling more BKF10's. Good luck.

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# technical notes

## SWEEP MEASUREMENTS

BKF10 with B & K 2307 Level Recorder

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### Introduction

The x-rec. facility of the B & K 2307 makes this recorder usable as an x-y recorder and thus suitable for use together with the BKF10. (The B & K 2305 has not this facility and cannot be used for this application).

The following accessories for the 2307 are necessary:

Linear potentiometer: ZR0002

Recording paper: QP1124

### Interface circuit

The B & K 2307 is a level recorder for AC signals. In the DC mode the input voltage is chopped. Therefore, the recorder cannot distinguish between positive and negative signals. For this reason an interface circuit for signal conditioning is necessary. The circuit is shown on the enclosed diagram. In addition to the signal conditioning it includes means for adjustment and pen control.

### Operating

#### Setting of the controls of the 2307 recorder

Potentiometer range:	20 dB
Rectifier response:	DC
Lower limiting frequency:	10 Hz
Writing speed:	25 mm/sec
Paper drive function:	x-Rec.
Paper speed:	3 cm/sec.
Input attenuator:	20 dB

### Adjustment procedure

1. Set FUNCTION Selector (on interface box) to ADJ. FREQ.
2. Set REF switch to MIN
3. Adjust x-recording zero (on the right side panel of 2307) to paper position: 20 Hz
4. Set REF switch to MAX
5. Adjust x-recording sensitivity to paper position: 20 kHz
6. Repeat steps 2 to 5
7. Set FUNCTION Selector to ADJ. LEVEL
8. Set REF switch to MIN
9. Adjust LEVEL ZERO (on interface box) to new position 0 dB
10. Set REF switch to MAX
11. Set Input potentiometer on 2307 to pen position 50 dB
12. Repeat steps 8-11

### Recordings

#### 1. DISTORTION

Range: -70 ... -20 dB

Upper edge of paper:  $k = 10\% \sim -20$  dB

Lower edge of paper:  $k = 0.03\% \sim -70$  dB

With PEN LIFT in AUTO writing starts when SWEEP START on BKF10 is activated. Pen goes up when fly-back starts.

For recorded sweep (when the built-in oscillator is not used) the pen must be controlled manually. (PEN LIFT in pos. MAN).

#### 2. FREQUENCY RESPONSE

Ranges: 0 .... 50 dB

0 .... 25 dB

The level corresponding to the lower edge of the paper (0 dB) is chosen by means of the REF LEVEL Selector.





Variable Sweep Start Frequency BKF10Introduction

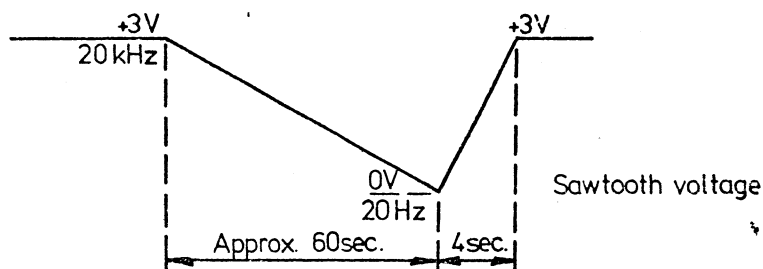
FM-transmitters, tape recorders and other electronic equipment often have an upper cut-off frequency lower than 20 kHz. Therefore it is desirable, when using the internal sweep in the BKF10, to start the sweep lower than 20 kHz.

This technical note describes modifications to make the internal BKF10 sweep start frequency variable. The start frequency can then be set by means of the "Output freq." button.

Description

When the BKF10 in the "single sweep" mode, the output frequency is controlled by a sawtooth generator, which sweeps from +3 V to 0 V.

+3 V represents 20 kHz and 0 V represents 20 Hz.



The modifications make the start voltage, and therefore the start frequency, variable without changing the sawtooth slope.

Parts list

<u>Items</u>		<u>Code No.</u>
1 transistor	BC 159 B	360-085
3 diodes	BAV 10	350-022
1 tantalum capacitor	4.7 $\mu$ F 25 V -20 +50%	267-004
1 carbon film resistor	22 M $\Omega$ 5% 0.5 W	100-822
1 carbon film resistor	100 k $\Omega$ 5% 0.2 W	106-610
1 carbon film resistor	120 k $\Omega$ 5% 0.2 W	106-612
1 carbon film resistor	1.5 M $\Omega$ 5% 0.5 W	100-715

## Modifications

The modifications are made on the frequency regulation PC-board Code 900-464 pos. 12.

1. Remove the resistors R1237, R1238, R1239 and R1240, and place straps at R1238 and R1240, as shown in Fig. 1.

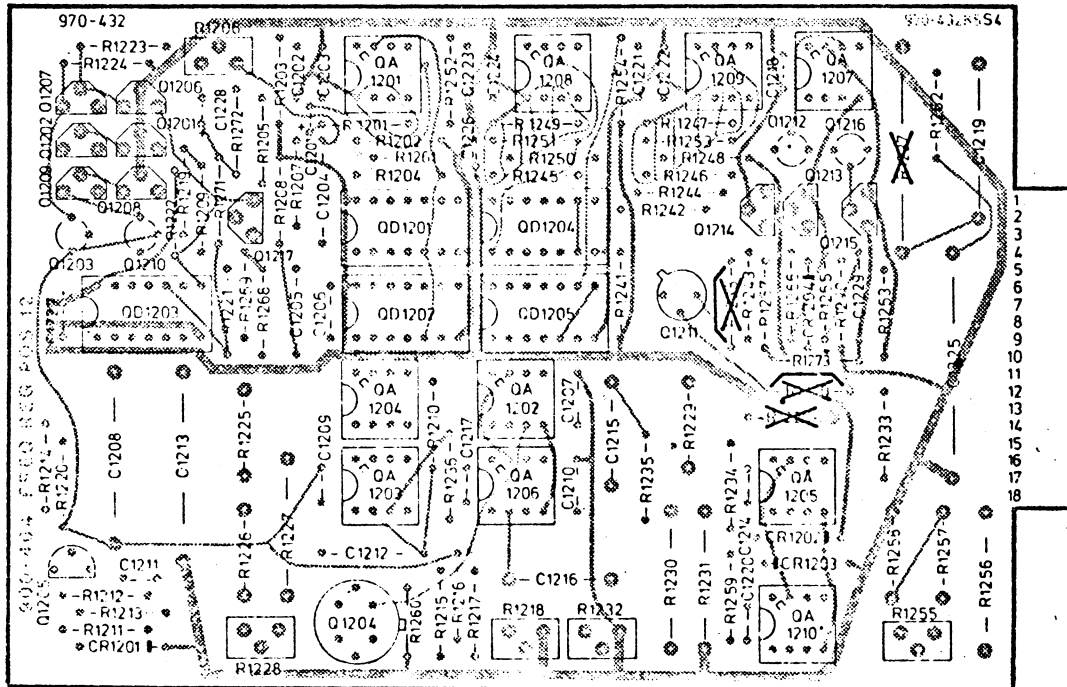


Fig. 1.

2. Using a sharp knife, remove 1-2 mm of the foils at the points as shown in Fig. 2.

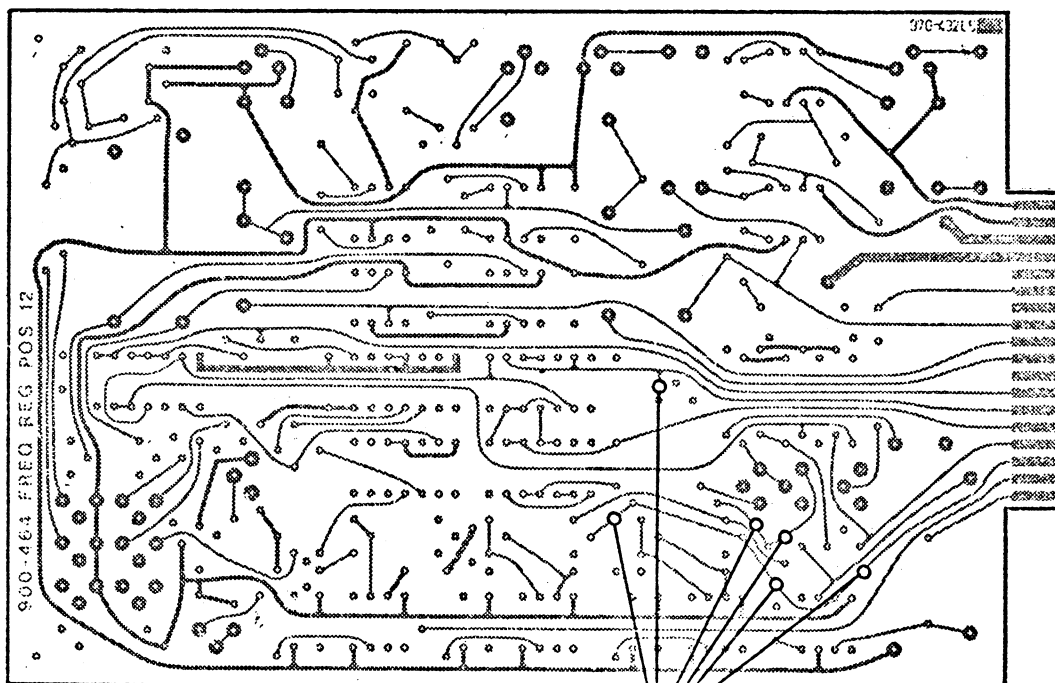


Fig. 2. Solder Side.

cut foils here

3. Place straps on the solder side as shown in Fig. 3.

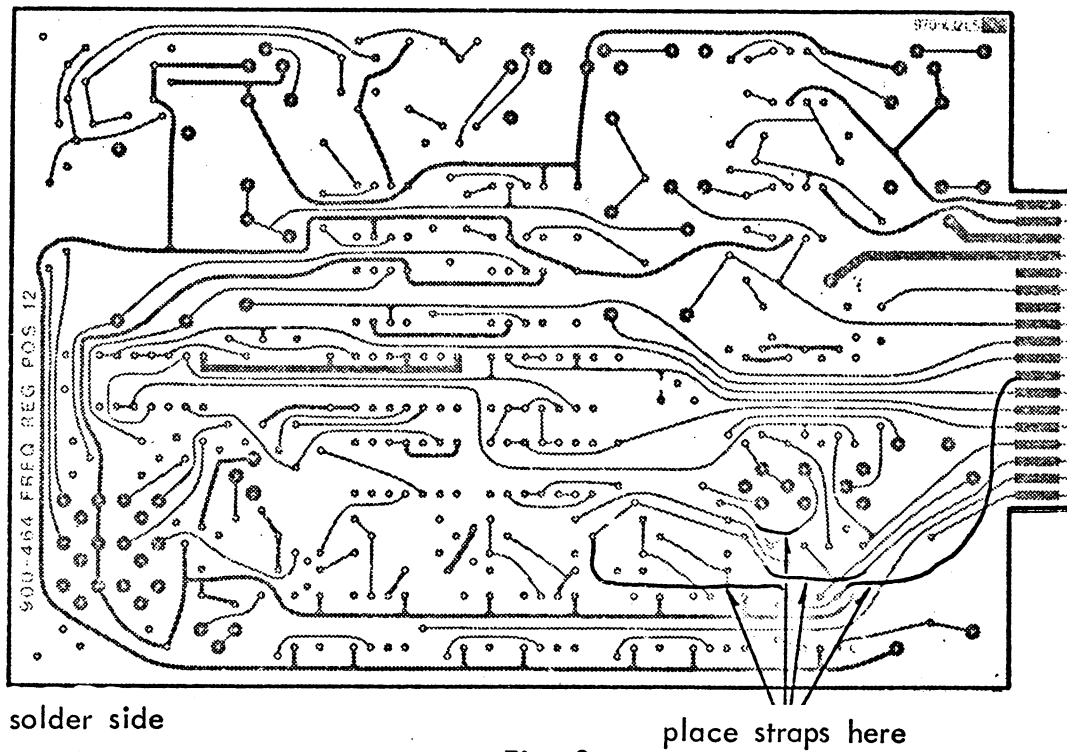


Fig. 3.

4. Place the 3 diodes, the 1.5 M $\Omega$  resistor and the 4.7  $\mu$ F capacitor as shown in Fig. 4.

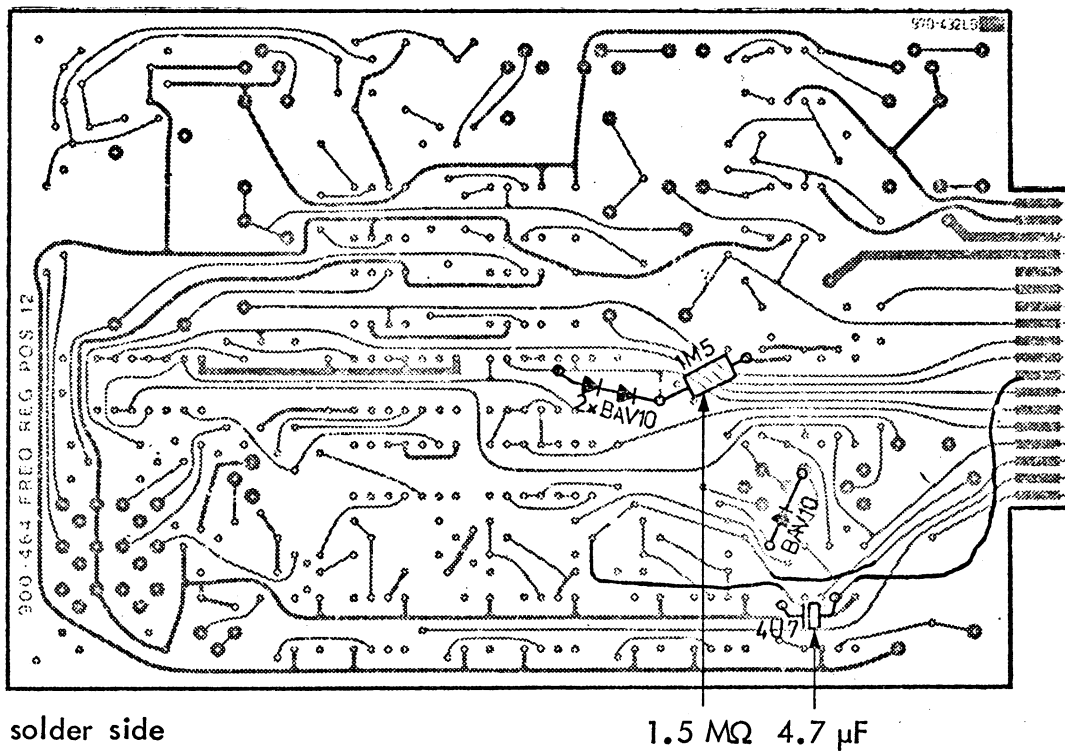


Fig. 4.

5. Place the transistor BC159B, the 100 k $\Omega$  resistor, the 120 k $\Omega$  resistor and the 22 M $\Omega$  resistor as shown in Fig. 5.

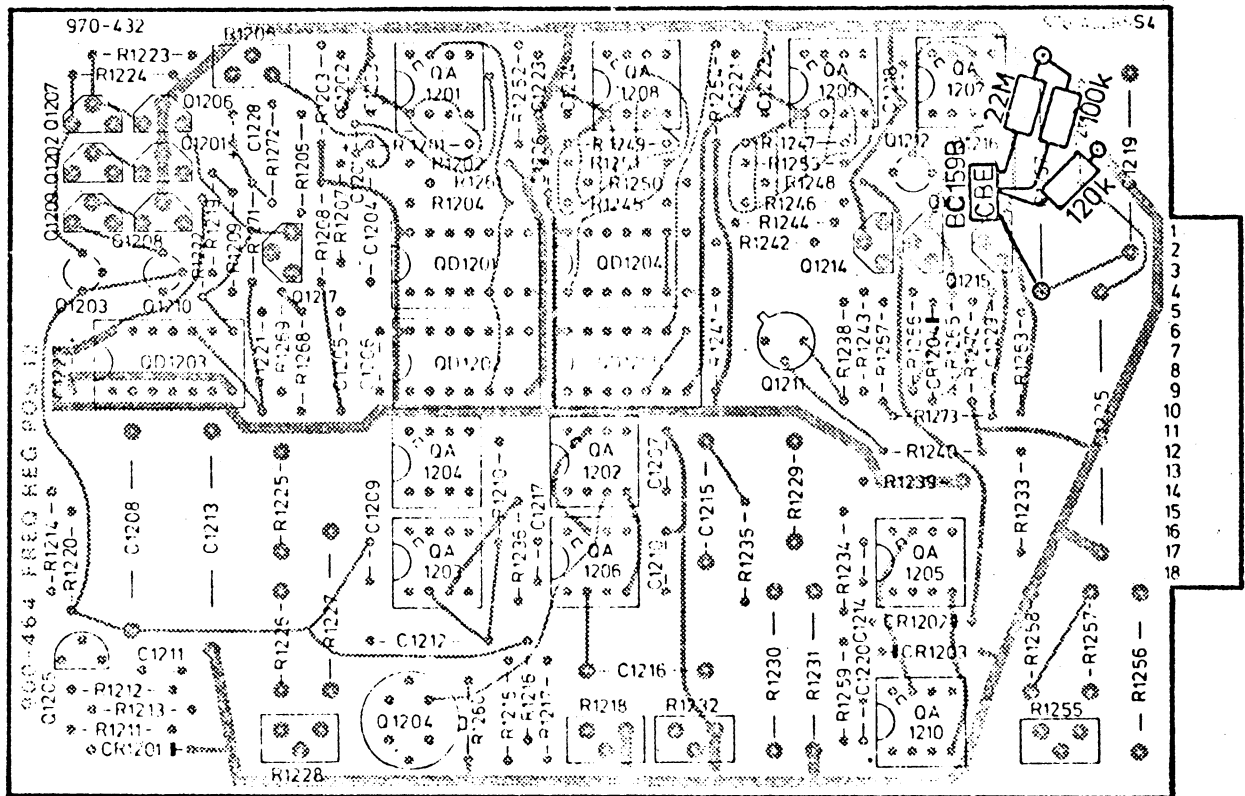
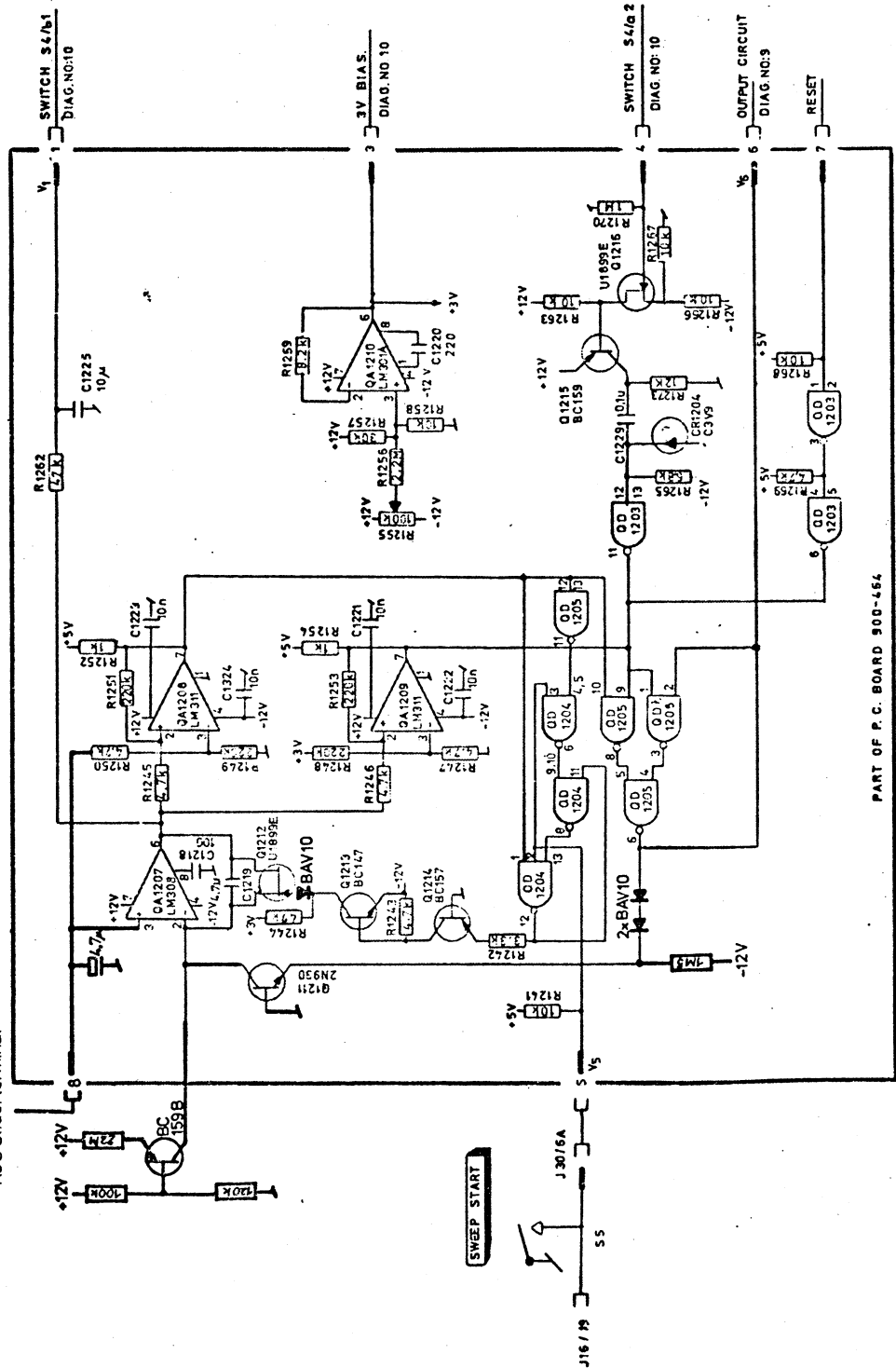


Fig. 5.

6. From the slider terminal of the "output freq." potentiometer (on front plate), connect a lead to J12, pin No. 8.



PART OF P. C. BOARD 900-454

QD 1203 : QUAD 2-IN POS. HAND GATE O.C.  
QD 1204 : TRIPLE 3-IN POS. HAND GATE.

Q01205: QUAD 2-IN POS.NAND GATE.

VALUES INQ ORpf IF NOT OTHERWISE STATED.

**J 16 AND J 30: DIAG. NO. 15**

RADIOMLTERMS		RADIOMLTERMS		RADIOMLTERMS	
COPY		COPY		COPY	
5	238364	10.6.75	OH	A1	
4	210683	1.1.74	BLP		
3	204317	4.9.74	OH		
2	204817	26.8.74	OH	A1/1	
1	202487	2.2.73	OH	4005	
Page	Frage Nr.	Date	Art.	Teil	Form

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**RADIOMETER**  **COPENHAGEN**  
72 EMDRUPVEI NV

2151-A2

**Sawtooth Generator  
for  
Variable sweep start**

Sweep measurements on loudspeakers. BKF10 - SMU401 - REC61S2Introduction

The combination of the BKF10, SMU401 and REC61S2 together with a condenser microphone, a microphone amplifier and a power amplifier is ideally suited for measuring all relevant characteristics of loudspeakers.

The following sweep measurements can be made:

- Frequency response
- Total harmonic distortion
- Single harmonic component of the 2nd to the 5th order.

All measurements can be made either at a constant voltage supplied to the loudspeaker or with a constant sound pressure delivered by the loudspeaker, (i.e. at a constant output voltage from the microphone.)

Set-up for measurements

Fig. 1. shows the setup of the instruments. The type numbers for the condenser microphone and microphone amplifier mentioned are Brüel & Kjær products which are well suited for the measurements but, of course, other types can be used. The power amplifier can be any amplifier capable of delivering the necessary power at a sufficiently low distortion.

The controls of the BKF10 must be set according to the output voltage of the microphone amplifier and the gain of the power amplifier. For measurement with constant voltage supplied to the loudspeaker during sweep, the LEVEL AT switch is set to OUTPUT. With this switch set at INPUT the voltage at the output of the microphone amplifier, and thus the sound pressure, is kept constant.

Fig. 2. shows a typical measurement on an 8" Woofer, driven at a constant voltage. At the upper end of the frequency range the output from the loudspeaker is very low. Therefore a distortion measurement in this range has no meaning, and the sweep has been started from approx. 6 kHz and downwards for the distortion measurements. This can be done simply by turning the paper drive to the required start frequency after the zero setting of the paper has been completed, and before activating the sweep start button on the REA241.

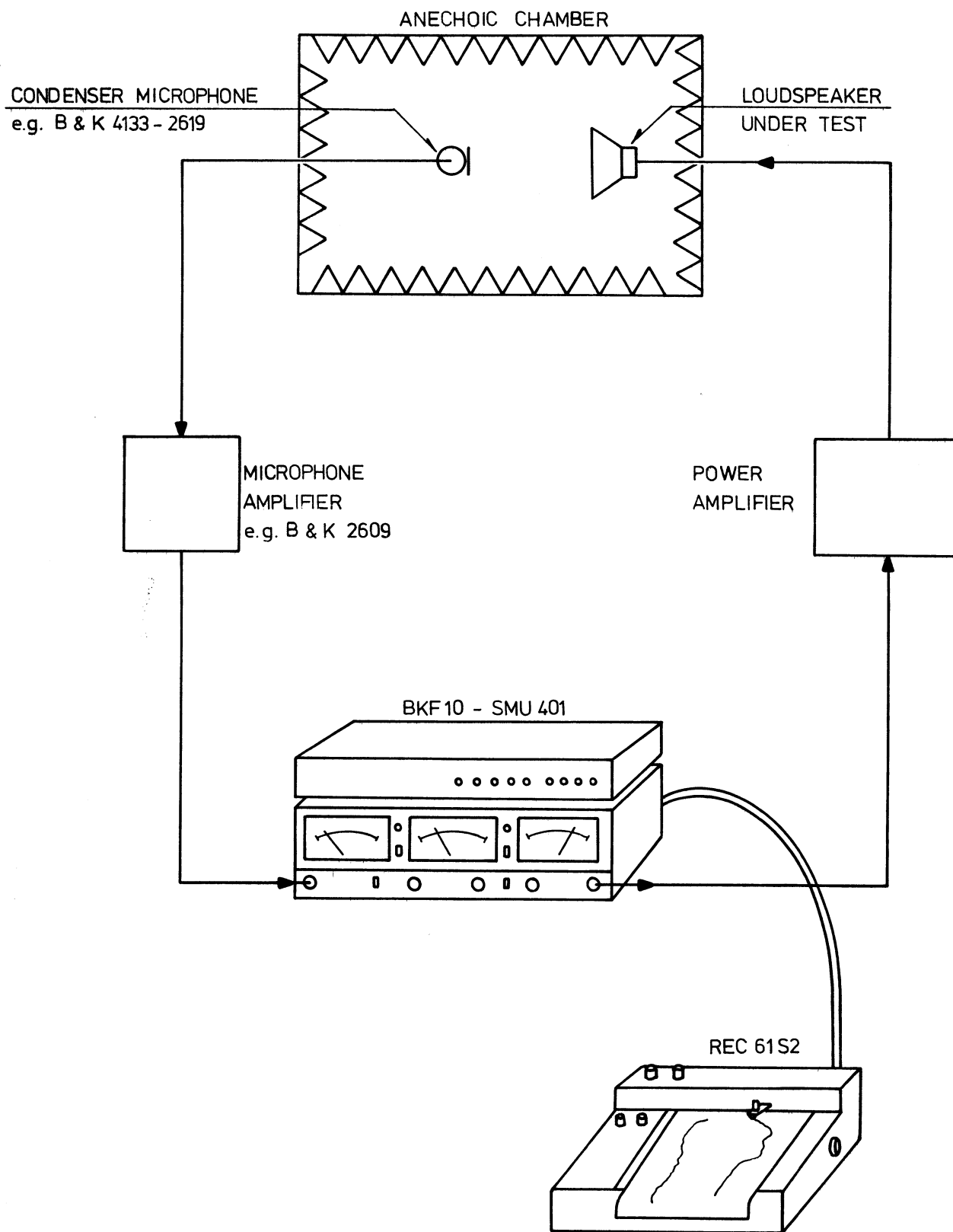
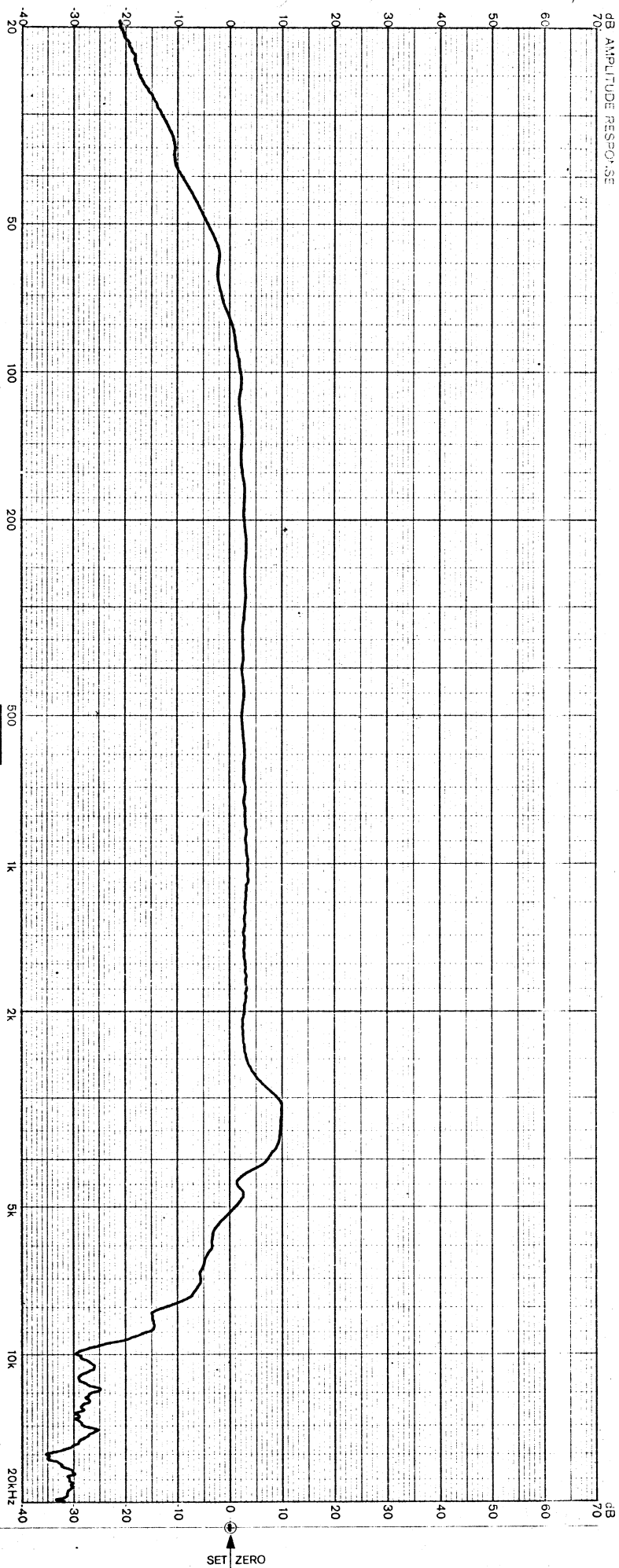


Fig.1 Set-up for loudspeaker measurements



984-043

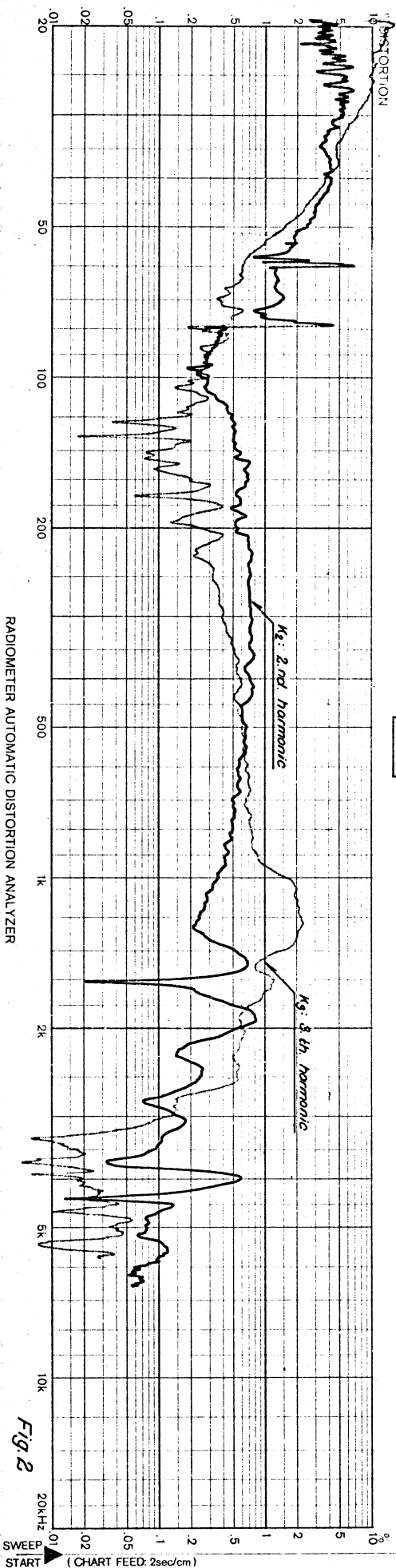



Fig. 2

Rec. no:	Measuring object: 8" WODFER	<b>RADIOMETER</b> <b>COPENHAGEN</b> 
Date:	z = 8.2 V = 5V	
Sign:		

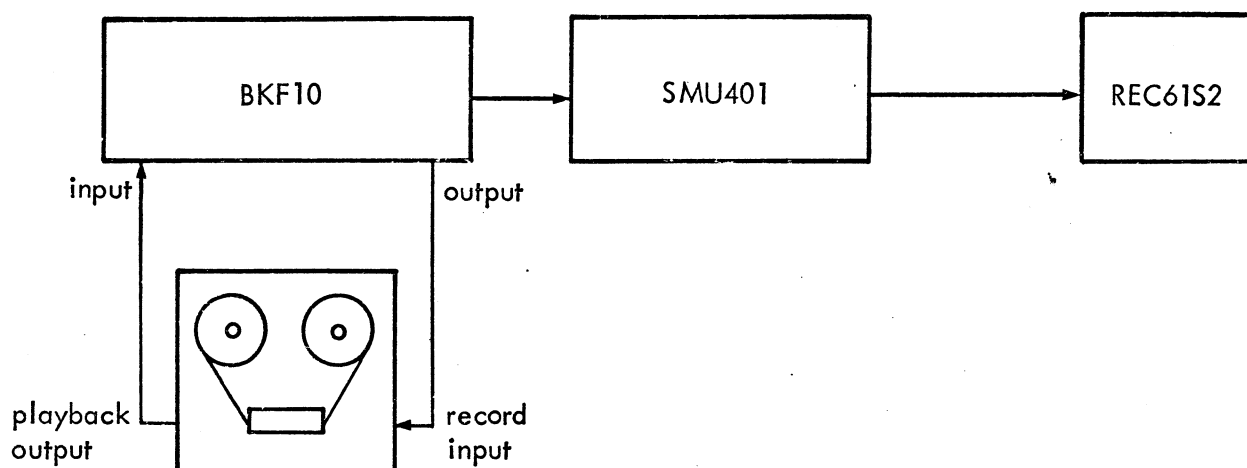


BKF10 - measurement on tape recorders

This application note describes how to measure and record the frequency response, the total harmonic distortion and the level of each single harmonic component up to the fifth harmonic all as a function of frequency.

We show first a measuring system consisting of a BKF10, SMU401 and an REC61S2, and secondly where we have interchanged the REC61S2 with an x-y recorder.

The main problems associated with this type of measurement is to calibrate the frequency axis, and to avoid the influence of the bias and erase frequencies on the distortion measurements.

Measurements with BKF10 - SMU401 - REC61S2

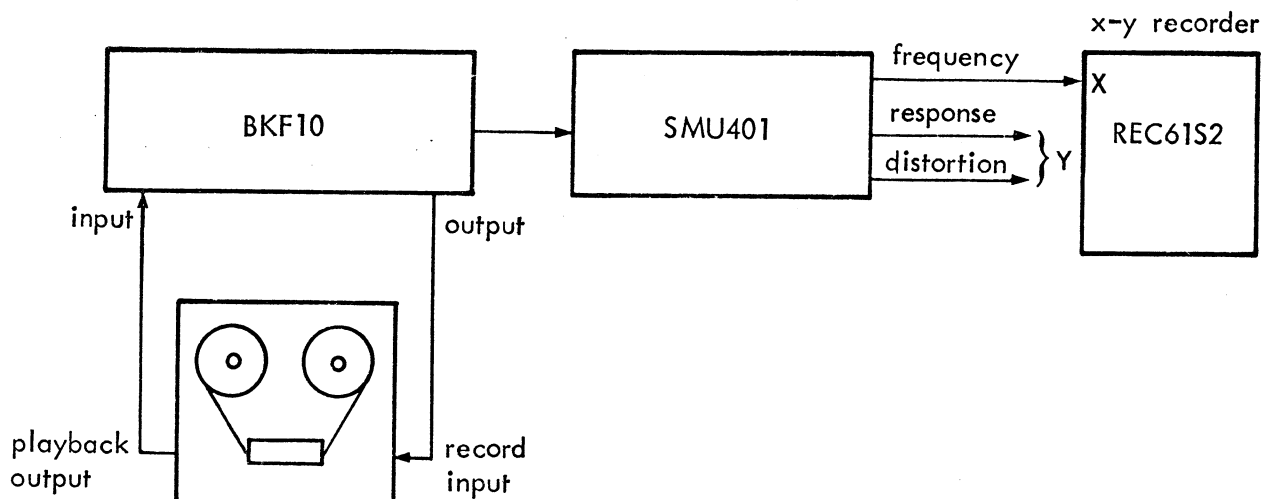
If the tape recorder has separate recording and playback heads it is possible to record the sweep and play it back at the same time, but there is a delay between input and output, which will cause a frequency delay. The offset in mm of the frequency axis can be calculated by measuring the distance between the two heads and the recording speed. By using the calculated offset, the frequency axis on the paper is calibrated.

Decreased bandwidth on tape recorders can cause fluctuations at high frequencies. To avoid this problem, start the sweep at a lower frequency, by simply resetting the paper on the REC61S2 to a lower frequency before starting the sweep.

If the tape recorder has a combined record-playback head it is necessary first to record the sweep and then play it back. In this system it can be rather difficult to calibrate the frequency axis.

- Set the BKF10 to normal sweep.
- Adjust the frequency to 1 kHz.
- Start recording and turn slowly the frequency to 20 kHz and stop the recording.
- Rewind and playback while observing the frequency meter of the BKF10.
- Note the frequency where the BKF10 goes out-of-range.
- Reset the BKF10 to external sweep.
- Adjust the paper on the REC61S2 to the frequency where the BKF10 went out-of-range.
- Record this frequency for approx. 10 sec.
- Start the sweep on REC61S2.
- After recording the sweep, adjust the recorder paper to a frequency 1 kHz lower than the sweep start frequency.
- Rewind and start playback.
- When any fluctuations have stopped, set the pen switch on the REC61S2 to "pen down".
- Observe the BKF10 frequency meter and when the pointer passes the recorder paper calibrated frequency, activate the sweep start button on the REC61S2.
- After a few seconds, reset the REC61S2 to "PEN UP" (REMOTE).

# Measurements with BKF10 - SMU401 and an x-y recorder



The table below shows the connections to be used when the BKF10 - SMU401 and an x-y recorder are combined.

		BKF10 recorder output 25 pole D-con- nector	SMU401 recorder output 37 pole D-con- nector	
To x-axis	frequency	pin No. 2	pin No. 1	$V_{dc} = \log \frac{f}{20 \text{ Hz}} \text{ [volt]}$
To y-axis	distortion	pin No. 3	pin No. 2	$V_{dc} = \log k \text{ [volt]}$ (100% ~ k = 1)
	Input/output	pin No. 1	pin No. 2	$V_{dc} = \log \frac{V_{\text{input}}}{V_{\text{output}}} \text{ [volt]}$
	0 volt	pin No. 20	pin No. 30	
Pen lift		pin No. 4	pin No. 25	TTL output 0 = lift

### Calibration of the x-y recorder

The calibration of the x-y recorder can be achieved with the input connected to the output of the BKF10.

#### Calibration of the x-axis:

- With the BKF10 output frequency at 20 Hz, adjust ZERO position on the recorder.
- Frequency = 20 kHz, adjust x-axis sensitivity.
- Repeat the calibration to verify the adjustments.

#### Calibration of the y-axis:

- Connect the input/output ratio lead to the y-axis.
- Set "MAX. INPUT" switch on the BKF10 to 3 V and adjust ZERO position on the y-axis to your chosen 0 dB line.
- Set "MAX. INPUT" switch to 30 V and adjust the y-axis sensitivity to -20 dB.
- Repeat the calibration to verify the adjustments.

The y-axis is now calibrated for both response- and distortion measurements. The zero volt level represents "100% distortion", -20 dB represents 10% and -40dB represents 1%, etc.

If the tape recorder has separate recording - and playback heads, it is possible to record the internal BKF10 sweep and play it back at the same time. If the tape recorder has decreased bandwidth so that fluctuations occur at higher frequencies, it may be necessary to make the BKF10 sweep start variable. (See Technical Note No. 12.010A - 77-05). Turn the sweep start frequency slowly downwards until any fluctuations stop, and then start the sweep.

If the tape recorder has a combined record-playback head, it is necessary first to record the BKF10 sweep and then play it back.

- Set the BKF10 to manual sweep.
- Adjust the frequency to 1 kHz.
- Start the recording and slowly turn the frequency to 20 kHz and then stop the recording.
- Rewind, and then playback while observing the frequency meter on the BKF10.
- Note the frequency at which the BKF10 goes out-of-range.
- Reset the BKF10 to single sweep and adjust the sweep start frequency to the frequency noted.

- Record the frequency for approx. 10 sec., and start the sweep.
- Rewind and then playback the sweep. During the start frequency (first 10 seconds) the x-y recorder can be set to "PEN-UP". Set the x-y recorder to "PEN-DOWN" just prior to the start of the sweep, and it will record the selected curve.

All these measurements can be made both with and without the SMU401. Where the single contents of each harmonic component are required, repeat the playback of the sweep for each of the selected harmonics.

Modification of BKF10 to include the LP/A-weighted filter

NOTE: After the following modifications have been made, the BKF10 in question will be identical to the BKF10S1 version.

The modified preamplifier is shown on the circuit diagram 2781-A2 included with these instructions.

1. Modify the preamplifier pc-board as shown in Fig. 1:
  - a) Using a scalpel or similar, carefully remove about 2 mm of the print foil at X, as shown in Fig. 1.
  - b) Connect an insulated lead from the point marked 1 on the pc-board to pin 14 on the edge connector.
  - c) Connect an insulated lead from the point marked 2 on the pc-board to pin 7 on the edge connector.
2. Remove the orange/white and green/yellow leads to the filter switch.
3. Mount the filter box on the rear side of the BKF10 display by means of two M3x20 mm screws.
4. Connect the leads to the filter box as shown in the diagram below:

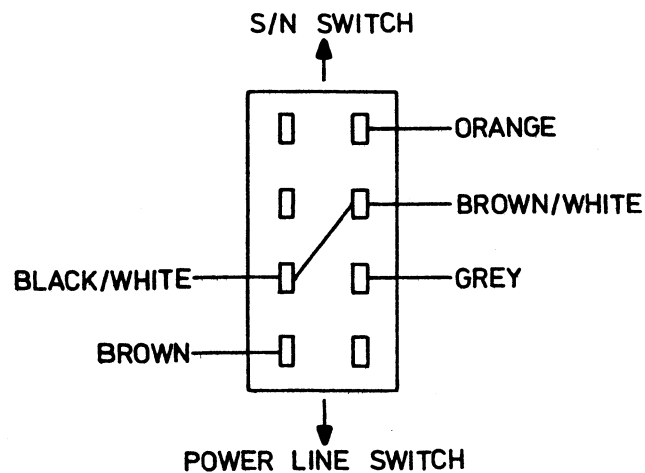


Diagram of filter connections

5. Connect the red lead from the filter box to the +12 V pin on the motherboard (J17-18), and the blue lead to the -12 V pin on the motherboard (J17-17).
6. Connect the shields of the coaxial cables from the filter box to the 0 V pin on the motherboard (J17-16).
7. Connect the center lead of the coaxial labeled (1) to J17-7, on the motherboard.
8. Connect the center lead of the coaxial labeled (2) to J17-14, on the motherboard.
9. Mount the front panel switch label.

10. Performance check.

To check the BKF10S1 a BKF10 oscillator or similar is required. For the test set-up, refer to the BKF10 Service Manual, Section E3: Checking the distortion measurement using a signal with known distortion.

10.1 Set filter switch in position FLAT.

10.2 Adjust BKF10S1 oscillator to 10 kHz 1 Volt.

10.3 Adjust the additionally used BKF10 oscillator to 1 kHz and adjust level to read -25 dB distortion on BKF10S1. Be sure not to change this level during the following procedure -

10.4 Set filter switch in position LP and check that the distortion reading does not change by more than  $\pm 0.1$  dB.

10.5 Set filter switch in position A and check that the distortion reading does not change by more than  $\pm 0.5$  dB.

10.6 Adjust BKF10S1 oscillator to 100 Hz and BKF10 oscillator to 20 kHz.

10.7 Check the distortion reading on BKF10S1; this should be -34.3 dB  $\pm 3$  dB.

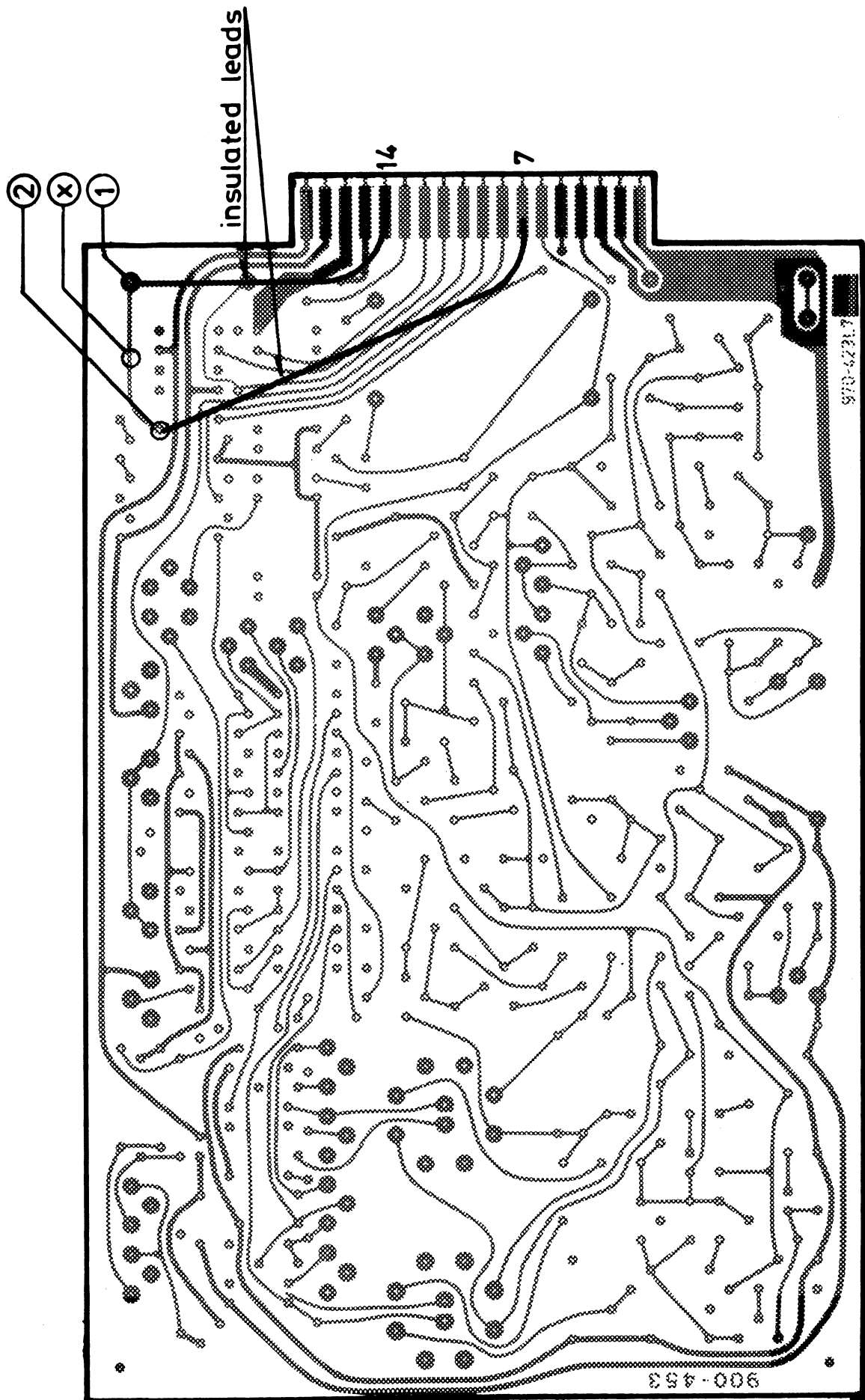
10.8 Check the following further distortion readings:

<u>BKF10</u>	<u>BKF10S1</u>
10 kHz	-27.5 dB $\pm 2$ dB
4 kHz	-24 dB $\pm 1$ dB

10.9 Adjust BKF10S1 oscillator frequency to 5 kHz. Adjust BKF10 oscillator to 1 kHz. Set level on BKF10 to read -20 dB  $\pm 0$  dB distortion on BKF10S1.

10.10 Check the following further distortion readings:

<u>BKF10</u>	<u>BKF10S1</u>
250 Hz	-28.6 dB $\pm 1$ dB
100 Hz	-39.1 dB $\pm 1$ dB
20 Hz	-70.5 dB $\pm 5$ dB





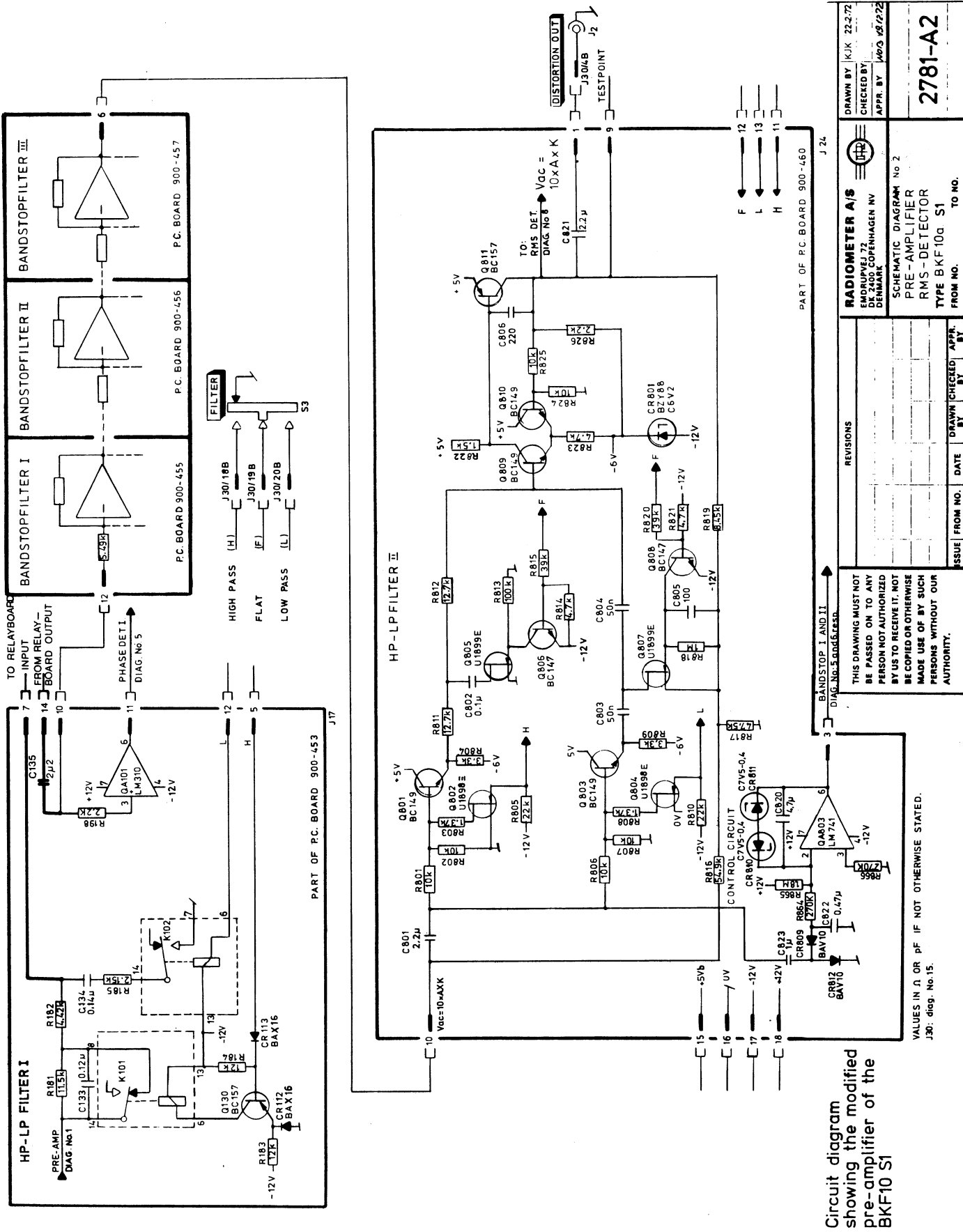


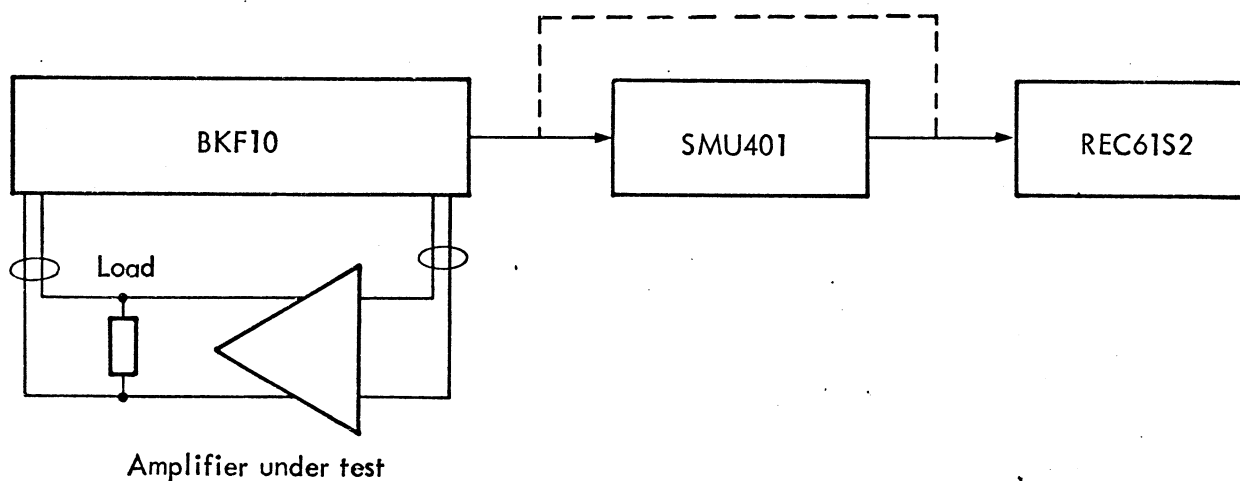
Fig. 1. BKF10S1 Modification to 900-453 PC-board

BKF10 power sweep measurement

This application note describes how to measure distortion as a function of power on power amplifiers with the BKF10 - REC61S2 or the BKF10 - SMU401 - REC61S2. It is possible to make this measurement without any other equipment than a load for the amplifier.

Note:

It is only possible to make the power sweep measurement with the REA241 Distortion Interface on the REC61S2.



When making Power Sweep measurements, the tracking potentiometer in REC61S2 is used to control the input power level at the BKF10 and therefore the output level of the amplifier. When using a  $4\ \Omega$  load, 20 kHz on the recorder paper will represent 200 W and 20 Hz represent 0.2 W. Using an  $8\ \Omega$  load, 20 kHz will represent 100 W and 20 Hz represent 0.1 W.

Important:

To avoid damage to the amplifier by overloading the input during the following calibration procedure, disconnect the amplifier input.

- Set "MAX. INPUT" switch to 30 V.
- Set "LEVEL CONTROL" switch to 'Ext.' Level at input.
- Calibrate the recorder paper and turn the paper feed knob so that the pen is at about 5 W (500 Hz).

- Connect the amplifier input to the BKF10 output.
- Select the measuring frequency by manually adjusting the BKF10 output frequency.
- Slowly turn the recorder paper feed knob to the required start power level.
- Depress the SWEEP START button on the REA241, and the sweep will now start..

If the BKF10 goes out-of-range, check that the oscillator does not exceed the 1 mV to 1 V range.

SMG40 - use with other signal generators

When SMG40 is used to modulate other signal generators than the RE101, attention should be paid to the location of the cable carrying the MPX signal to the signal generator and the cable carrying the RF signal to the test object.

Due to the square wave logic circuitry in the SMG40, the content of high harmonics can radiate in the FM band and can cause problems, if the practice mentioned below is not followed.

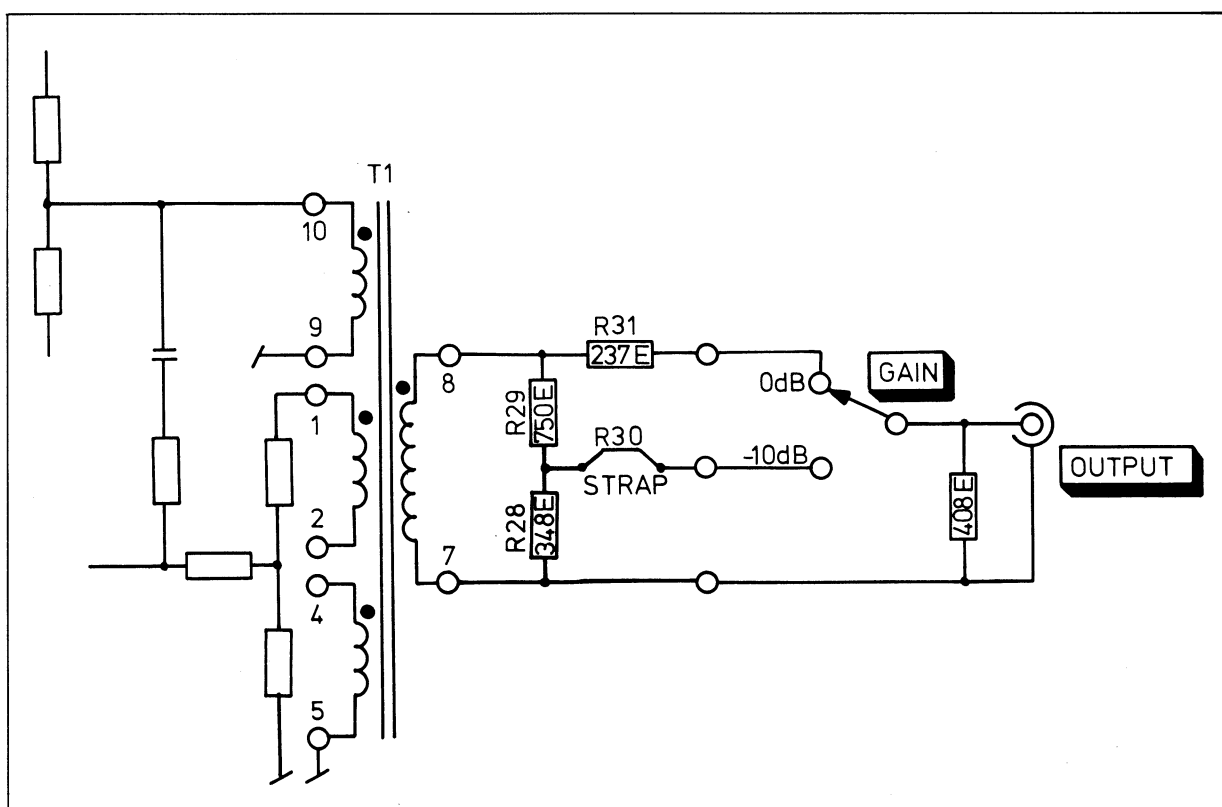
The problem shows up when S/N ratio measurements on FM receivers are performed. Dependent on the type of coaxial cable used, leakage between the two cables can influence the measurement when the distance between the cables is short. In general, the RF radiation from the SMG40 is only a problem when the distance between the two cables is less than approx. 20 cm.

When the SMG40 and the RE101 are used together, the MPX signal is coupled by means of a short cable on the rear panel, and the RF signal coupled to test object by means of a cable connected on the front panel, and the problem does not exist.

## BKF10-BAT10 converting the BAT10 output impedance to 150Ω.

This Technical Note describes modifications to convert the output impedance of the BAT10 from 600Ω to 150Ω. The 150Ω output impedance is used in 150Ω line systems.

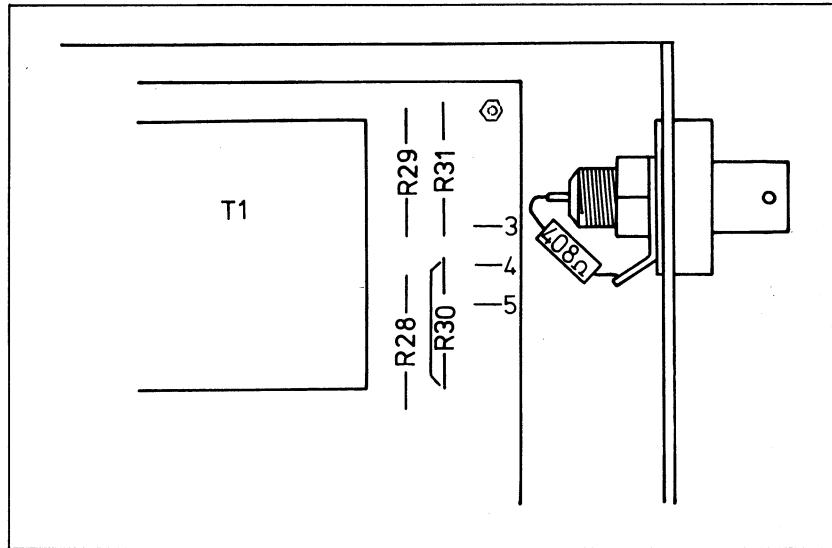
The BAT10 gain is 0 dB with a 150Ω load and with the gain switch in the 10 dB position, and -10 dB in the 0 dB position. The output stage of the BAT10, 150Ω version, is shown below:



## Parts list

Items				code no.
R28	Metalfilm resistor	348Ω. 1%	0.1 W	140-807
R29	Metalfilm resistor	750Ω0.5%	0.125 W	140-765
R31	Metalfilm resistor	237Ω. 1%	0.1 W	140-530
	Metalfilm resistor	408Ω0.25%	0.250 W	140-315

### Modification



1. Remove R30 and place a strap instead.
2. Change R28 from 825 $\Omega$  to 348 $\Omega$ .
3. Change R29 from 1K78 to 750 $\Omega$ .
4. Change R31 from 590 $\Omega$  to 237 $\Omega$ .
5. Place the 408 $\Omega$  resistor on the BNC plug as shown.

The specification of the BAT10 is not changed except for the gain.

BKF10: A-weighting Filter

Some of our customers have shown interest in measuring the signal-to-noise ratio weighted in accordance with the standard A-curve, and to have a low pass filter with a cut-off at 20 kHz.

We are therefore introducing the

**BKF10S1**

which is a standard version with the following changes:

The function of the LP filter has been replaced by:

an LP filter:  $f(3 \text{ dB}) = 22.5 \text{ kHz}$ . Attenuation at 40 kHz greater than 50 dB.

The function of the HP filter has been replaced by:

a filter conforming to the A-weighting requirements of:

DIN 45.500 bl. 4

DIN 45.633 bl. 1

IEC 179

The first two of a series of BKF10S1's will be delivered to Eumig through our distributor in Austria. Messrs. Drott, early in May 1977.

The delivery time for additional BKF10S1 will be approximately 4 weeks after receipt of order from June 1, 1977.

This introduction of a special version of the BKF10 should give you further possibilities for selling more BKF10's. Good luck.

BKF10/SMU401 Combination: ModificationsModifying the BKF10

Please refer to the list of enclosures included with these instructions.

Opening the BKF10

Disconnect the BKF10 from the line supply.

Remove the top and bottom plates and flip the rear panel upwards as described in the BKF10 Service Manual, Section D, steps 1-4. Remove the right hand side plate (when viewed from the front of the BKF10), by pulling it backwards.

Mounting the Modification PC-board

1. Unscrew the two upper screws which secure the Motherboard at the right hand side (behind the Input Frequency Meter).
2. Mount the modification PC-board, as shown in enclosures 3 and 4 using the screws and spacers supplied with the modification kit.
3. The modification cable should be routed together with the connection cable from J30 to the multiconnector J16 on the rear panel. Replace the three cable clamps shown in enclosure 3 with the clamps supplied in the modification kit, so that both cables pass through the clamps. To give access to the rear clamp on the side plate of the BKF10, it is necessary to remove the plate on which the line receptacle is mounted. Unscrew the six screws which secure this plate, and carefully move the plate aside. Then replace the rear cable clamps and remount the plate.
4. Mount the leads W1-5 of the modification cable to the multiconnector J16 on the rear panel as shown in enclosure 3.
5. Connect the yellow/white lead (W12) between the center pin at the BNC-connector and pin 12 on the multiconnector.
6. Cut the connection to J30/13B on the Motherboard as shown in enclosure 4. Then connect the W6 (blue) lead of the modification cable to J30/13B.
7. Connect the leads W7-11 to the Motherboard as shown in enclosure 4.



### Modifying the RMS-detector (PC-board No. 8)

1. Unplug the RMS-detector PC-board.

Note: Two different versions designated 71-PT-66-2 and 970-648S3, of the RMS-detector PC-board have been supplied. The modifications must be performed according to the component placement drawings for the version of the RMS-detector in question, see enclosures 5 or 6 as required.

2. Replace the following components with those supplied in the Modification Kit:

Replace R866 by a 270 k $\Omega$  resistor.

Replace R864 by a 270 k $\Omega$  resistor.

Replace C822 by a 0.47  $\mu$ F capacitor.

Replace CR809 by a BAV10 diode.

Mount C823 (1  $\mu$ F).

Mount CR812 (BAV10).

Connect the components as shown on the respective component placement drawings for the RMS-detector in question. See enclosures 5 or 6 as required.

3. Fasten one of the self-adhesive labels marked "SMU401 COMPATIBLE" on the PC-board. The label is metal, therefore, take care not to short circuit any component leads, etc., with the label.
4. Plug in the RMS-detector PC-board.

### Adjusting the Modification Circuit

1. Switch on the BKF10.
2. Connect Pin 7 to Pin 24 on the multiconnector J16 on the rear panel.
3. Connect a dc power supply between Pin 10 (minus) and Pin 20 on the multiconnector J16, and set the voltage to +1.000 V  $\pm$  1 mV.
4. Adjust the potentiometer on the modification PC-board until the distortion meter reads 10%.
5. Remove the connections established in items 2 and 3 above.

### Assembling the BKF10

1. Remount the side plate, the rear panel and the top and bottom plates.
2. Fasten a self-adhesive label marked "SMU401 COMPATIBLE" alongside the multiconnector on the rear panel.

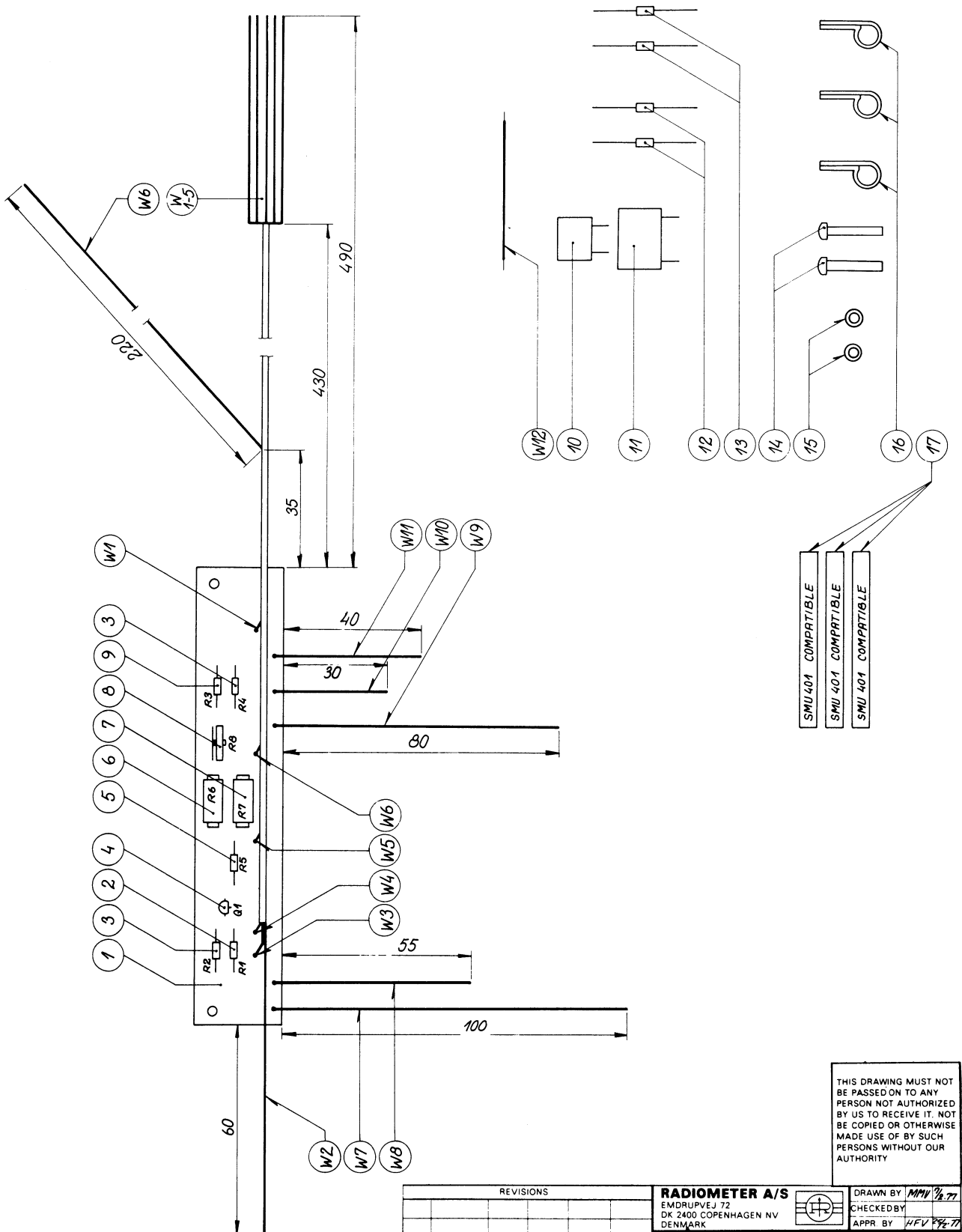
### Modifying the REA241 Distortion Interface


1. Unscrew the four screws which secure the rear and side cover, and remove the cover.
2. Unsolder the three interconnections marked 14, 17 and 18 between the two PC-boards.
3. Remount the rear and side cover.
4. Fasten a self-adhesive label marked "SMU401 COMPATIBLE" below the 25-pin multiconnector.

## LIST OF ENCLOSURES

- ENC. 1      Drawing No. 1854-A1, modification kit
- 2      Component list of the modification kit
  - 3      Drawing No. 2764-A2, mounting of the modification kit
  - 4      Motherboard pin connection drawing
  - 5      Component placement drawing showing the modified RMS detector,  
designated 970-428 S3
  - 6      Component placement drawing showing the modified RMS detector,  
designated 71-PT-66-2
  - 7      Circuit diagram No. 4739-A3, covering the modification kit
  - 8      Circuit diagram No. 2147-A2, covering the modified preamplifier,  
RMS detector

# ENCLOSURE 1.



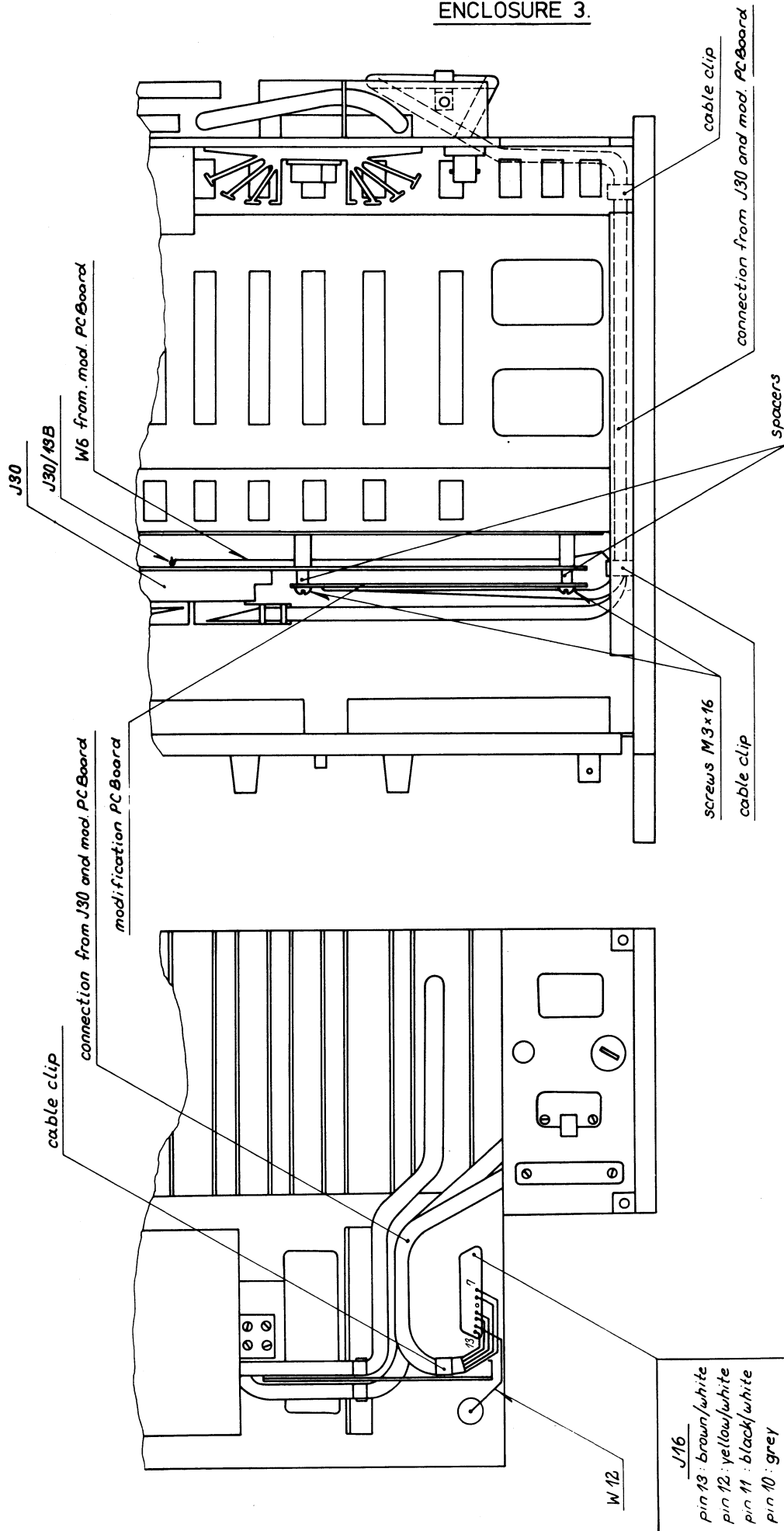
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					Modification kit for BKF 10/ SMU 401			CHECKED BY	APPR BY <i>HJV/12.77</i>
					TYPE 900-823			1854-A1	
ISSUE	FROM NO	DATE	DRAWN	CHECKED	APPR	FROM NO	TO NO		

## ENCLOSURE 2.

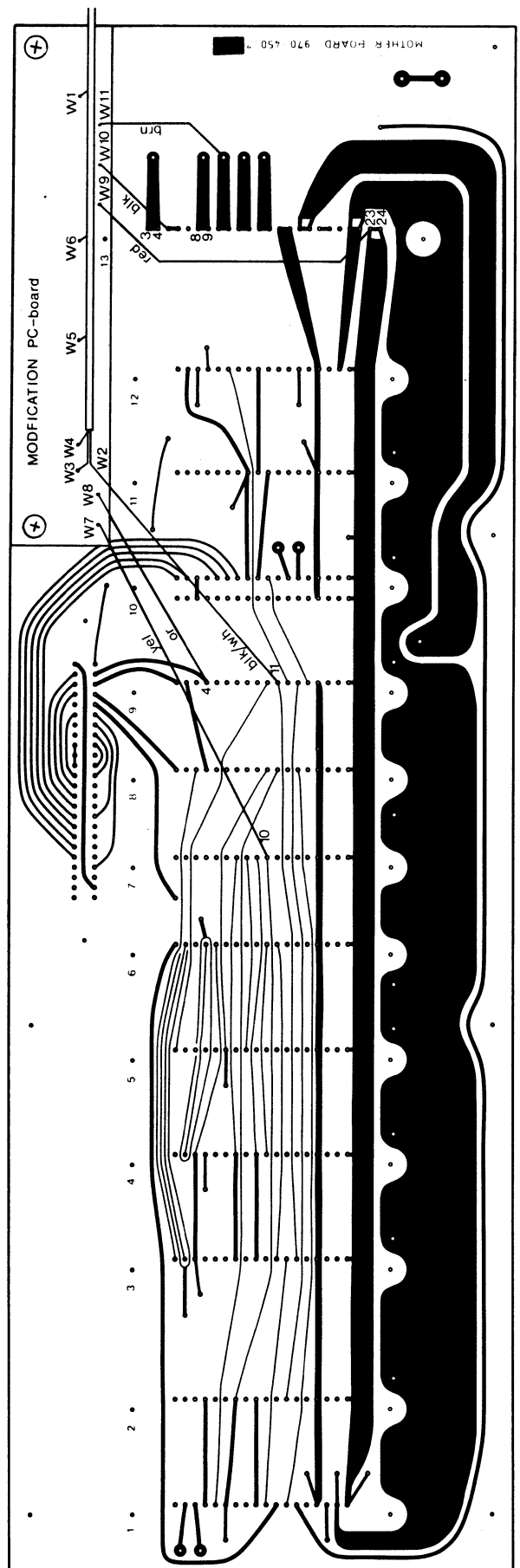
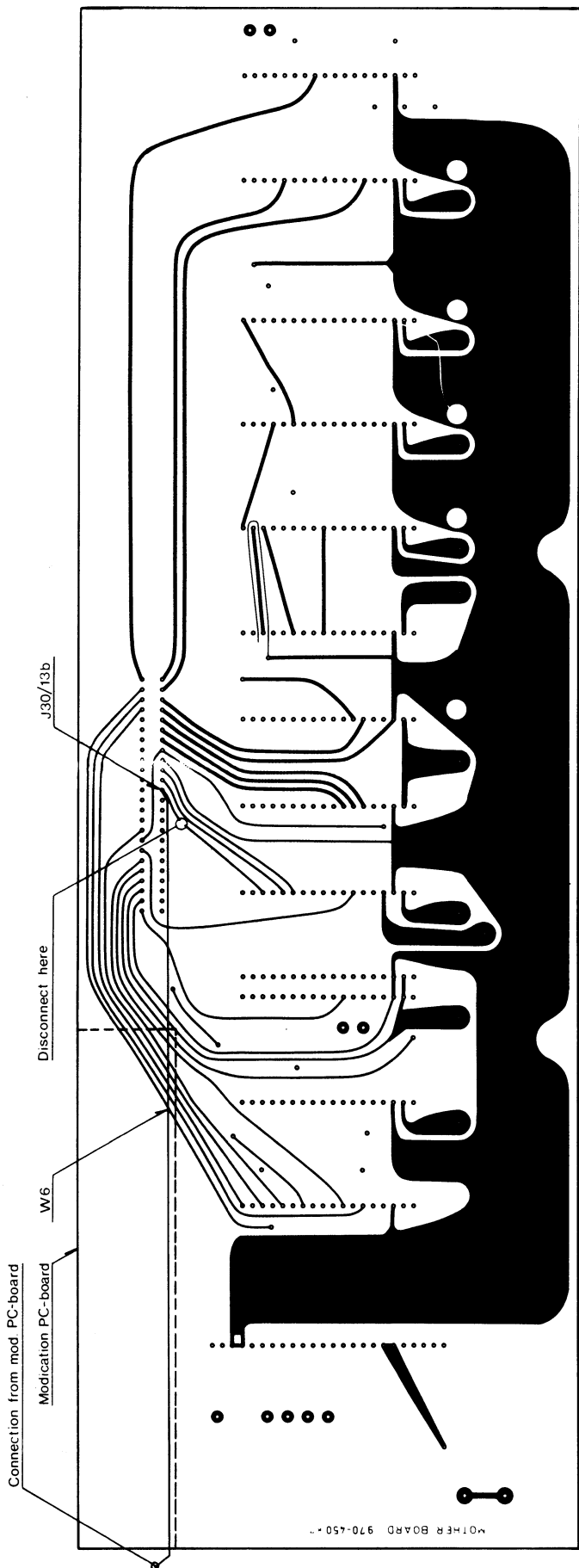
17	Sticker		3
16	Cabelclamp 8mm.	064-508	3
15	Tube 3,2/4,8x6	038-306	2
14	Screw M3x16	008-316	2
13	Resistor 270k (R866, R864)	106-627	2
12	Diode BAV10 (CR809, CR812)	350-022	2
11	Capacitor 0,47µF (C822)	241-038	1
10	Capacitor 1µF (C823)	241-027	1
W12	Mounting wire, yellow/white	L: 60mm. 634-094	1
W11	—————, brown	L: 47mm. 634-001	1
W10	—————, black	L: 37mm. 634-000	1
W9	—————, red	L: 87mm. 634-002	1
W8	—————, orange	L: 62mm. 634-003	1
W7	—————, yellow	L: 107mm. 634-004	1
W6	—————, blue	L: 323mm. 634-006	1
W5	—————, violet	L: 584mm. 634-007	1
W4	—————, grey	L: 609mm. 634-008	1
W3	—————, white	L: 615mm. 634-009	1
W2	—————, black/white	L: 687mm. 634-090	1
W1	Mounting wire, brown/white	L: 523mm. 634-091	1
9	Resistor 56k	106-556	1
8	Variable potentiometer 470Ω	182-038	1
7	Resistor 18k 78	152-204	1
6	————— 6k 26	152-163	1
5	Resistor 33k	106-533	1
4	Transistor J109	360-188	1
3	Resistor 680Ω	106-368	2
2	Resistor 2k7	106-427	1
1	Printet circuit board	970-784	1
POS.	DESIGNATION	DWG./CODE	No.

THIS DRAWING MUST NOT BE PASSED ON TO ANY PERSON NOT AUTHORIZED BY US TO RECEIVE IT, NOT BE COPIED OR OTHERWISE MADE USE OF BY SUCH PERSONS WITHOUT OUR AUTHORITY	REVISIONS						<b>RADIOMETER A/S</b> EMDRUPVEJ 72 DK 2400 COPENHAGEN NV DENMARK  <i>Modification kit for</i> <b>BKF10/SMU 401</b>  <b>TYPE 900-823</b> FROM NO.                      TO NO.	DRAWN BY	MMV	24
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								APPR. BY	HEV	11.3.77
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ISSUE    FROM NO.    DATE    DRAWN BY    CHECKED BY    APPR. BY										

# ENCLOSURE 3.

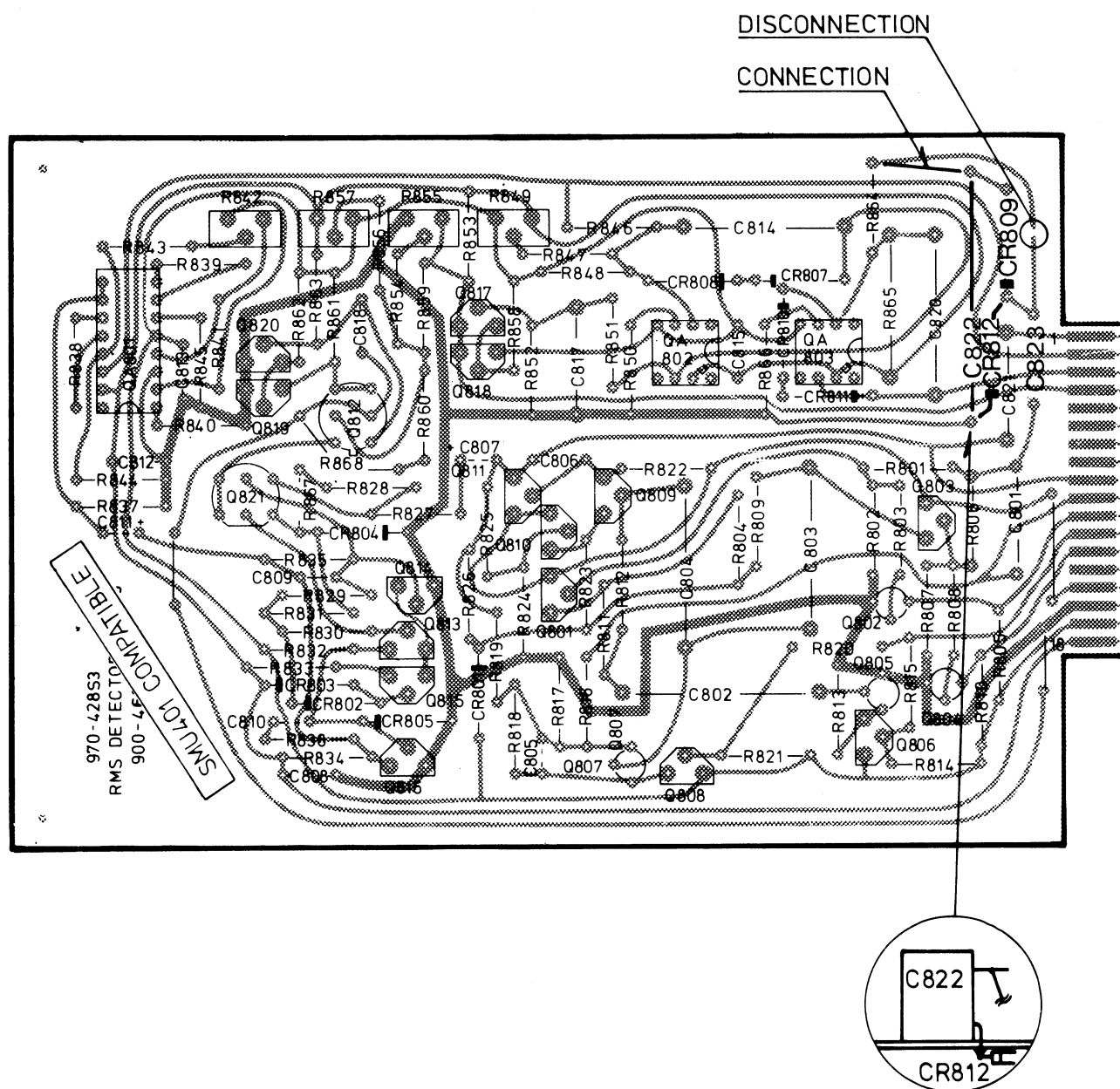


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NO.	DATE	BY	APPROVED BY																						
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ISSUE FROM NO.		DRAWN CHECKED BY		FROM NO. TO NO.																					



ENCLOSURE 5.

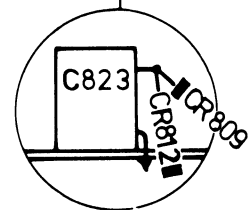
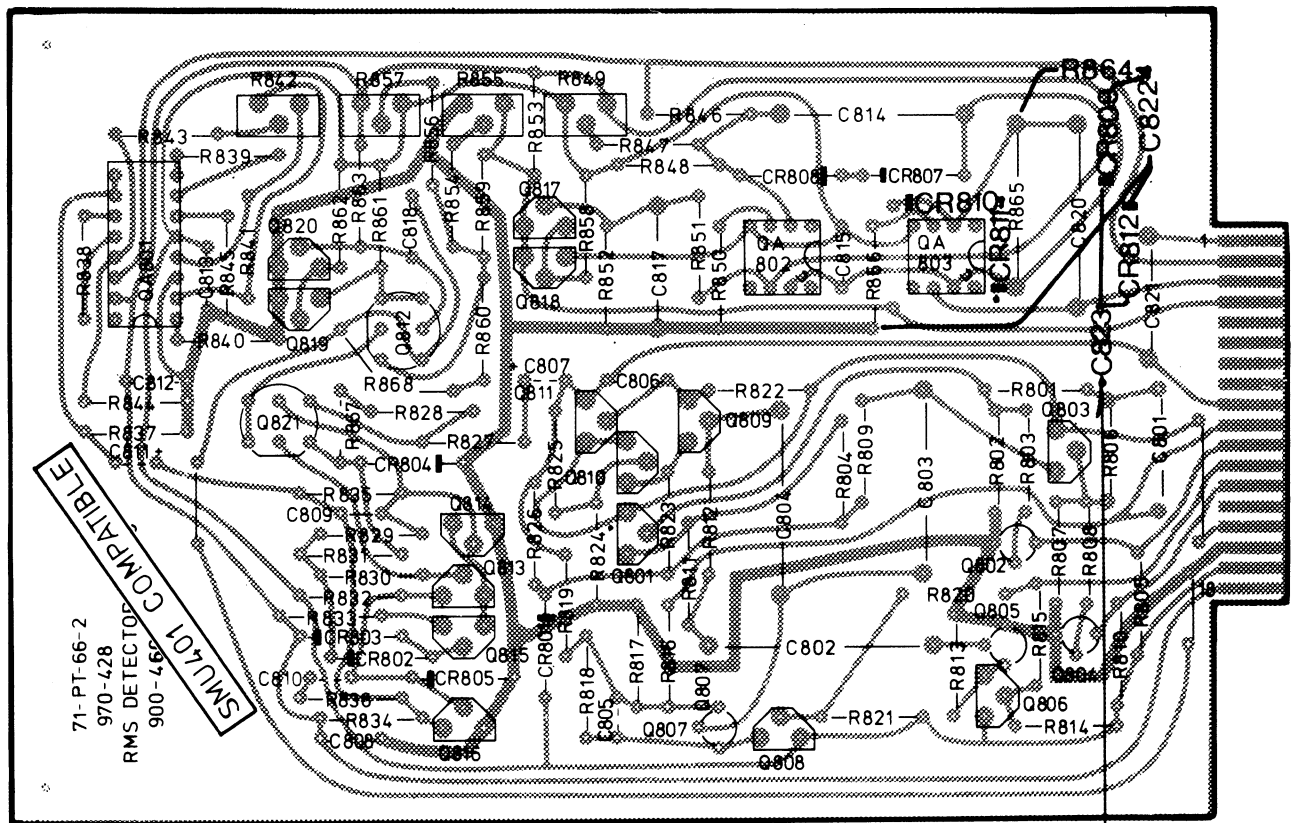
MODIFICATIONS TO THE RMS DETECTOR. VERSION DESIGNATED 970-42853



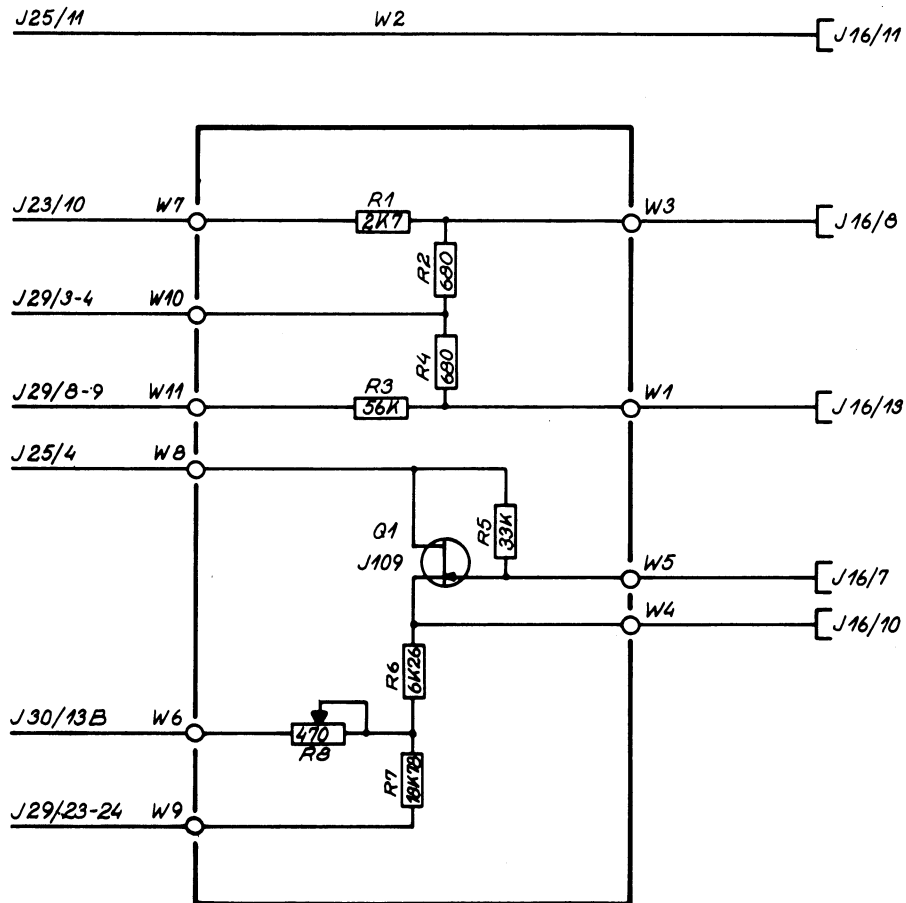



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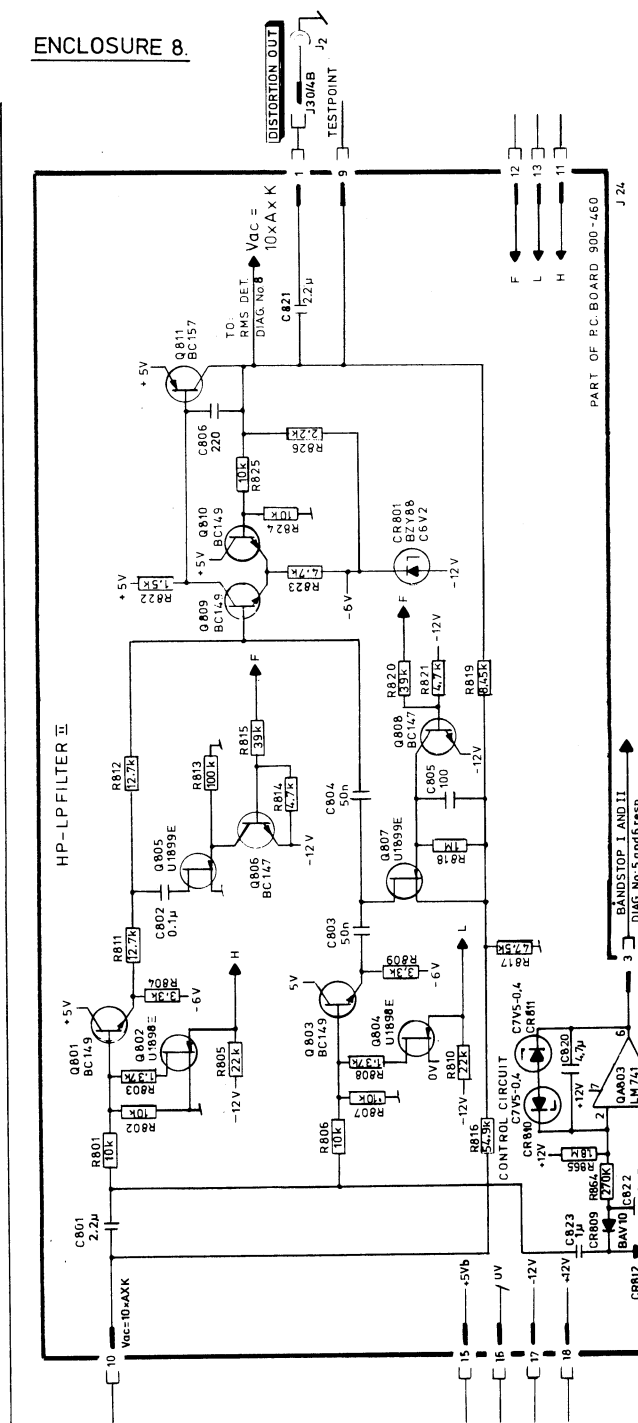
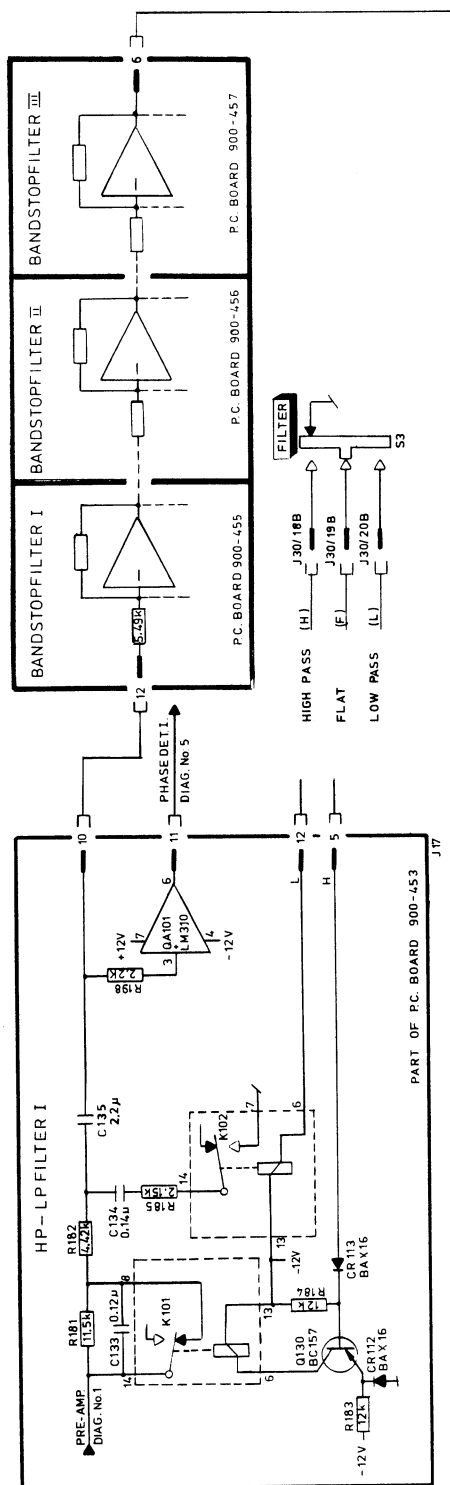
MODIFICATIONS TO THE RMS DETECTOR. VERSION DESIGNATED 71-P-66-2




# ENCLOSURE 7.



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								4739-A3		
ISSUE	FROM NO.	DATE	DRAWN BY	CHECKED BY	APPR. BY					



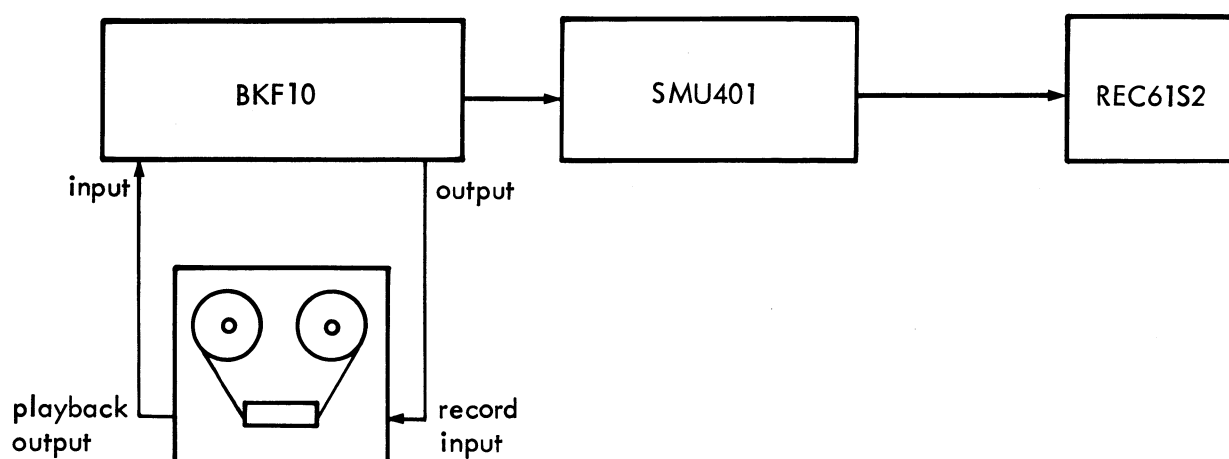
THIS DRAWING MUST NOT BE PASSED ON TO ANY PERSON NOT AUTHORIZED BY US TO RECEIVE IT, NOT BE COPIED OR OTHERWISE MADE USE OF BY SUCH PERSONS WITHOUT OUR AUTHORITY.										DRAWN BY KJK 22-272 CHECKED BY APPR. BY WGS 08/22/82									
REVISIONS																			
5 238384 25-77 BLØ										RADIMETER A/S									
4 213173 28-75 BLØ										SMØRSTEDT 72									
3 238384 11-57s OH										2650 HERNIMENGEN NV									
2 204717 18-37s OH										DENMARK									
2/2										SCHEMATIC DIAGRAM No 2									
KJ										PRE-AMPLIFIER									
A11/										RMS - DETECTOR									
TYPE BK F10q										2147-A2									
FROM NO.										TO NO.									
ISSUE FROM NO.										DRAWN/CHECKED APPR.									

BKF10-measurement on tape recorders

This application note describes how to measure and record the frequency response, the total harmonic distortion and the level of each single harmonic component up to the fifth harmonic all as a function of frequency.

We show first a measuring system consisting of a BKF10, SMU401 and an REC61S2, and secondly where we have interchanged the REC61S2 with an x-y recorder.

The main problems associated with this type of measurement is to calibrate the frequency axis, and to avoid the influence of the bias and erase frequencies on the distortion measurements.

Measurements with BKF10 - SMU401 - REC61S2

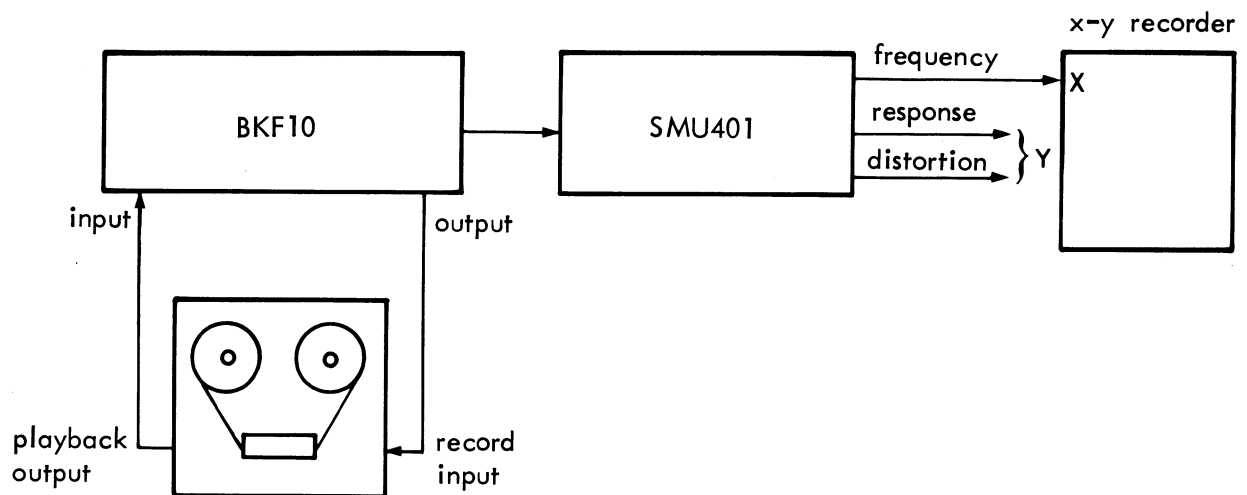
If the tape recorder has separate recording and playback heads it is possible to record the sweep and play it back at the same time, but there is a delay between input and output, which will cause a frequency delay. The offset in mm of the frequency axis can be calculated by measuring the distance between the two heads and the recording speed. By using the calculated offset, the frequency axis on the paper is calibrated.

Decreased bandwidth on tape recorders can cause fluctuations at high frequencies. To avoid this problem, start the sweep at a lower frequency, by simply resetting the paper on the REC61S2 to a lower frequency before starting the sweep.

If the tape recorder has a combined record-playback head it is necessary first to record the sweep and then play it back. In this system it can be rather difficult to calibrate the frequency axis.

- Set the BKF10 to manual output frequency.
- Adjust the frequency to 1 kHz.
- Start recording and turn slowly the frequency to 20 kHz and stop the recording.
- Rewind and playback while observing the frequency meter of the BKF10.
- Note the frequency where the BKF10 goes out-of-range.
- Reset the BKF10 to external output frequency.
- Adjust the paper on the REC61S2 to the frequency where the BKF10 went out-of-range.
- Record this frequency for approx. 10 sec.
- Start the sweep on REC61S2.
- After recording the sweep, adjust the recorder paper to a frequency 1 kHz lower than the sweep start frequency.
- Rewind and start playback.
- When any fluctuations have stopped, set the pen switch on the REC61S2 to "pen down".
- Observe the BKF10 frequency meter and when the pointer passes the recorder paper calibrated frequency, activate the sweep start button on the REC61S2.
- After a few seconds, reset the REC61S2 to "PEN UP" (REMOTE).

### Measurements with BKF10 - SMU401 and an x-y recorder



The table below shows the connections to be used when the BKF10 - SMU401 and an x-y recorder are combined.

		BKF10 recorder output 25 pole D-con- nector	SMU401 recorder output 37 pole D-con- nector	
To x-axis	frequency	pin No. 2	pin No. 1	$V_{dc} = \log \frac{f}{20 \text{ Hz}} \text{ [volt]}$
To y-axis	distortion	pin No. 3	pin No. 2	$V_{dc} = \log k \text{ [volt]}$ (100% ~ k = 1)
	Input/output	pin No. 1	pin No. 2	$V_{dc} = \log \frac{V_{\text{input}}}{V_{\text{output}}} \text{ [volt]}$
	0 volt	pin No. 20	pin No. 30	
Fly-back*		pin No. 4	pin No. 25	TTL output 0 = lift

\*Fly-back can only be used at measurements on tape recorders with separate recording-playback heads.

### Calibration of the x-y recorder

The calibration of the x-y recorder can be achieved with the input connected to the output of the BKF10.

#### Calibration of the x-axis:

- With the BKF10 output frequency at 20 Hz, adjust ZERO position on the recorder.
- Frequency = 20 kHz, adjust x-axis sensitivity.
- Repeat the calibration to verify the adjustments.

#### Calibration of the y-axis:

- Connect the input/output ratio lead to the y-axis.
- Set "MAX. INPUT" switch on the BKF10 to 3 V and adjust ZERO position on the y-axis to your chosen 0 dB line.
- Set "MAX. INPUT" switch to 30 V and adjust the y-axis sensitivity to -20 dB.
- Repeat the calibration to verify the adjustments.

The y-axis is now calibrated for both response- and distortion measurements. The zero volt level represents "100% distortion", -20 dB represents 10% and -40dB represents 1%, etc.

If the tape recorder has separate recording - and playback heads, it is possible to record the internal BKF10 sweep and play it back at the same time. If the tape recorder has decreased bandwidth so that fluctuations occur at higher frequencies, it may be necessary to make the BKF10 sweep start variable. (See Technical Note No. 12.010A - 77-05). Turn the sweep start frequency slowly downwards until any fluctuations stop, and then start the sweep.

If the tape recorder has a combined record-playback head, it is necessary first to record the BKF10 sweep and then play it back.

- Set the BKF10 to manual output frequency.
- Adjust the frequency to 1 kHz.
- Start the recording and slowly turn the frequency to 20 kHz and then stop the recording.
- Rewind, and then playback while observing the frequency meter on the BKF10.
- Note the frequency at which the BKF10 goes out-of-range.
- Reset the BKF10 to single sweep and adjust the sweep start frequency to the frequency noted.

- Record the frequency for approx. 10 sec., and start the sweep.
- Rewind and then playback the sweep. During the start frequency (first 10 seconds) the x-y recorder can be set to "PEN-UP". Set the x-y recorder to "PEN-DOWN" just prior to the start of the sweep, and it will record the selected curve.

All these measurements can be made both with and without the SMU401. Where the single contents of each harmonic component are required, repeat the playback of the sweep for each of the selected harmonics.



Modification of BKF10 to include the LP/A-weighted filter

NOTE: After the following modifications have been made, the BKF10 in question will be identical to the BKF10S1 version.

The modified preamplifier is shown on the circuit diagram 2781-A2 included with these instructions.

1. Modify the preamplifier pc-board as shown in Fig. 1:
  - a) Using a scalpel or similar, carefully remove about 2 mm of the print foil at X, as shown in Fig. 1.
  - b) Connect an insulated lead from the point marked 1 on the pc-board to pin 14 on the edge connector.
  - c) Connect an insulated lead from the point marked 2 on the pc-board to pin 7 on the edge connector.
2. Remove the orange/white and green/yellow leads to the filter switch.
3. Mount the filter box on the rear side of the BKF10 display by means of two M3x20 mm screws.
4. Connect the leads to the filter box as shown in the diagram below:

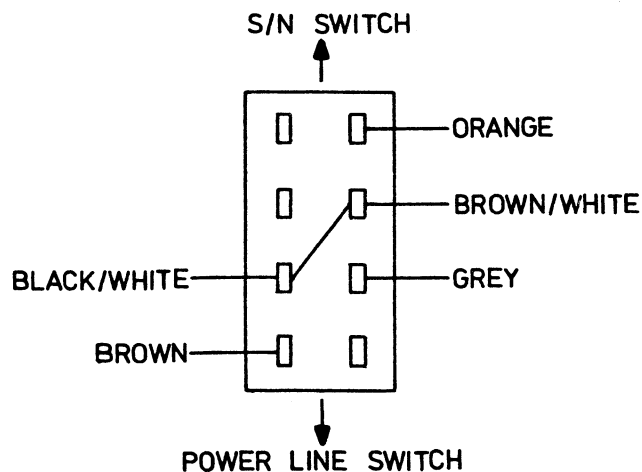


Diagram of filter connections

5. Connect the red lead from the filter box to the +12 V pin on the motherboard (J17-18), and the blue lead to the -12 V pin on the motherboard (J17-17).
6. Connect the shields of the coaxial cables from the filter box to the 0 V pin on the motherboard (J17-16).
7. Connect the center lead of the coaxial labeled (1) to J17-7, on the motherboard.
8. Connect the center lead of the coaxial labeled (2) to J17-14, on the motherboard.
9. Mount the front panel switch label.

10. Performance check.

To check the BKF10S1 a BKF10 oscillator or similar is required. For the test set-up, refer to the BKF10 Service Manual, Section E3: Checking the distortion measurement using a signal with known distortion.

10.1 Set filter switch in position FLAT.

10.2 Adjust BKF10S1 oscillator to 10 kHz 1 Volt.

10.3 Adjust the additionally used BKF10 oscillator to 1 kHz and adjust level to read -25 dB distortion on BKF10S1. Be sure not to change this level during the following procedure -

10.4 Set filter switch in position LP and check that the distortion reading does not change by more than  $\pm 0.1$  dB.

10.5 Set filter switch in position A and check that the distortion reading does not change by more than  $\pm 0.5$  dB.

10.6 Adjust BKF10S1 oscillator to 100 Hz and BKF10 oscillator to 20 kHz.

10.7 Check the distortion reading on BKF10S1; this should be -34.3 dB  $\pm 3$  dB.

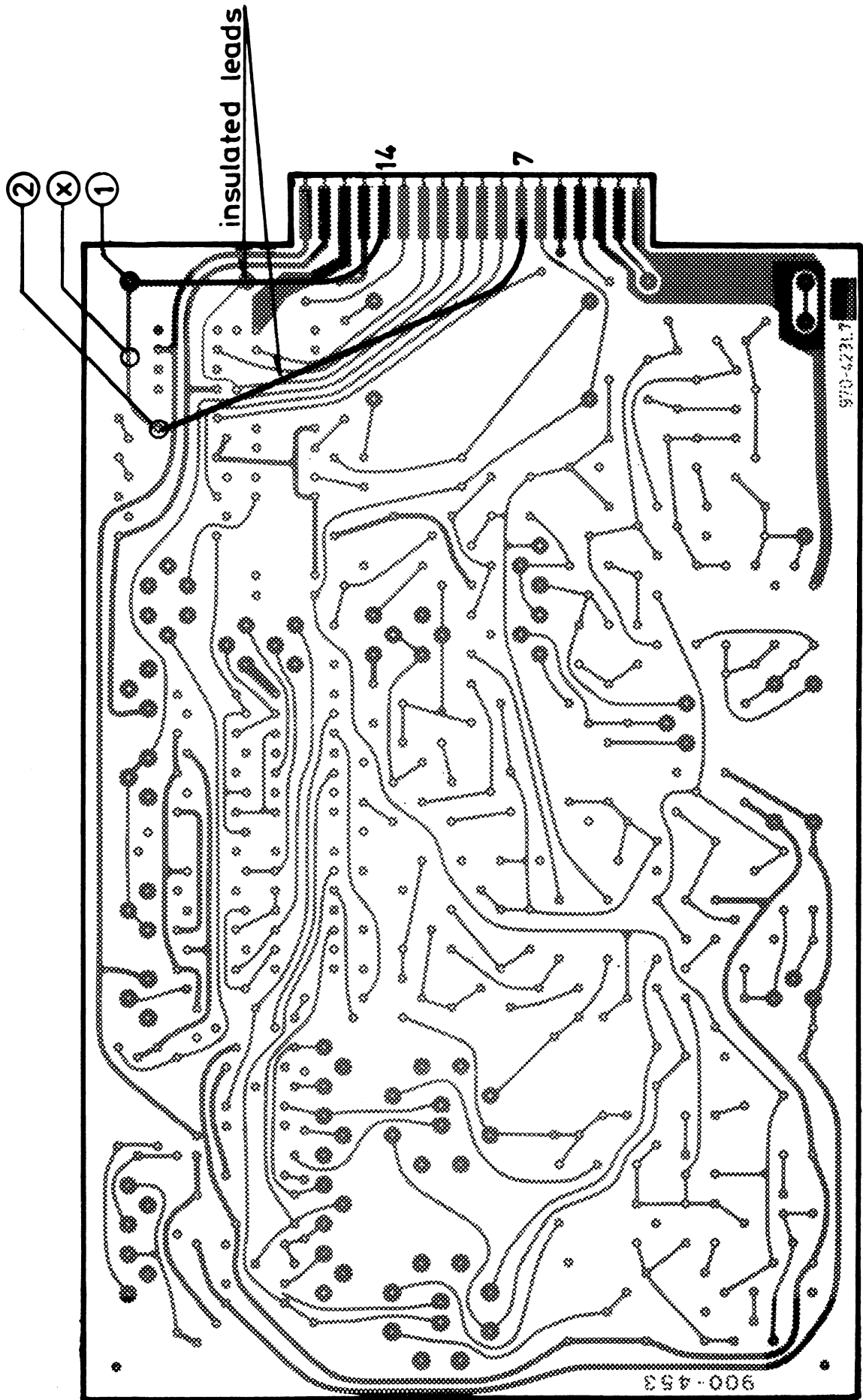
10.8 Check the following further distortion readings:

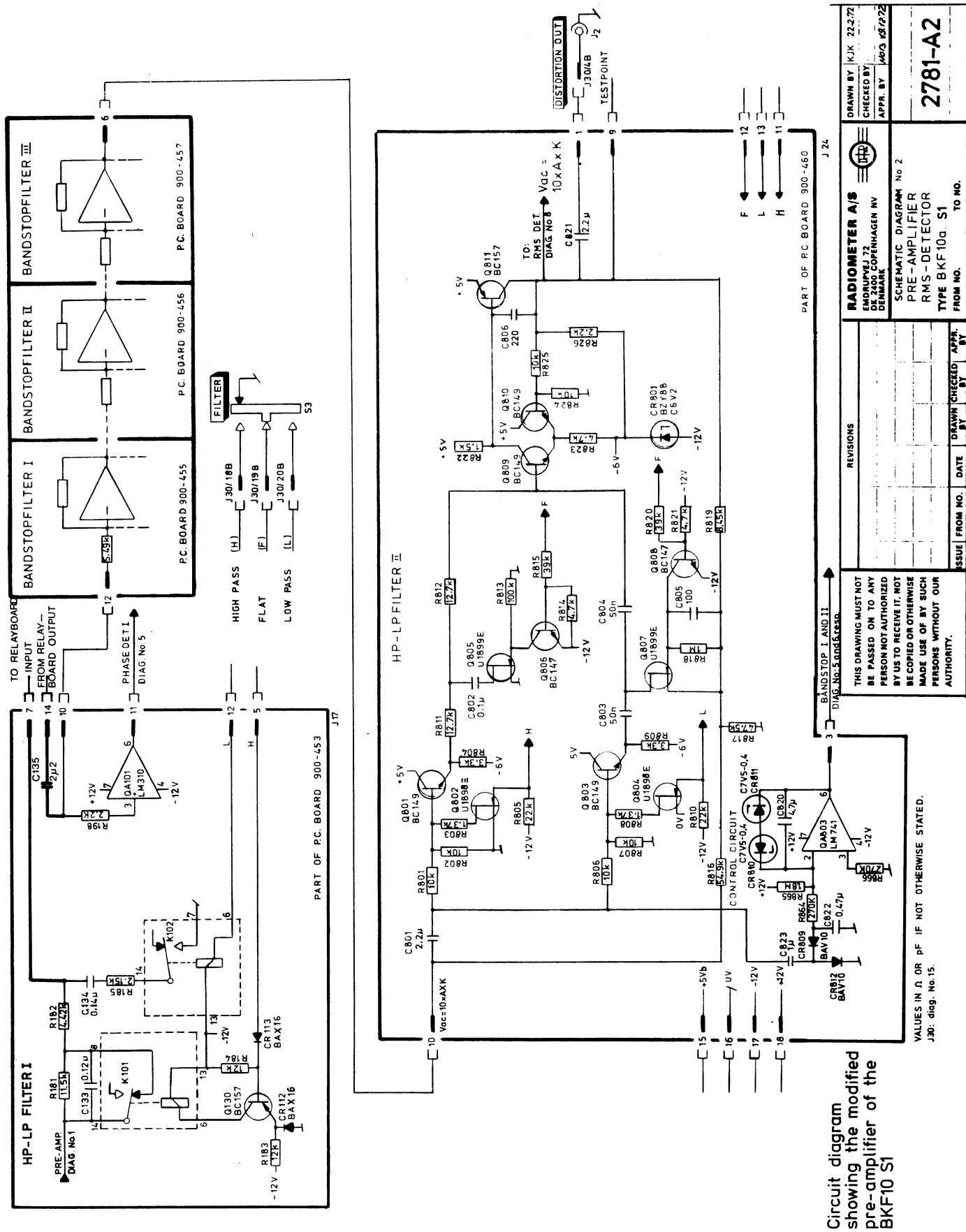
<u>BKF10</u>	<u>BKF10S1</u>
10 kHz	-27.5 dB $\pm 2$ dB
4 kHz	-24 dB $\pm 1$ dB

10.9 Adjust BKF10S1 oscillator frequency to 5 kHz. Adjust BKF10 oscillator to 1 kHz. Set level on BKF10 to read -20 dB  $\pm 0$  dB distortion on BKF10S1.

10.10 Check the following further distortion readings:

<u>BKF10</u>	<u>BKF10S1</u>
250 Hz	-28.6 dB $\pm 1$ dB
100 Hz	-39.1 dB $\pm 1$ dB
20 Hz	-70.5 dB $\pm 5$ dB





Circuit diagram showing the modified pre-amplifier of the BKF10 S1

Fig. 1. BKF10S1 Modification to 900-453 PC-board

<b>RADIOMETER A/S</b> EMDRUPVEJ 72 DK-2400 COPENHAGEN NV DENMARK		DRAWN BY: KJK 22-2-72 CHECKED BY: APPR. BY: JAC 18/12/72
SCHEMATIC DIAGRAM No. 2 PRE-AMPLIFIER RMS-DETECTOR TYPE BKF10a S1		<b>2781-A2</b>
REVISIONS	ISSUE FROM NO. DATE DATE DRAWN CHECKED APPR. BY	FROM NO. TO NO.

VALUES IN  $\Omega$  OR pF IF NOT OTHERWISE STATED.  
 J30: diag. No. 15.