

# Sailor

# Sailor

INSTRUKTIONSBOG FOR  
SAILOR RECEIVER R2022

INSTRUCTION BOOK FOR  
SAILOR RECEIVER R2022

INSTRUKTIONSBUCH FÜR  
SAILOR RECEIVER R2022

INSTRUCTIONS POUR  
SAILOR RECEIVER R2022

INSTRUCCIONES PARA  
SAILOR RECEIVER R2022



A. P. RADIO · AALBORG · DENMARK

# CONTENTS

1. INTRODUCTION
  - 1.1. GENERAL DESCRIPTION
  - 1.2. TECHNICAL DATA
  - 1.3. CONTROLS
  - 1.4. PRINCIPLE OF OPERATION
  
2. INSTALLATION
  - 2.1. MOUNTING POSSIBILITIES
  - 2.2. DIMENSIONS AND DRILLING PLAN
  - 2.3. ELECTRICAL CONNECTIONS
  - 2.4. AERIAL AND EARTH
  - 2.5. AERIAL TUNE-UP PROCEDURE
  - 2.6. R2022 USED IN CONJUNCTION WITH T121, T122, T124, T126 OR T128
    - 2.6.1. ELECTRICAL CONNECTIONS OF R2022 AND T12X
    - 2.6.2. DIMENSIONS AND DRILLING PLAN FOR H2093
  
3. SERVICE
  - 3.1. MAINTENANCE
  - 3.2. NECESSARY TEST EQUIPMENT
  - 3.3. TROUBLE SHOOTING
  - 3.4. PERFORMANCE CHECK
  - 3.5. ADJUSTMENT PROCEDURE
  - 3.6. NECESSARY ADJUSTMENT AND CHECK AFTER REPAIR
  - 3.7. FUNCTION CHECK
  - 3.8. PIN CONFIGURATIONS
  - 3.9. ADJUSTMENT, TEST POINT & MODULE LOCATIONS
  
4. MECHANICAL DISASSEMBLING
  
5. CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS
  - 5.1. FRONT END (MODULE 1)
  - 5.2. IF AMP. DET. AGC AND AF PRE.AMP. (MODULE 2)
  - 5.3. FREQUENCY SYNTHESIZER (MODULE 3)
  - 5.4. PROCESSOR UNIT (MODULE 4)
  - 5.5. CONVERTER UNIT (MODULE 5) AND AF AMP, AND FILTER UNIT (MODULE 7)
  - 5.6. WIRING DIAGRAM (INTERCONNECTION CABLE DIAGRAM) (MAIN CHASSIS MODULE 6)
  
6. PARTS LIST

## CONTENTS

- 1. INTRODUCTION
- 1.1. GENERAL DESCRIPTION
- 1.2. TECHNICAL DATA
- 1.3. CONTROLS
- 1.4. PRINCIPLE OF OPERATION

# 1. INTRODUCTION

The SAILOR R2022 radiotelephone receiver has been designed to be used with the SAILOR Compact 2000 module programme.

The SAILOR R2022 can be installed and operated either as an independent unit or in combination with the other elements of the Compact 2000 programme. These include a 400 Watt SSB coast telephony transmitter T2031, a duplex VHF RT2047, and a scrambler CRY2001.

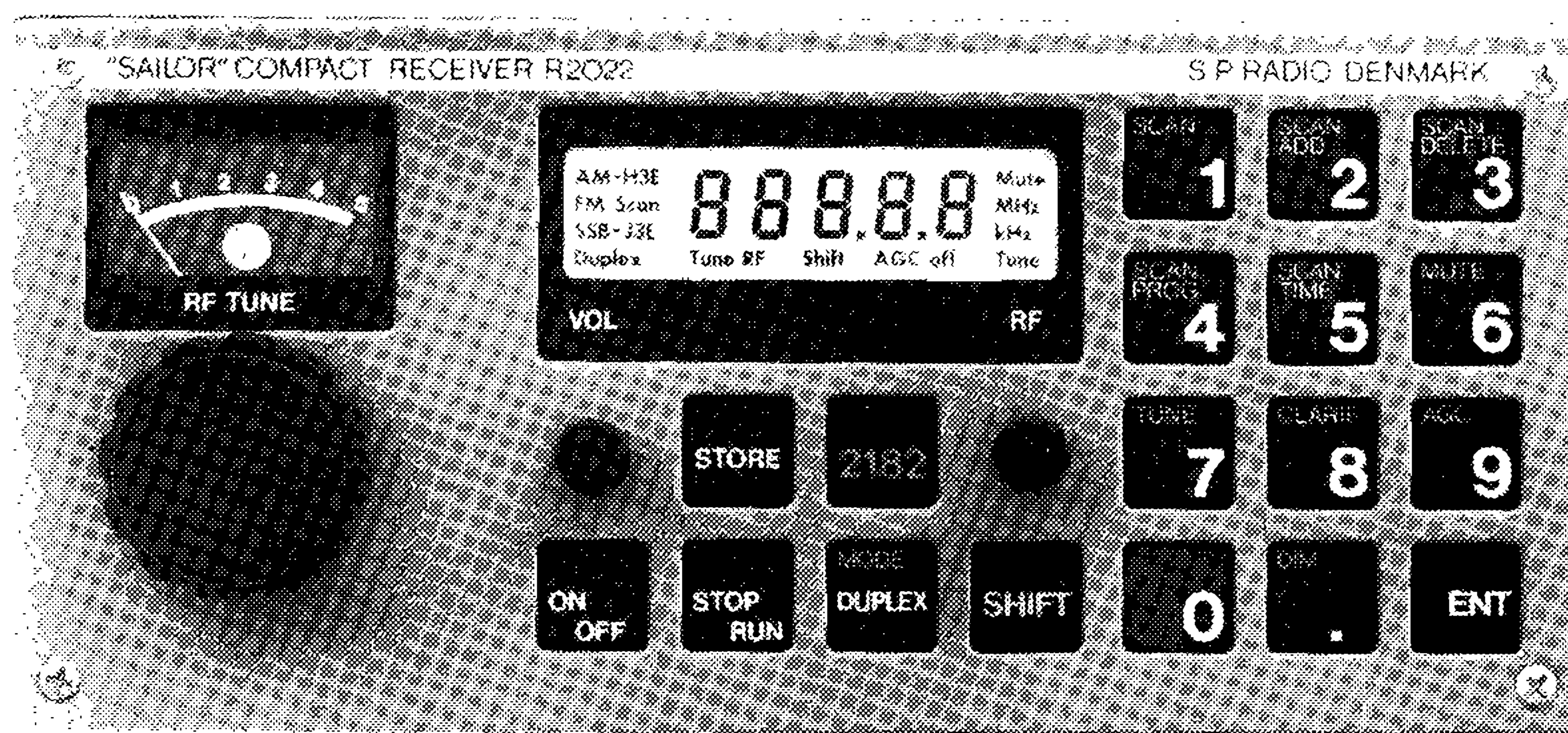
The SAILOR R2022 is an advanced SSB coast telephony receiver which also operates on AM and FM. The compact, nylon-treated metal cabinet contains power supply, duplex filter, and receiver. Fly-wheel tuning, 94 quick-select frequencies, keyboard controls, LCD-display, and scanning facilities make the SAILOR R2022 simple and speedy to operate.

The SAILOR R2022 has been constructed to withstand the most extreme conditions experienced in small, semi-open boats. The compact weatherproof construction ensures a degree of resistance to sea spray. The printed circuits, which have made possible a combination of compactness and exceptional performance, are coated with a special moisture-repellent lacquer.

In the design of this communication receiver, S. P. Radio have taken into account all the circumstances it will be exposed to in day-to-day operating. However, even a product of this high quality requires regular service and maintenance, and we recommend a close observance of the directions contained in the instruction book.

S. P. Radio is one of Europe's leading producers of maritime radio communication equipment - a position which has been maintained by means of constant and extensive product development. We have a world-wide network of dealers with general agencies in fifty countries. All our dealers are well-trained and able to service all SAILOR products.

R2022A





## 1.1. GENERAL DESCRIPTION

SAILOR R2022 is an all solid state constructed marine SSB duplex communication receiver intended for reception of J3E, R3E, H3E, and A3E signals in the frequency range 1605 - 4500 kHz.

SAILOR R2022 offers in addition reception of general broadcasting in the frequency ranges 140 - 1605 and 87 - 108 MHz.

SAILOR R2022 has 94 user programmed quick-select frequencies.

SAILOR R2022 has six scanning programmes, one standard programme containing all the programmed quick-select frequencies and 5 user programmed scanning sequences.

SAILOR R2022 has one key operation of the distress frequency 2182 kHz.

SAILOR R2022 is fully synthesized and the frequency stability is controlled from a crystal oscillator.

SAILOR R2022 is almost completely controlled by a microcomputer controlling the frequency synthesizer, the readings from the EEPROM, the display, the scanning sequences, and the simplex protection circuits.

SAILOR R2022 can be supplied from 10 - 32V DC mains.

SAILOR R2022 is provided with membrane switches for controls, easy to use, reliable, and hardwearing. Cut-outs in the metal front serve as a safe finger-guide.

SAILOR R2022 is fitted with night illumination, all lettering can be illuminated.

SAILOR R2022 employs the most modern circuit technology housed in a corrosion resistant aluminium cabinet with a green nylon finish.

SAILOR R2022 has built-in preference setting of the mode, the AGC, the RF gain, and the input selectivity.

From 140 - 1605 kHz the preferences are AM mode, AGC on, RF gain off, and simplex selectivity.

From 1605 - 4500 kHz the preferences are SSB mode, AGC on, RF gain on, and simplex selectivity.

From 87 - 108 MHz the preferences are FM mode, AGC on, and RF gain off.

## 1.2. TECHNICAL DATA

The receiver is fully synthesized and has a frequency resolution of 100 Hz (10 kHz).

The receiver is intended for reception of the following wave types:

140 - 1605 kHz A3E (A3)  
 1605 - 4500 kHz J3E (A3J), R3E (A3A), H3E (A3H), and A3E (A3)  
 87.2 - 108 MHz F3E (F3)

Frequency Range Simplex: 140 - 384.9 kHz  
 385 - 1604.9 kHz  
 1605 - 4499.9 kHz

Frequency Range Duplex: 1605 - 4499.9 kHz

Sensitivity 20 dB SN/N: 140 - 1605 kHz, A3E: <30 dB/uV  
 1605 - 4000 kHz, J3E: <15 dB/uV  
 4000 - 4500 kHz, J3E: <10 dB/uV  
 Duplex filter: 1605 - 4000 kHz, J3E: < 4 dB/uV  
 4000 - 4500 kHz, J3E: < 7 dB/uV

Tuning Error: less than 20 Hz

Frequency Drift, Short Time: less than 5 Hz

Frequency Drift, Long Time: less than 20 Hz

Frequency Drift: 0-40°C: less than 40 Hz

IF-Band Width:

Mode	Min. Pass-band at -6 dB	Max. Pass-band at -60 dB
SSB-J3E	+350 Hz +2700 Hz	-1075 Hz +3825 Hz
AM-A3E	+3.3 kHz	+11 kHz

Adjacent Channel Selectivity:

J3E:	50 dB at - 1 kHz and + 4 kHz 60 dB at - 4 kHz and + 5 kHz 75 dB at - 5 kHz and + 8 kHz
A3E:	50 dB at -10 kHz and +10 kHz 65 dB at -20 kHz and +20 kHz

Blocking: Wanted signal 60 dB/1 uV  
 Blocking level >110 dB/1 uV

Cross Modulation: Wanted signal 60 dB/1 uV  
 Cross modulation level >100 dB/1 uV

Intermodulation, Second Order: Ref. signal 30 dB/1 uV  
 Intermodulation level >90 dB/1 uV

Intermodulation, Third Order: Ref. signal 30 dB/ 1 uV  
 Frequency separation f = 30 kHz  
 Intermodulation level >90 dB/1 uV

Temperature Range: Specification 0°C to +40°C  
 Operating -15°C to +55°C  
 Storage -20°C to +70°C

## 1.2. TECHNICAL DATA cont.:

Spurious Rejection: IF >70 dB  
Image >70 dB  
All others >70 dB

Spurious Emission:  $P_{out} < 0.1 \text{ nW}$  into dummy aerial.

Audio Outputs:  $V_{in} = 24V$  Loudspeaker 7W into 8 ohms  
Earpiece fixed 0 dBm into 600 ohms (J3E)

Automatic Gain Control: J3E AGC attack time approx. 2 msec.  
 $\Delta V_{in} = 30 \text{ dB}$  decay time approx. 2.5 sec.

A3A AGC attack time approx. 35 msec.  
decay time approx. 100 msec.

IF-Frequency: 10,7008 MHz

Quick-Select Frequencies: 94 operator-programmed freely chosen  
in all the frequency ranges.

Scanning Facilities: 5 independent operator-programmed  
scanning programmes.  
The scanning frequencies are freely  
chosen among the 94 quick-select  
frequencies.

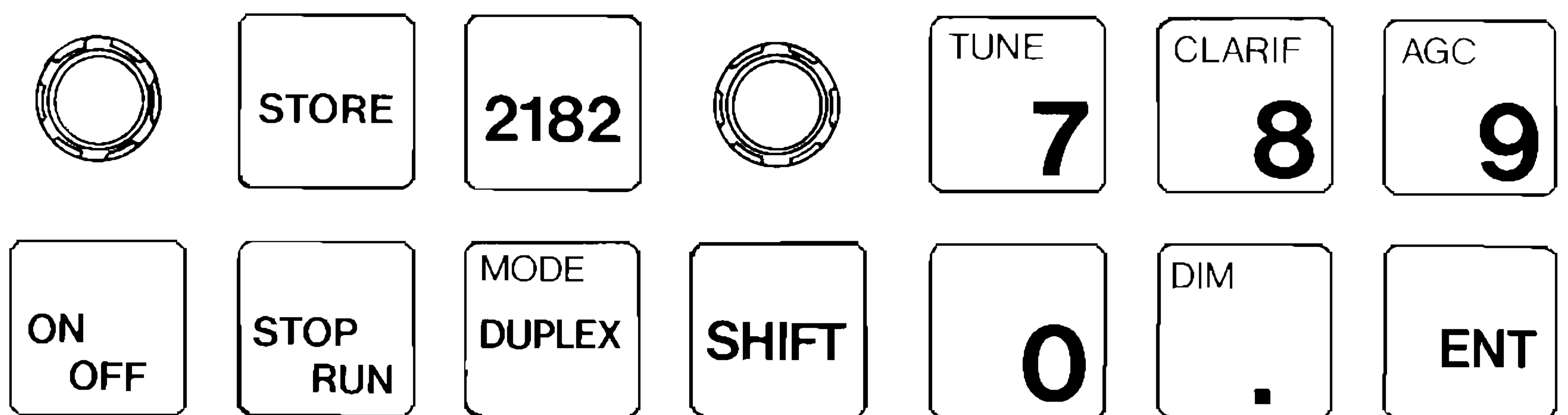
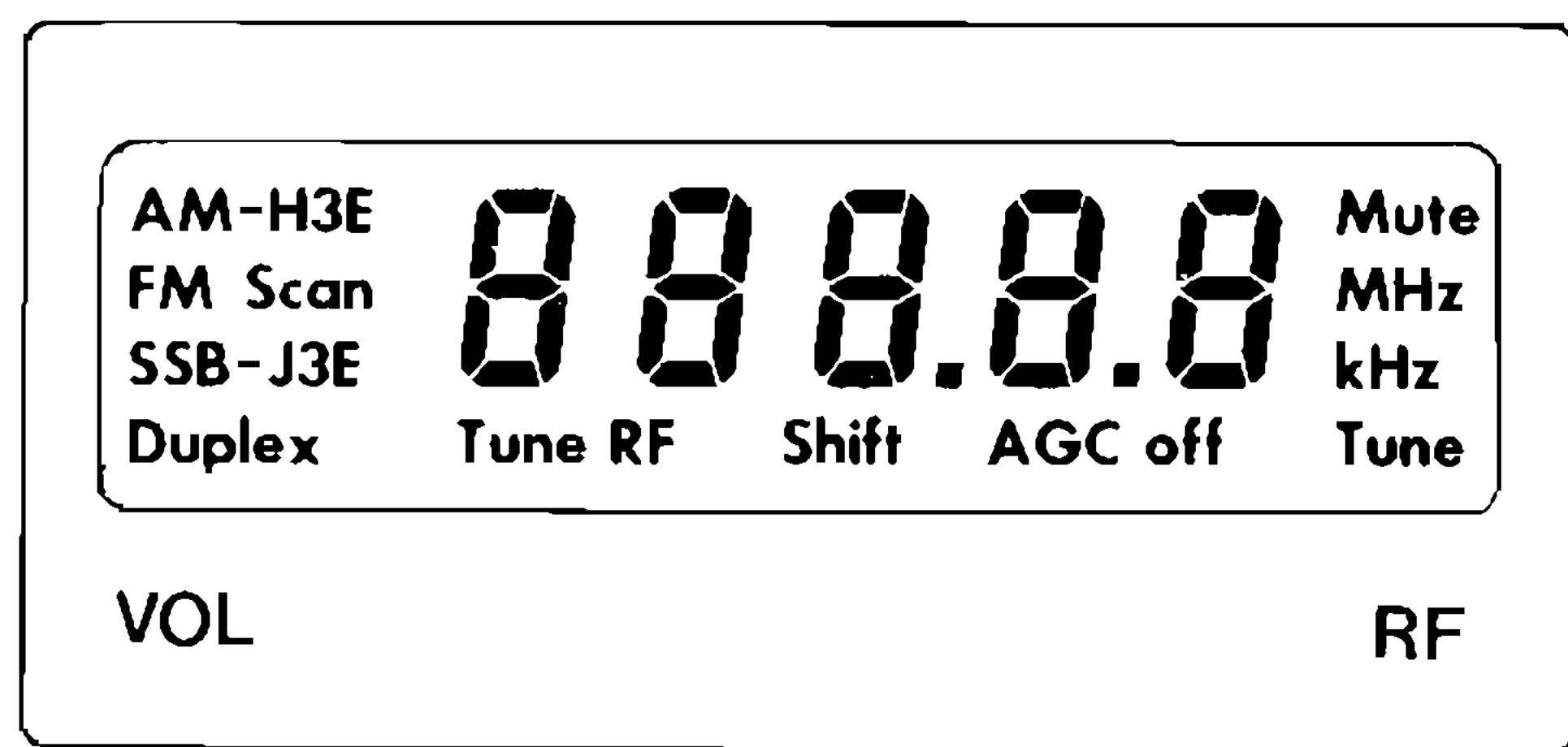
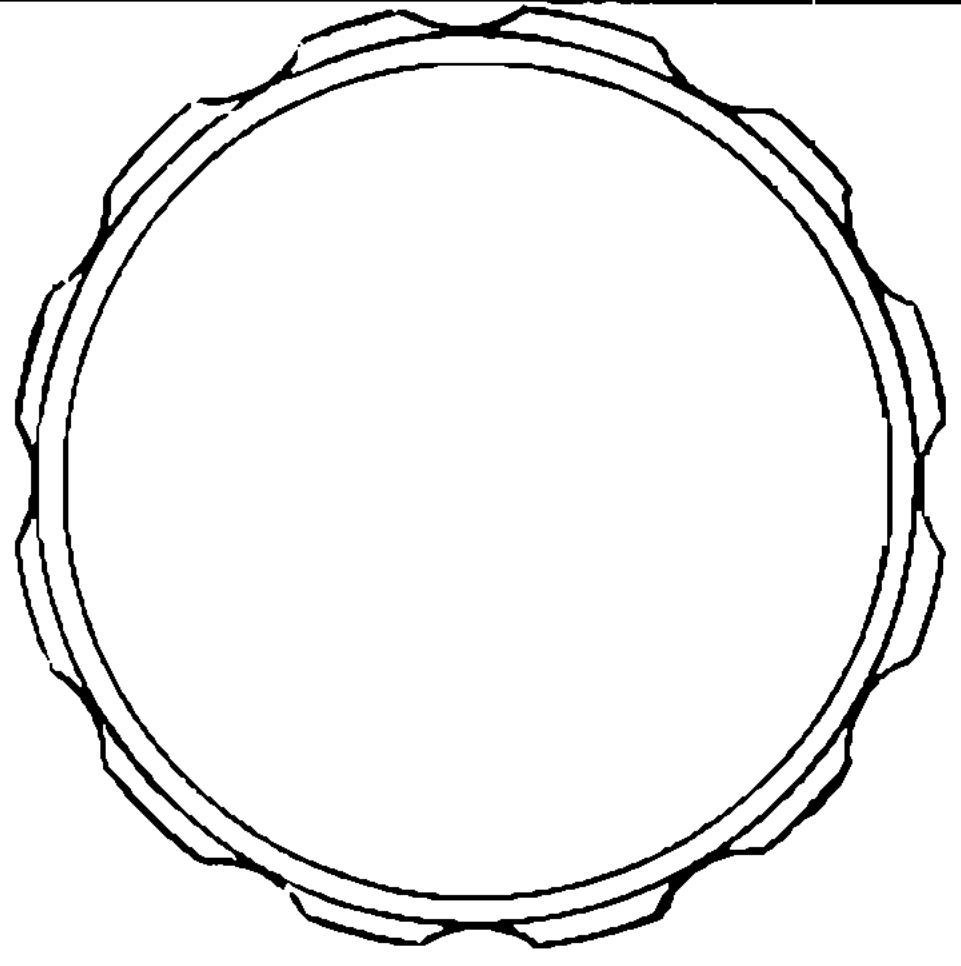
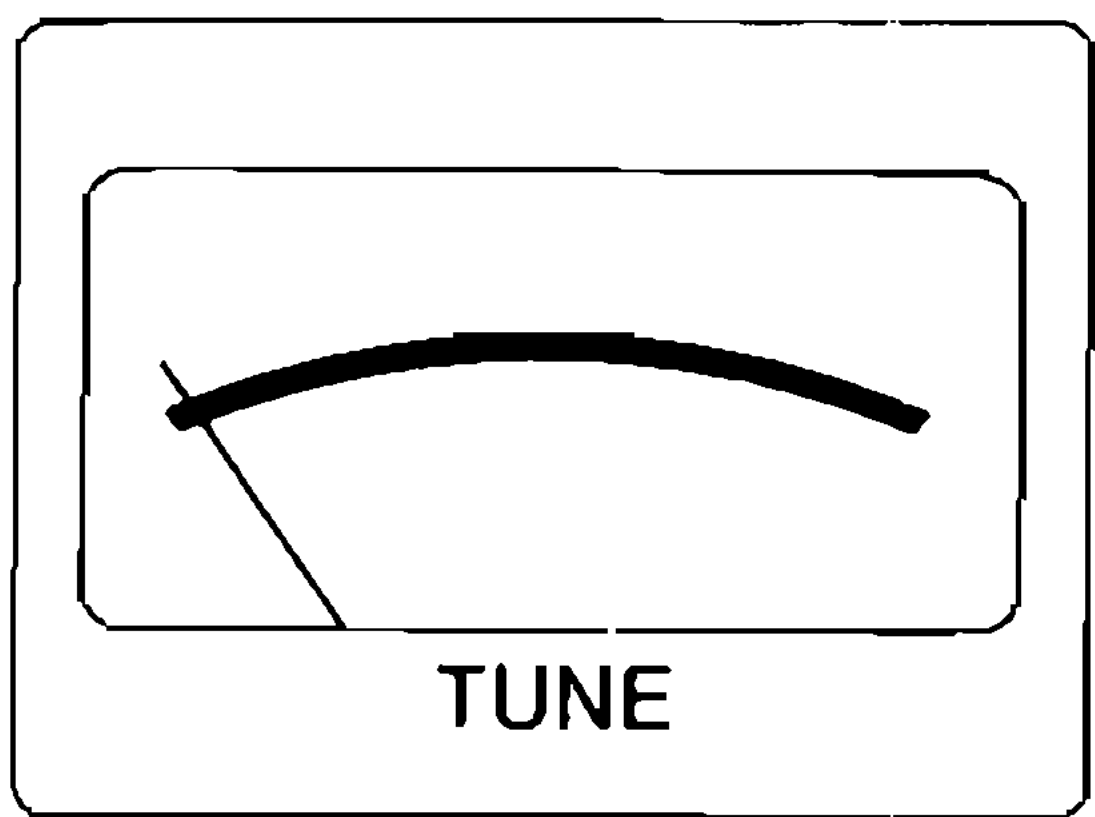
### POWER SUPPLY

Input Voltage: 10 to 32V DC

Power Consumption: approx. 20 W

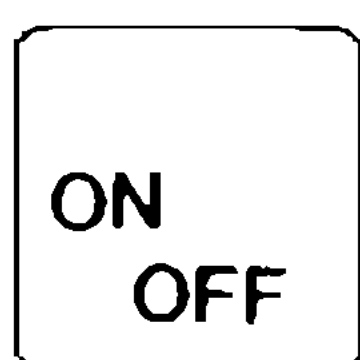
Output Voltage: +5V 0.70 A max.  
+18V 0.65 A max.  
-18V 0.20 A max.  
+24V 0.05 A max.

Switch Frequency: approx. 50 kHz

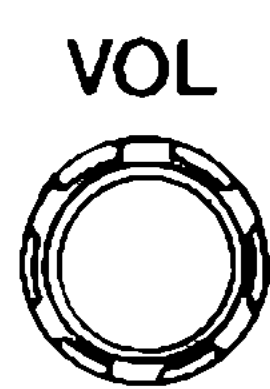




### 1.3. CONTROLS



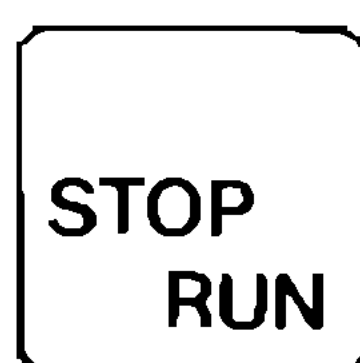
Turns the receiver on or off.



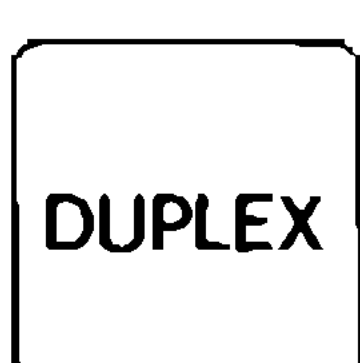
Controls the volume.



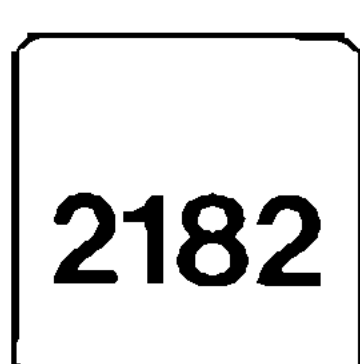
Stores the keyed-in frequency in the memory.



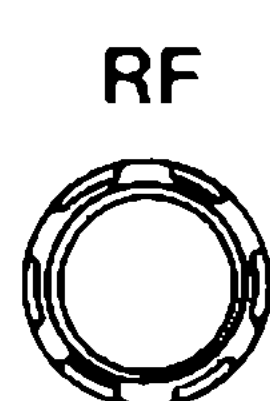
Stops and starts the scanning sequence.



Inactivates the simplex protective circuit and mutes the receiver until the duplex filter is tuned.



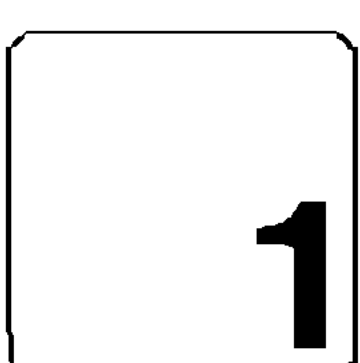
Quick-select of the distress and call frequency 2182 kHz in A3E mode.



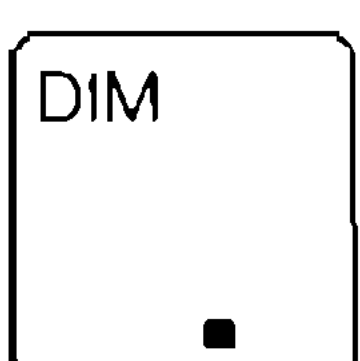
Controls receiver RF amplification or sets the scanning mute threshold.



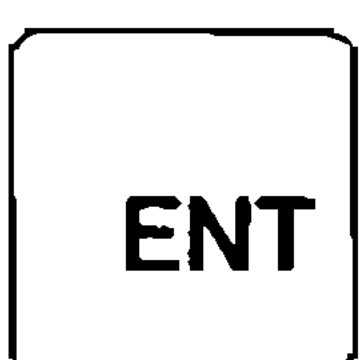
Activates the orange functions on the keyboard.



Digits from 0 to 9.



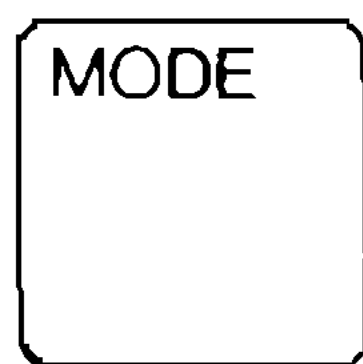
Decimal point.



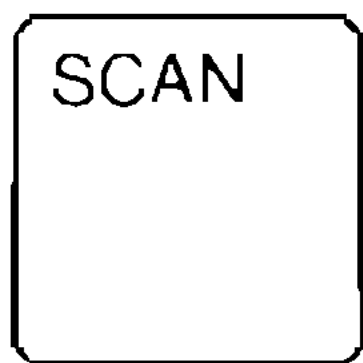
Enters a new frequency in the microprocessor or starts a selected scanning programme.

### 1.3. CONTROLS cont.:

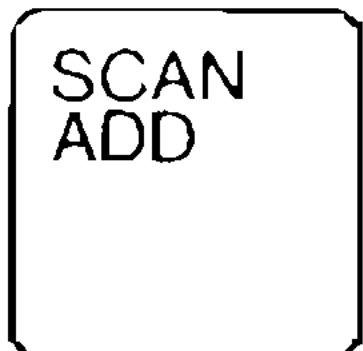
#### SHIFT FUNCTIONS



Switches between A3E and J3E.



Selects scanning programmes.



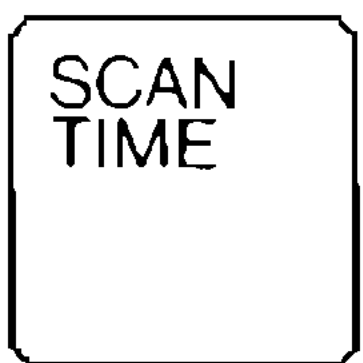
Adds a quick-select number to the scanning programme.



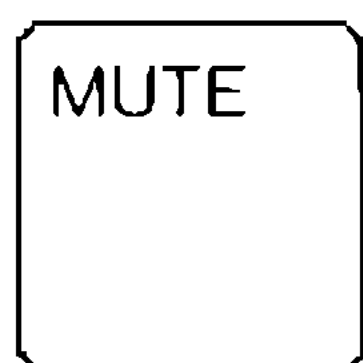
Deletes a quick-select number from the scanning programme.



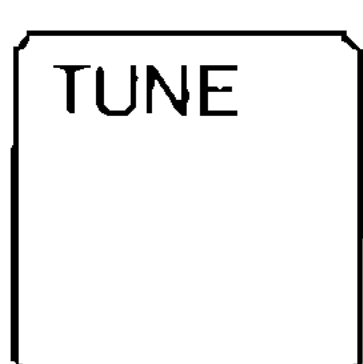
Stores the current scanning programme in the memory.



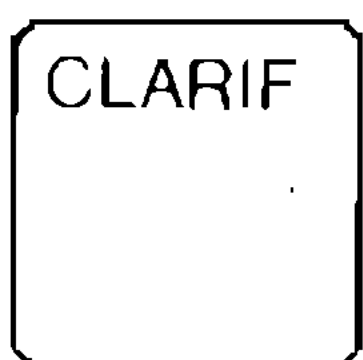
Opens for programming of the "Scan Time", which is the demuting time of the receiver when receiving a signal in the scanning mode.



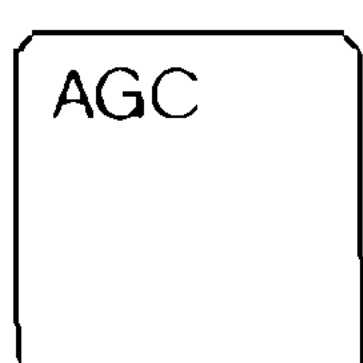
Mutes the receiver when the AGC voltage is below a value determined by the RF control. (Shown on receiver meter).



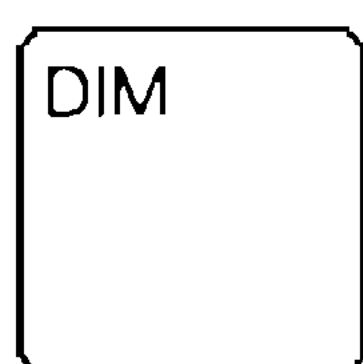
Activates the continuous tuning knob.



Converts the tuning knob to clarifier function with a range of +/- 150 Hz and a resolution of 10 Hz.

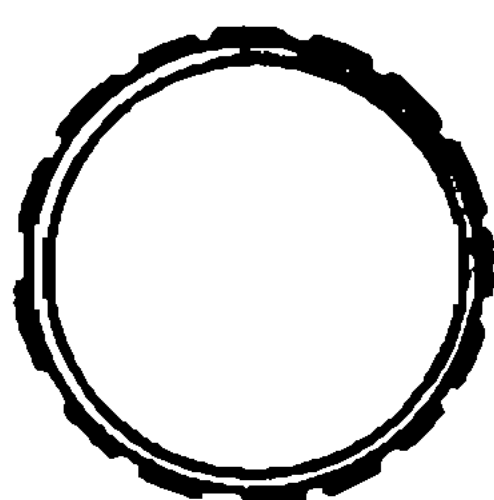


Switches between automatic and manual amplification control.



Turns the panel illumination on or off.

TUNE



Activates the noise generator when the duplex filter is being tuned. Varies the receiver frequency in 100 Hz/1 kHz/50 kHz steps or the clarifier in 10 Hz steps.

## 1.4. PRINCIPLE OF OPERATION

### RECEIVER R2022

SAILOR R2022 is a fully synthesized single superheterodyne receiver with an IF frequency of 10.7008 MHz.

The signal from the aerials is led through the AERIAL SWITCH & SIMPLEX RELAY section to the RF selectivity, either the simplex filters or the duplex filter, to the mixer where it is mixed with the LO1 signal which has a frequency resolution of 100 Hz. 10 Hz is the clarifier mode.

The produced IF signal is led through one of the two monolithic IF filters to the IF AMP., DET., AGC, and AF PRE. AMP. where it is amplified and output regulated.

The signal is then fed to the detectors where, dependent on the received signal, it is detected in the quadrature detector. For SSB detection a carrier reinjection is provided from the X-tal oscillator.

The detected signal is fed to the active AF filters. The bandwidth of the AF filters are determined by the microprocessor. The AF signal is then fed to both the earpiece and the AF PRE. AMP.

In FM mode the aerial signal is fed to the FM TUNER, consisting of a tuned RF amplifier followed by a FET mixer producing an IF signal on 10.7008 MHz.

### FREQUENCY GENERATION

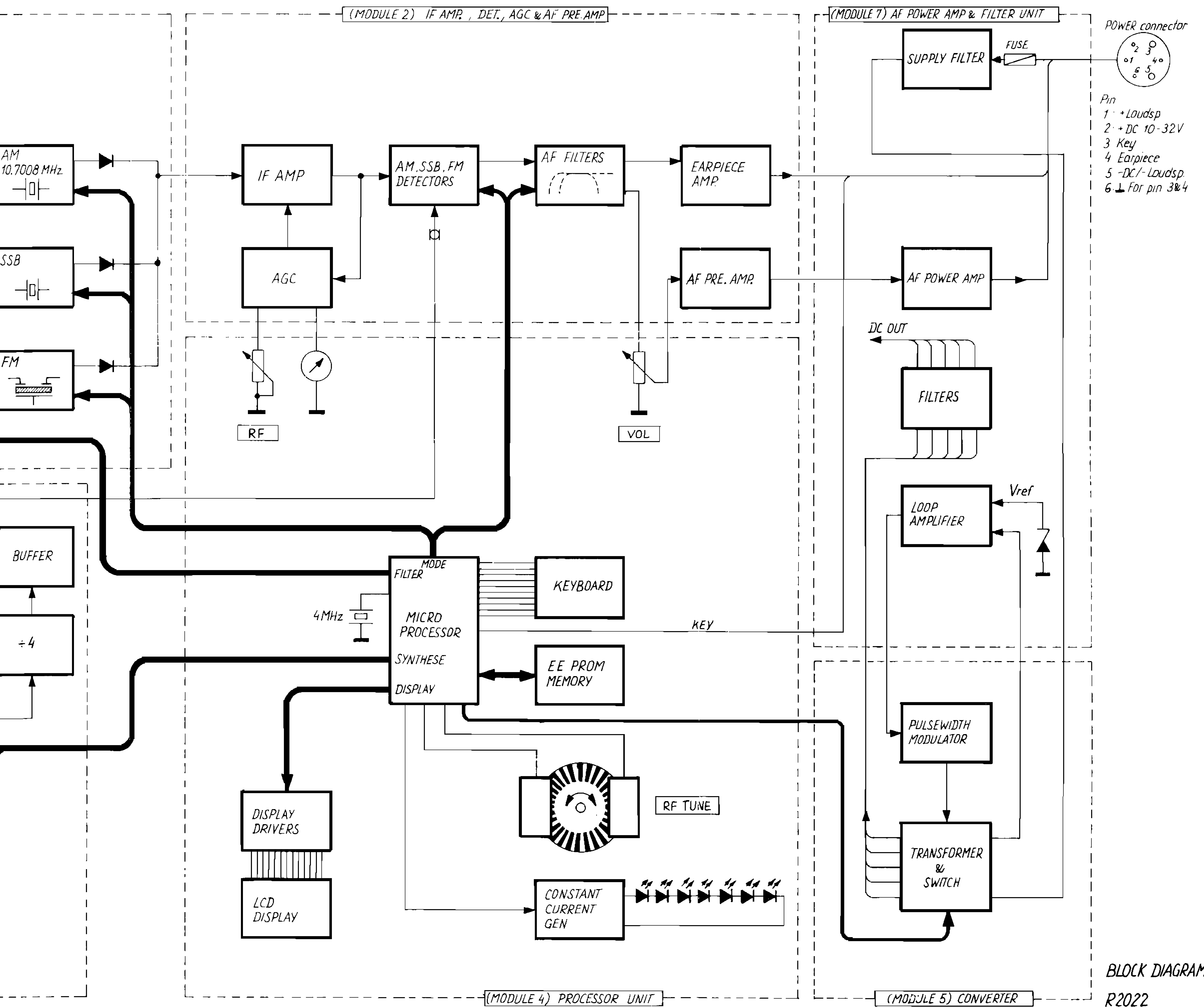
The necessary oscillator frequencies are generated by a frequency synthesizer according to fractional synthese phase loop principle.

The master frequency is generated in a X-tal oscillator on 10.7008 MHz. This frequency is led to the SSB detector and the reference divider, where it is divided down to 10.24 kHz, which is the reference frequency for the phase detector.

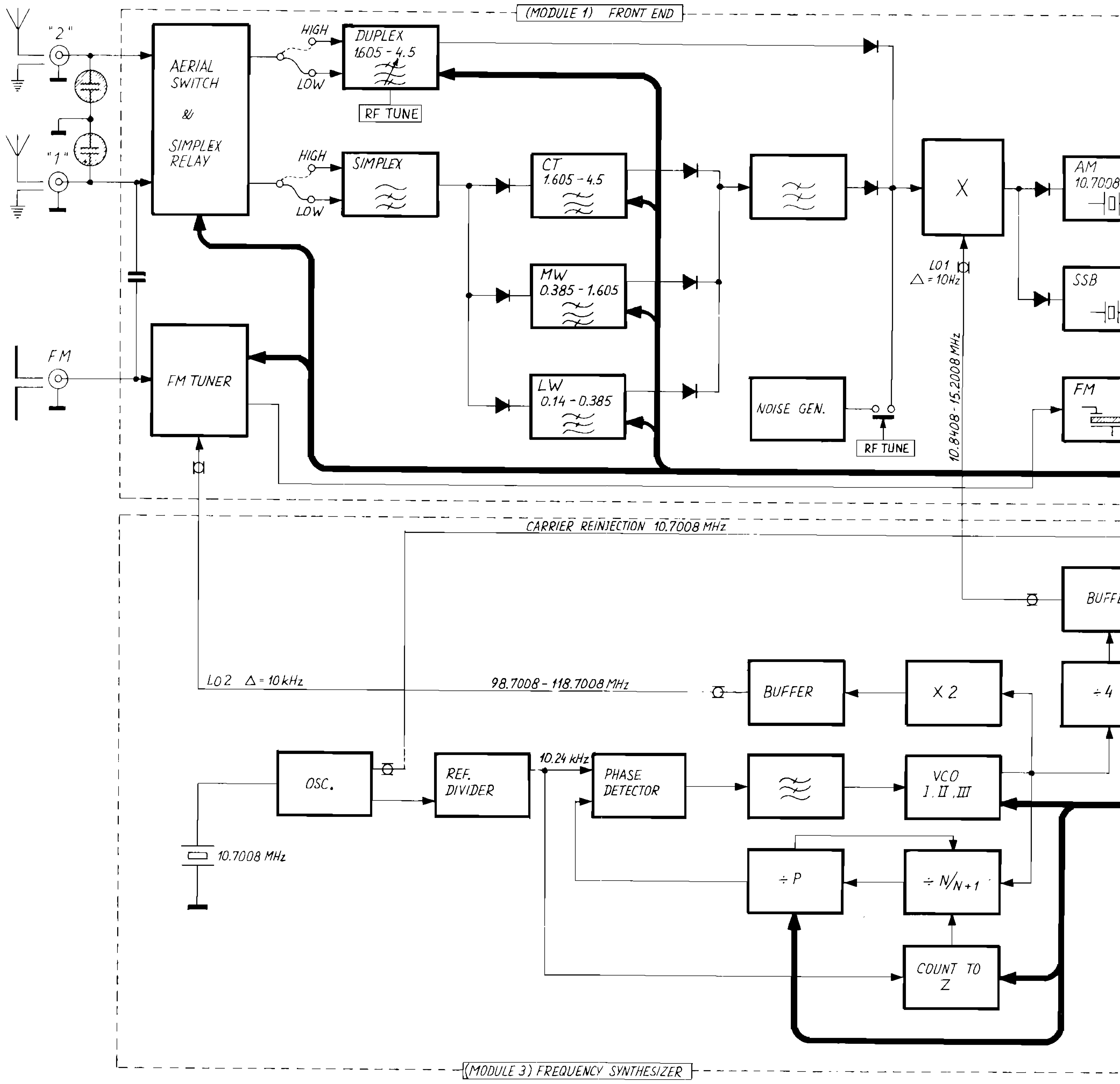
The voltage controlled oscillators (VCO) generate the signals, which are either divided by 4 or multiplied by 2 to get the proper mixer frequencies.

The VCO signal is fed to the modulus prescaler where the dividing figure can be changed from N to N+1, determined by the z register, to obtain a fraction in the total dividing figure. The signal is then divided by P and fed to the phase detector, which corrects for frequency offset via the loop filter and the VCO.

All the dividing figures are controlled by the microprocessor.



BLOCK DIAGRAM  
R2022



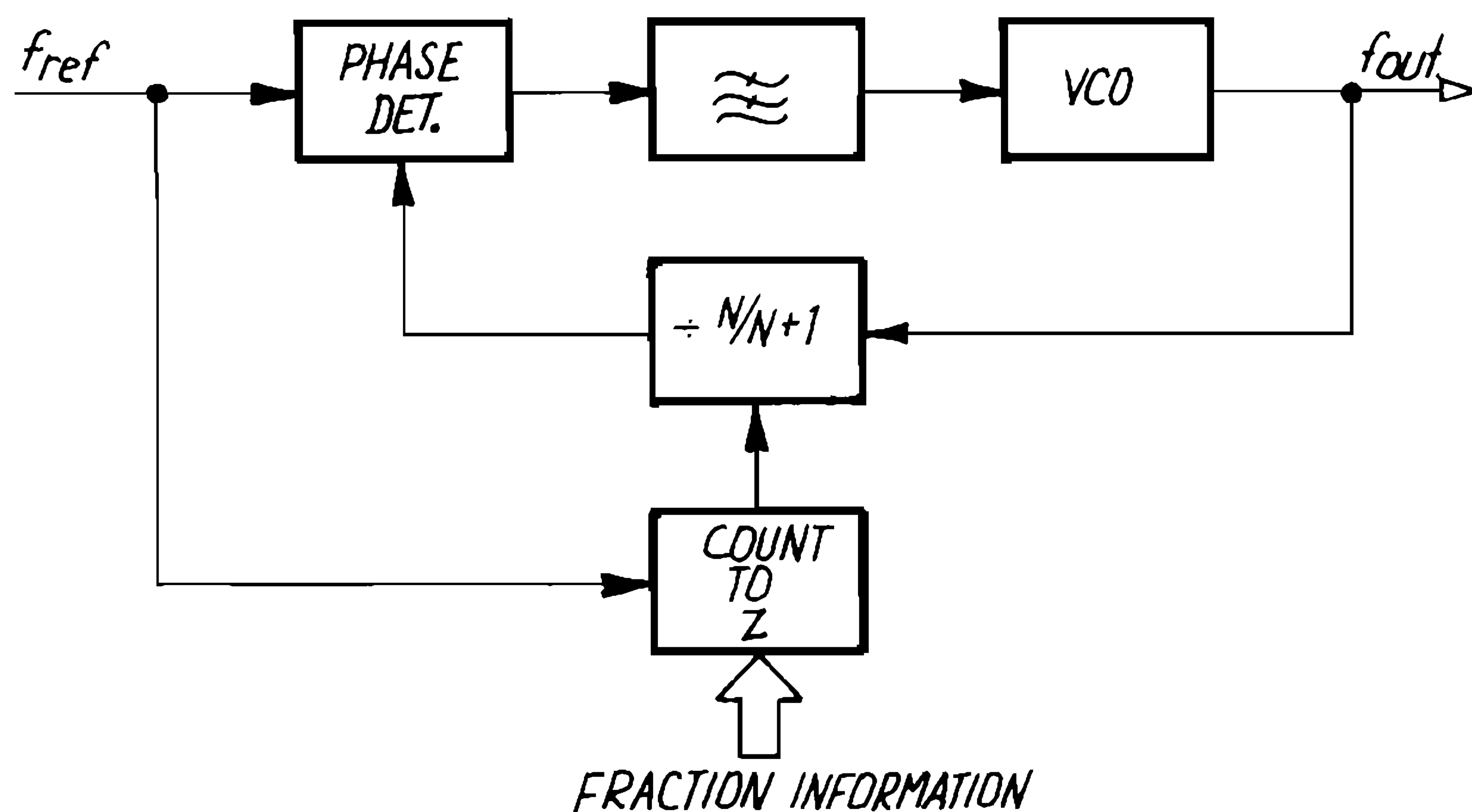
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## 1.4. PRINCIPLE OF OPERATION cont.:

### FRACTIONAL SYNTHESIS PHASE LOCKED LOOP



No fraction:  $f_{out} = f_{ref} \times N$   
E.g.  $f_{out} = 10 \times 10 = 100$

With fraction:  $z = 10, N = 10, f_{ref} = 10$   
 $f_{out} = 9 \times 10 + 1 \times 11 = 101$

### MICROPROCESSOR

The microprocessor supervises the keyboard, calculates the dividing figures for the synthesizer, chooses the aerial filter in question, controls the detector mode and AF filter, reads/programmes the EEPROMS, controls the display, and stores the frequency setting when the receiver is switched off.

### POWER SUPPLY

The converter unit is constructed for supplying the coast telephony receiver R2022 from 12V DC or 24V DC without change-over. (10-32V DC continuously). The audio amplifier is fully integrated in a single chip. It operates directly on the 12 or 24V DC battery and performs a powerful amplifier.

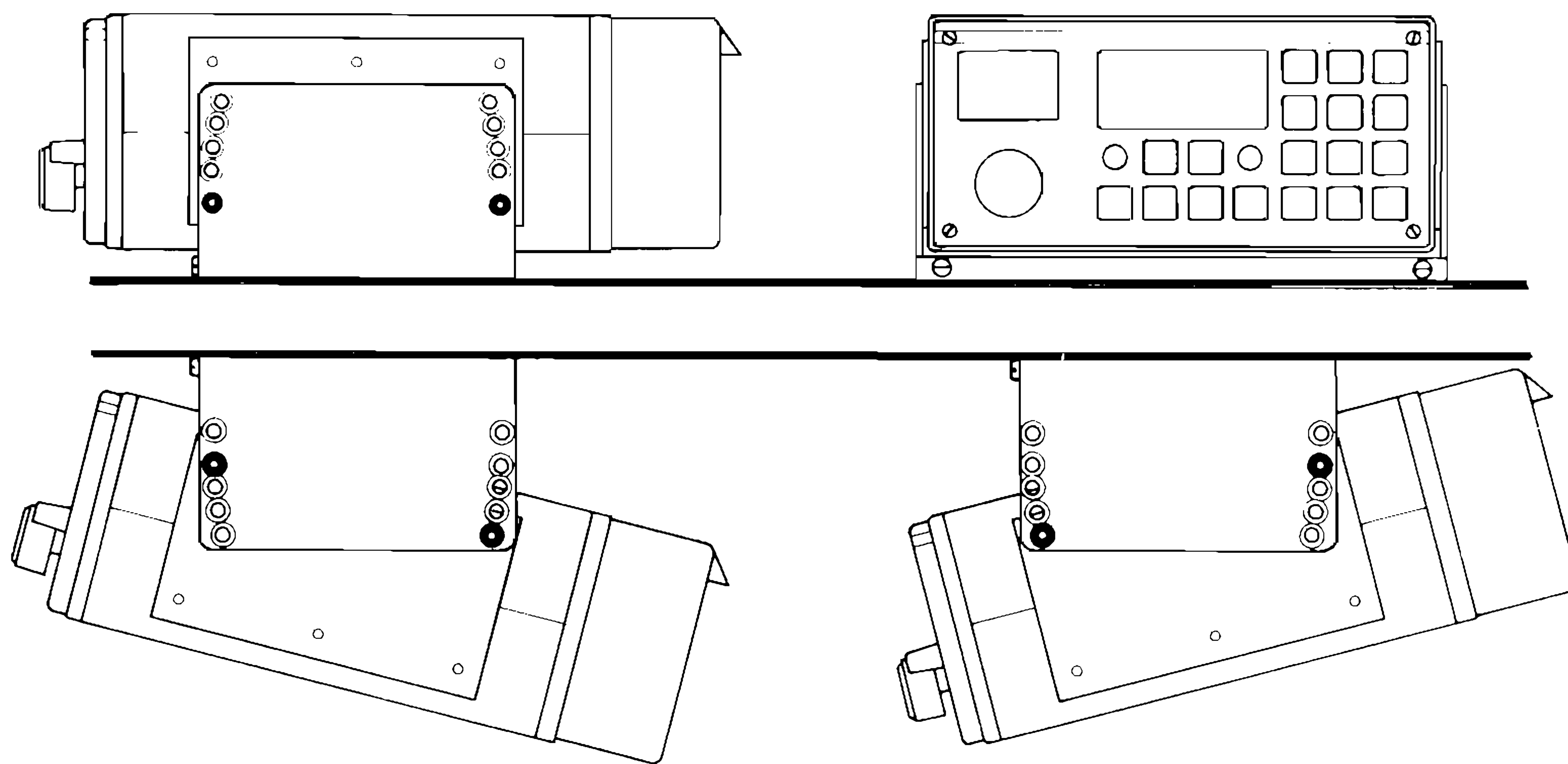
## CONTENTS

- 2. INSTALLATION
- 2.1. MOUNTING POSSIBILITIES
- 2.2. DIMENSIONS AND DRILLING PLAN
- 2.3. ELECTRICAL CONNECTIONS
- 2.4. AERIAL AND EARTH
- 2.5. AERIAL TUNE-UP PROCEDURE
- 2.6. R2022 USED IN CONJUNCTION WITH T121, T122, T124, T126  
OR T128
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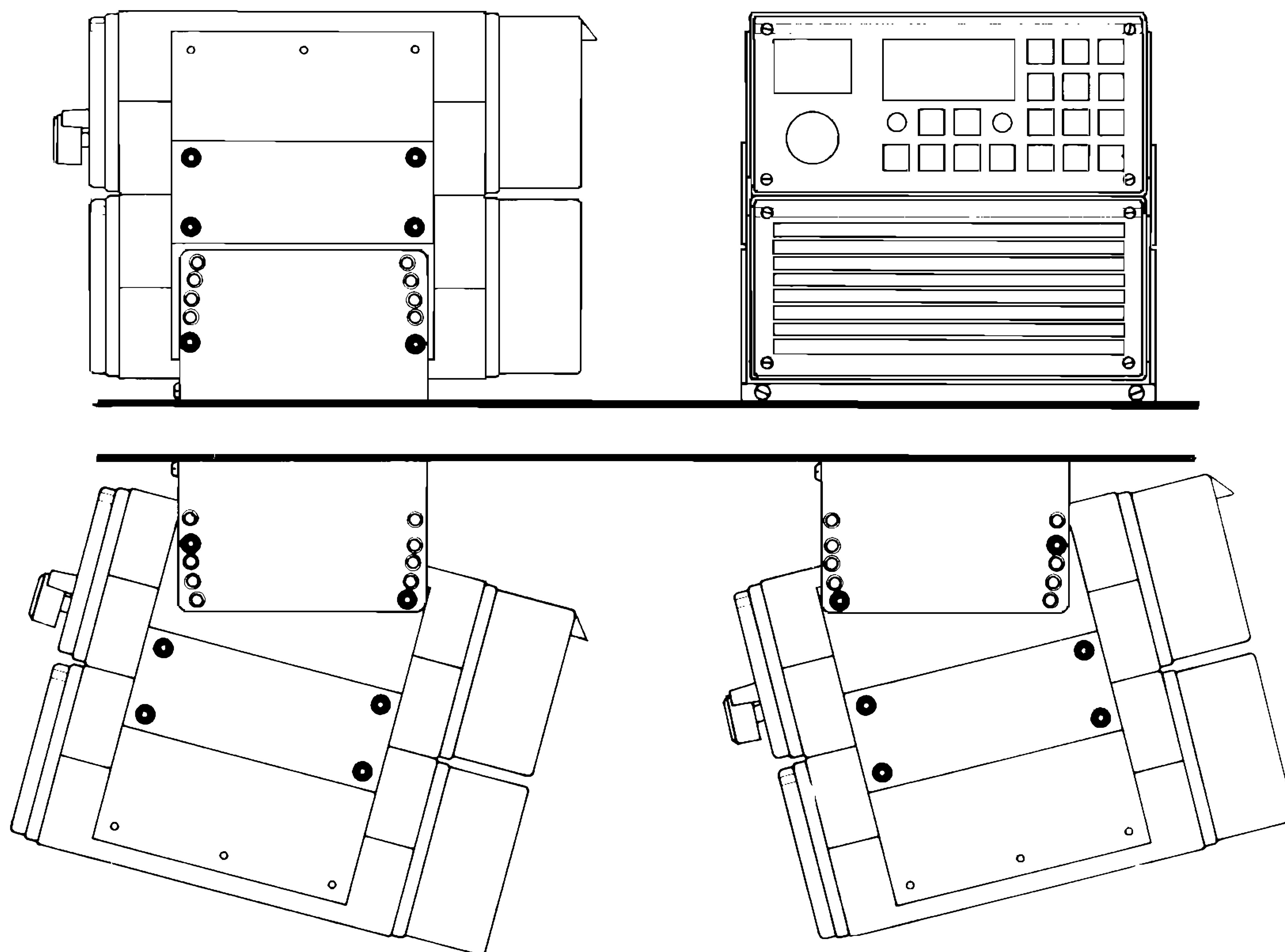
## 2. INSTALLATION

### 2.1. MOUNTING POSSIBILITIES

#### TABLETOP AND DECKHEAD



Mounting bracket H2055 which offers the same possibilities for the loudspeakers H2054 and H2074.

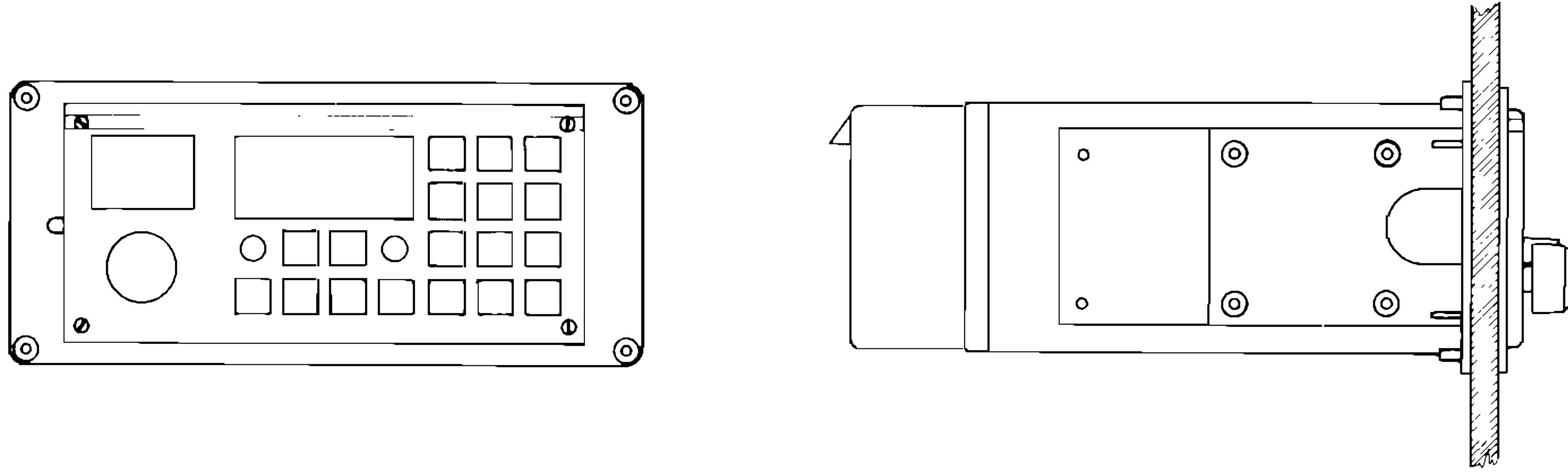


Mounting kit H2068 and H2055

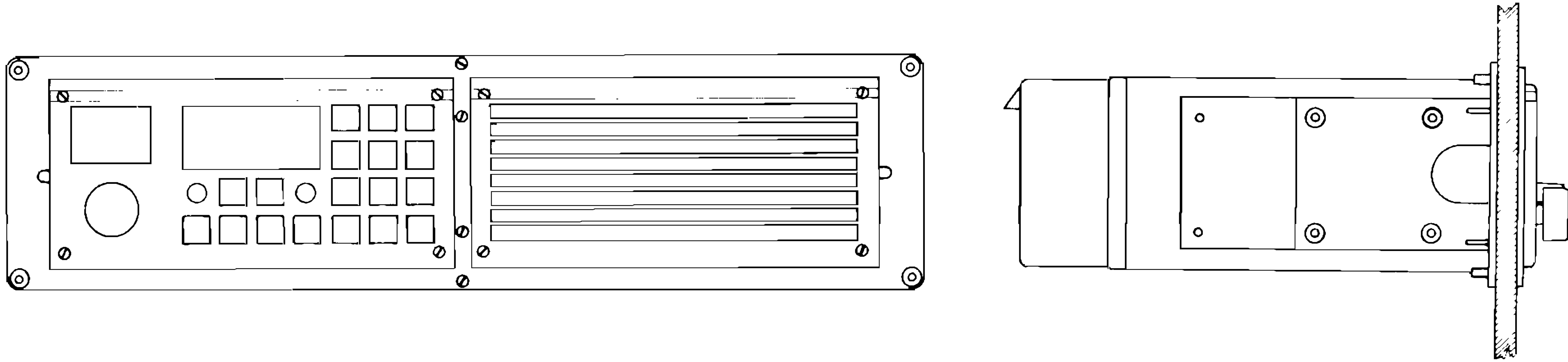
R2022B  
4-0-24766 4-0-24767  
4-0-24764

2.1. MOUNTING POSSIBILITIES cont.:

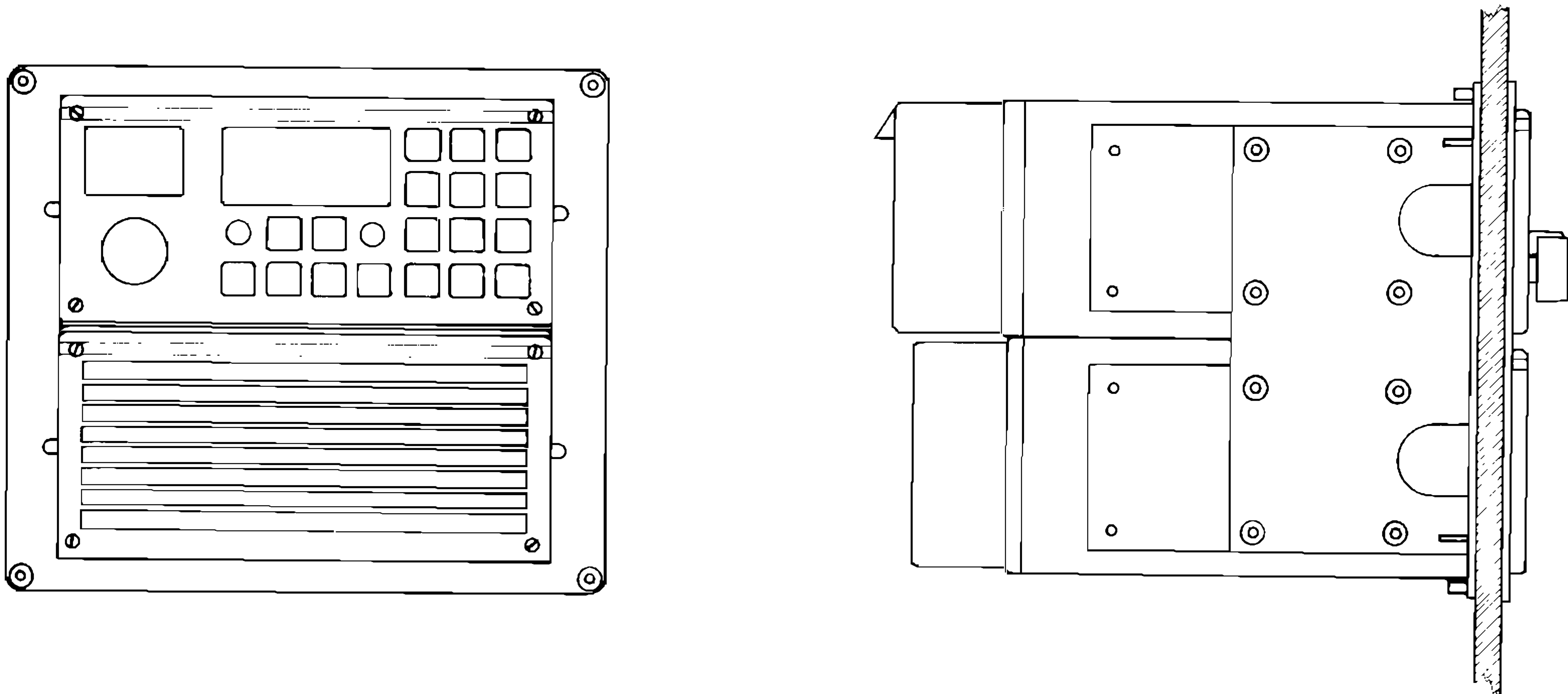
BULKHEAD AND CONSOLE



Mounting kit H2063 which offers the same possibilities for the loudspeakers H2054 and H2074.



Mounting kit H2062 or



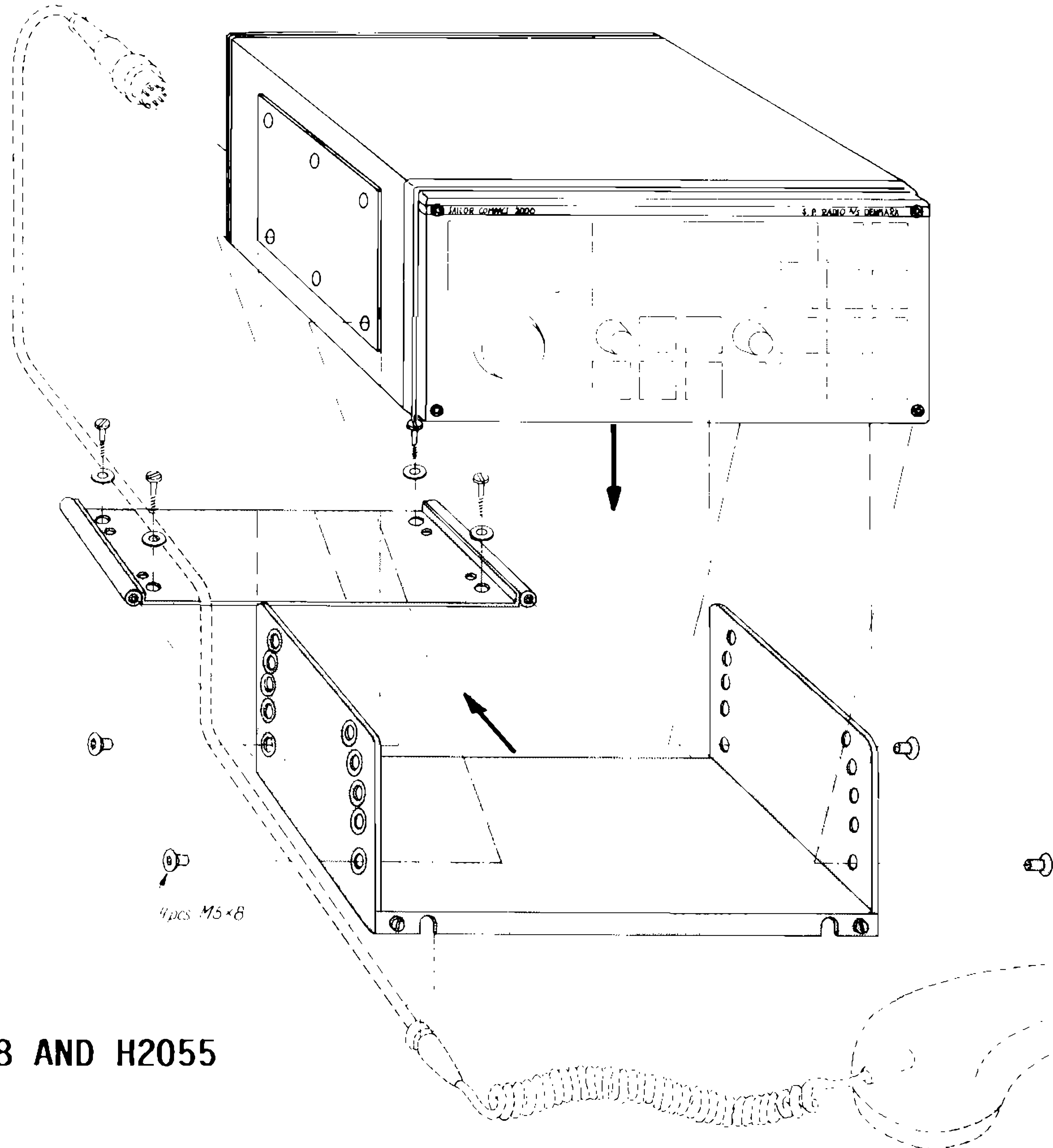
Mounting kit H2064.

**IN CONJUNCTION WITH OTHER SAILOR EQUIPMENT**

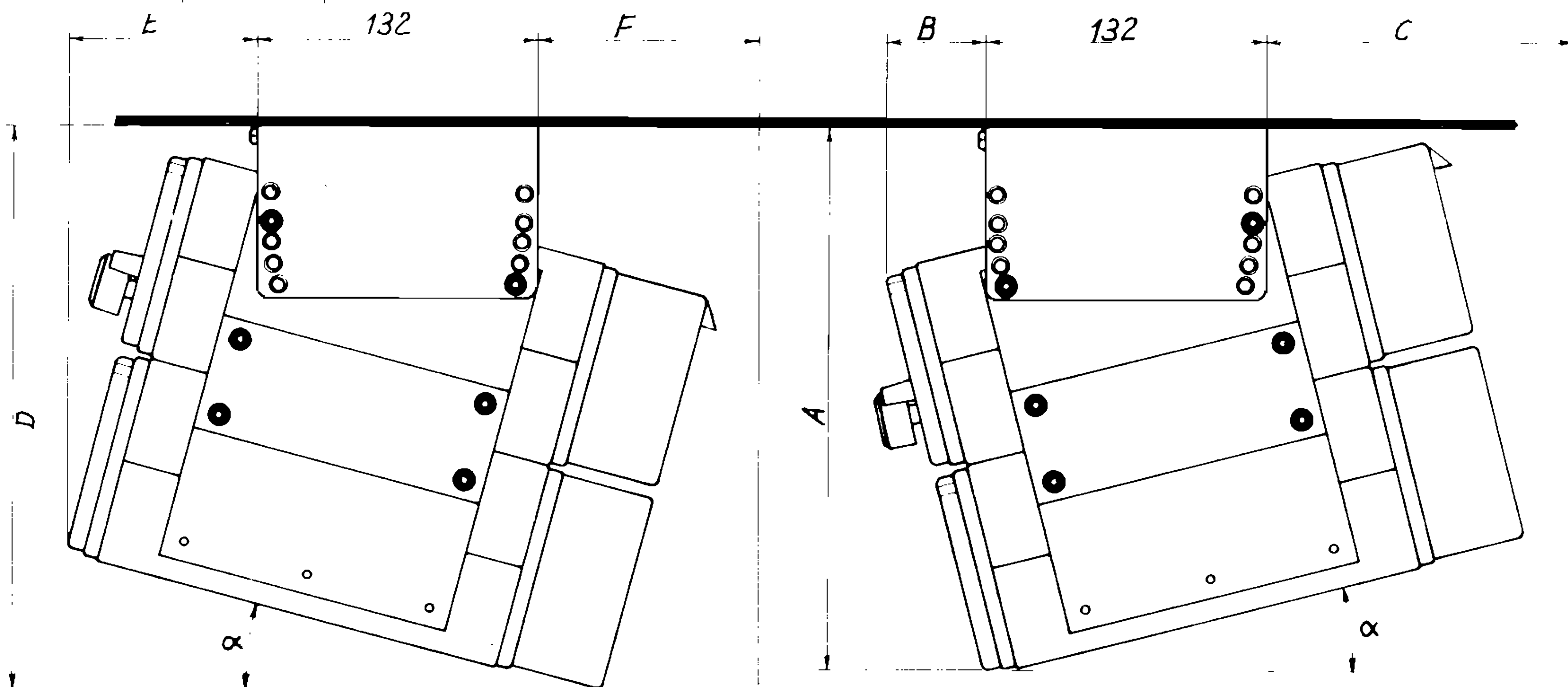
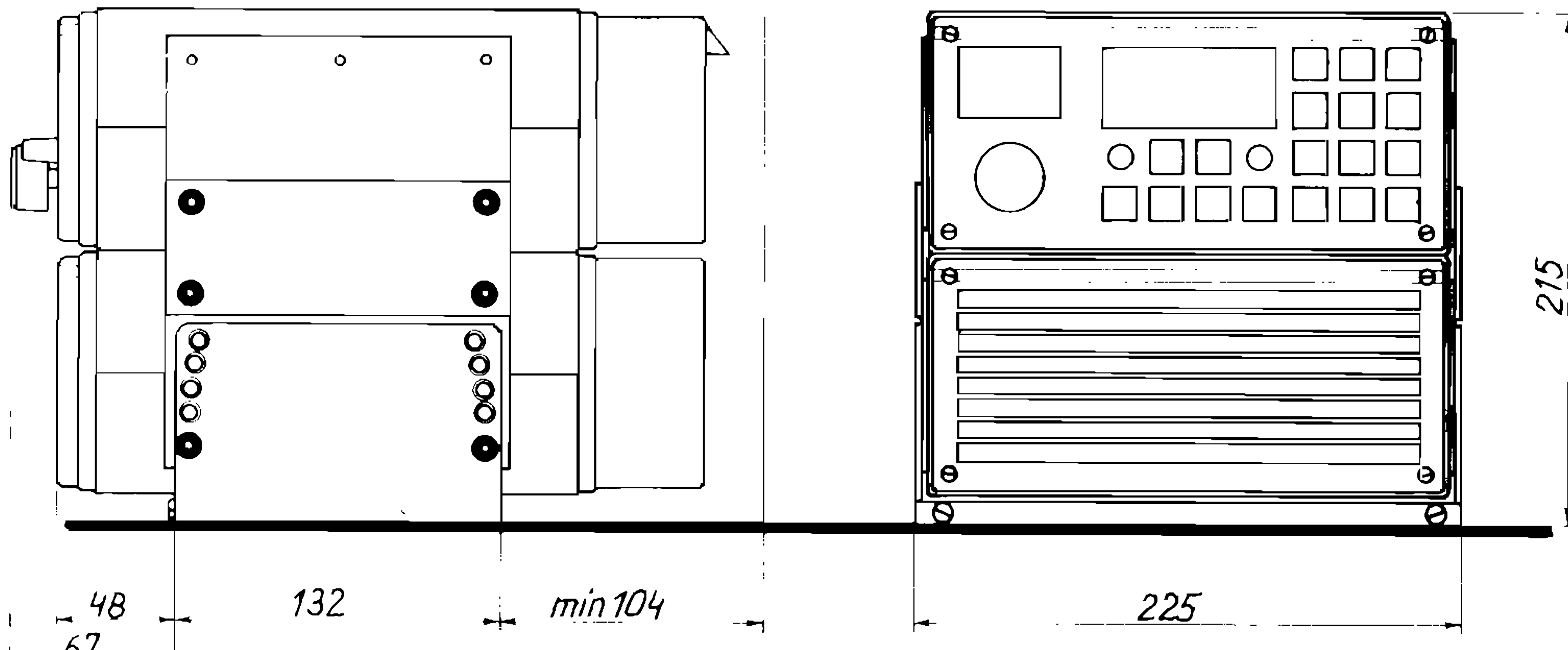
Look up the INSTALLATION section for the SAILOR unit in question.

R2022B  
4-0-24769 4-0-24771

2.2. DIMENSIONS AND DRILLING PLAN cont.:



MOUNTING KIT H2068 AND H2055



$\alpha$	A	B	C	D	E	F
0°	230	48	130	230	48	130
4.8°	243	53	138	248	65	118
9.6°	255	59	147	262	78	110
14.4°	265	65	155	275	89	105

Dimensions in mm

WEIGHT

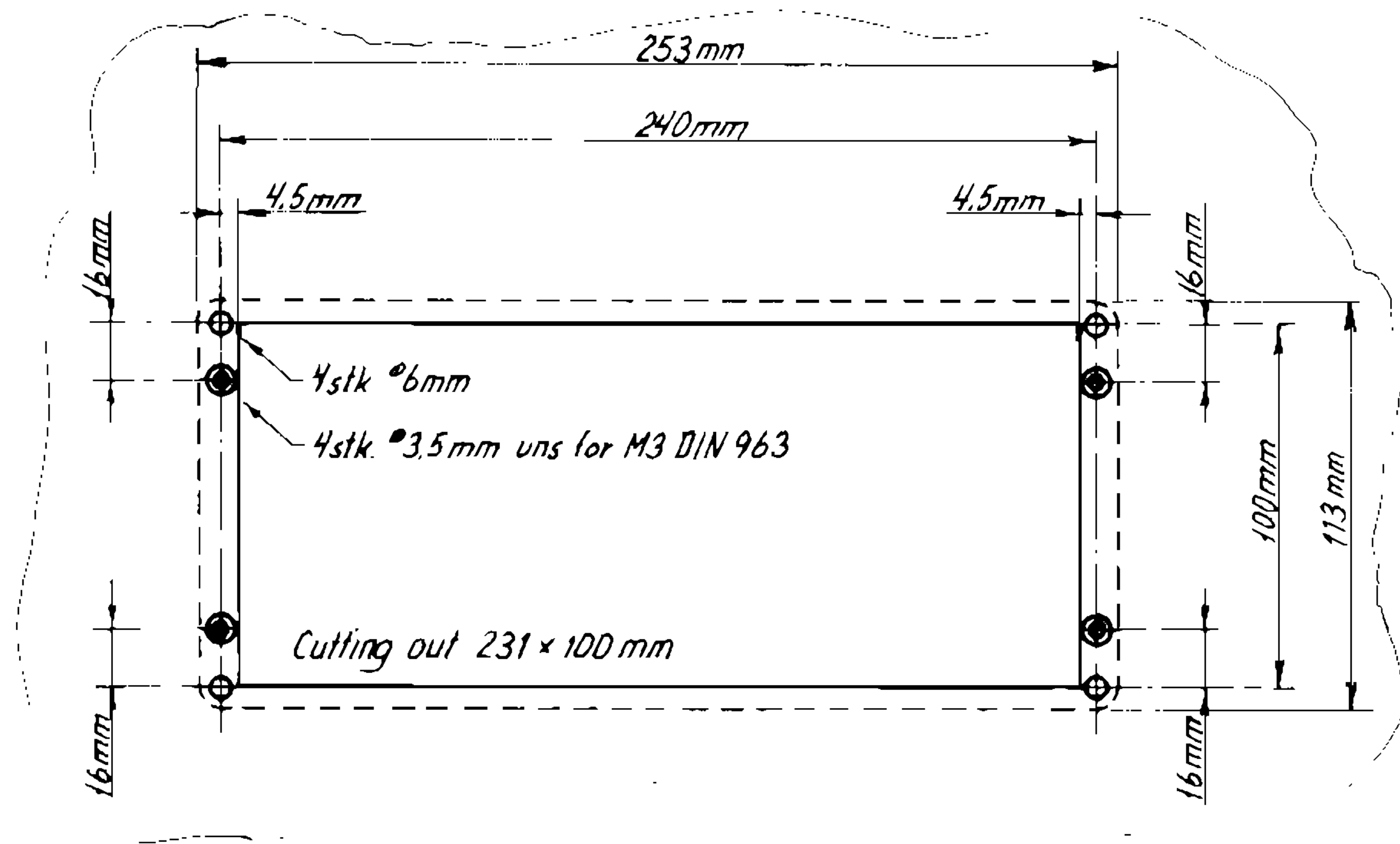
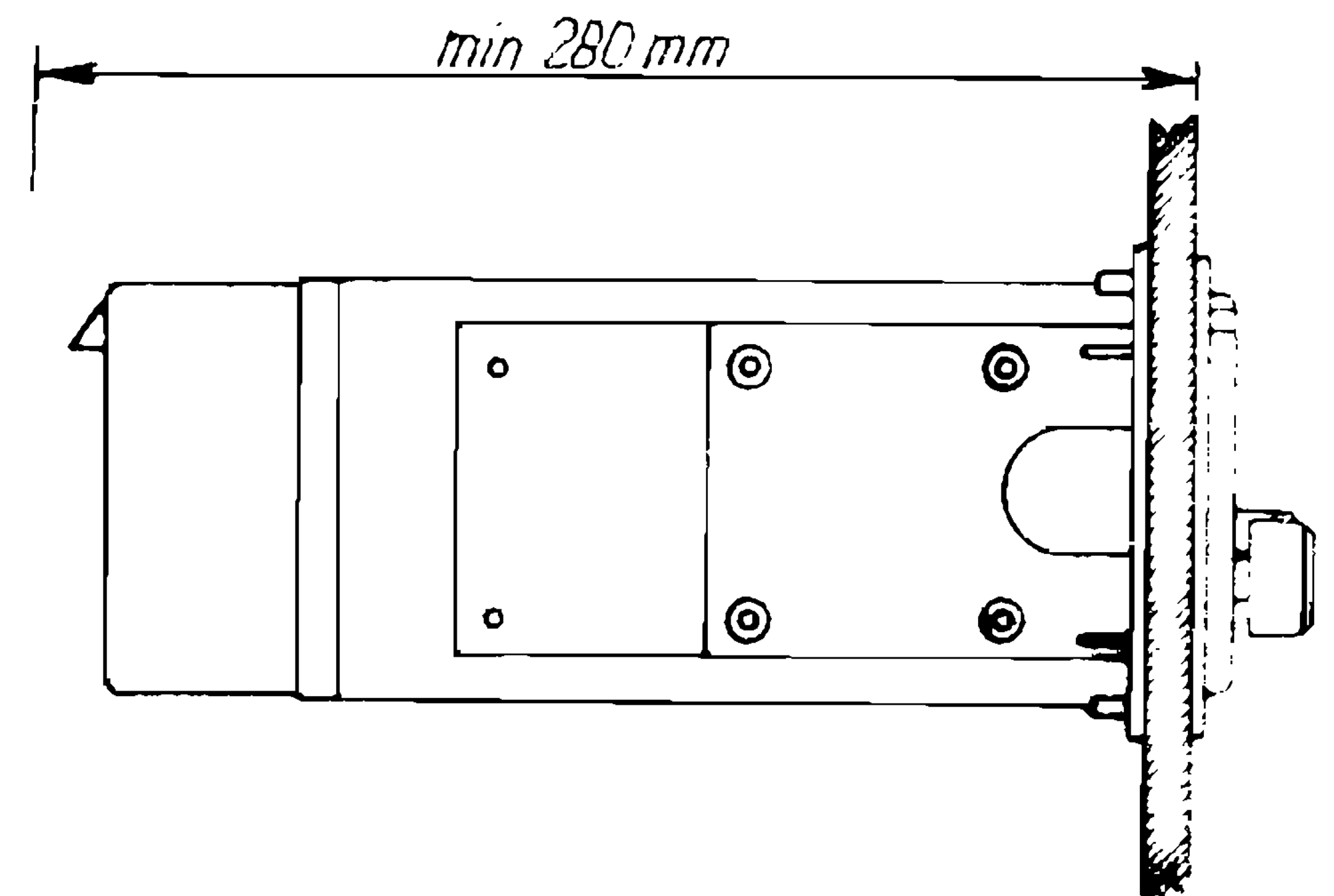
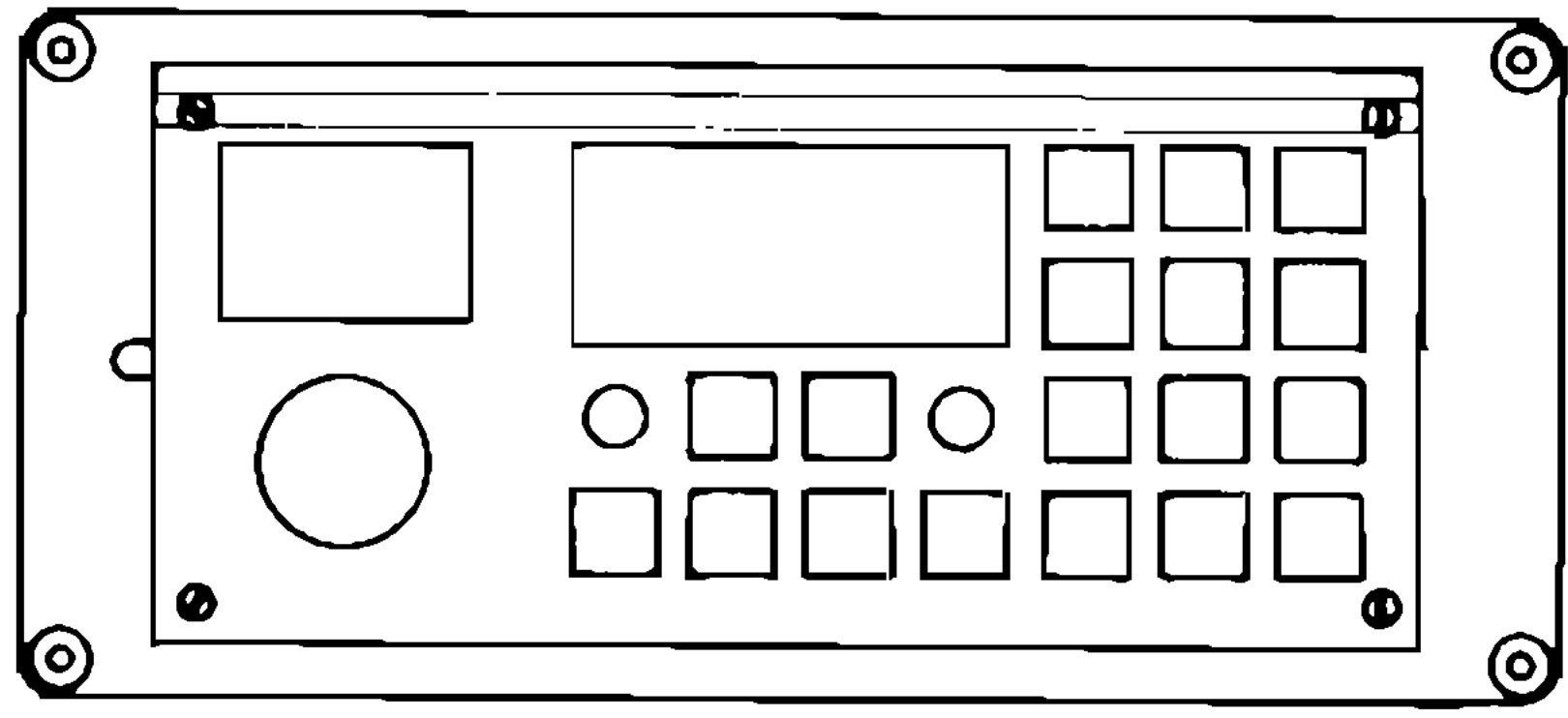
- Lashing kit H2068: 1.5 kg
- Mounting kit H2055: 1.5 kg
- Receiver R2022: 4.5 kg
- Loudspeaker H2054: 5.5 kg
- Loudspeaker H2074: 4.0 kg

R2022A  
 4-0-24766 4-0-24767  
 4-0-24768



## 2.2. DIMENSIONS AND DRILLING PLAN cont.:

### MOUNTING KIT H2063

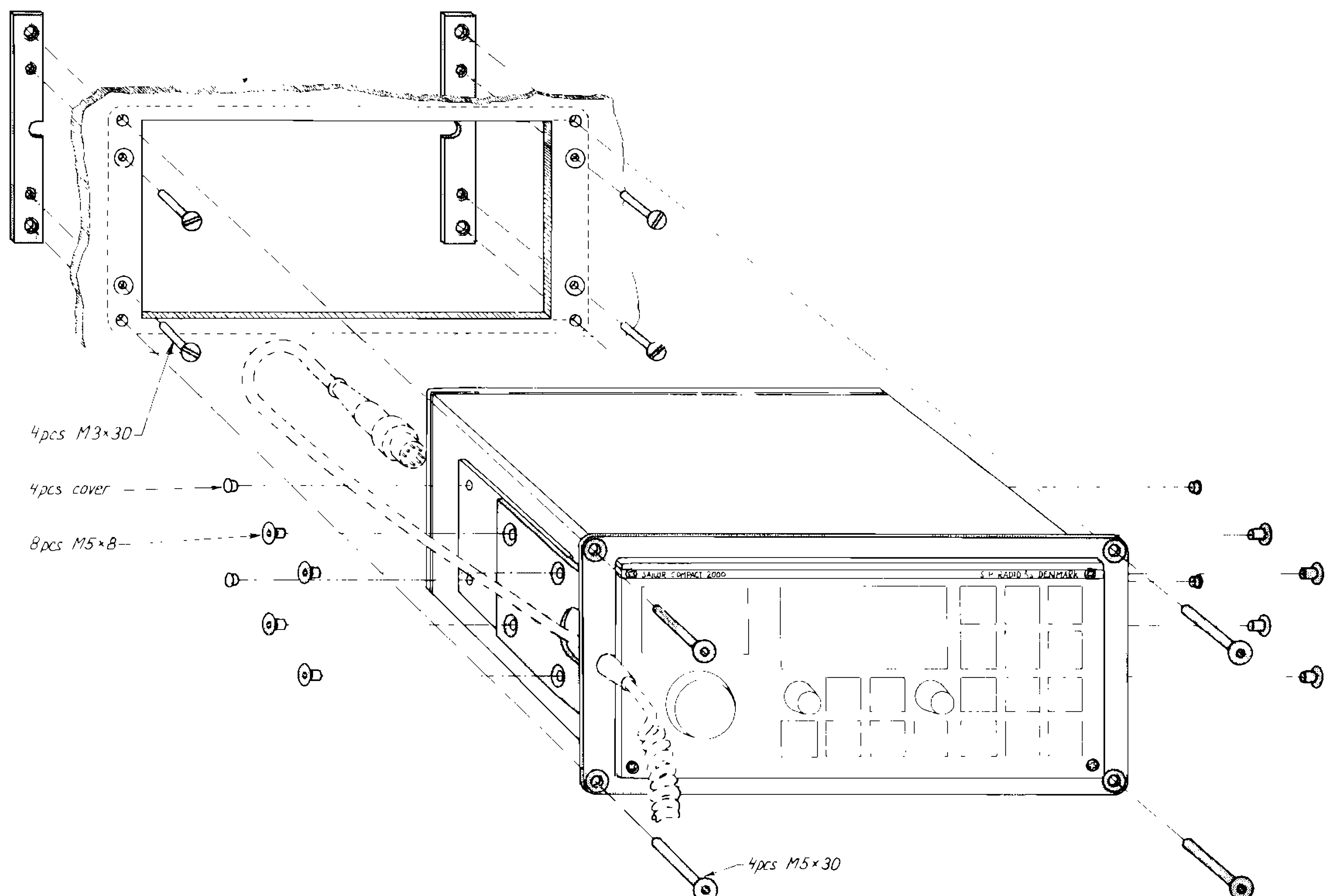


Free distance must be kept to allow free air circulation ambient temperature max. 40°C.

#### WEIGHT

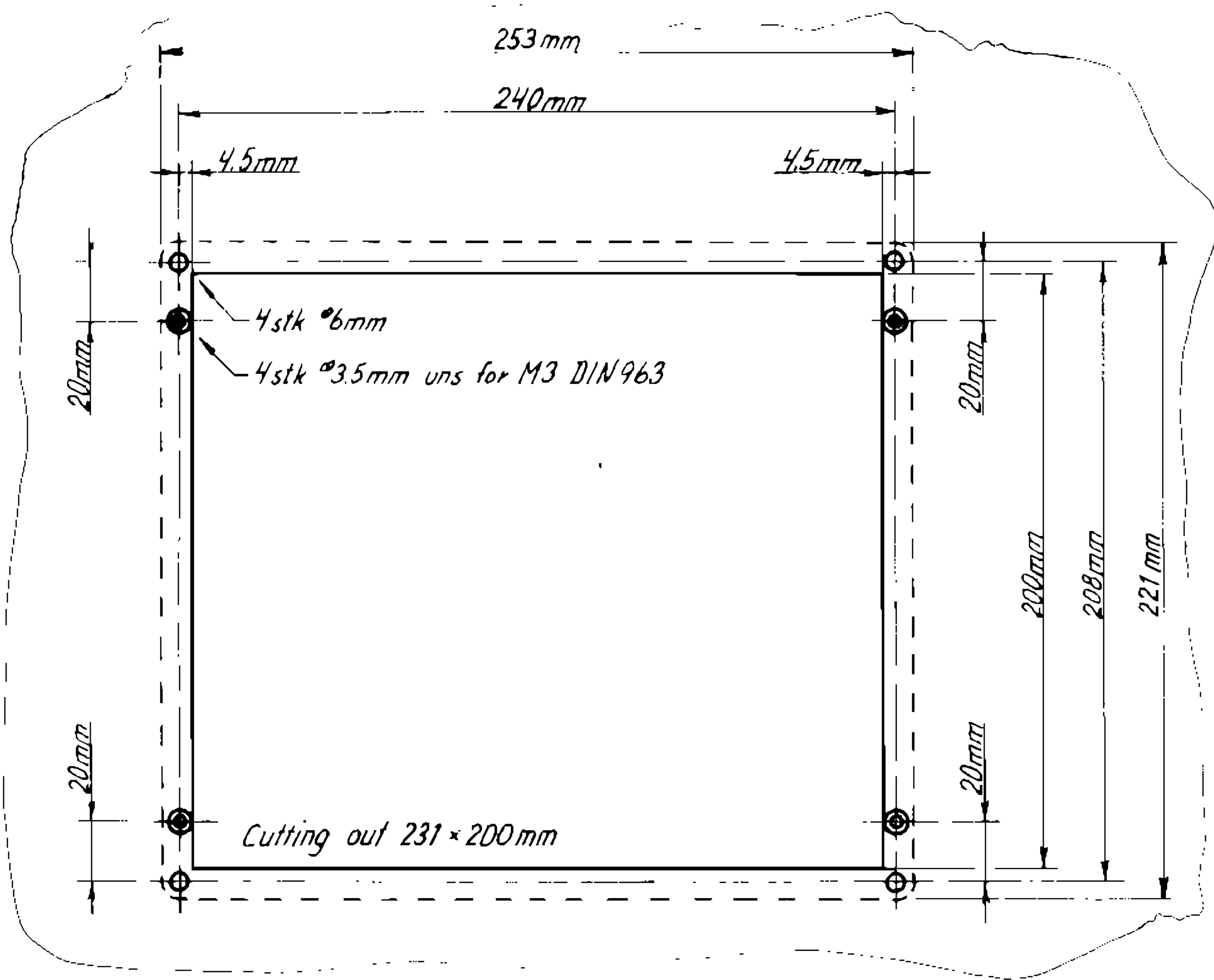
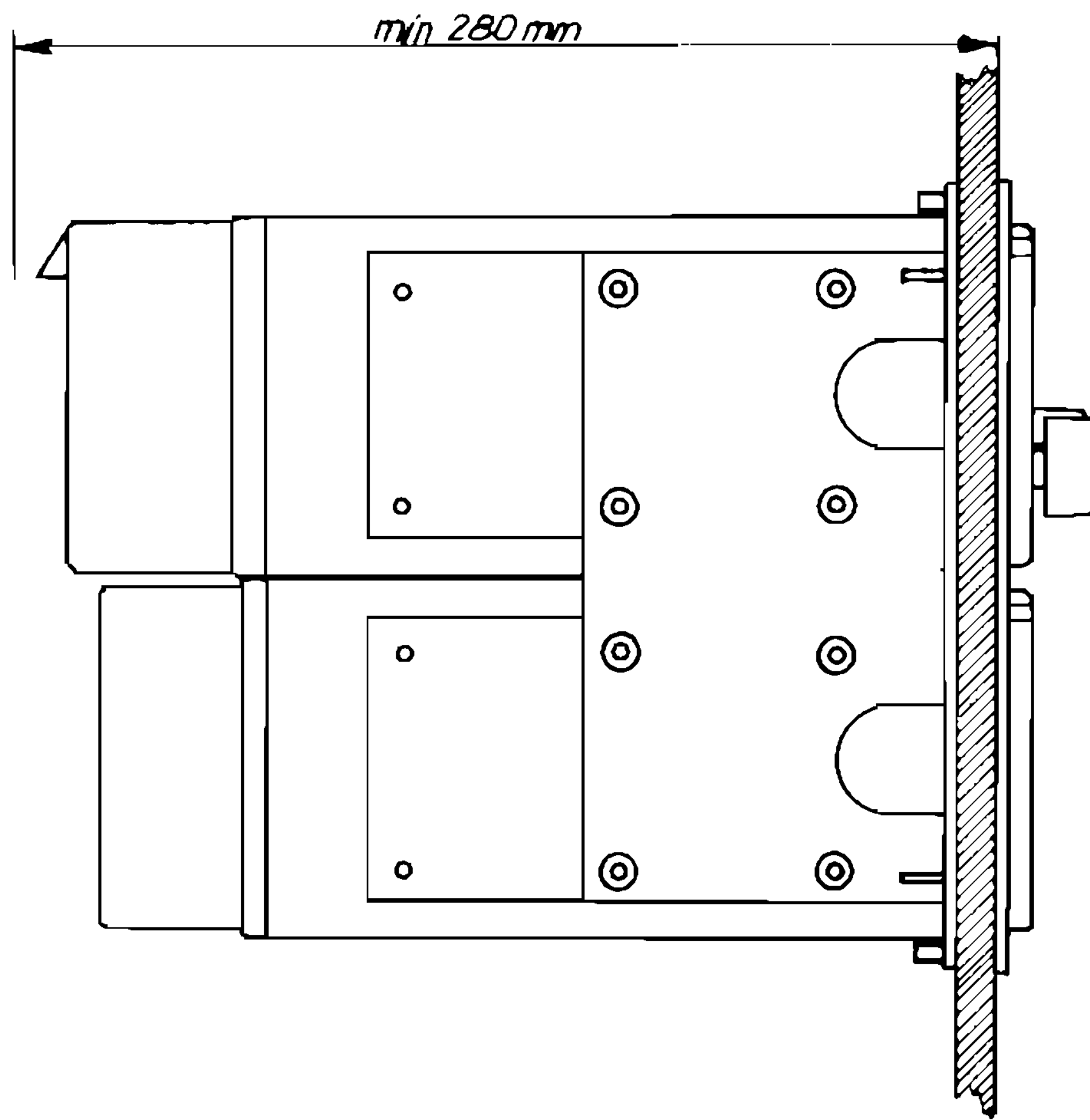
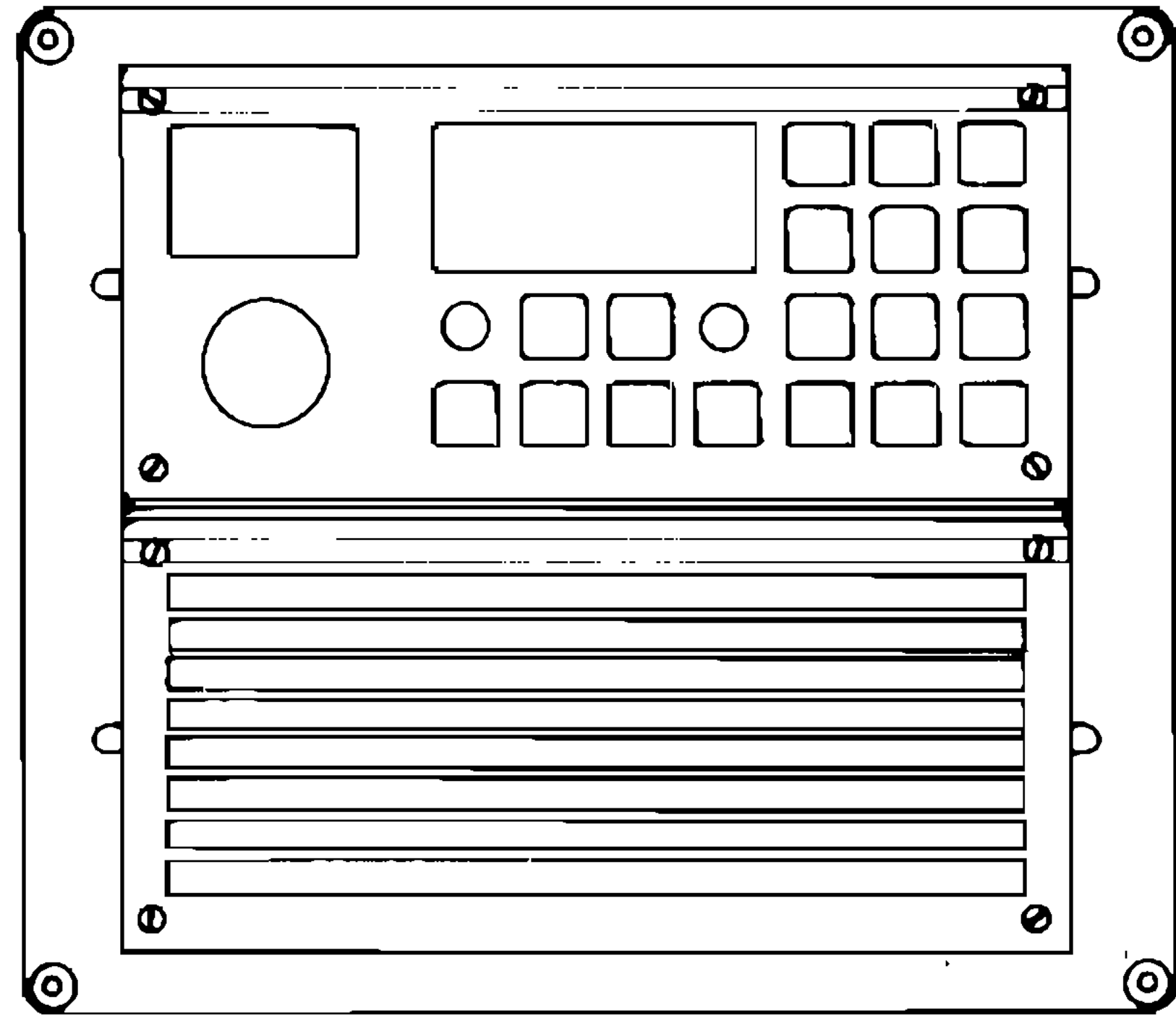
Mounting kit H2063:	1.0 kg
Receiver R2022:	4.5 kg
Loudspeaker H2054:	5.5 kg
Loudspeaker H2074:	4.0 kg

R2022A  
4-0-24769 4-0-24703  
4-0-24770



2.2. DIMENSIONS AND DRILLING PLAN cont.:

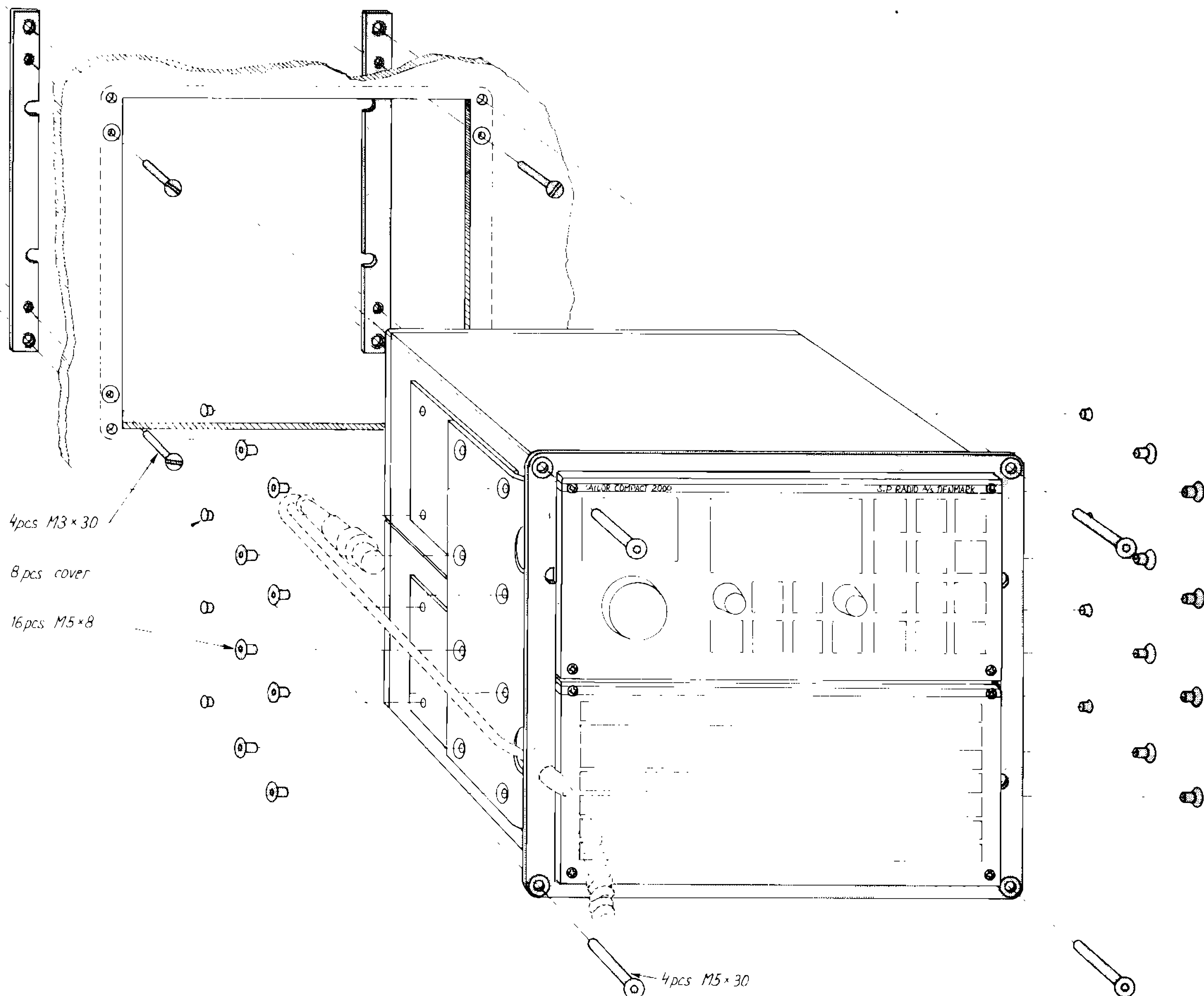
MOUNTING KIT H2064



Free distance must be kept to allow free air circulation ambient temperature max. 40°C.

WEIGHT

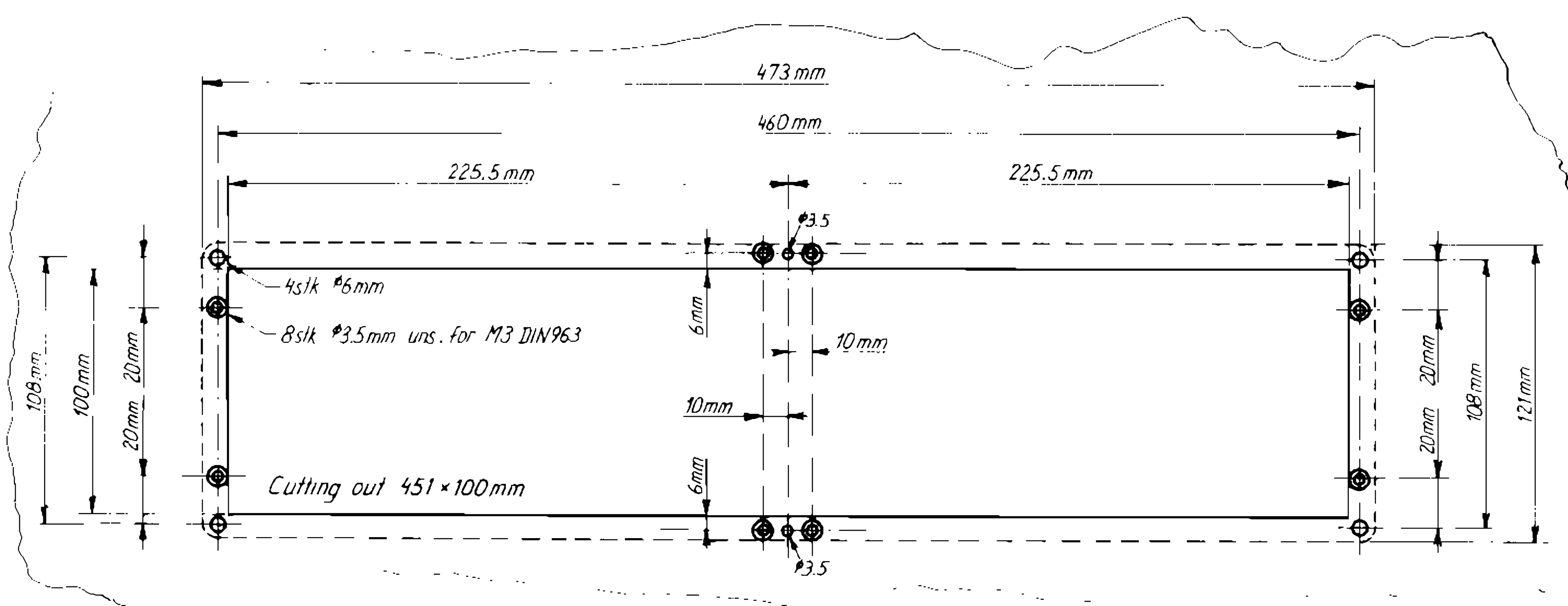
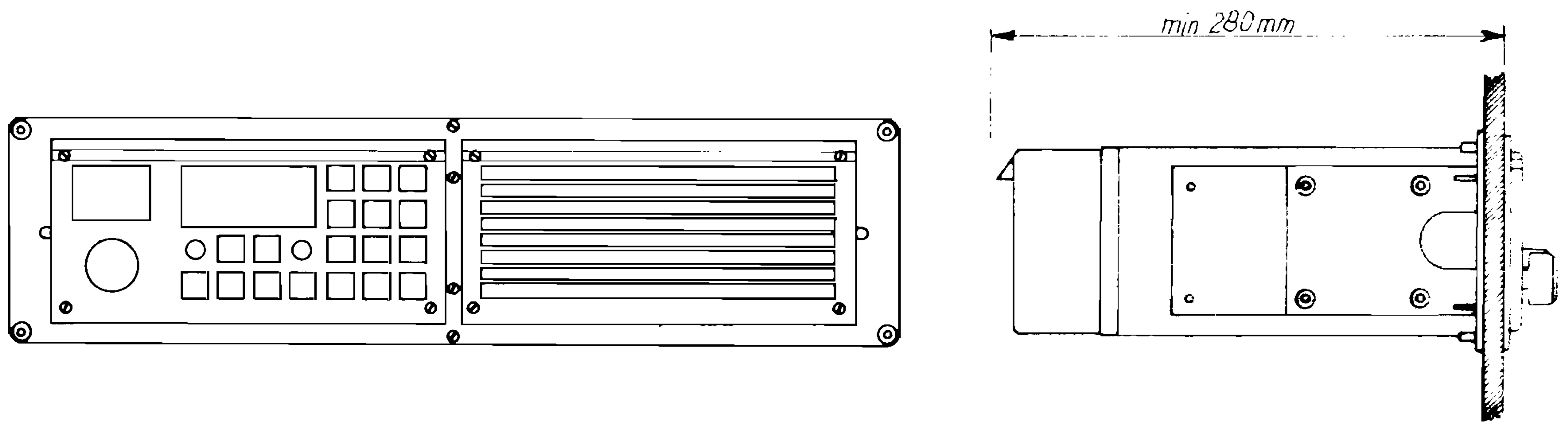
- Mounting kit H2064: 1.5 kg
- Receiver R2022: 4.5 kg
- Loudspeaker H2054: 5.5 kg
- Loudspeaker H2074: 4.0 kg



R2022A  
4-0-24771 4-0-24704  
4-0-24772

## 2.2. DIMENSIONS AND DRILLING PLAN cont.:

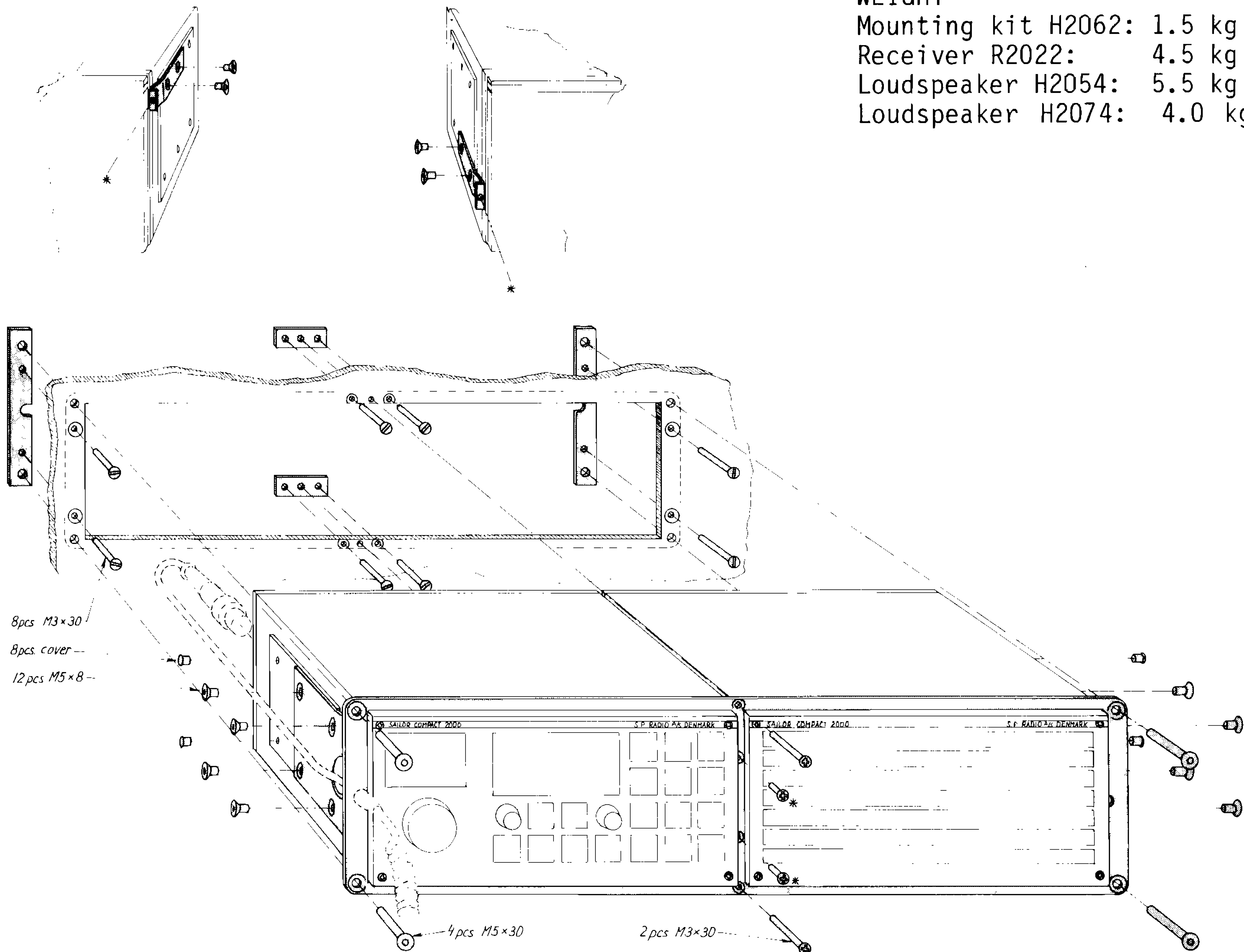
### MOUNTING KIT H2062



Free distance must be kept to allow free air circulation ambient temperature max. 40°C.

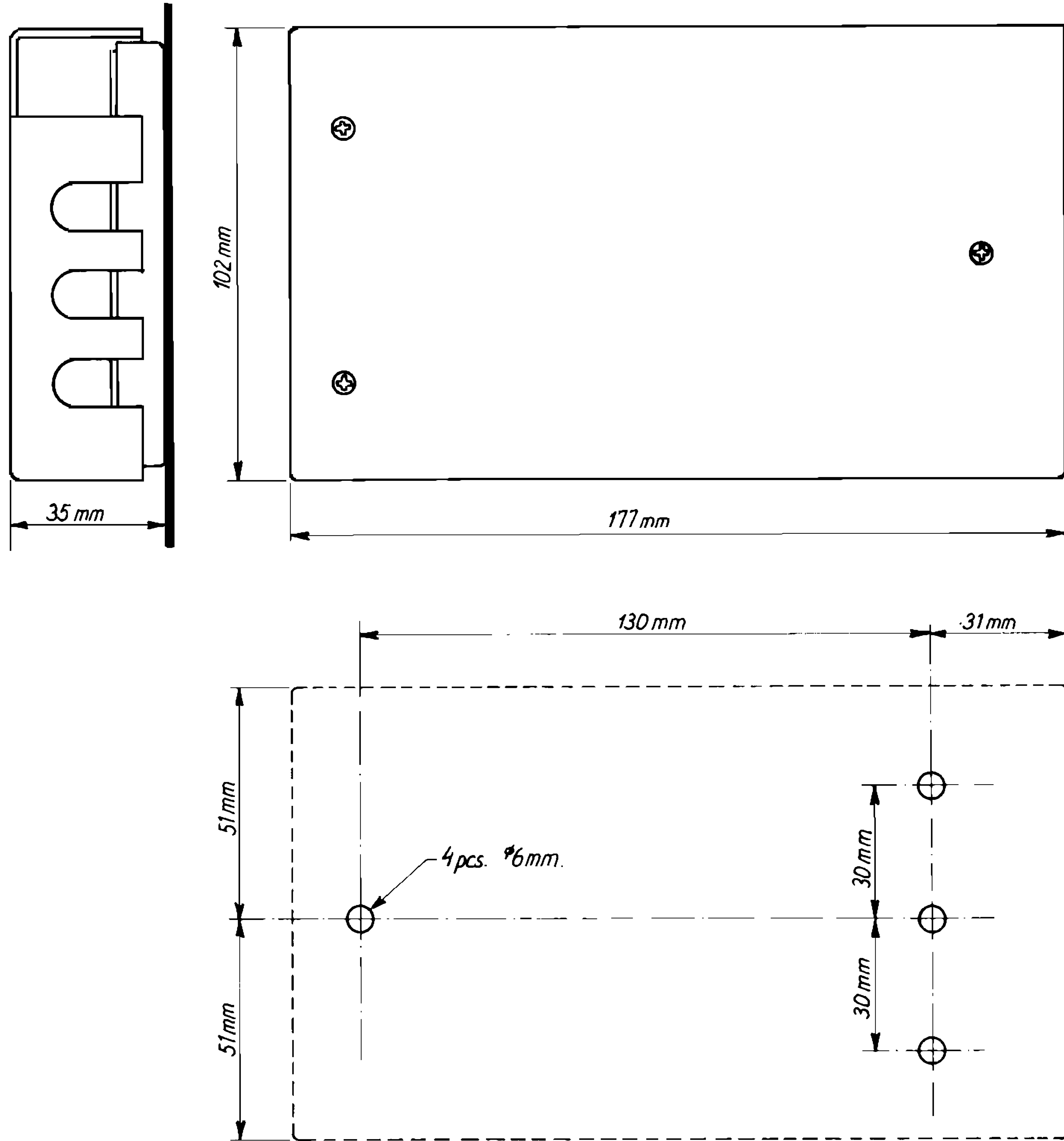
R2022A  
4-0-24769 4-0-24732  
4-0-24773

**WEIGHT**  
 Mounting kit H2062: 1.5 kg  
 Receiver R2022: 4.5 kg  
 Loudspeaker H2054: 5.5 kg  
 Loudspeaker H2074: 4.0 kg



2.2. DIMENSIONS AND DRILLING PLAN cont.:

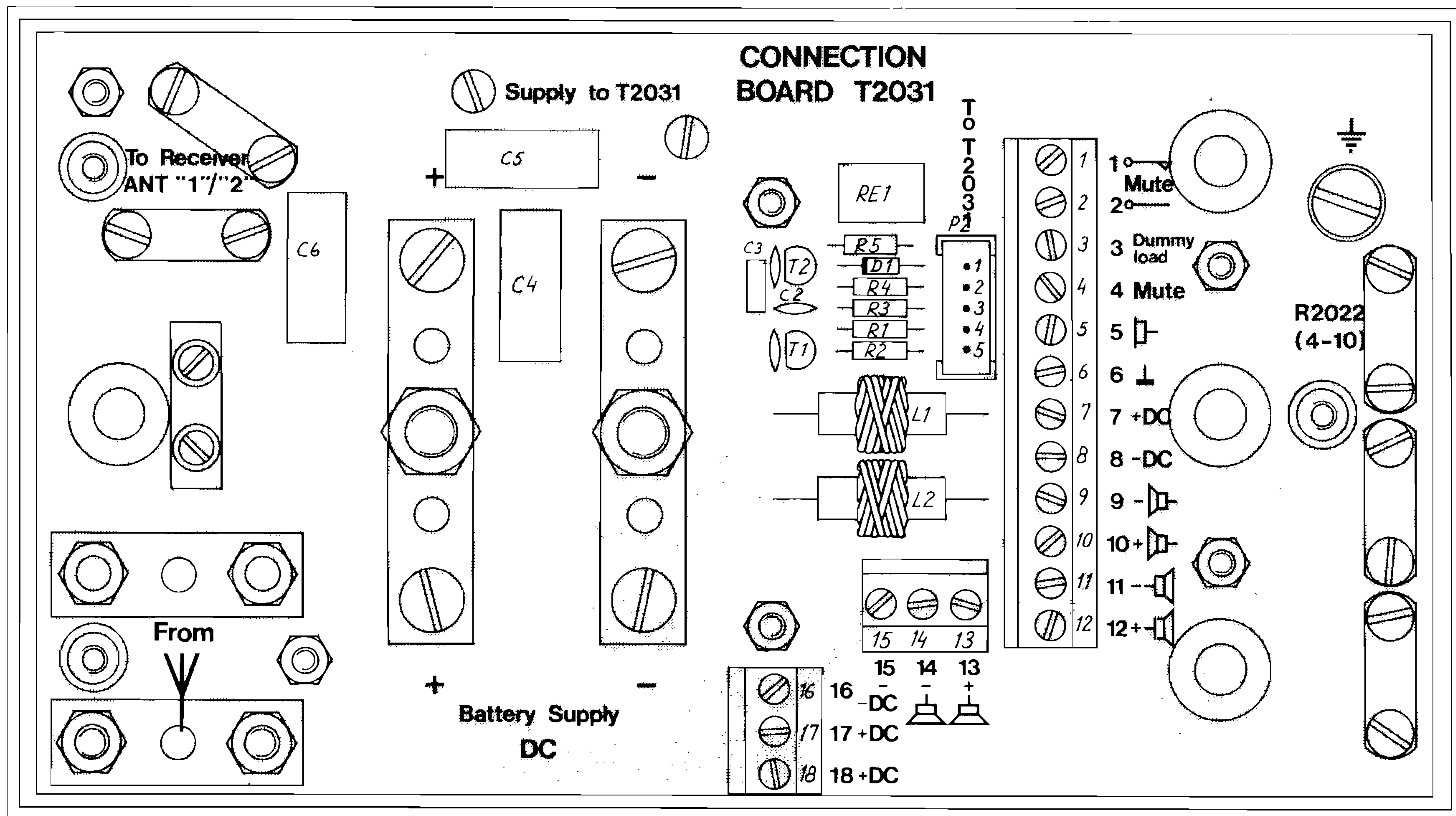
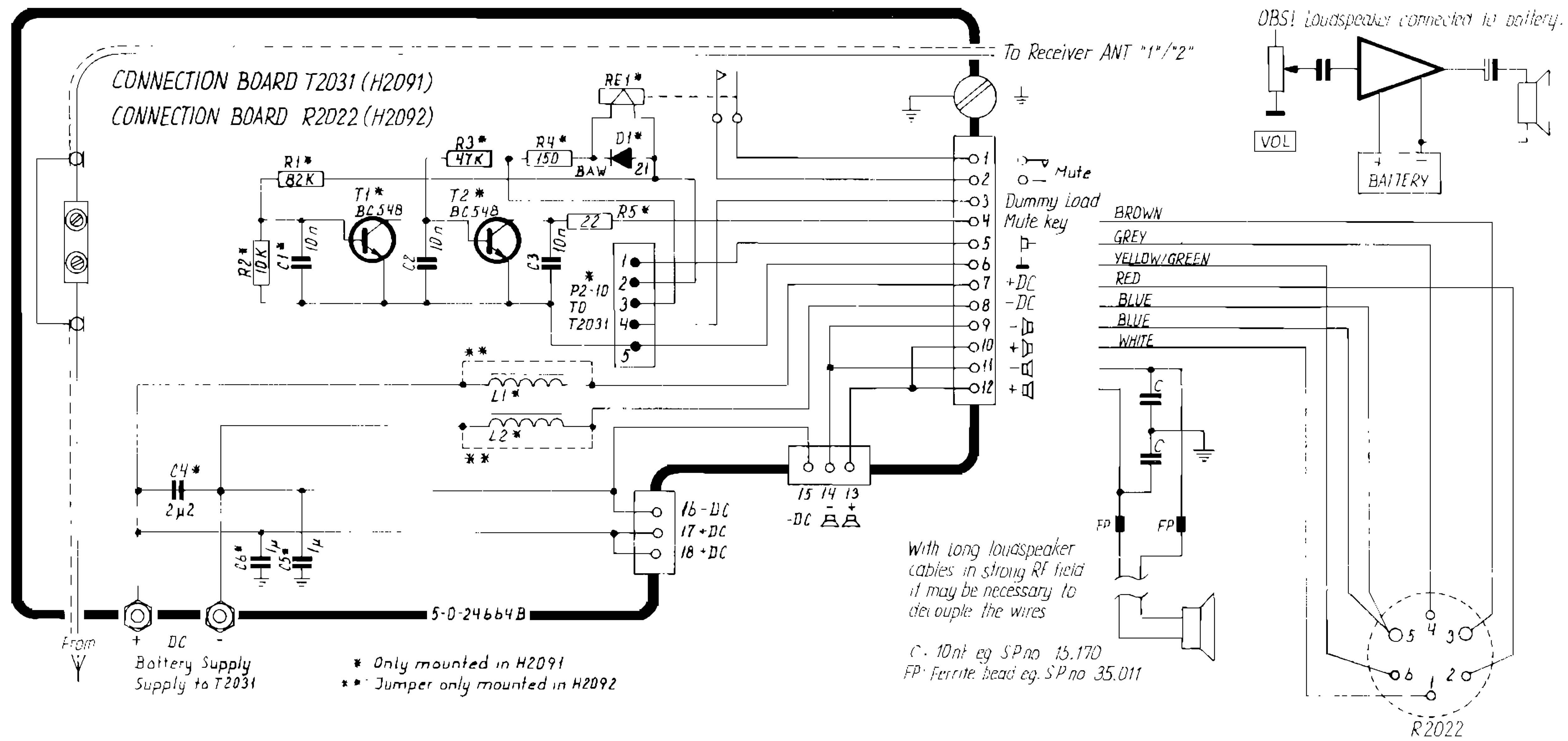
CONNECTION BOX H2091 OR H2092



T2031A R2022A4-0-24785

2.2. DIMENSIONS AND DRILLING PLAN cont.:

DIAGRAM AND COMPONENT LOCATION H2091/H2092



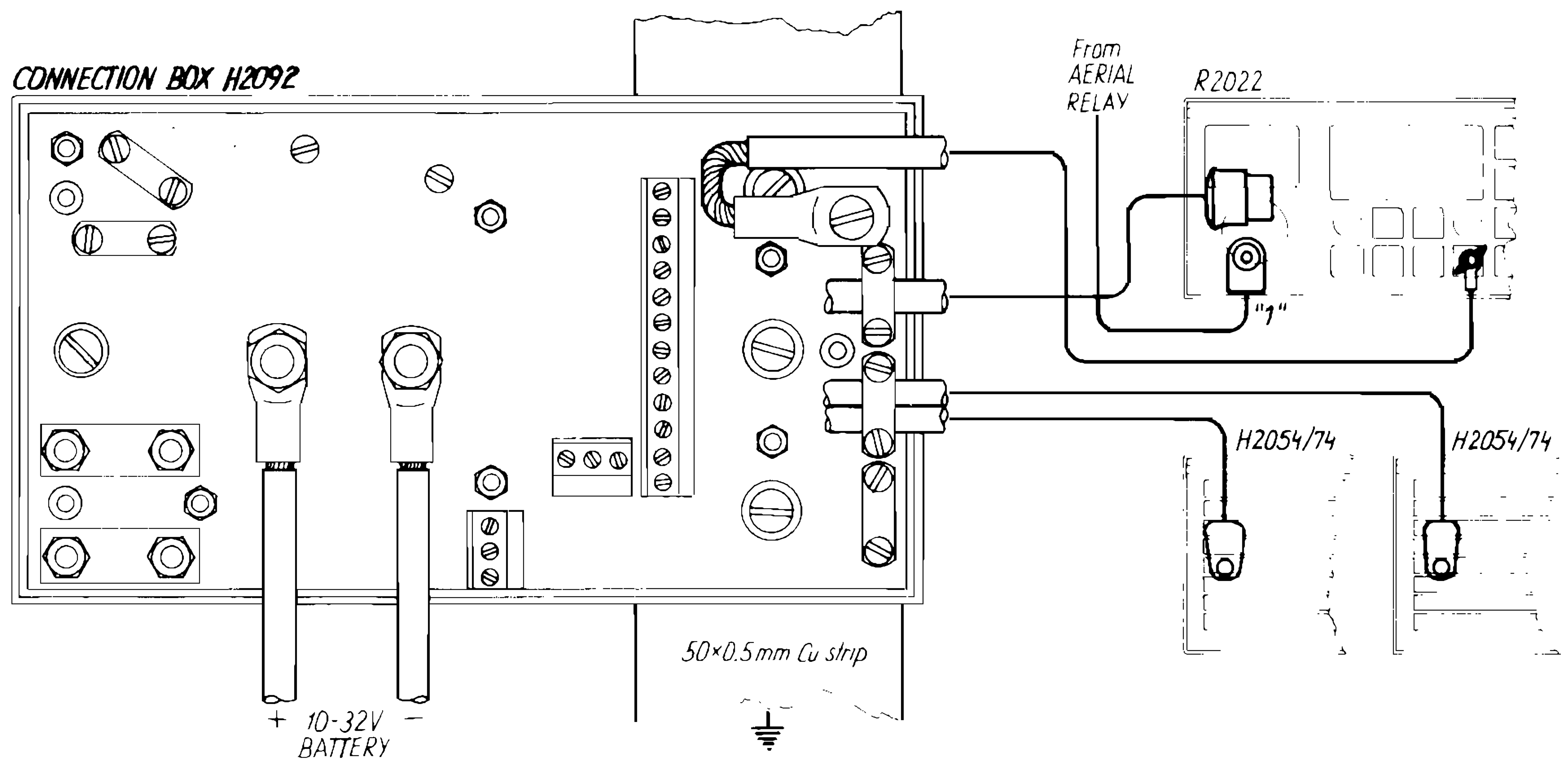
View from component side with lower side tracks.

T2031A R2022A  
4-0-24664A 4-6-24664A



## 2.3. ELECTRICAL CONNECTIONS

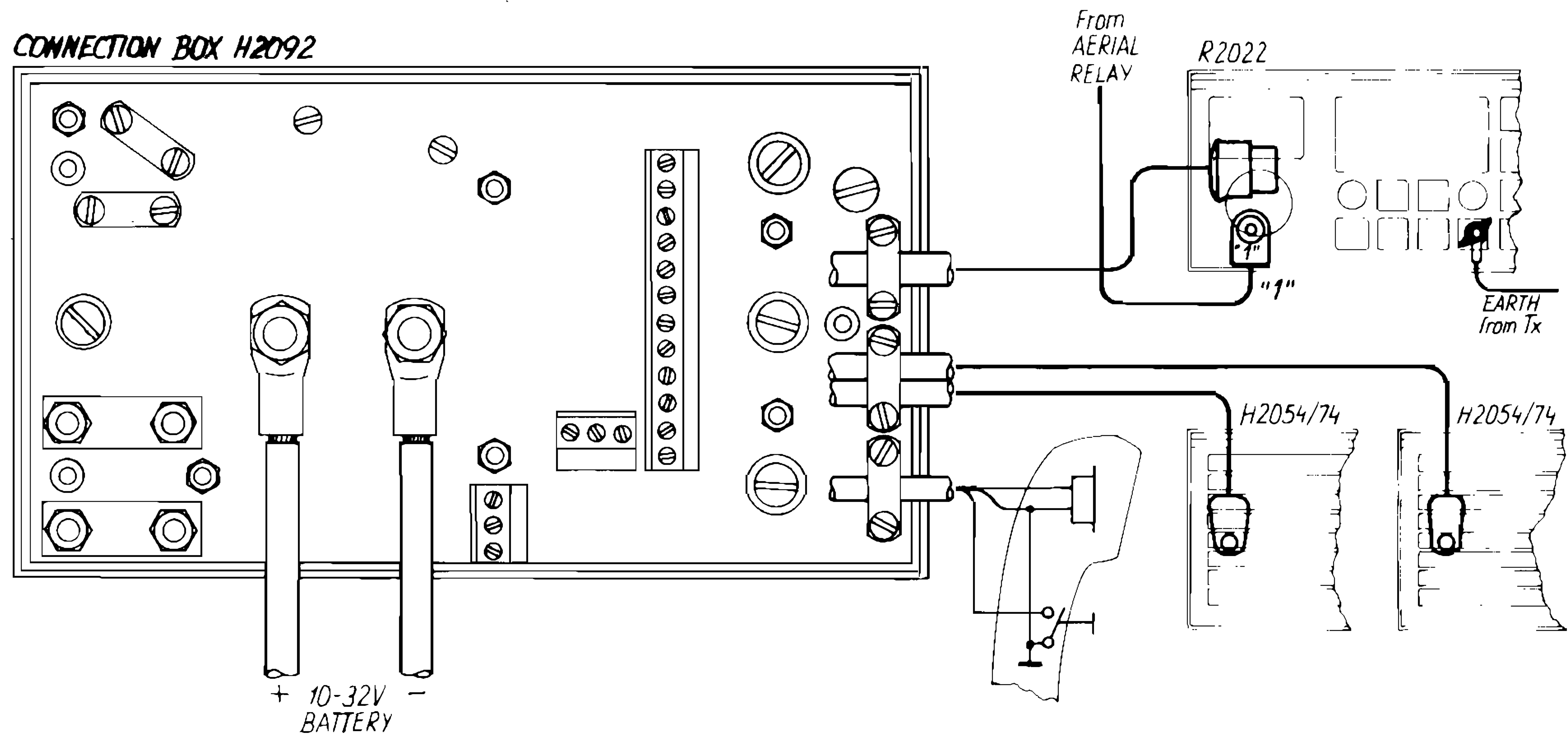
### RECEIVER ALONE



#### NOTE!

The receiver must be programmed for one aerial simplex installation. Look-up the section 2.5. AERIAL TUNE-UP PROCEDURE.

### SIMPLEX

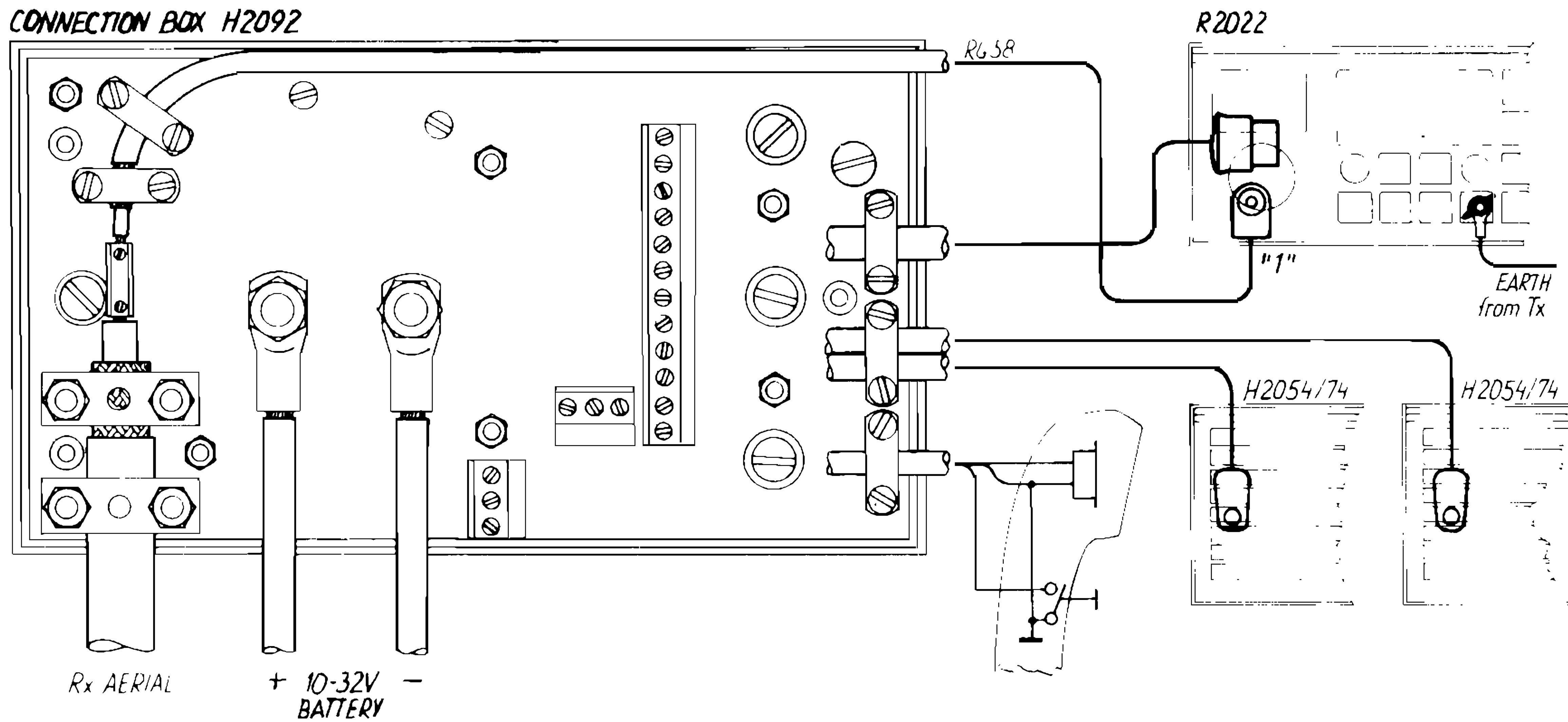


#### NOTE!

The receiver must be programmed for one aerial simplex installation. Look-up the section 2.5. AERIAL TUNE-UP PROCEDURE.

## 2.3. ELECTRICAL CONNECTIONS cont.:

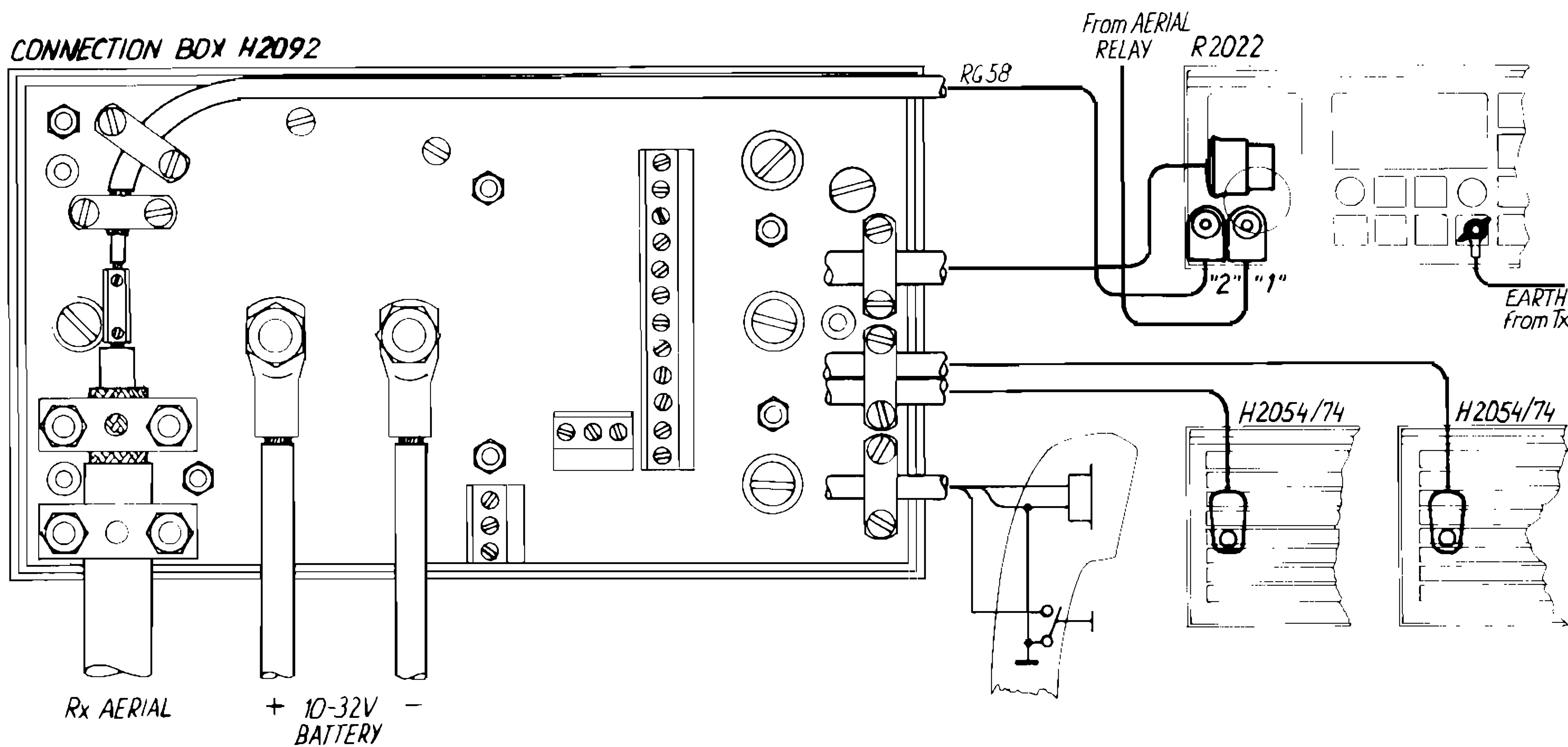
### ONE AERIAL DUPLEX



#### NOTE!

The receiver must be programmed for one aerial duplex installation. Look-up the section 2.5. AERIAL TUNE-UP PROCEDURE.

### TWO AERIAL DUPLEX



#### NOTE!

The receiver must be programmed for two aerial duplex installation. Look-up the section 2.5. AERIAL TUNE-UP PROCEDURE.

## 2.4. AERIAL AND EARTH

### AERIAL

For receiver aerial use either a whip aerial of at least 6 metres length or a wire aerial of 6-30 metres length.

For lead-downs of less than 12 metres use a low capacitance cable, e.g. ET10MA. For longer lead-downs use a good quality of 50 ohm coaxial cable, e.g. RG213U and shift from HIGH to LOW (50 ohm) input impedance of the duplex filter.

To determine which position is the most advantageous, search for a weak station near 1605 kHz and note the meter reading. Shift to the other input impedance and check if the meter reading has increased. Remember to tune the aerial capacitor. Look-up the AERIAL TUNE-UP PROCEDURE.

In noisy environments it may be advantageous to use a triaxial cable, e.g. SAILOR H1213 where the outer screen acts as static shield. This means that outer and inner screen has to be connected at the receiver.

The aerial must be placed as high and as much in the clear as possible, and for duplex reasons as far from the transmitter aerial as possible.

If wire aerial is used, keep the angle between the aerial lead-in and the transmitter aerial as perpendicular as possible.

For aerial and cable connection use a junction box mounted at the foot point of the aerial. The junction box must be designed for outdoor mounting in maritime environments. E.g. SAILOR H1209.

OBSERVE! Don't connect any power splitter (combiner) in the aerial lead-down as we have seen some serious decrease in sensitivity due to such a device.

## 2.4. AERIAL AND EARTH cont.:

### EARTH

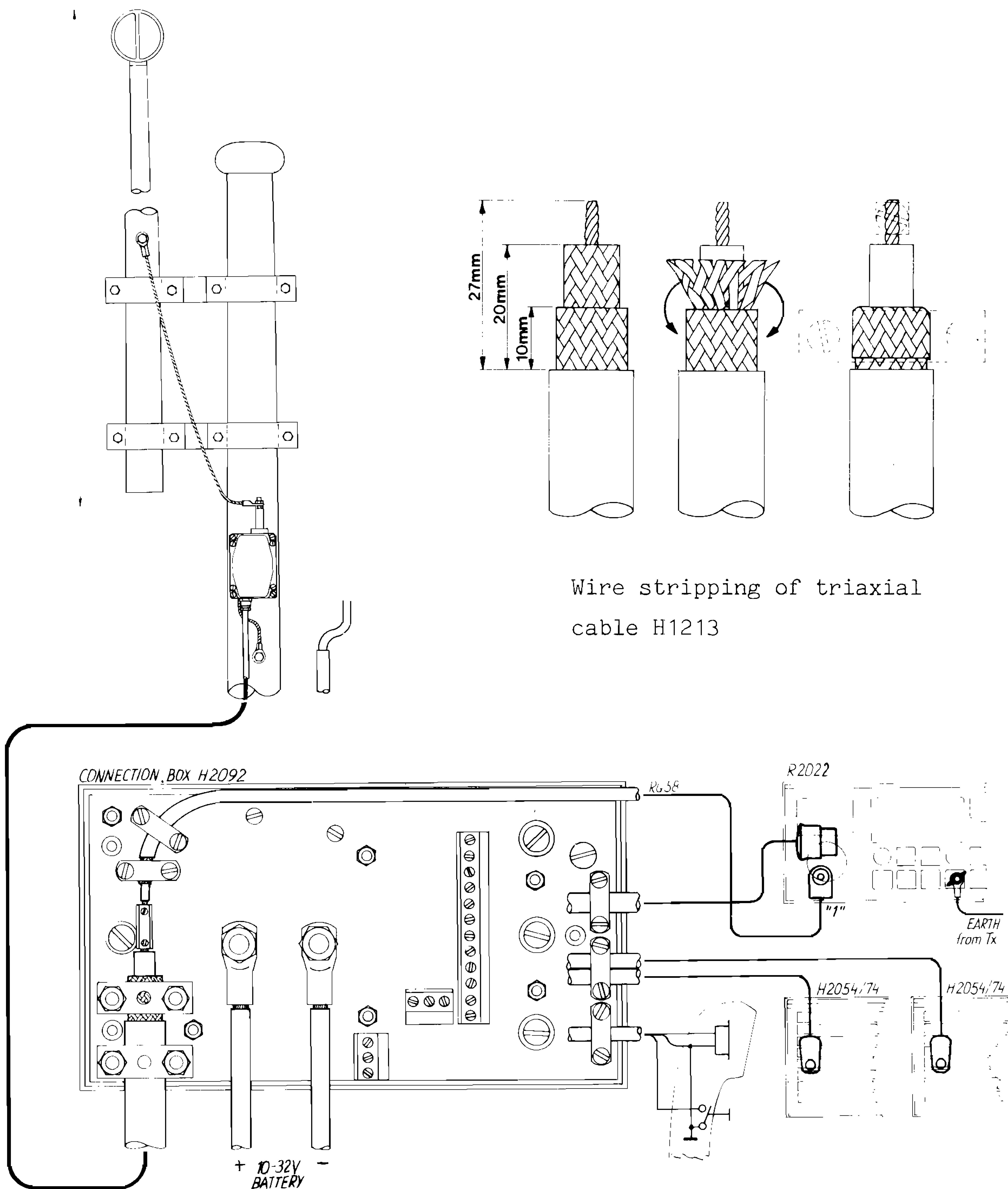
#### Receiver without Transmitter

In iron vessels the earthband is led to the deck (hull) of the vessel or to the deckhouse.

In fibre-glass and wooden vessels the earthband is led either to a keel bolt, if the vessel has an external ballast keel (sailing vessels), or to an external metal plate of at least 1 sqm on the hull below the water line.

#### Receiver in Conjunction with a Transmitter

Connect the earthband to the transmitter earth terminal in the shortest possible way to keep the receiver at the same RF potential as the transmitter.



R2022A 9-3-23824A  
4-0-24776  
4-0-22165

## 2.4. AERIAL AND EARTH cont.:

To be grounded effectively.

If metal mast to mast.

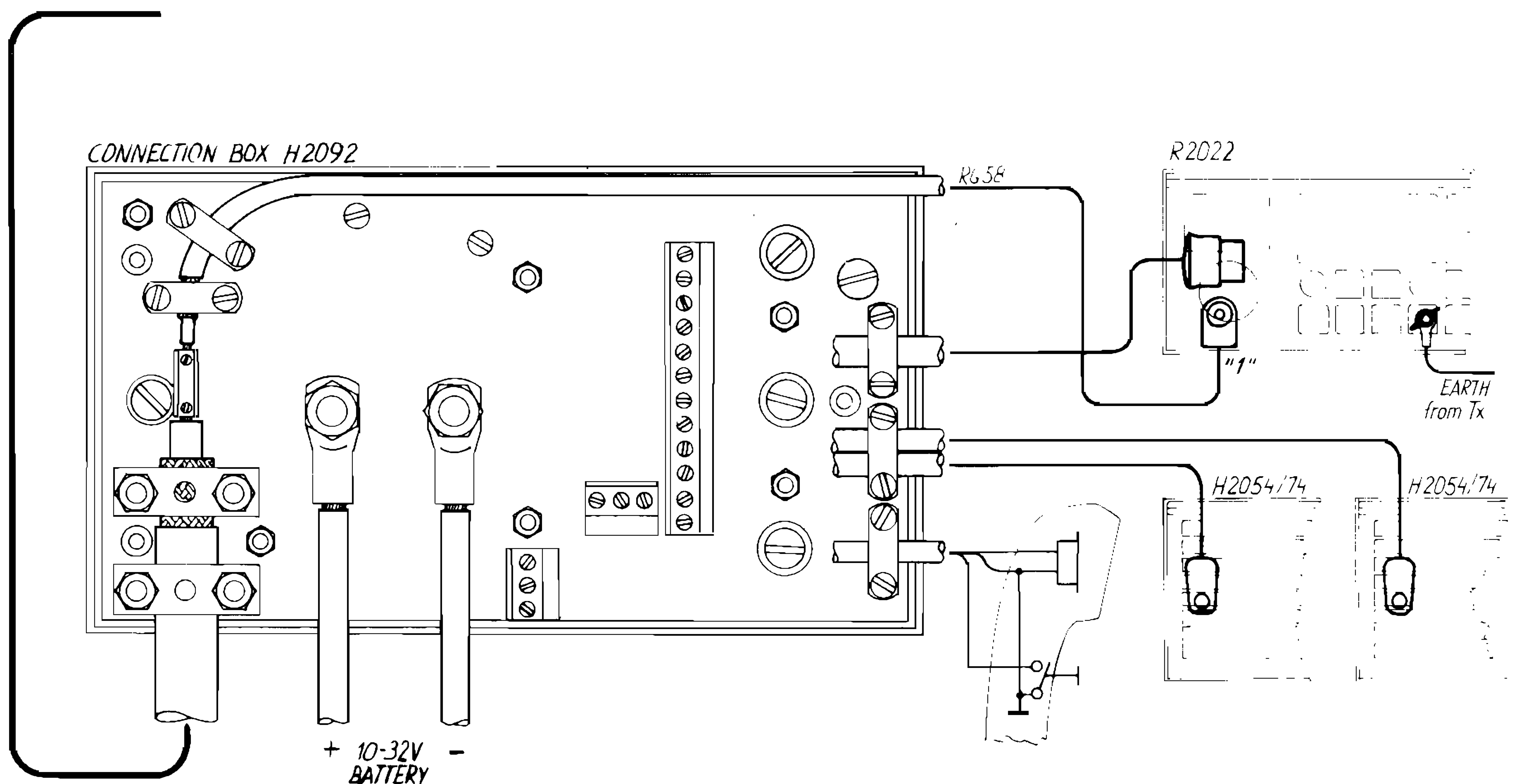
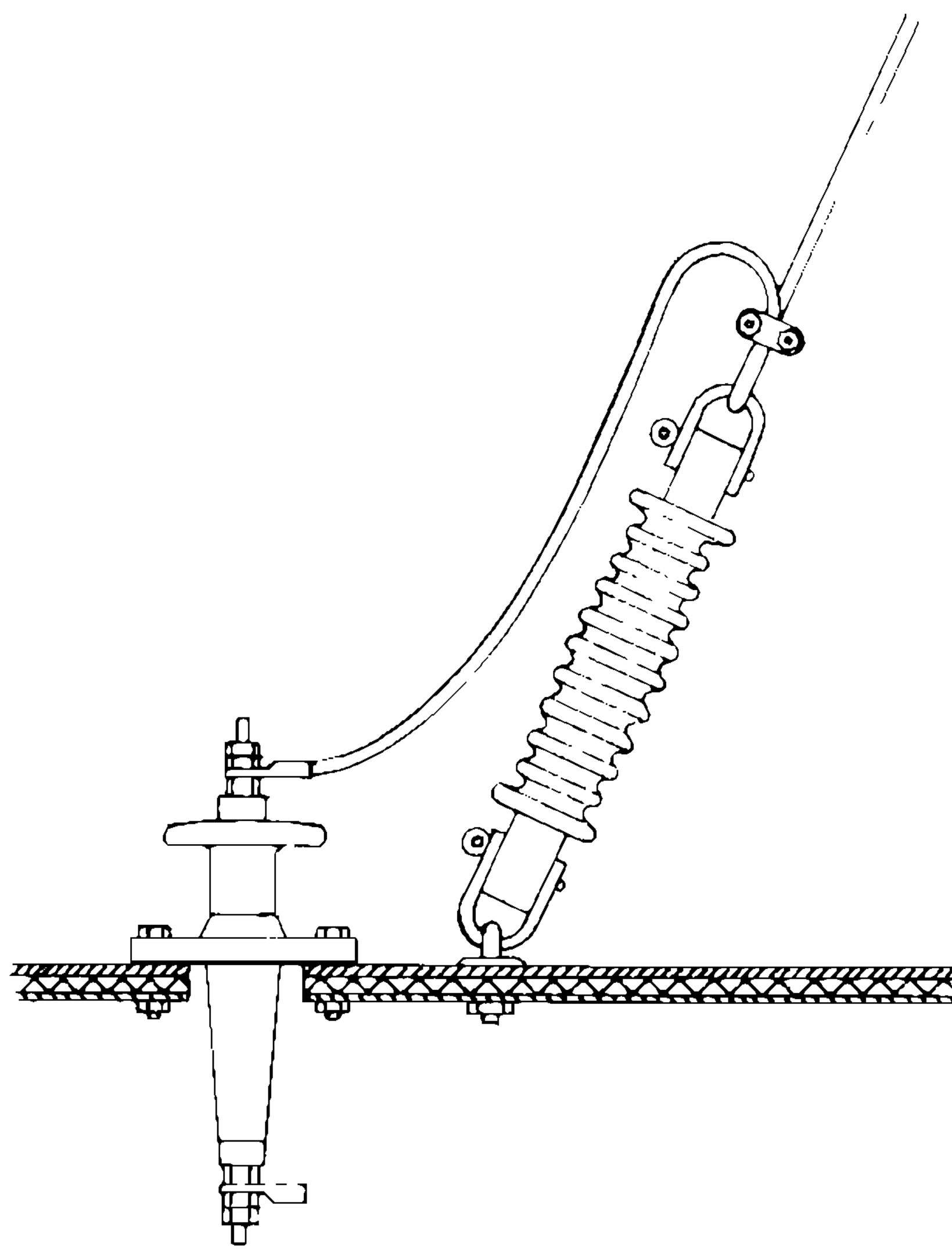
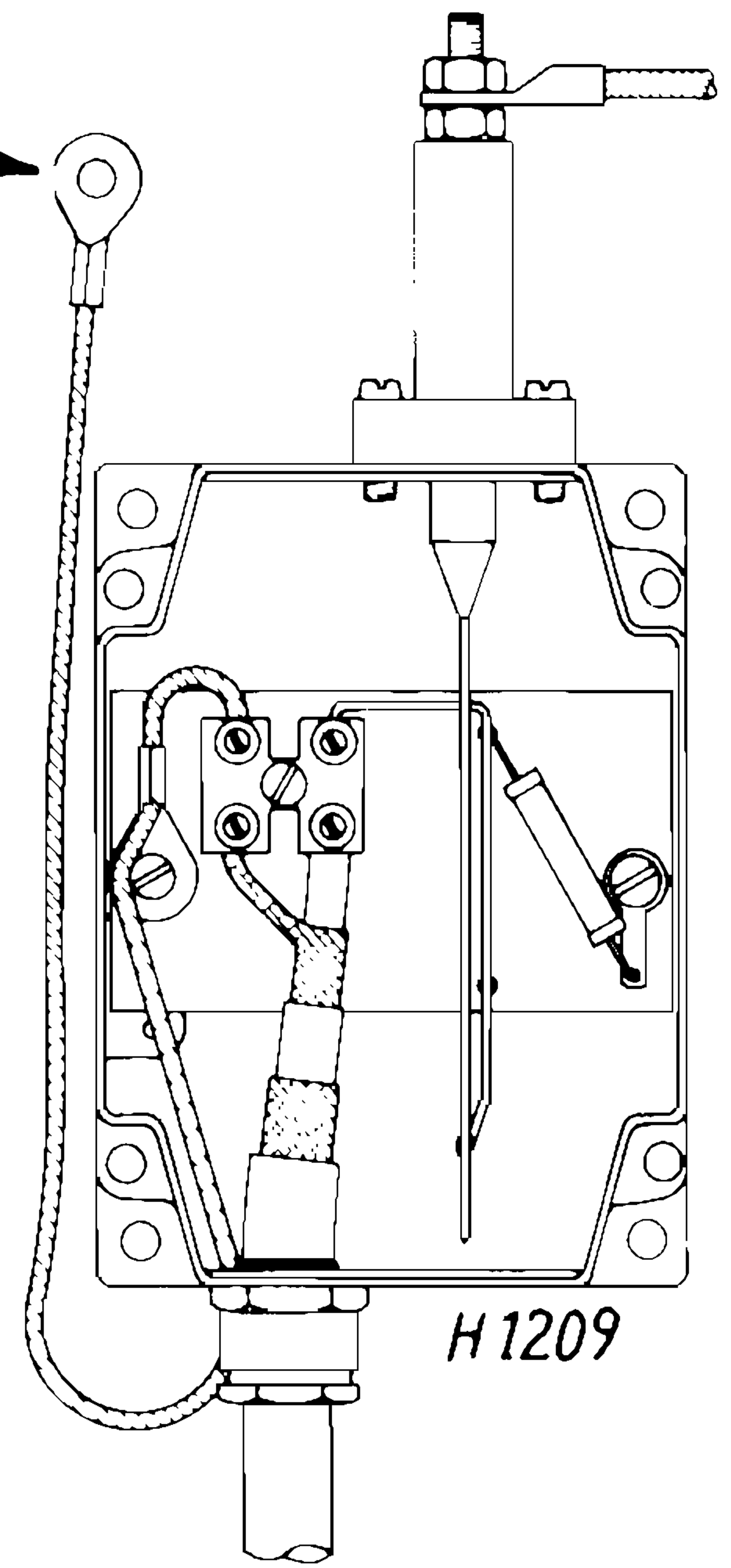
Metal mast must be connected to either metal hull or to grounding system.

If wooden mast to cu-strip (50 x 1) fastened to the mast.

In the lower end the strip must be connected to hull (if metal ship) or to separate grounding system (equal to transmitter system) close to mast.

All standing rigging must in the top end be connected to metal mast or cu-strip and in the receiver end to cu-strip or grounding system.




To avoid crackling noise make all connections by welding, bolting or soldering.




R2022A  
4-0-22171 4-0-22128  
4-0-24776





## 2.5. AERIAL TUNE-UP PROCEDURE

When the receiver has been installed it has to be programmed for the installation in question. There are 3 possibilities, either one aerial simplex, one aerial duplex, or two aeriels duplex. The 3 configurations are stored in a "roll stack" entered by the    keys and it is rolled

by pressing the  key.

Read-outs are:

Keep  activated and press

Release TUNE

2Adu0

1A5.0

1Adu1

2Adu0









### HOW TO PROGRAMME THE RECEIVER AERIAL CONFIGURATION

E.g. one aerial simplex.

Keep  activated and press

Release TUNE

2Adu0

1A5.0

The frequency in  
file no 0 is shown.





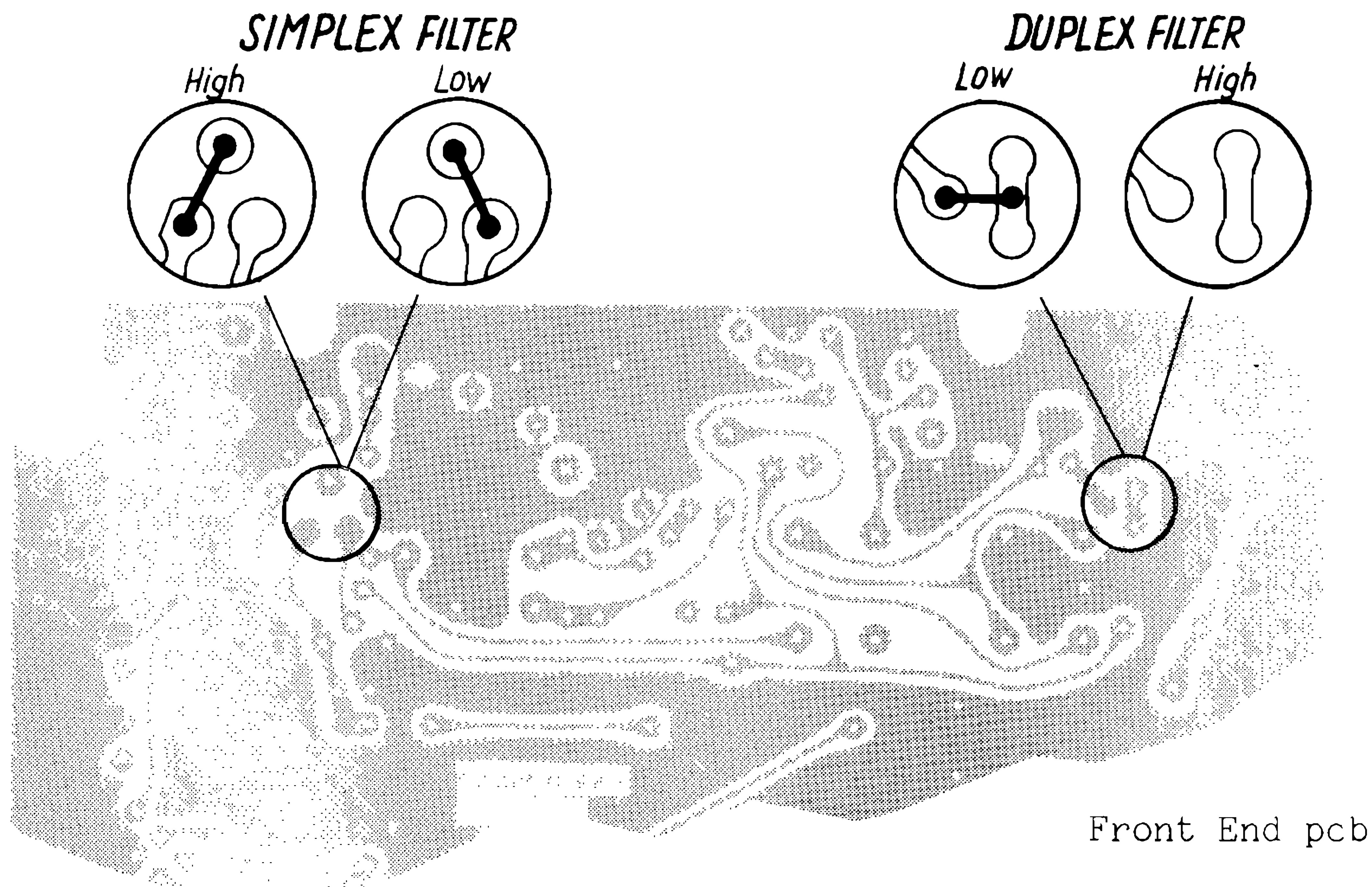
## 2.5. AERIAL TUNE-UP PROCEDURE cont.:

SAILOR R2022 has two aerial input impedances, HIGH 500 ohm approx. and LOW 50 ohm approx.

The low impedance is to be used in installations with long coaxial cable of approx. 12 metres or more.

The receiver is factory set for HIGH aerial impedance.

### HOW TO SHIFT FROM HIGH TO LOW INPUT IMPEDANCE



SAILOR R2022 has three aerial sockets, FM, ANT "1", and ANT "2".

FM socket is intended for an FM dipole aerial (75 ohm).

ANT "1" is intended for a one aerial installation, either the transmitter aerial in a simplex installation or a foremast aerial for duplex installation.

ANT "2" is intended for a two aerial installation where the simplex aerial is the transmitter aerial connected to the ANT "1" connector, and the duplex foremast aerial is connected to the ANT "2" connector.

Anyway the aerial trimmer for the duplex filter has to be tuned.

### HOW TO ADJUST THE DUPLEX FILTER AERIAL TRIMMER

#### Simplex Installation

1. Key-in a low frequency in the CT band, e.g. 1610 kHz.
2. Press the **SHIFT** **TUNE** keys and search for a weak station in the low end of the CT band. Then press the **SHIFT** **TUNE** keys again.

## 2.5. AERIAL TUNE-UP PROCEDURE cont.:

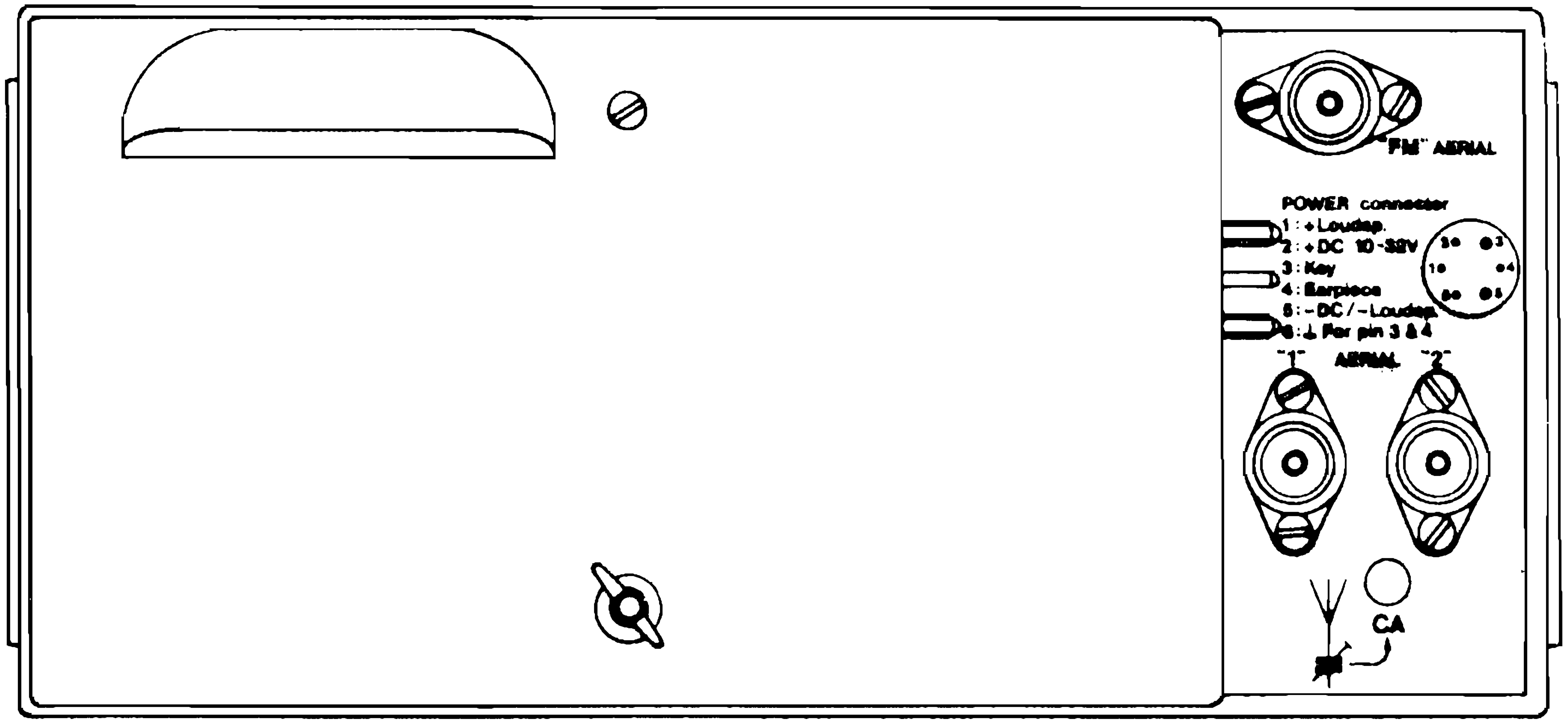
3. Activate the noise generator by pressing the RF TUNE knob and tune for maximum meter reading.
4. Adjust by means of an insulated trimming stick the aerial trimmer for max. meter reading.
5. Repeat point 3. and 4. until no essential improvement is achieved.

## DUPLEX INSTALLATION

1. Key-in a low frequency in the CT band e.g. 1610 kHz.
2. Press the  SHIFT  TUNE keys and search for a weak station in the low end of the CT band. Then press the  SHIFT  TUNE keys again.
3. Press the  DUPLEX key.
4. Activate the noise generator by pressing the RF TUNE knob, and tune for max. meter reading.
5. Adjust by means of an insulated trimming stick the aerial trimmer for max. meter reading.
6. Repeat point 4. and 5. until no essential improvement is achieved.

2.5. AERIAL TUNE-UP PROCEDURE cont.:

REAR VIEW

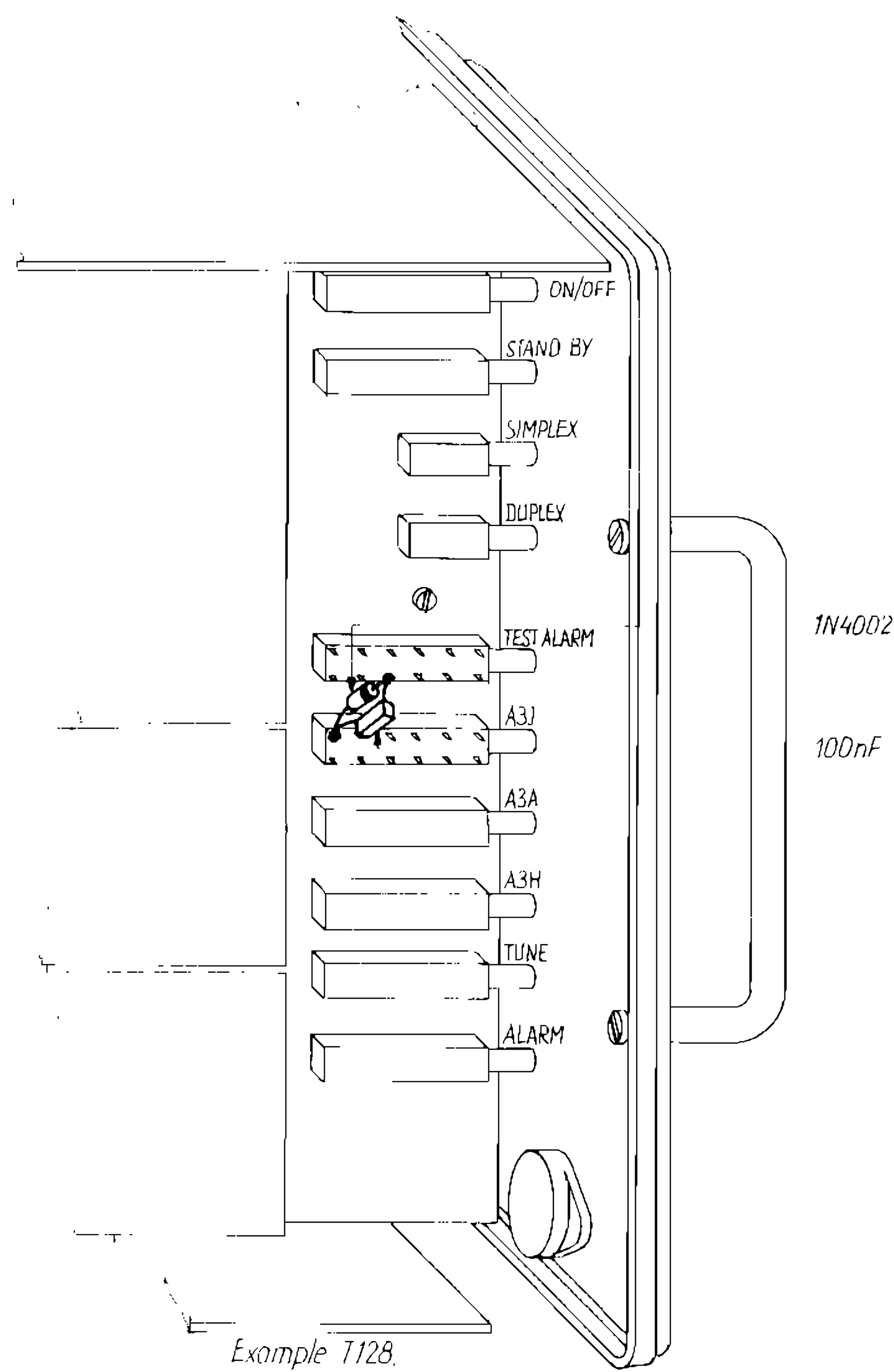


R2022A  
2-0-24778

## 2.6. R2022 USED IN CONJUNCTION WITH T121, T122, T124, T126 OR T128.

Connection box H2093 is used when R2022 is installed in conjunction with SAILOR T12X.

When used in conjunction with SAILOR T121, T124, T126 and T128 a minor modification must be made in the transmitter to secure that the station operates properly (see fig. 1).



**NOTE!**  
No need for modification in T122.

How to interconnect R2022, H2093 and T12X: look up sections 2.6.1. and 2.6.2. of this manual.

**IMPORTANT!** When R2022 is installed in conjunction with T12X there are a few changes to the operation of the station.

a) The simplex/duplex mode switch on the transmitter must always be placed in duplex position.  
Simplex/duplex mode shift is handled through keyboard on R2022 (look up the green covered operating manual).

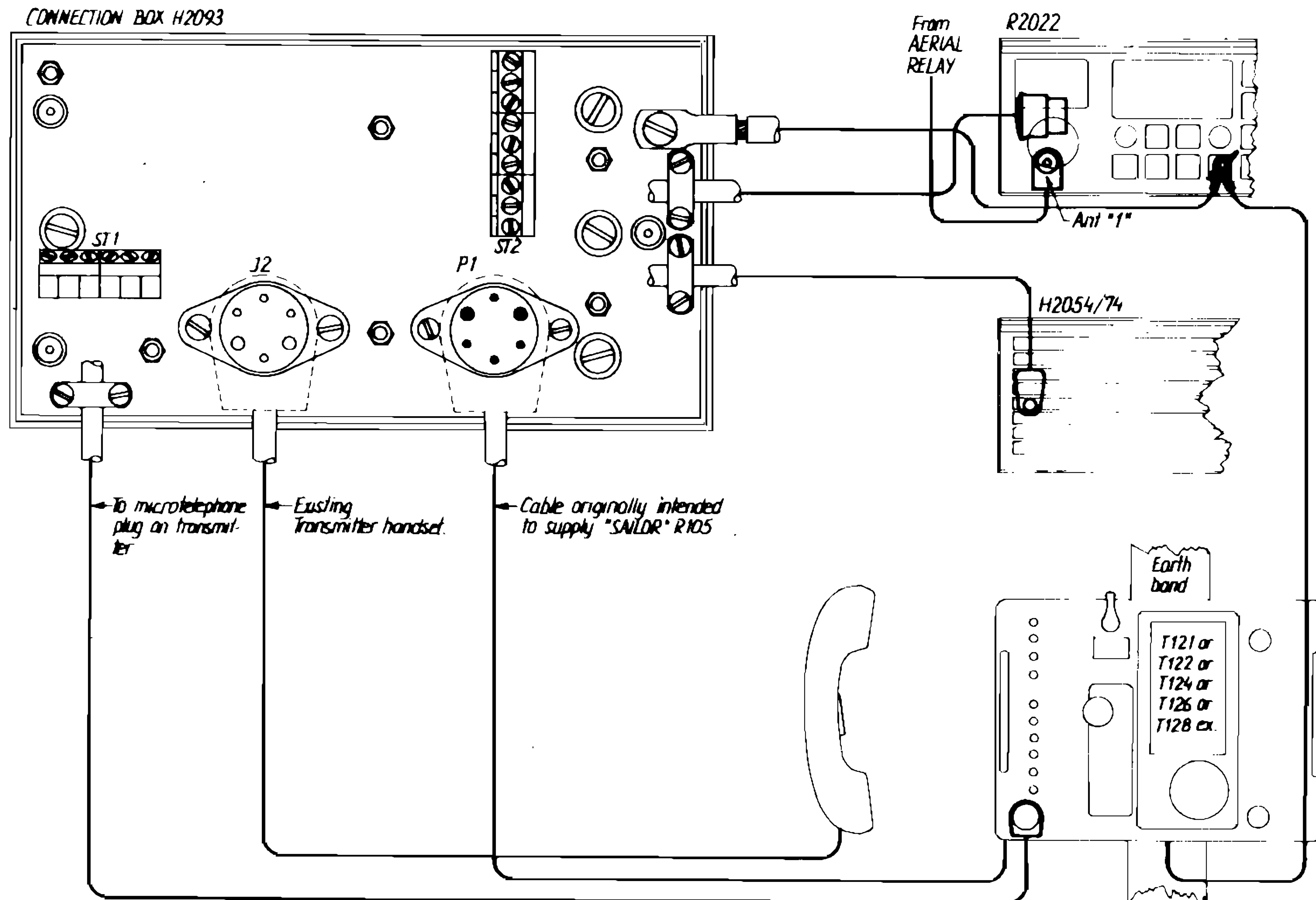
b) Test alarm function is carried out in the following way:  
1) Press a digit on the receiver keyboard to avoid AF signal from the receiver in the handset.  
2) Activate test alarm function on the transmitter, and the alarm signal is now heard in the handset.

**NOTE!** The procedures 1) and 2) are not to be followed if send alarm function is activated on the transmitter. In that case the receiver is automatically muted.

c) Earpiece level is adjusted through potentiometer R15 located on H2093 PCB.

## 2.6.1. ELECTRICAL CONNECTIONS OF R2022 AND T12X

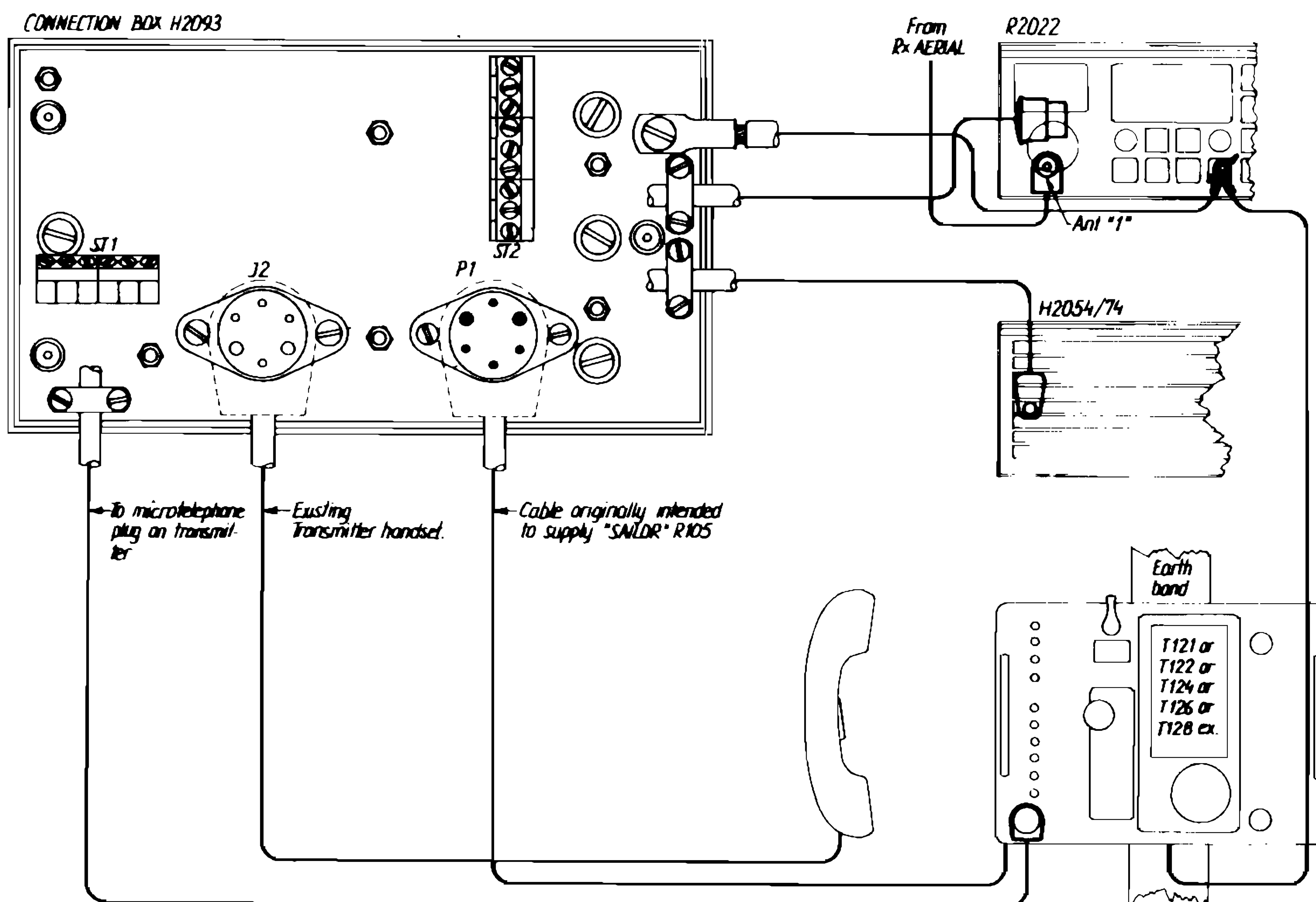
### SIMPLEX



#### NOTE!

The receiver must be programmed for one aerial simplex installation. Look-up the section 2.5. AERIAL TUNE-UP PROCEDURE.

### ONE AERIAL DUPLEX



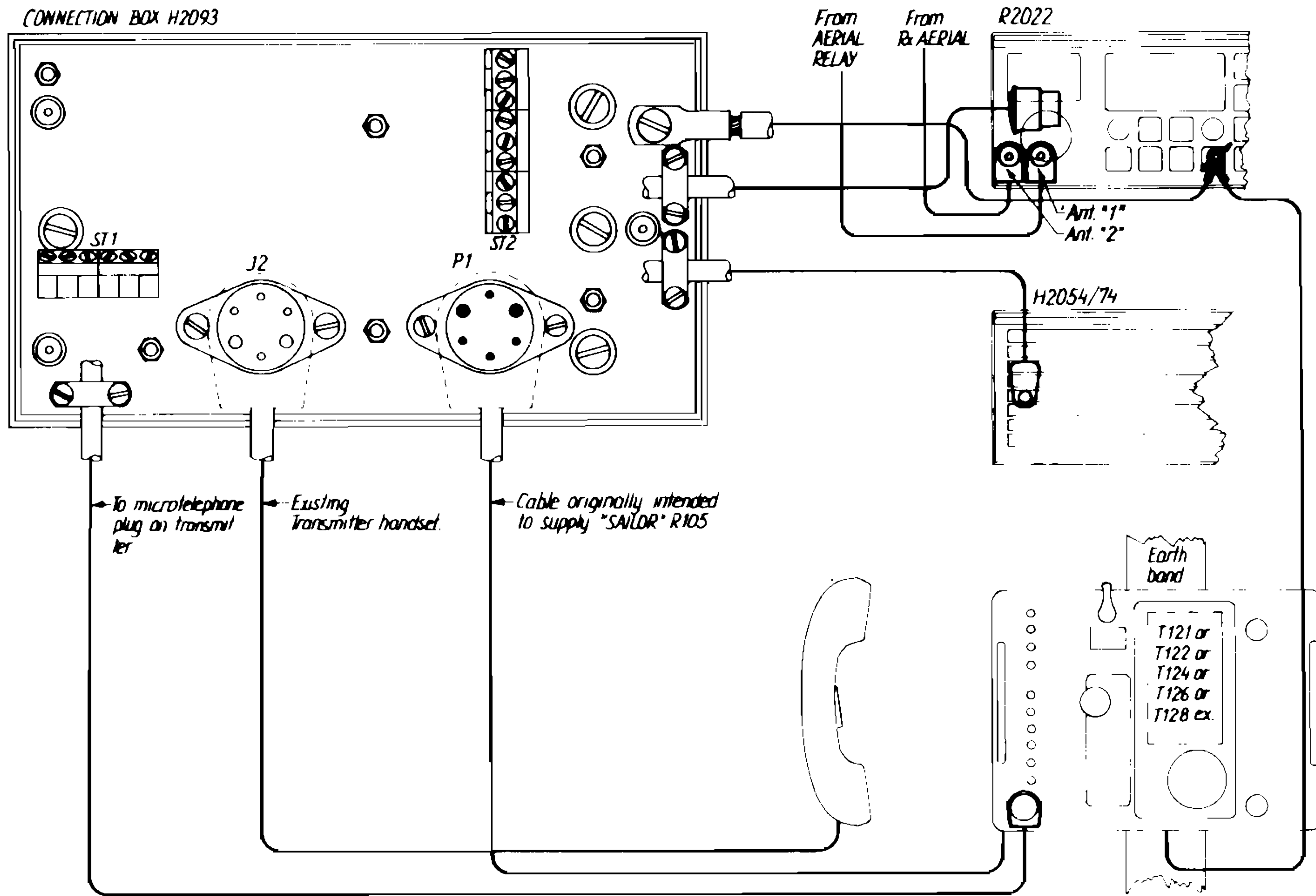
#### NOTE!

The receiver must be programmed for one aerial duplex installation. Look-up the section 2.5. AERIAL TUNE-UP PROCEDURE.



## 2.6.1. ELECTRICAL CONNECTIONS OF R2022 AND T12X cont.:

### TWO AERIAL DUPLEX

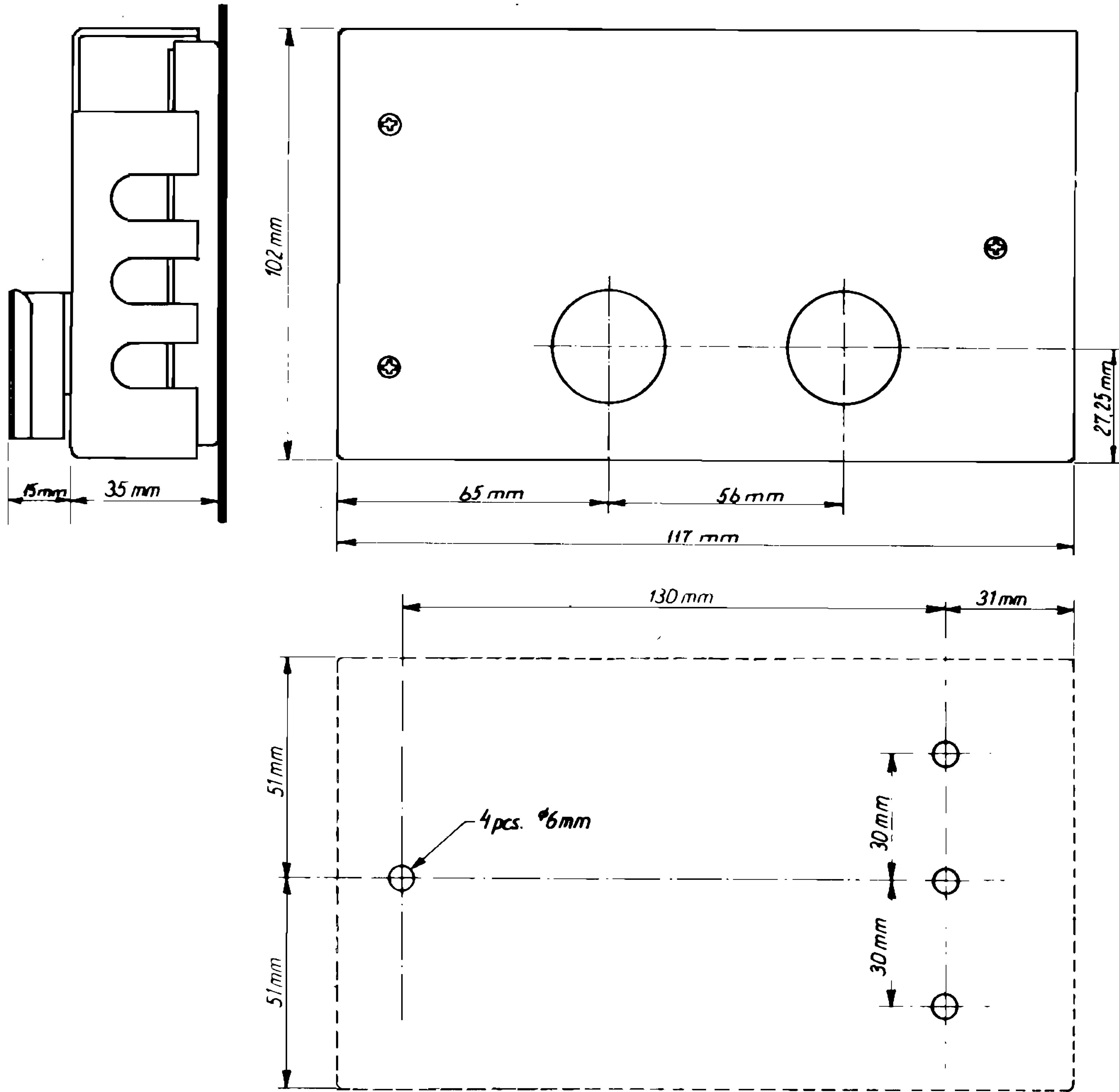


#### NOTE!

The receiver must be programmed for two aerial duplex installation. Look-up the section 2.5. AERIAL TUNE-UP PROCEDURE.

# 2.6.2. DIMENSIONS AND DRILLING PLAN FOR H2093

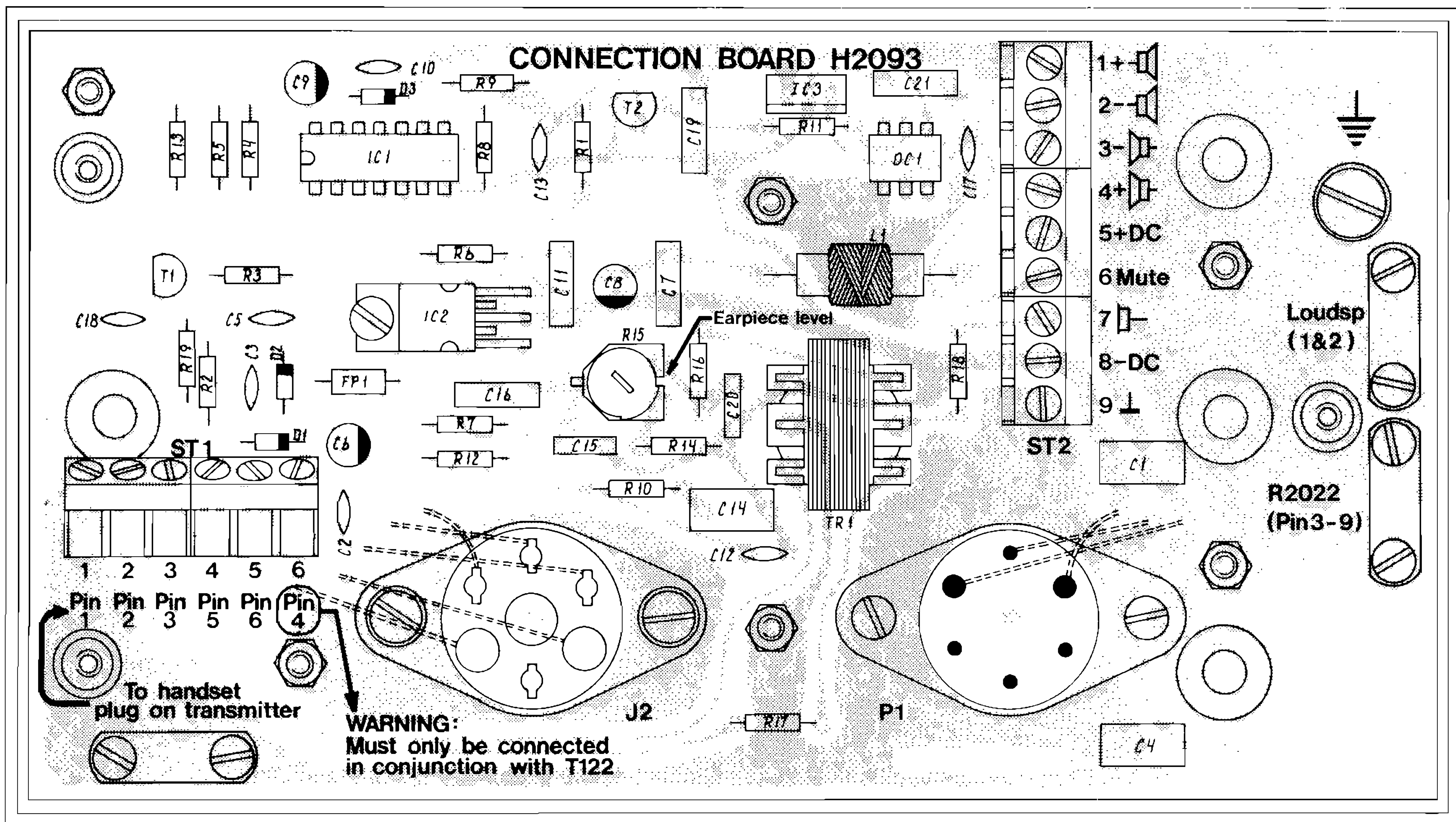
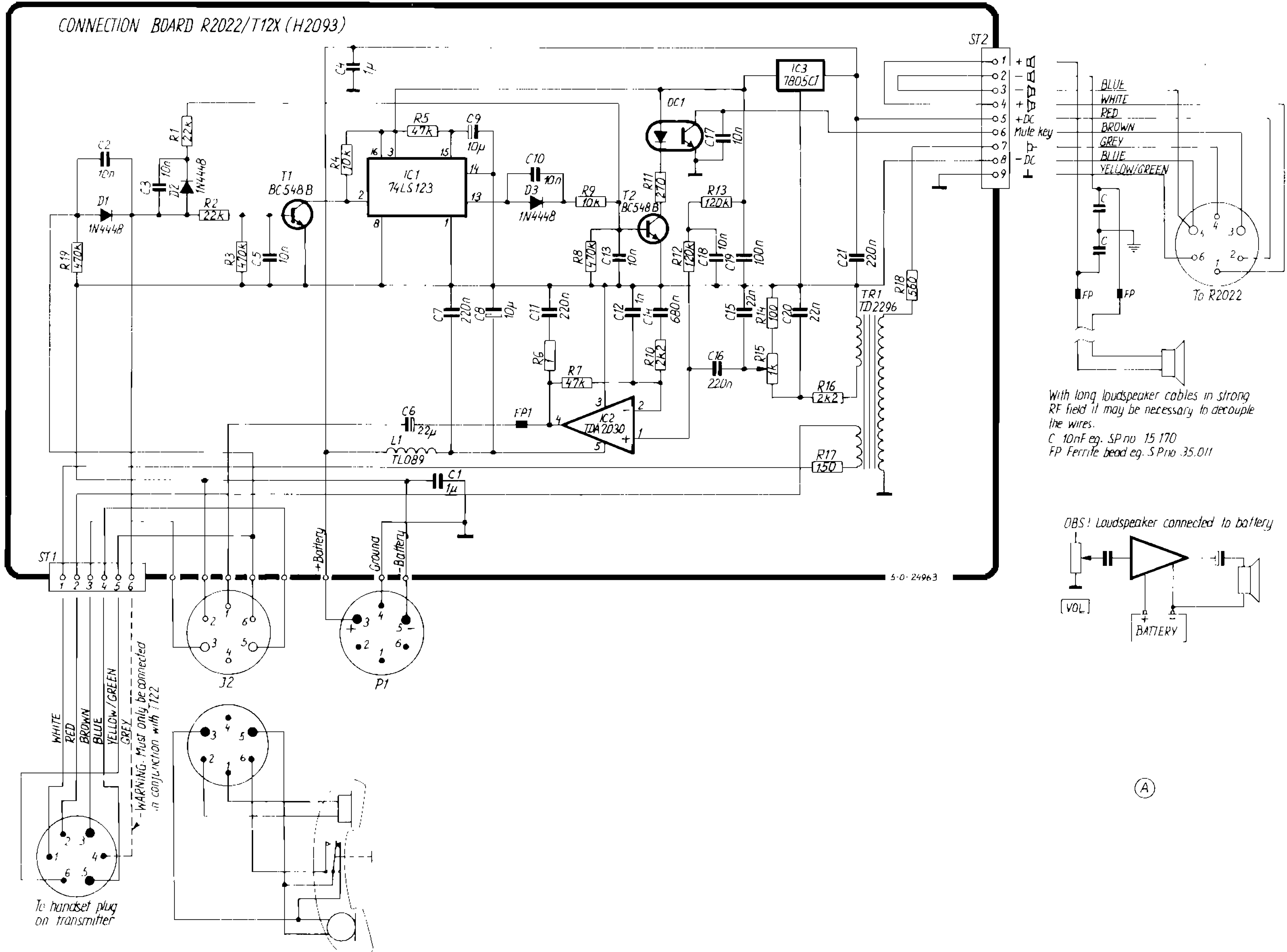
## CONNECTION BOX H2093



R2022A H2093A  
4-0-24990

## 2.6.2. DIMENSIONS AND DRILLING PLAN FOR H2093 cont.:

### DIAGRAM AND COMPONENT LOCATION H2093



View from component side with lower side tracks.

R2022B H2093B  
 4-0-24963A 4-6-24963A

## CONTENTS

- 3. SERVICE
- 3.1. MAINTENANCE
- 3.2. NECESSARY TEST EQUIPMENT
- 3.3. TROUBLE SHOOTING
- 3.4. PERFORMANCE CHECK
- 3.5. ADJUSTMENT PROCEDURE
- 3.6. NECESSARY ADJUSTMENT AND CHECK AFTER REPAIR
- 3.7. FUNCTION CHECK
- 3.8. PIN CONFIGURATIONS
- 3.9. ADJUSTMENT, TEST POINT & MODULE LOCATIONS

### 3. SERVICE

#### 3.1. MAINTENANCE

##### **PREVENTIVE MAINTENANCE**

When the receiver R2022 has been correctly installed, the maintenance can, dependent on the environments and working hours, be reduced to a performance check at the service workshop at intervals, not exceeding 5 years. A complete performance check list is enclosed in the section 3.4. PERFORMANCE CHECK.

Also inspect the antennas, cables, and plugs for mechanical defects, salt deposits, corrosion, and any foreign bodies.

Along with each set, a TEST SHEET is delivered, in which some of the measurings made at the factory are listed. If the PERFORMANCE CHECK does not show the same values as those on the TEST SHEET, the set *must be* adjusted as described in section 3.5. ADJUSTMENT PROCEDURE.

Any repair of the set should be followed by a FUNCTION CHECK.

## 3.2. NECESSARY TEST EQUIPMENT

### OSCILLOSCOPE:

Bandwidth	DC - 35 MHz
Sensitivity	2 mV/cm
Output impedance	1 Mohm//20 pF
E.g. Philips type	PM3216

### PASSIVE PROBE:

Attenuator	20 dB
Input impedance	10 Mohm//15 pF
Compensation range	10 - 30 pF
E.g. Philips type	PM8925

### MULTIMETER:

Sensitivity DC (f.s.d.)	100 mV
Input impedance	10 Mohm
Accuracy DC (f.s.d.)	1.5%
E.g. Philips type	PM2505

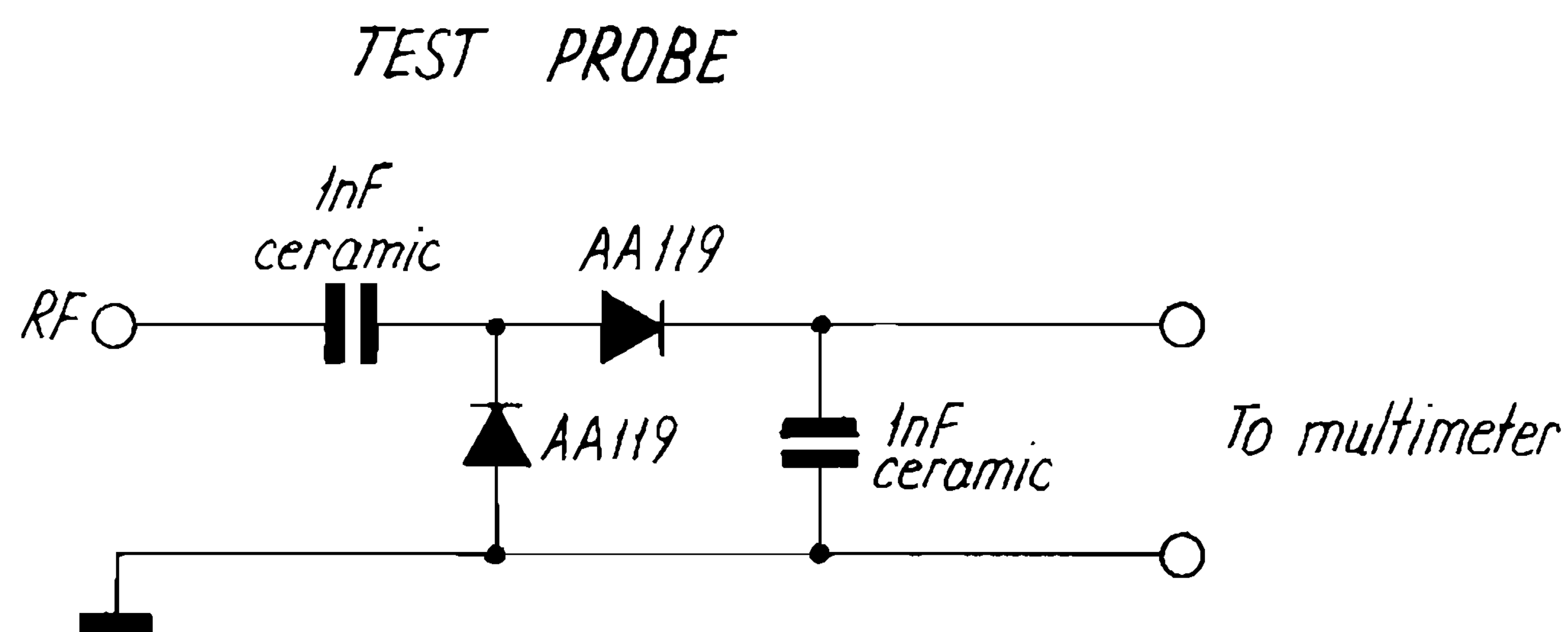
### FREQUENCY COUNTER:

Frequency range	100 Hz - 65.0 MHz
Resolution:	1 Hz at $f = 10$ MHz
Accuracy:	$1 \times 10^{-6}$
Sensitivity:	100 mV RMS
Input impedance:	1 Mohm/25 pF
E.g. Philips	PM6667/02

### SIGNAL GENERATOR:

Frequency range:	140 - 4500 kHz, 87 MHz - 108 MHz
Output voltage:	0 dB/uV - 113 dB/uV
Output impedance:	50 ohm
Type of modulation:	AM, FM
Modulation frequency:	1 kHz
E.g. Marconi type	2019

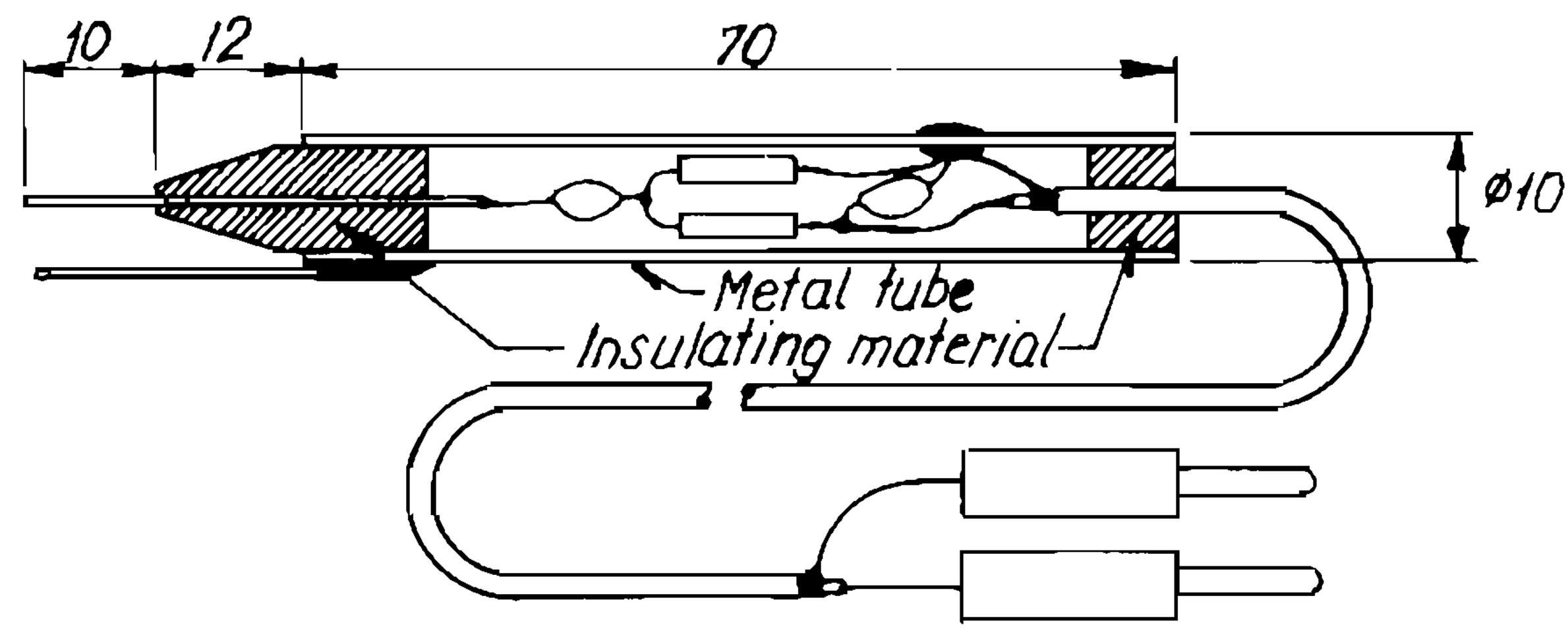
### DIODE PROBE:





3.2. NECESSARY TEST EQUIPMENT cont.:

LAYOUT OF THE PROBE:



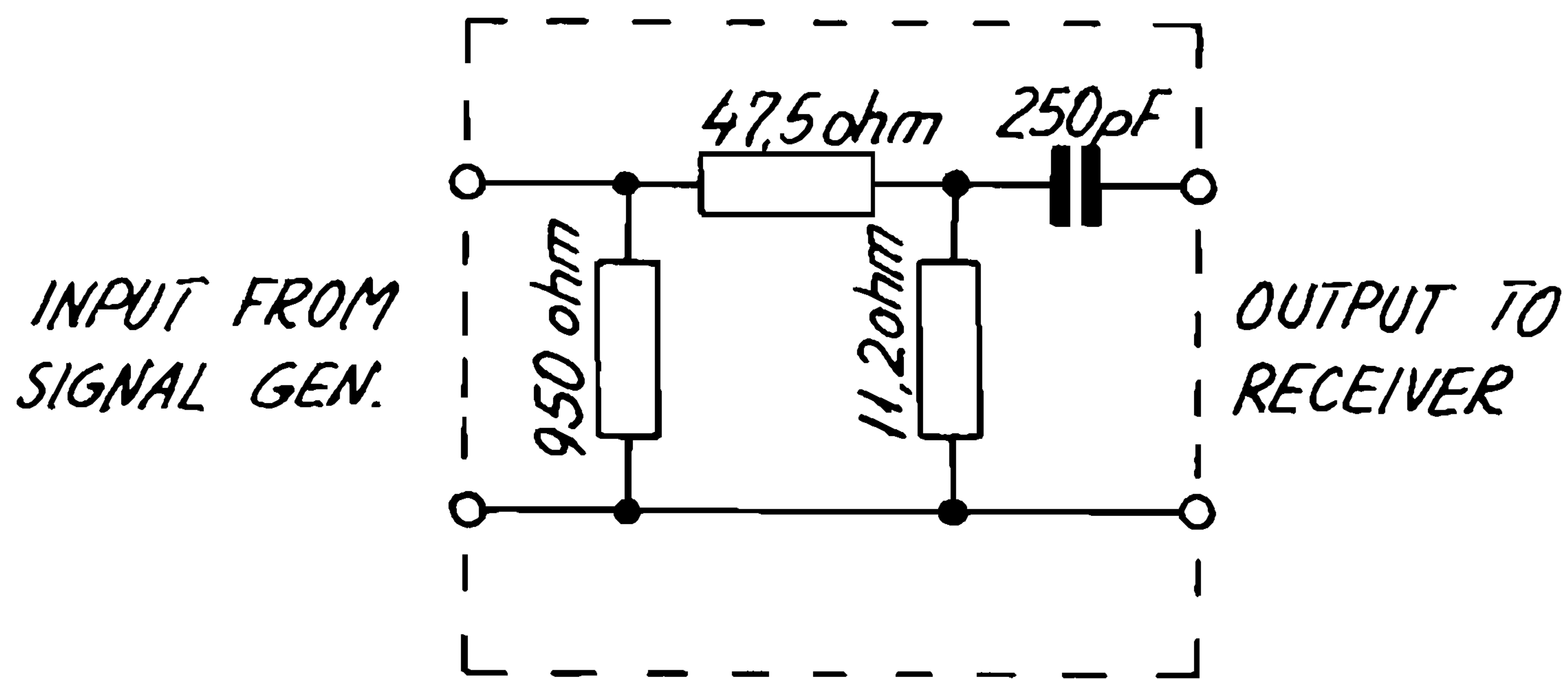
POWER SUPPLY:

$V_{out}$	10-32V DC
$I_{out}$	3.0 Amp.
E.g. Elcanic type	3010

DUMMY LOADS:

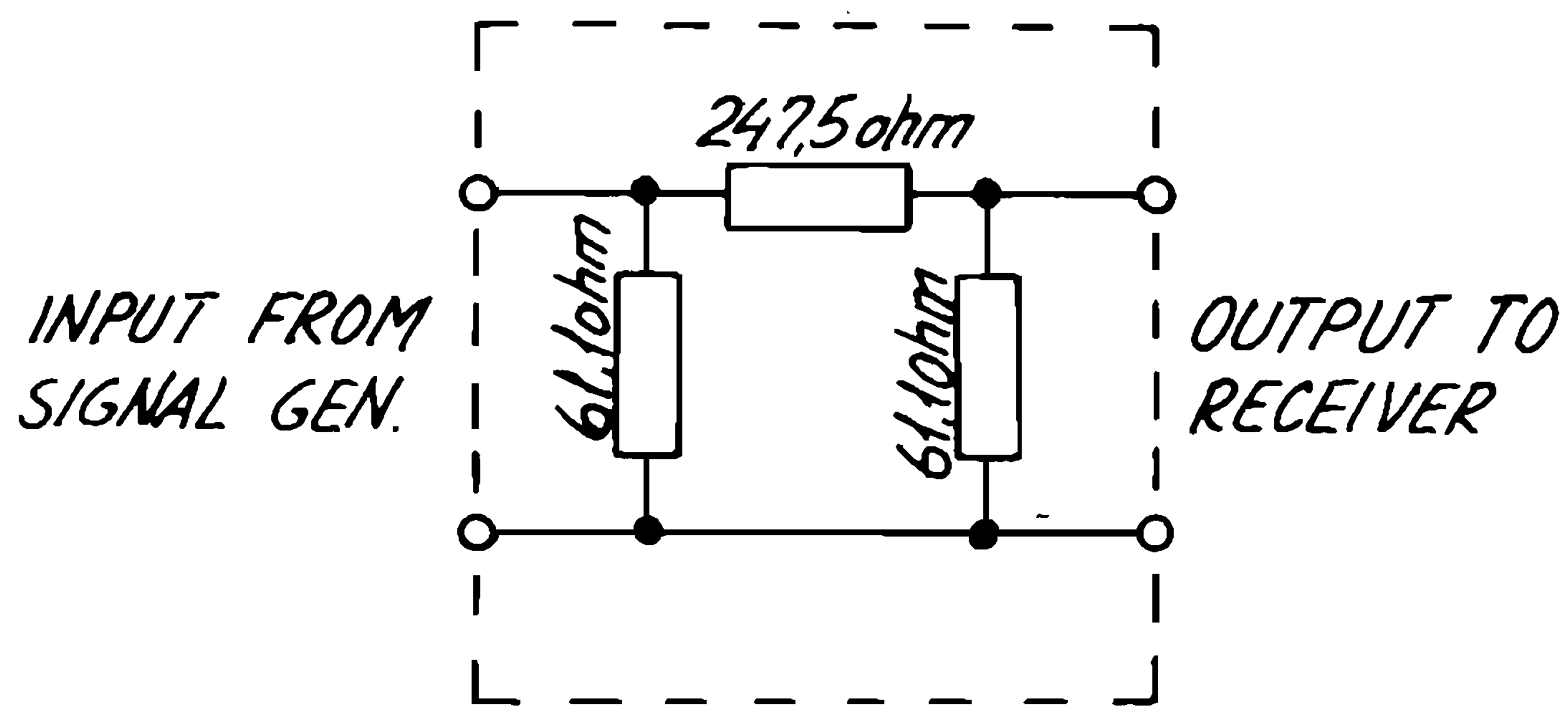
50 ohm -> 10 ohm/250 pF:

EMF-loss 20 dB



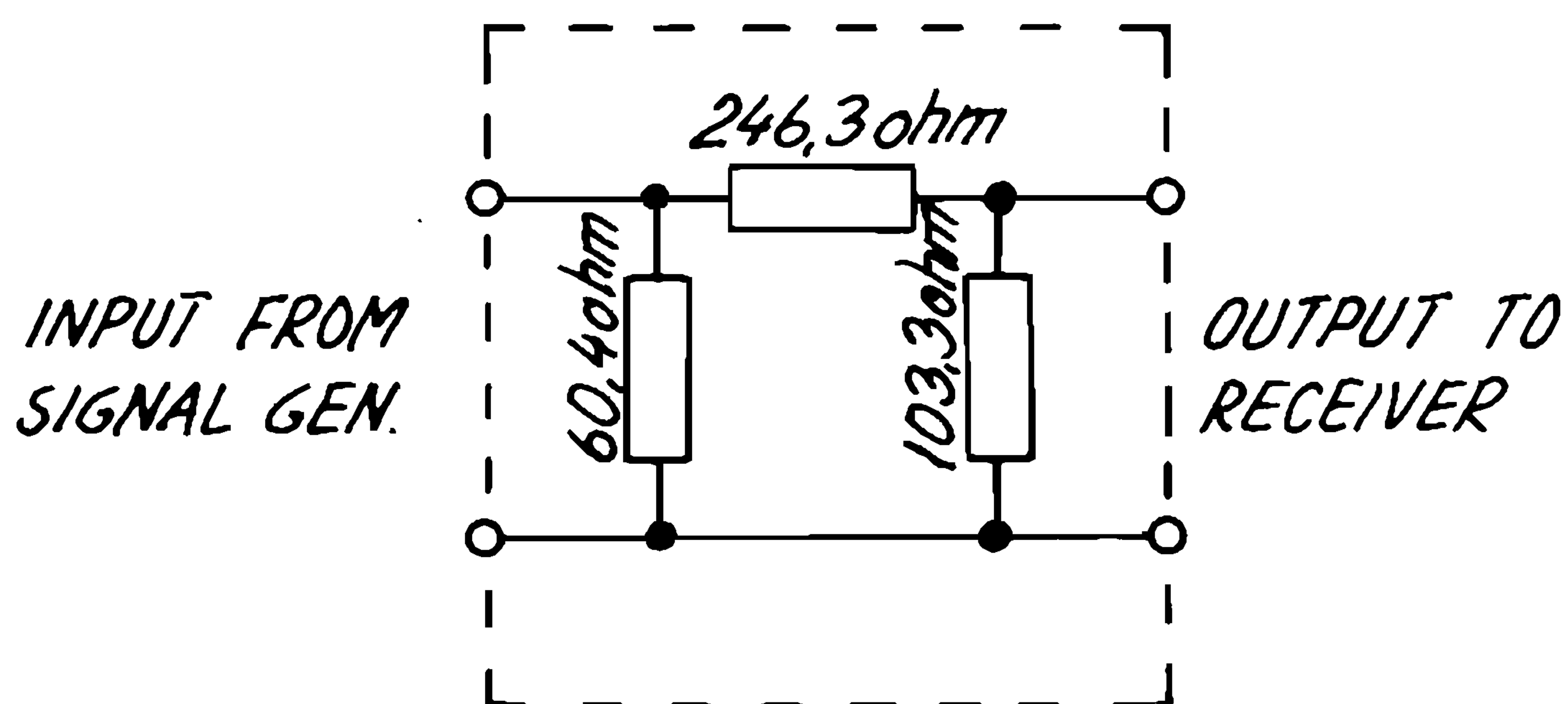
50 ohm -> 50 ohm:

EMF-loss 20 dB



50 ohm -> 75 ohm:

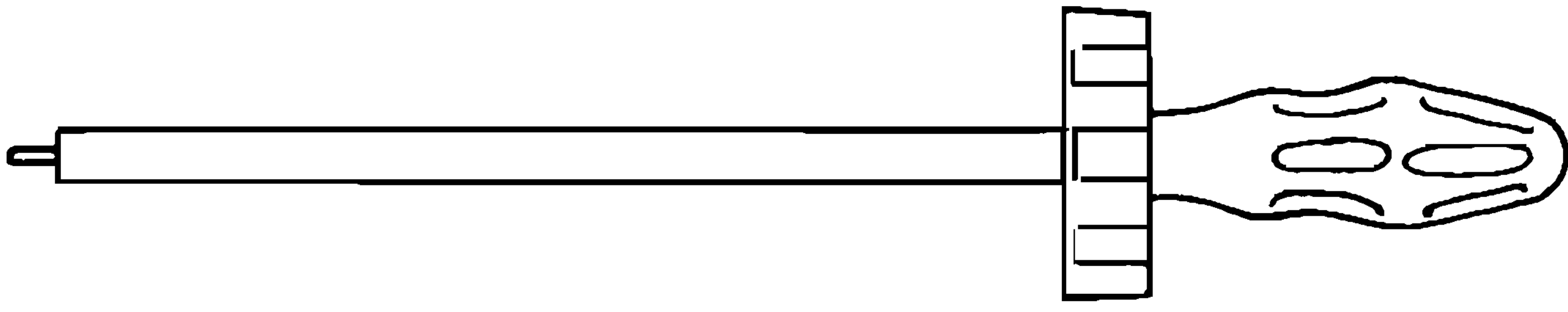
EMF-loss 20 dB



R2022A  
4-0-25079

3.2. NECESSARY TEST EQUIPMENT cont.:

ADDITIONAL TEST EQUIPMENT FOR ADJUSTMENT OF DUPLEX FILTER:



700931

### 3.3. TROUBLE SHOOTING

Trouble shooting, repair, and check of SAILOR R2022 should only be performed by persons with the sufficient technical knowledge, who have the necessary test equipment at their disposal and who have studied the operation principles and structure of the receiver carefully.

Start any trouble shooting procedure by investigating whether the fault in receiver function could be caused either by an incorrect installation or a failure in the external equipment connected to the receiver.

If it turns out that the failure has to be found in the receiver, read the section 1.4. PRINCIPLE OF OPERATION and try to locate the failure to one of the six modules in the receiver. Relevant parts of the receiver performance check might help to incircle the fault.

Then read section 5. CIRCUIT DESCRIPTION where it is explained how each single module works in principle.

This description is accompanied by a component location diagram together with an electrical diagram where typical values of the DC and AC-voltages and where they are measured, are indicated.

In the section 3.5. ADJUSTMENT PROCEDURE it is explained how to adjust the main part of the adjustable components in the receiver.

After repair or replacement of a module, look-up the section 3.6. NECESSARY ADJUSTMENT AFTER REPAIR, to see whether a unit has to be adjusted or not.

After repair, the receiver always has to have a complete function check.

**NOTE!** Some components on module 1 (L1-1, L3-1) and module 3 (L9-3, L10-3, L11-3, R44-3, R57-3) are factory adjusted and must not be touched unless the necessary test equipment for this particular adjustment is available (see section 3.2. in this manual).

### 3.4. PERFORMANCE CHECK

Before executing the performance check, remove the receiver covers (look-up the manual, section 4. MECHANICAL DISASSEMBLING).

Turn the RF amplification control fully clockwise and adjust the AF level potentiometer to approximately one third of maximum.

Connections from receiver to power supply, loudspeaker, instruments for measuring on earpiece output, and contact for supplying key message to the receiver, respectively, are made through power cable (look-up interconnection cable diagram).

The necessary test equipment for executing the performance check is described in the manual, section 3.2.

**NOTE!** Be aware that execution of performance check will cause changes to:

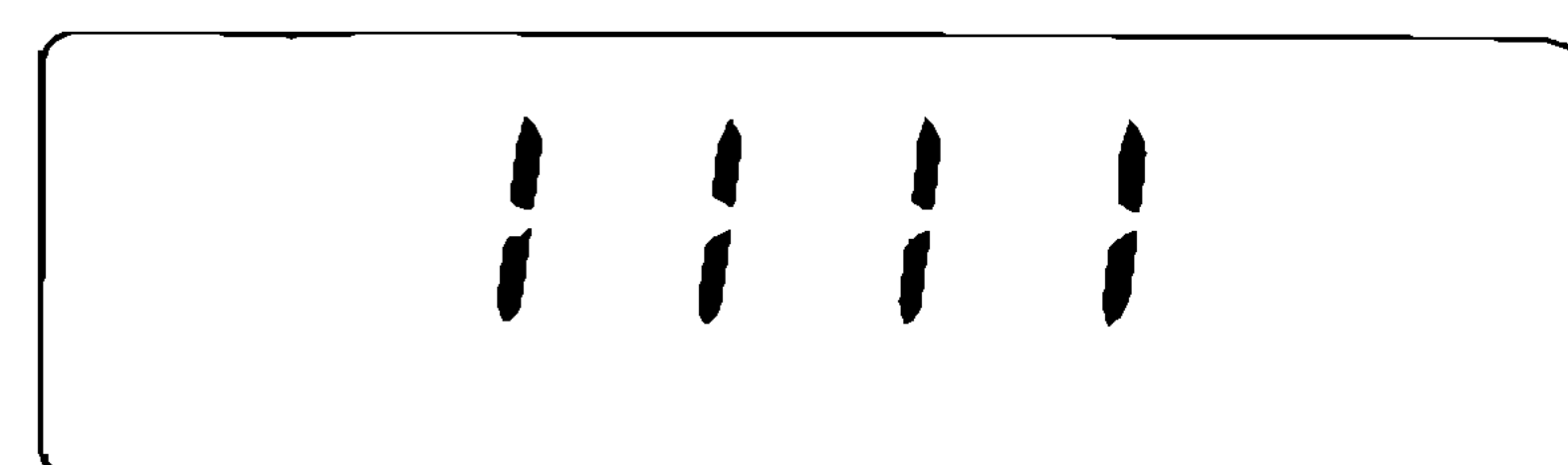
- 1) quick select file numbers 1, 32, and 64.
- 2) the contents of scanning programme 5.
- 3) trimming of the aerial trimmer C3-1  
and it might cause changes to
- 4) the programming of aerial configuration.

Especially the two items 3) and 4) have to be checked when reinstalling the equipment at the customer.

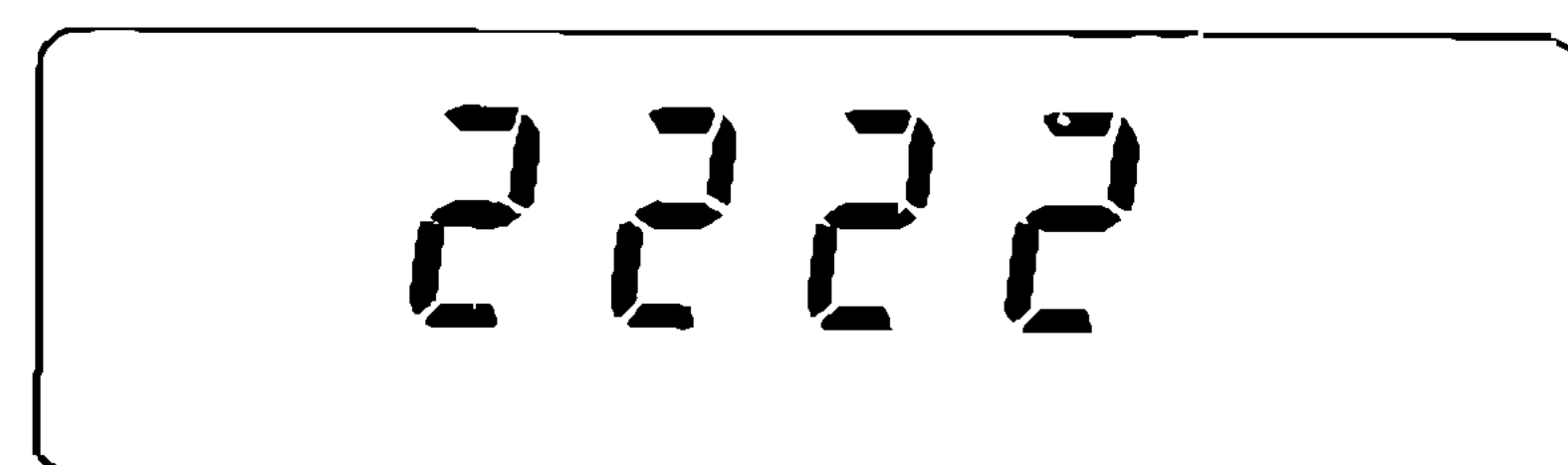
#### 3.4.1. Check of Keyboard and Display

1. Turn the receiver on by pressing
2. Press
3. Press each digit from  to

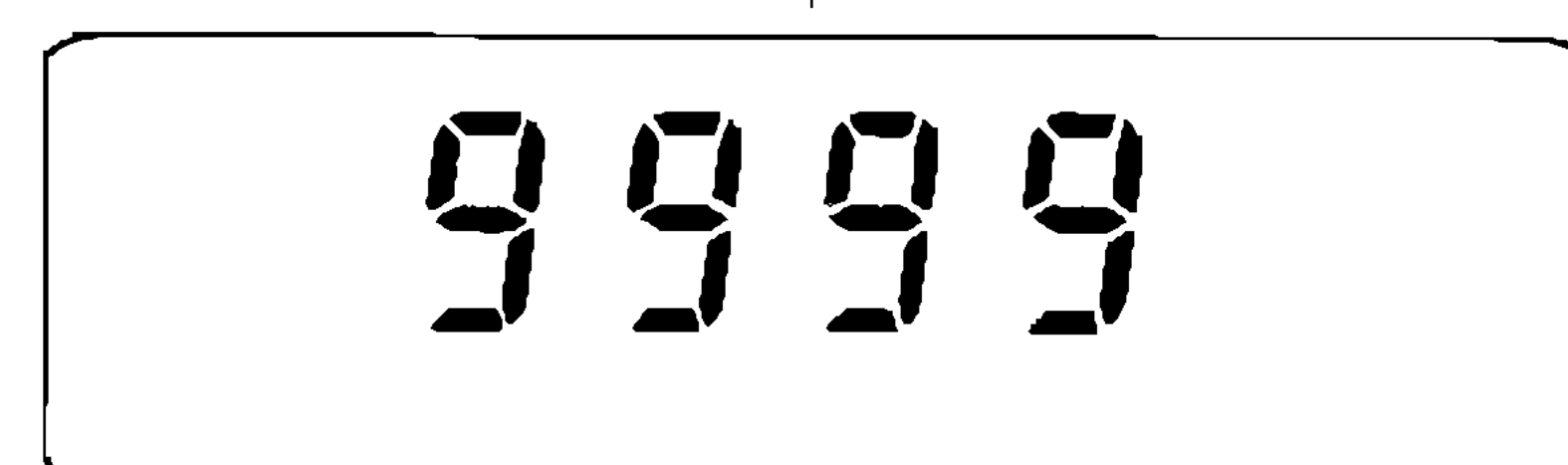
four times and observe the display read-out



1111

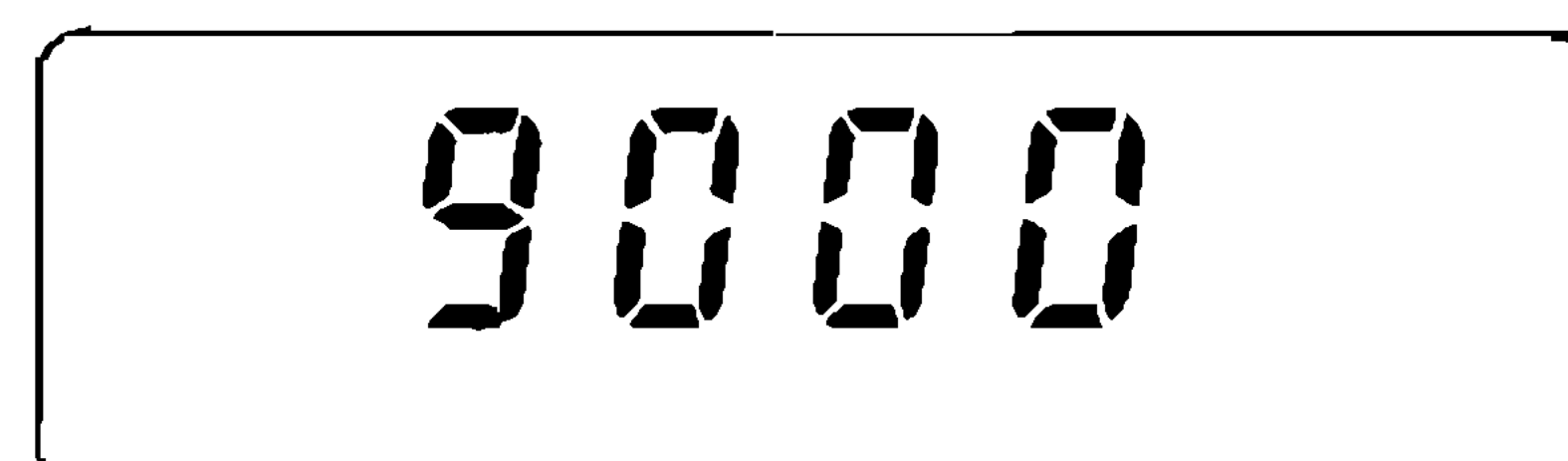


2222



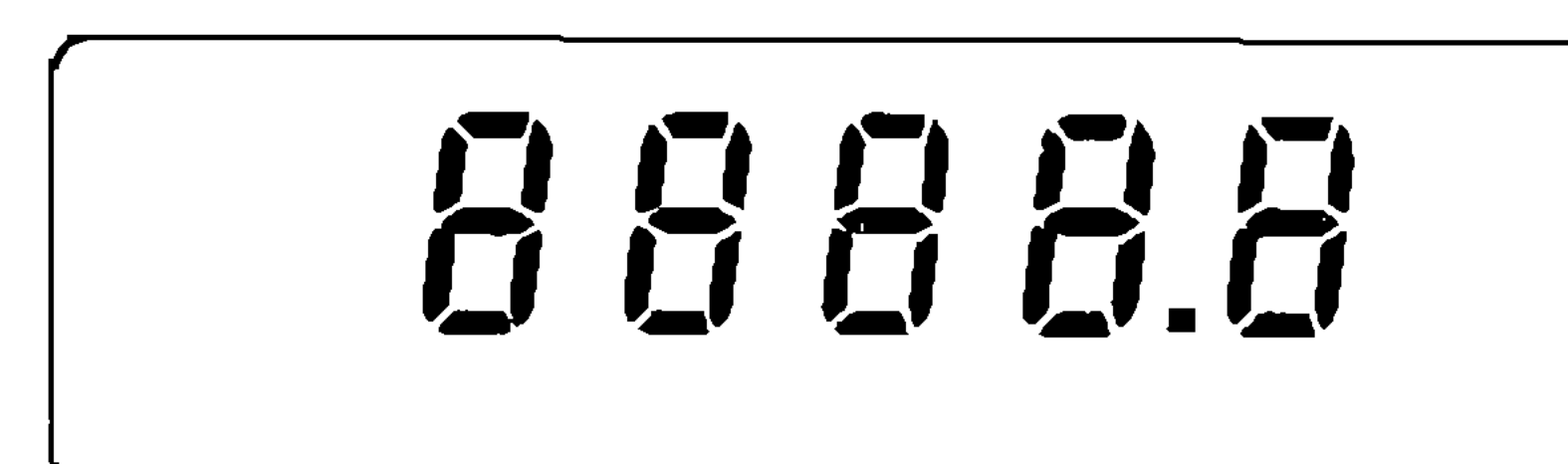
9999

4. Press the digit  three times and observe the display read-out



9000

5. Press the digit  four times, then press the point key  and digit  and . Observe the display read-out



8888.8

### 3.4.1. Check of Keyboard and Display cont.:

6. Key-in the following sequence

and observe the display read-out

FM 102.00 MHz

7. Press   and turn the tune knob clockwise and notice that the receiver frequency varies in steps of 50 kHz.

8. Press  and observe the display read-out

AM-H3E 2182.0 kHz

9. Press   and turn the tune knob clockwise until the display shows

AM-H3E 2200.0 kHz  
Tune

Notice that the receiver frequency must be varied in steps of 1 kHz.

10. Press   and turn the tune knob counter clockwise until the display shows

SSB-J3E 2182.0 kHz  
Tune

Notice that the receiver frequency must be varied in steps of 100 Hz.

11. Press   and observe the display read-out

SSB-J3E .00 kHz

12. Turn the tune knob counter clockwise until the display shows

SSB-J3E -.15 kHz

13. Turn the tune knob clockwise until the display shows

SSB-J3E .15 kHz

Notice in 3.4.1.12 and 3.4.1.13 that the receiver frequency is varied in steps of 10 Hz.

14. Press    and observe the display shows

SSB-J3E 2182.0 kHz

15. Key-in the following frequency      
 and press

SSB-J3E 1605.0 kHz

### 3.4.1. Check of Keyboard and Display cont.:

16. Key-in the following frequency      
 and press

SSB-J3E 4400.0 kHz

17. Press   and observe  
the display read-out

SSB-J3E 2182.0 kHz

18. Press    and observe  
the display read-out

SSB-J3E 1605.0 kHz

19. Press    and observe  
the display read-out

SSB-J3E 4400.0 kHz

20. Key-in scan time 1 sec. by pressing  
     and  
the read-out will be as shown

1.0

21. Press     and observe  
the display read-out. If the read-out differs  
from the one shown, execute  
the subsequent instructions.

Scan 5 no

If the read-out is as shown, jump to execute  
3.4.1.25.

22. Press

23. Press   and repeat the

instruction until the display read-out  
is as shown

Scan 5 no

24. Press

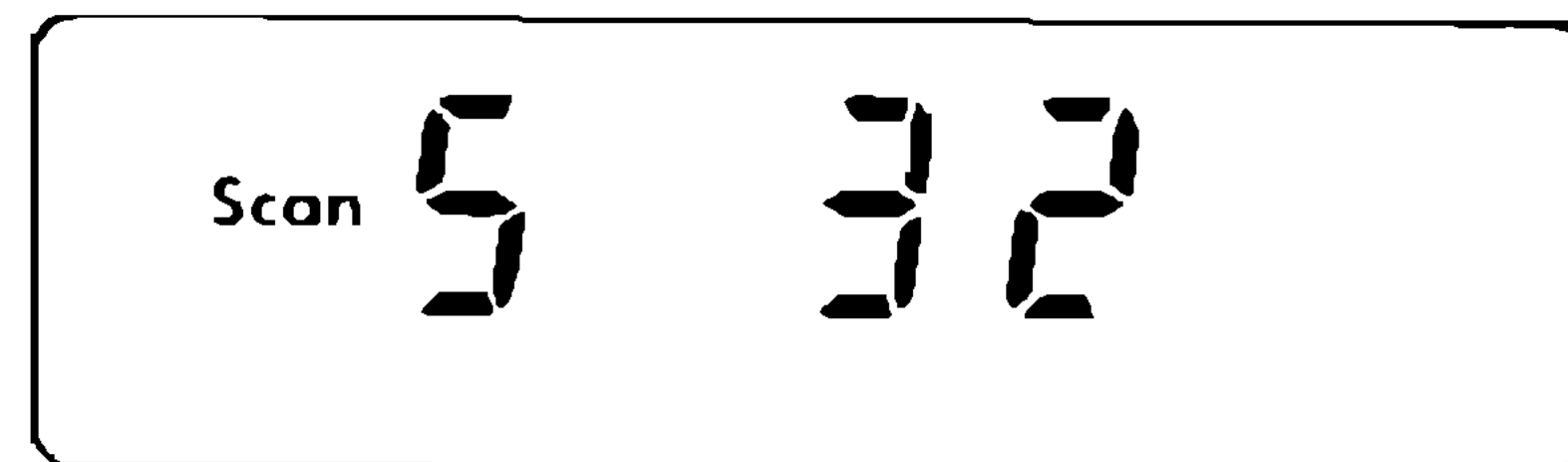
25. Press

Scan 5 1



### 3.4.1. Check of Keyboard and Display cont.:

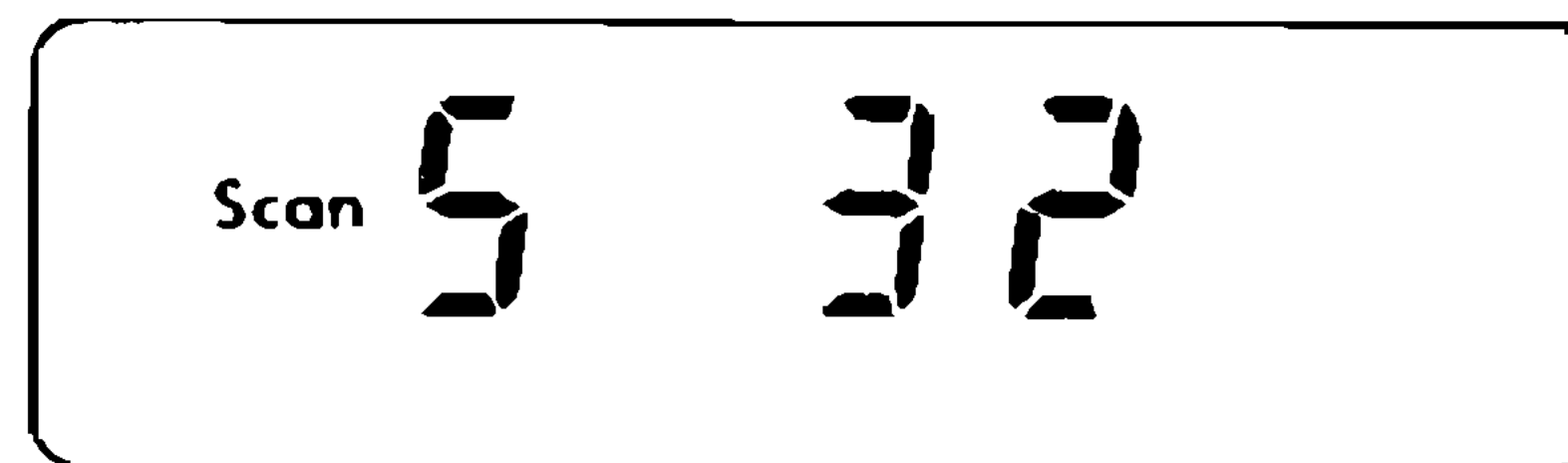
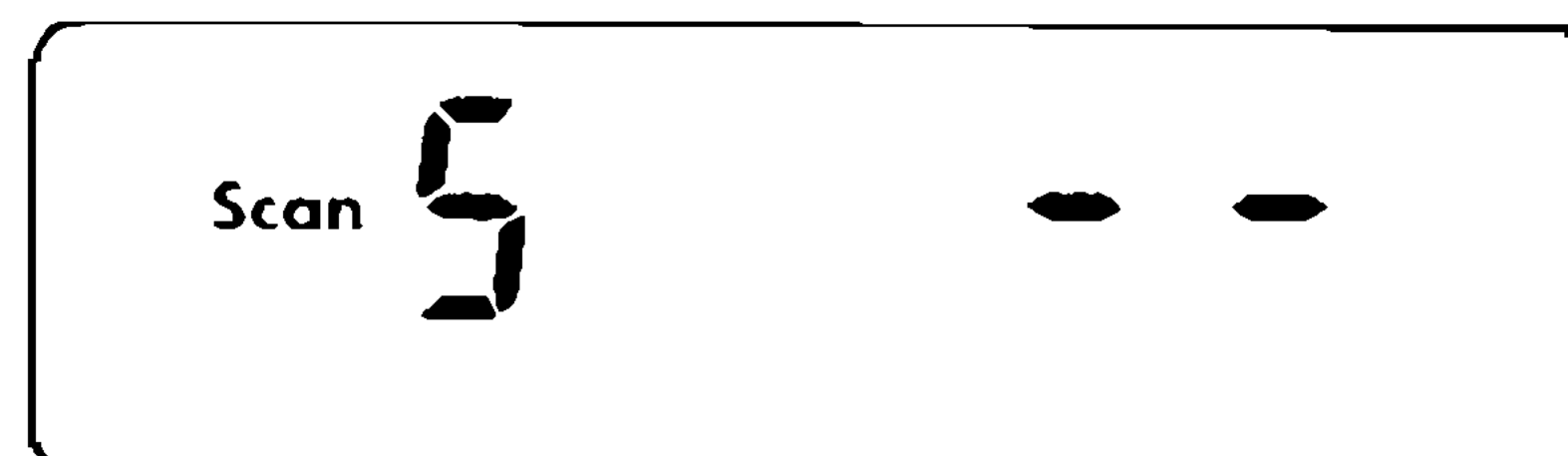
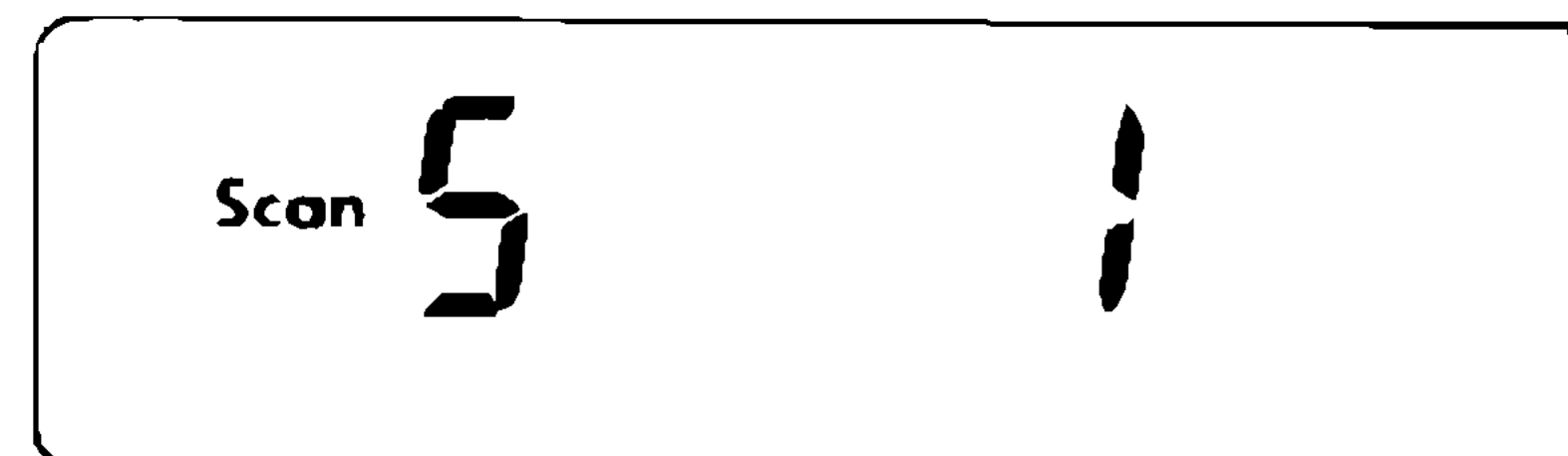
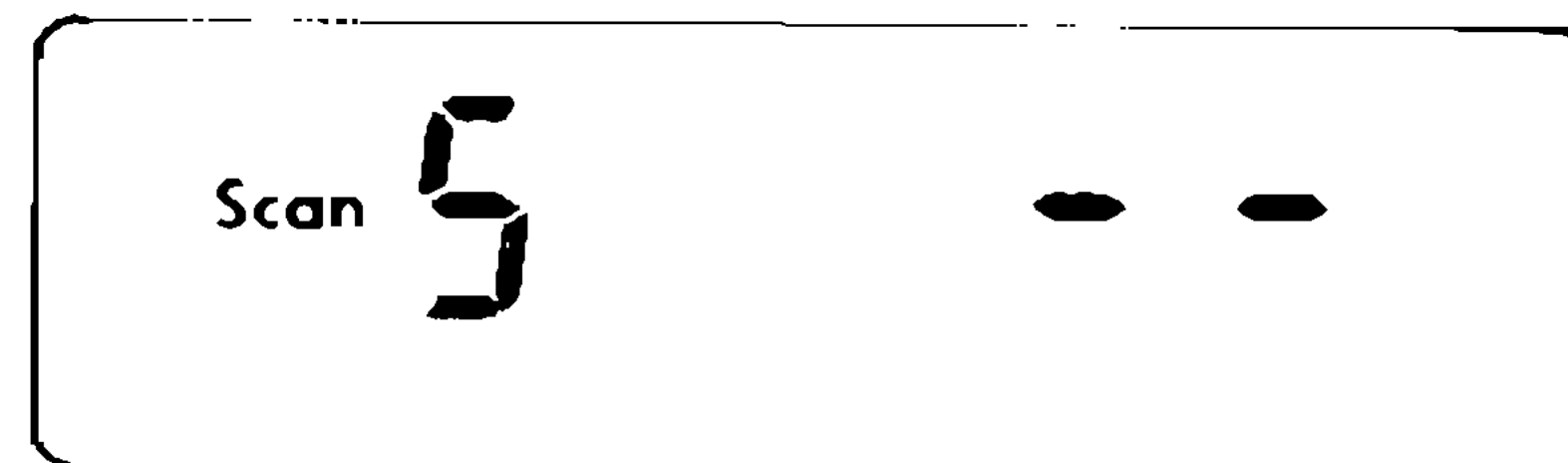
26. Press **32** **shift** **scan add**



27. Start the scanning sequence by pressing **run stop**

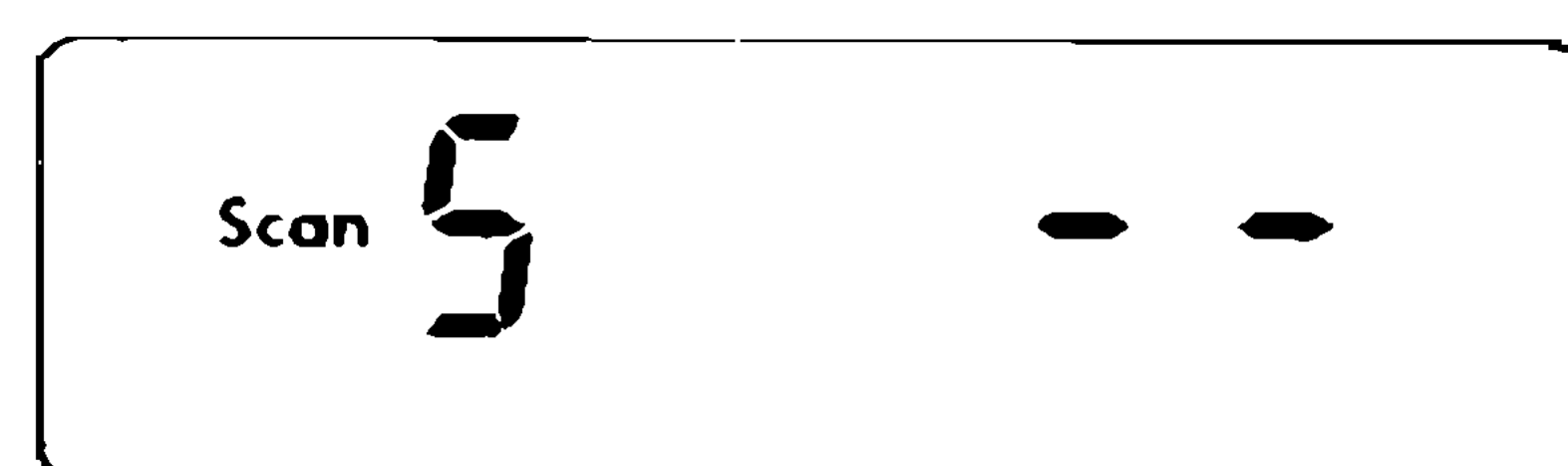
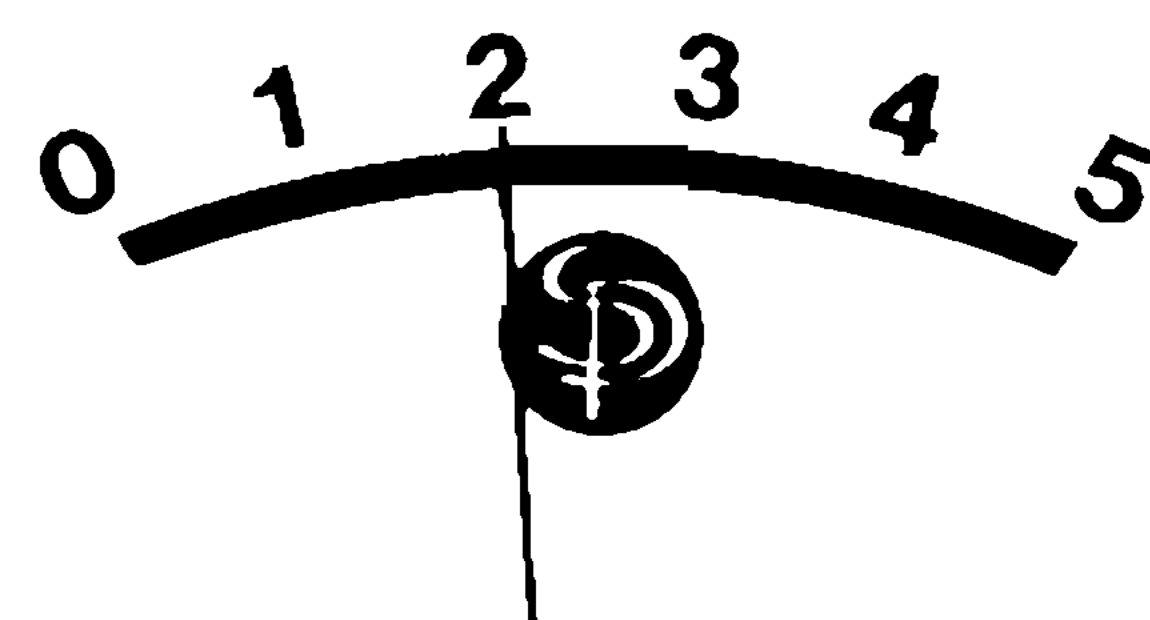
and observe that the display read-out changes as shown.

Notice that when the channel number is shown in the display the receiver is demuted.



28. Turn the RF-amplification control counter clockwise until a meter deflection of approx. 2 is reached.

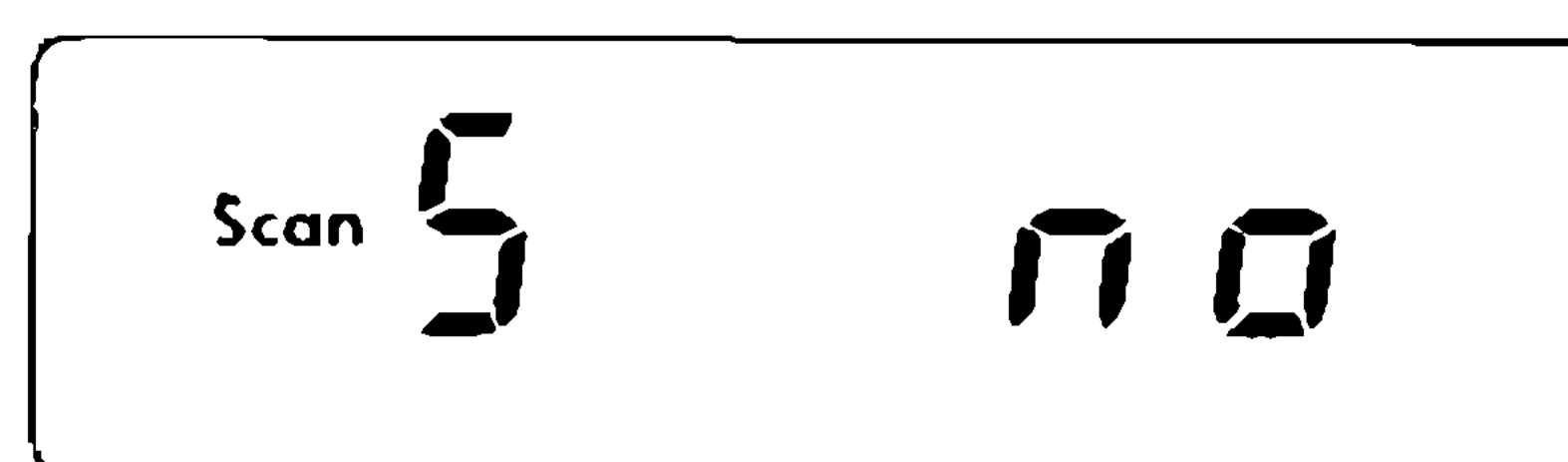
Notice that the read-out from display must be as shown and that the receiver is constantly muted.



29. Turn the RF-amplification fully clockwise and notice that the scanning sequence as described in 3.4.1.27 will start.

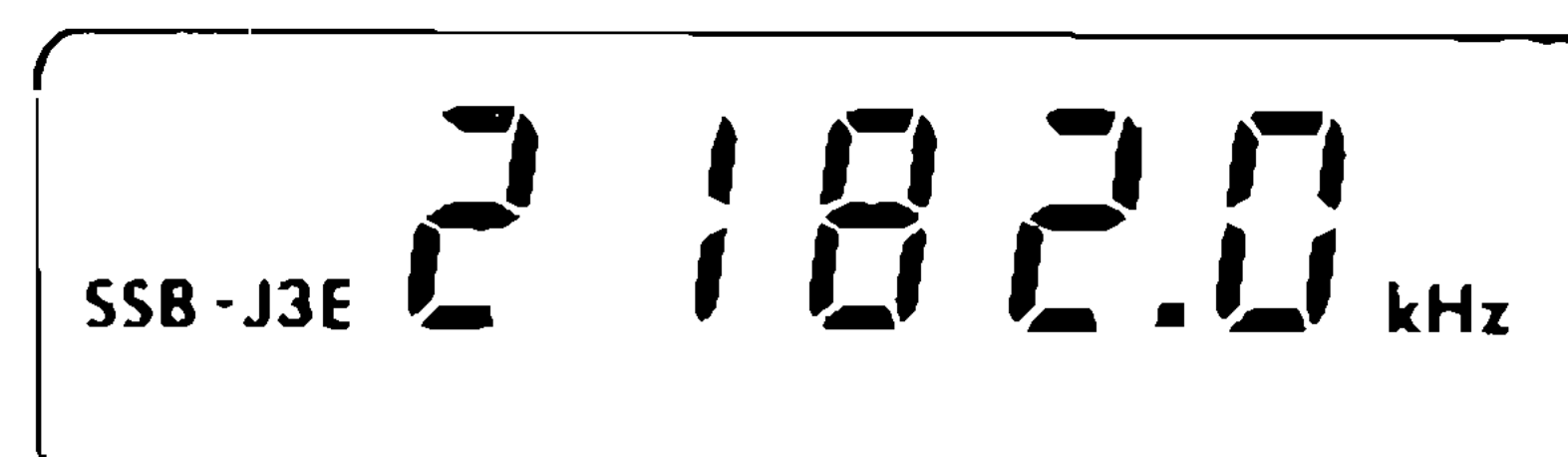
30. Stop the scanning sequence by pressing **run stop**

31. Press **shift** **scan prog** **shift** **scan delete** **shift** and **scan delete** and the display read-out will be as shown



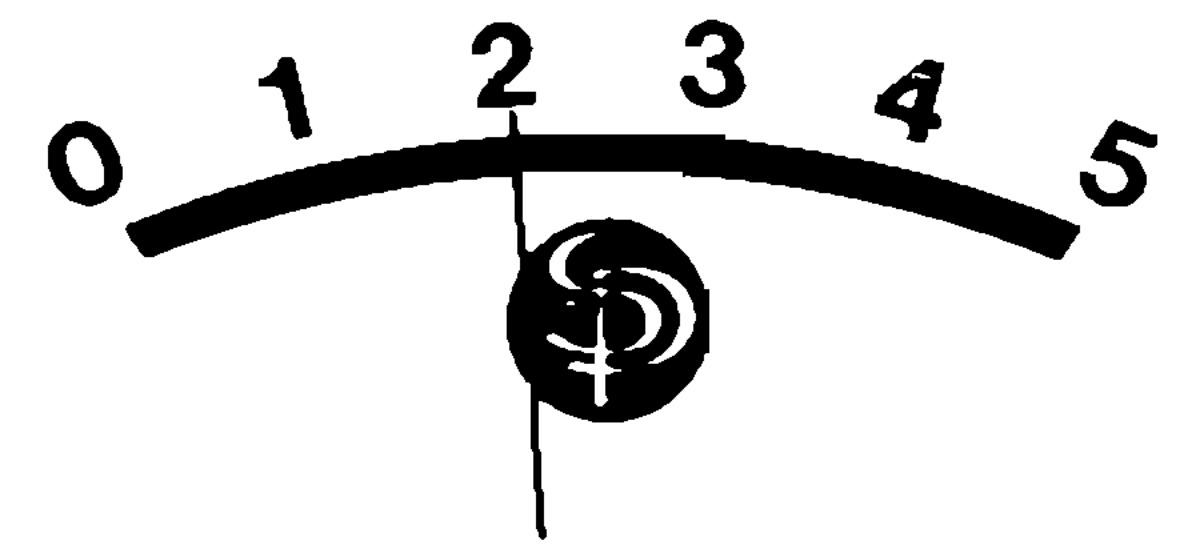
32. Press **shift** **scan** **5** **ENT** and the scanning sequence will start as described in 3.4.1.27.

33. To get out of the scanning mode press **1** **ENT** and observe the display read-out



### 3.4.1. Check of Keyboard and Display cont.:

34. To check the mute function press **shift** **mute** and turn the RF-amplification control counter clockwise until a meter deflection of approx. 2 is reached. The receiver will then be muted.



SSB-J3E 2 182.0 kHz Mute

35. Press **shift** **mute** and check that the receiver is demuted.

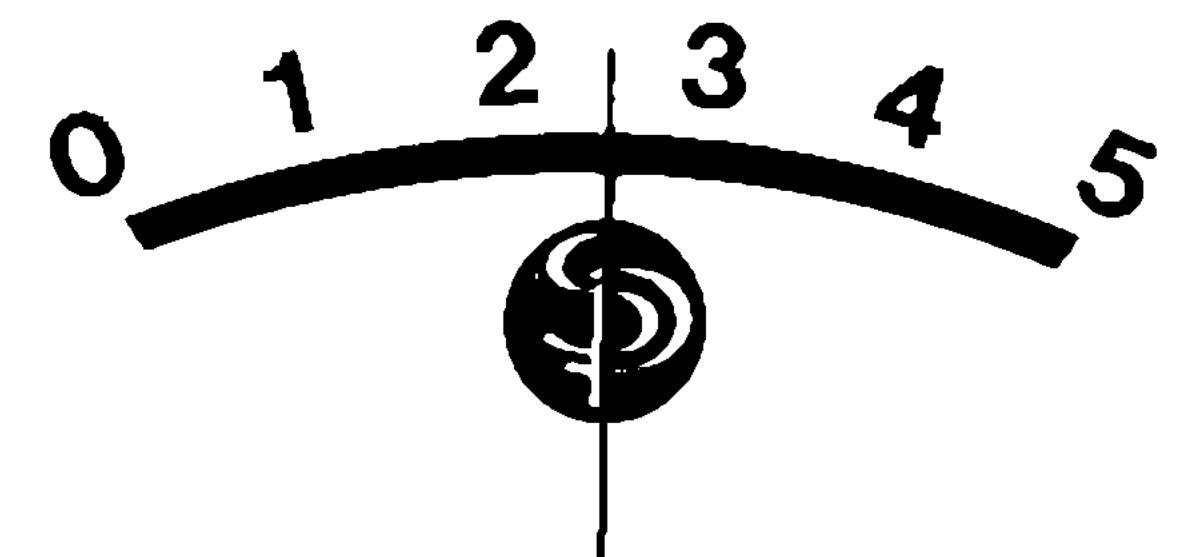
36. Turn the RF-amplification control fully clockwise and press **shift** **AGC**.  
Observe the display read-out and notice that white noise level from the receiver is increased.

SSB-J3E 2 182.0 kHz AGC off

37. Press **shift** **AGC** to turn the AGC into operation again.

38. To check the dimmer function, press **shift** **dim** and observe that panel illumination is turned off.  
To turn it on again, press **shift** **dim**.

39. To check the noise generator, press the tune knob and adjust for max. meter deflection.  
An increase of noise in loudspeaker must be heard and max. meter deflection must be above 2.5.



40. Press the tune knob and keep it activated while pressing **shift** **store**.  
Then release the tune knob.

41. The display read-out will then be as shown

2Adv0

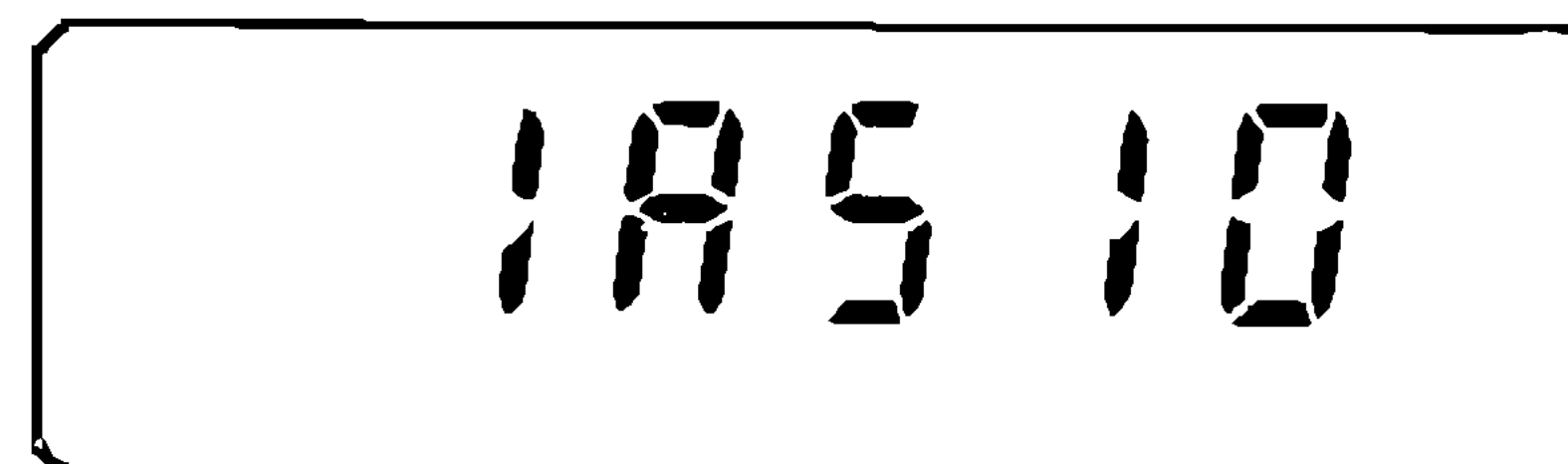
2Adv1

42. Press **shift** **shift** **store** and observe the read-out

SSB-J3E 2 182.0 kHz

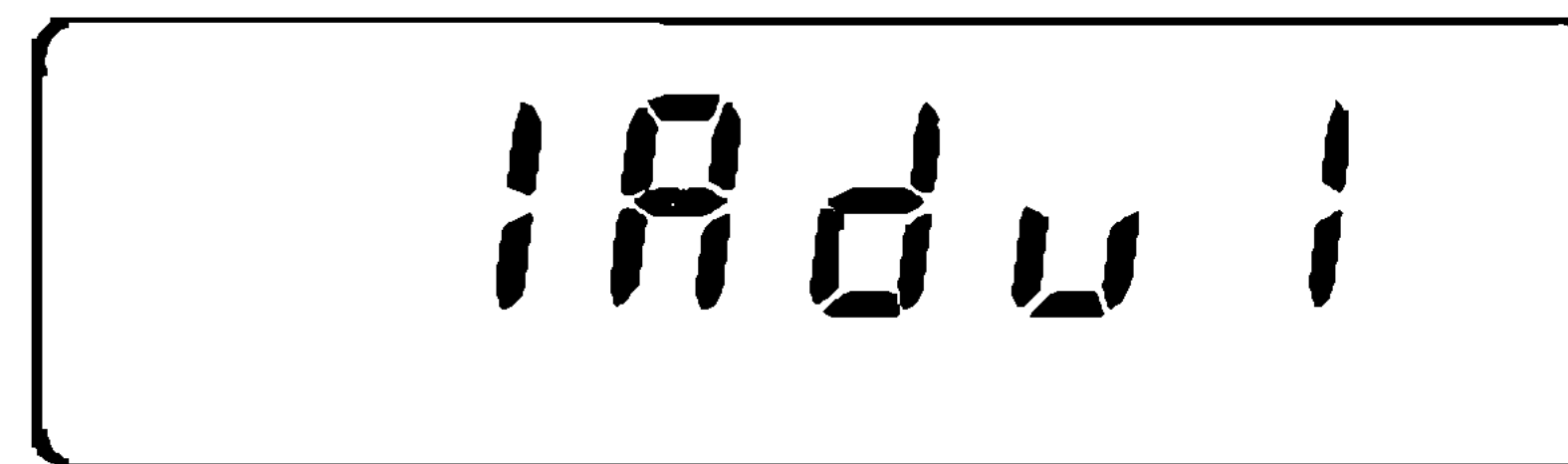
### 3.4.1. Check of Keyboard and Display cont.:

43. Execute 3.4.1.40 and press **shift**.  
Observe the read-out



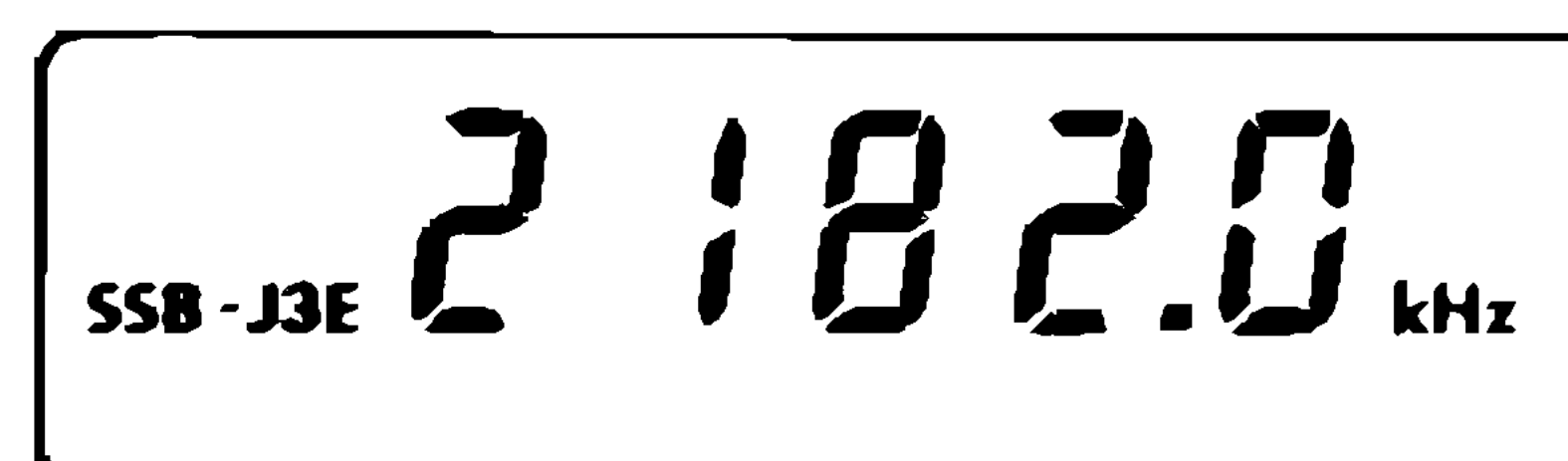
1A5 10

44. Press **shift** and observe the read-out



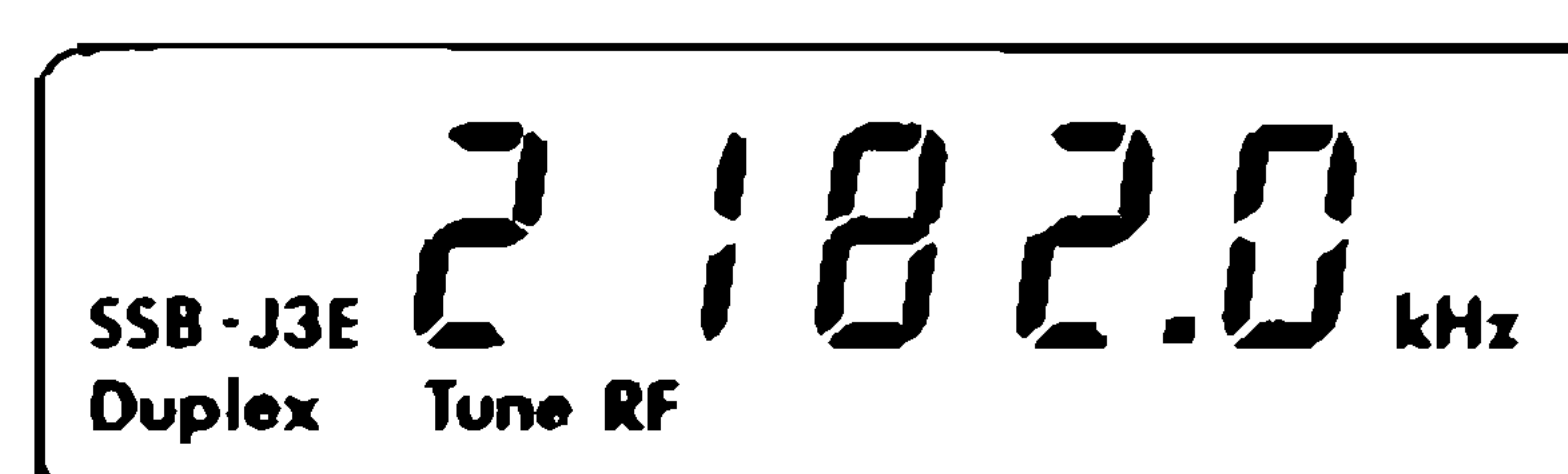
1Adu 1

45. Press **store**



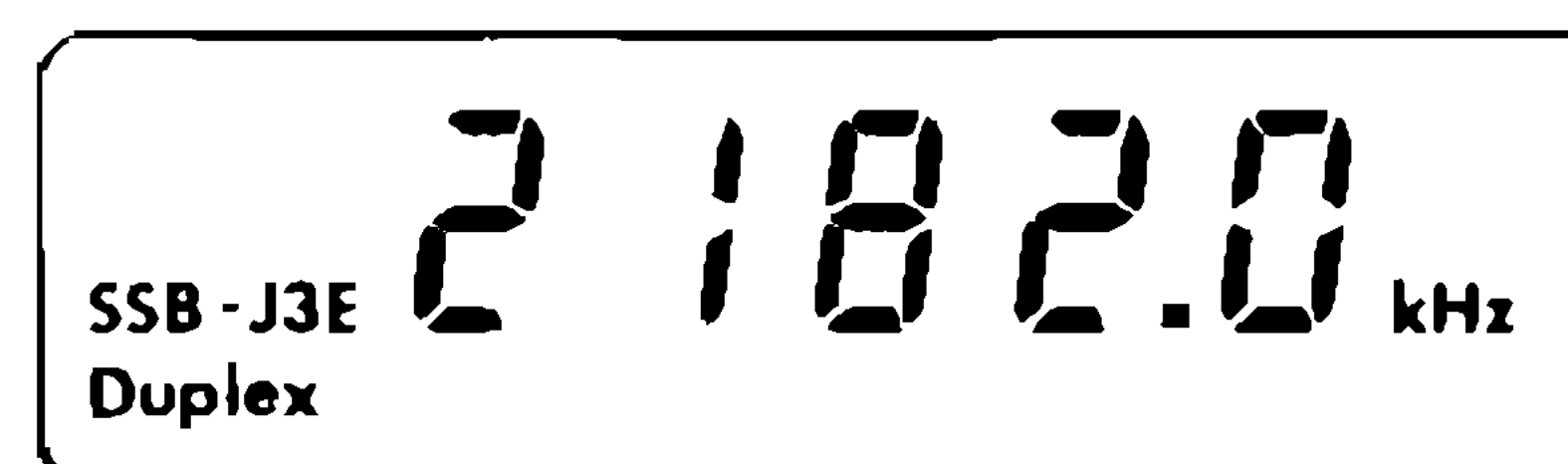
SSB-J3E 2 182.0 kHz

46. Press **duplex** and observe the read-out.  
Notice that the receiver is muted.



SSB-J3E Duplex Tune RF 2 182.0 kHz

47. Press the tune knob and observe the read-out.  
Notice that the receiver is demuted.



SSB-J3E Duplex 2 182.0 kHz

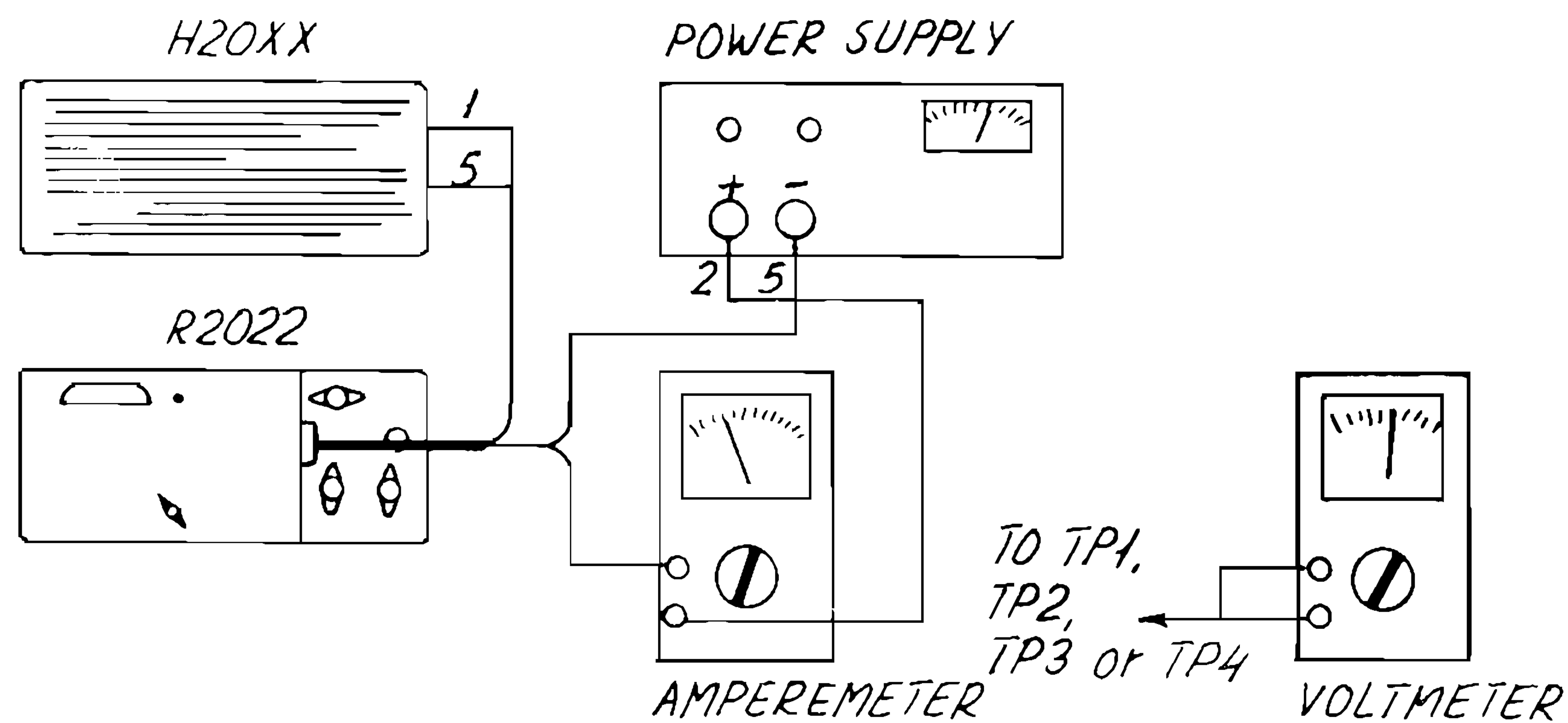
48. Press **duplex** and observe that the  
indication of duplex mode vanishes.

### 3.4.2. Check of Power Supply

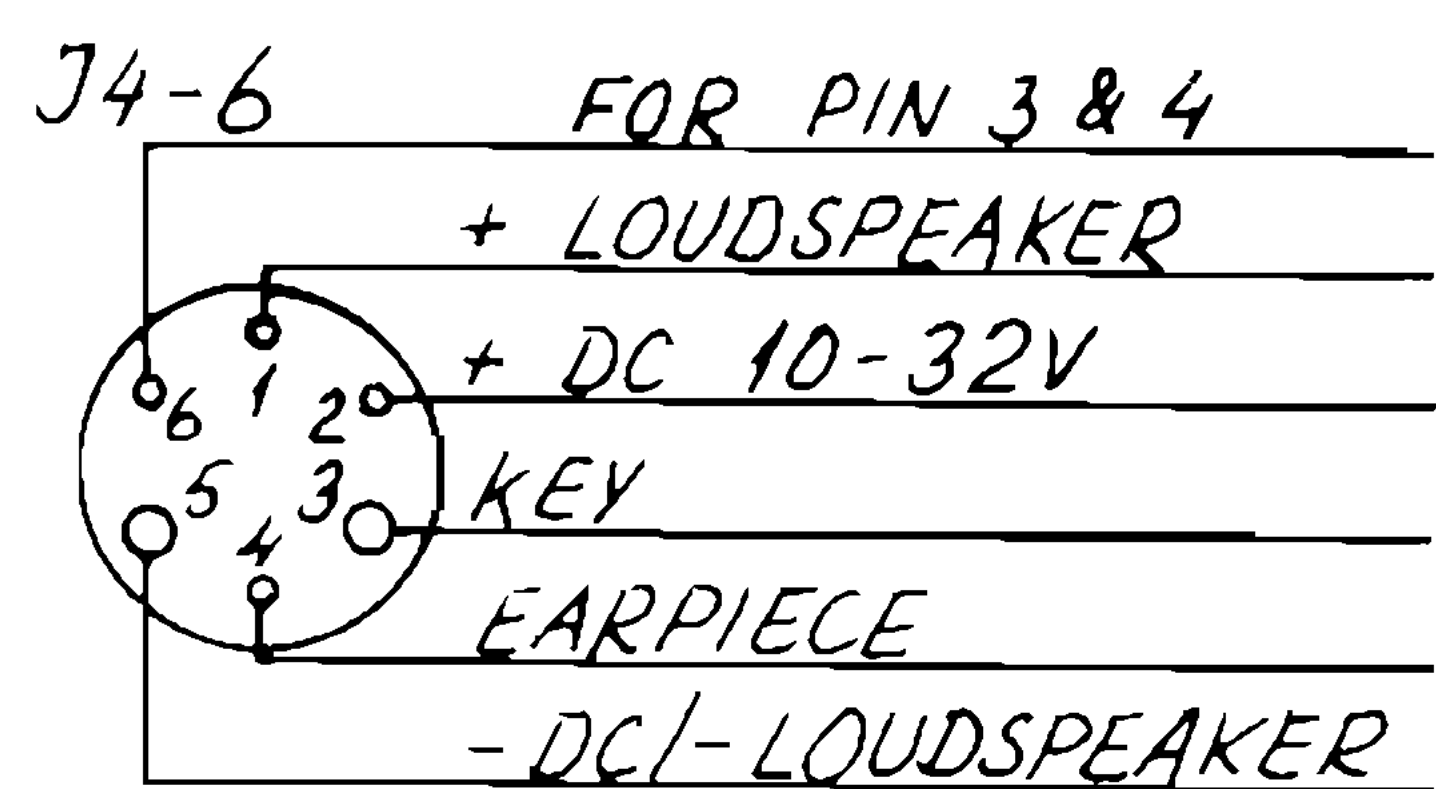
1. Adjust the receiver supply voltage to 10 Volt.
2. Turn on the receiver by pressing **on/off**.  
Notice that noise is heard from the loudspeaker.
3. Adjust the receiver supply voltage to 24 Volt.
4. Measure the current consumption  $I_{CC}$  for the receiver by means of an amperemeter to be 0.5 Amp.  $<I_{CC} < 0.9$  Amp.
5. Connect a voltmeter to TP1 and control the voltage to be  $18V \pm 0.5V$ .
6. Connect a voltmeter to TP2 and control the voltage to be  $-18.2V \pm 0.5V$ .
7. Connect a voltmeter to TP3 and control the voltage to be  $24.3V \pm 0.5V$ .
8. Connect a voltmeter to TP4 and control the voltage to be  $5.1V \pm 0.05V$ .
9. Adjust the receiver supply voltage from 10V to 32V and control that the voltage variation on TP4 not exceeds 0.1V.

### 3.4.2. Check of Power Supply cont.:

#### 10. Measuring set-up:



**NOTE!** The numbering of wires refers to R2022 power plug J4-6

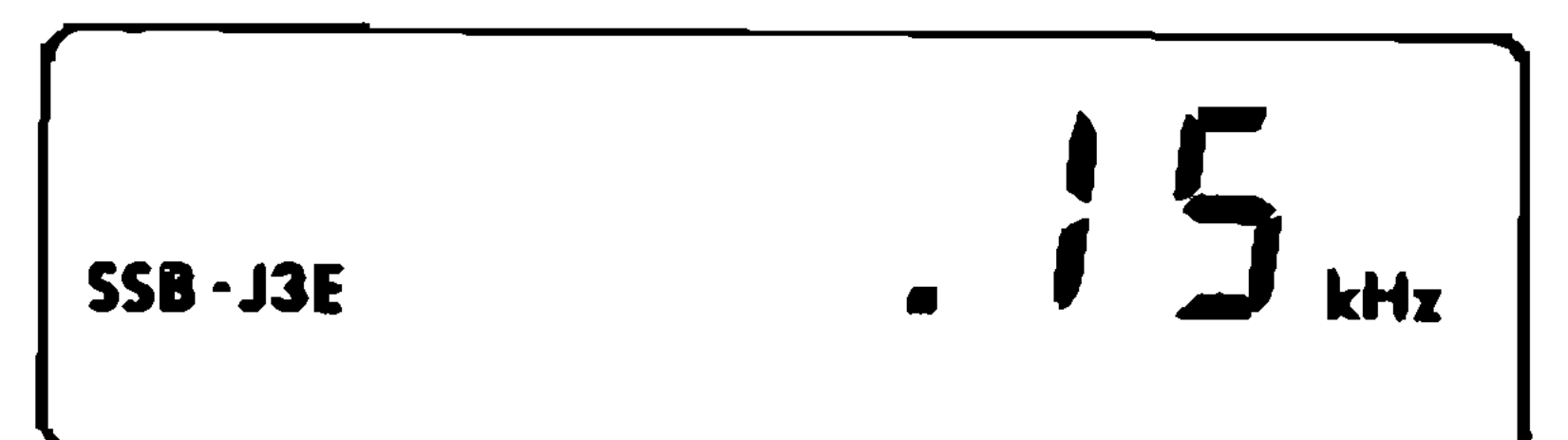


### 3.4.3. Check of Synthesizer

1. Turn the receiver on.
2. Key-in the following frequency
3. Connect a counter to TP5 and control the frequency to be 10.8408 MHz  $\pm 20$  Hz.

**NOTE!** The receiver must have been turned on for at least 5 min. before controlling the frequency.

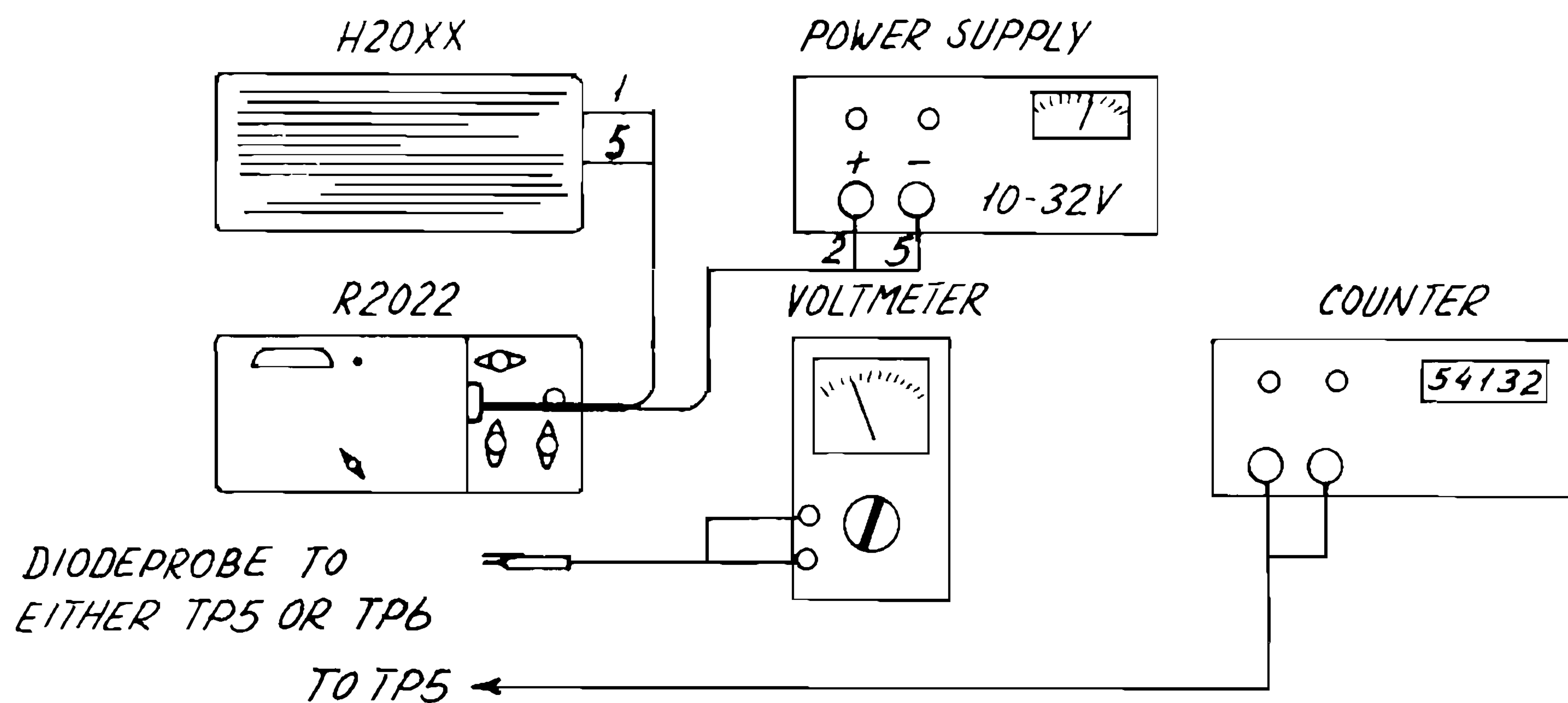
4. Key-in the following frequency
5. Press   and turn the tune knob clockwise until the display shows



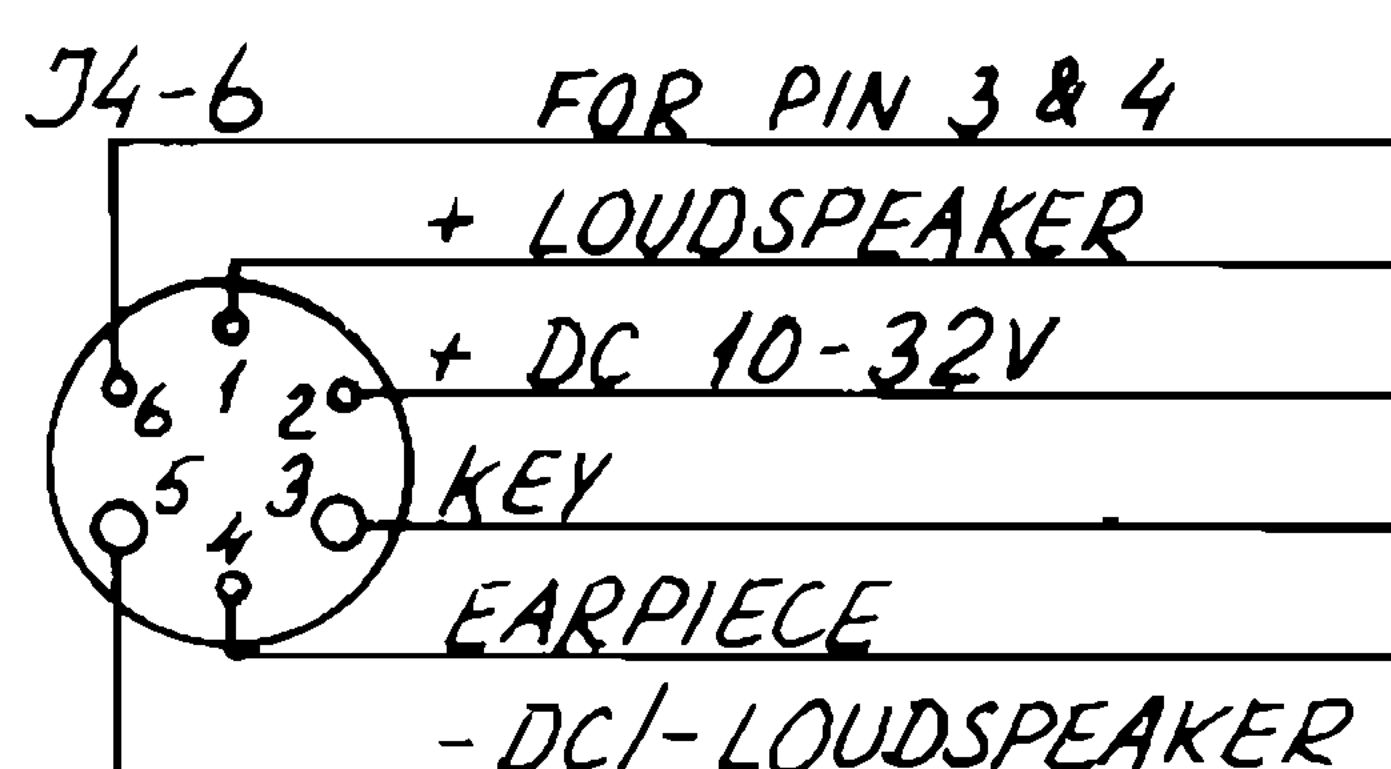
6. Measure the frequency on TP5.
7. Turn the tune knob counter clockwise and observe that the frequency on TP5 can be varied in steps of 10 Hz.
8. Press  .
9. Turn the tune knob and observe that the frequency on TP5 can be varied in steps of 100 Hz.
10. Key-in the following frequency       .

### 3.4.3. Check of Synthesizer cont.:

11. Measure the frequency on TP5 and subtract it from the frequency measured in check point 3.4.3.6. The result must be 814.95 kHz  $\pm$ 5 Hz.
12. Key-in the following frequency 3 6 3 9 . 2 ENT.
13. Measure the frequency on TP5 and subtract it from the frequency measured in check point 3.4.3.5. The result must be 814.35 kHz  $\pm$ 5 Hz.
14. Connect the diode probe to TP5.
15. Press 2182 and control the voltage to be 6V  $\pm$ 1V.
16. Connect the diode probe to TP6.
17. Key-in the following frequency 1 0 2 . ENT and control the voltage to be 1V  $\pm$ 0.5V.
18. Press 2182 and observe that the voltage drops to 0V.
19. Measuring set-up:



**NOTE!** The numbering of wires refers to R2022 power plug J4-6

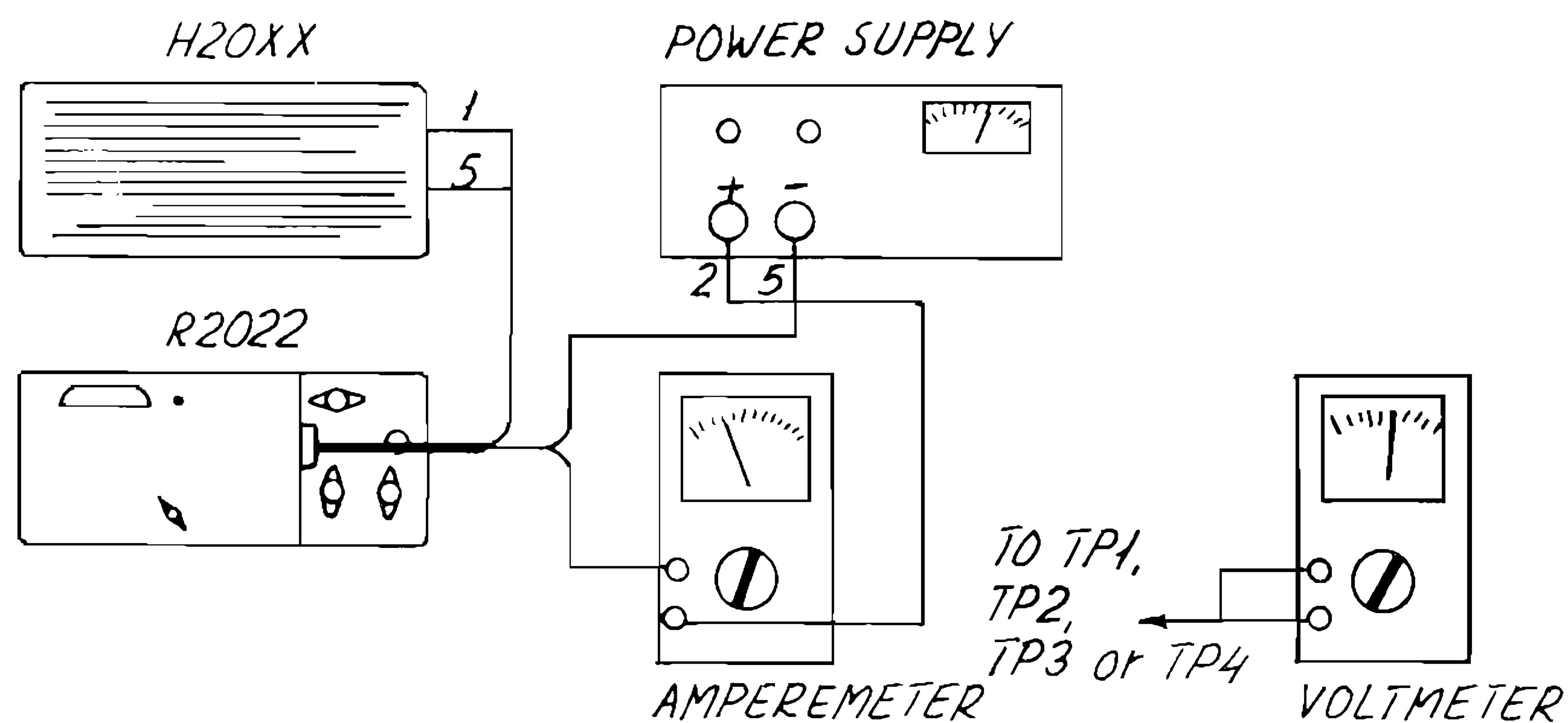


### 3.4.4. Check of Detector Circuit

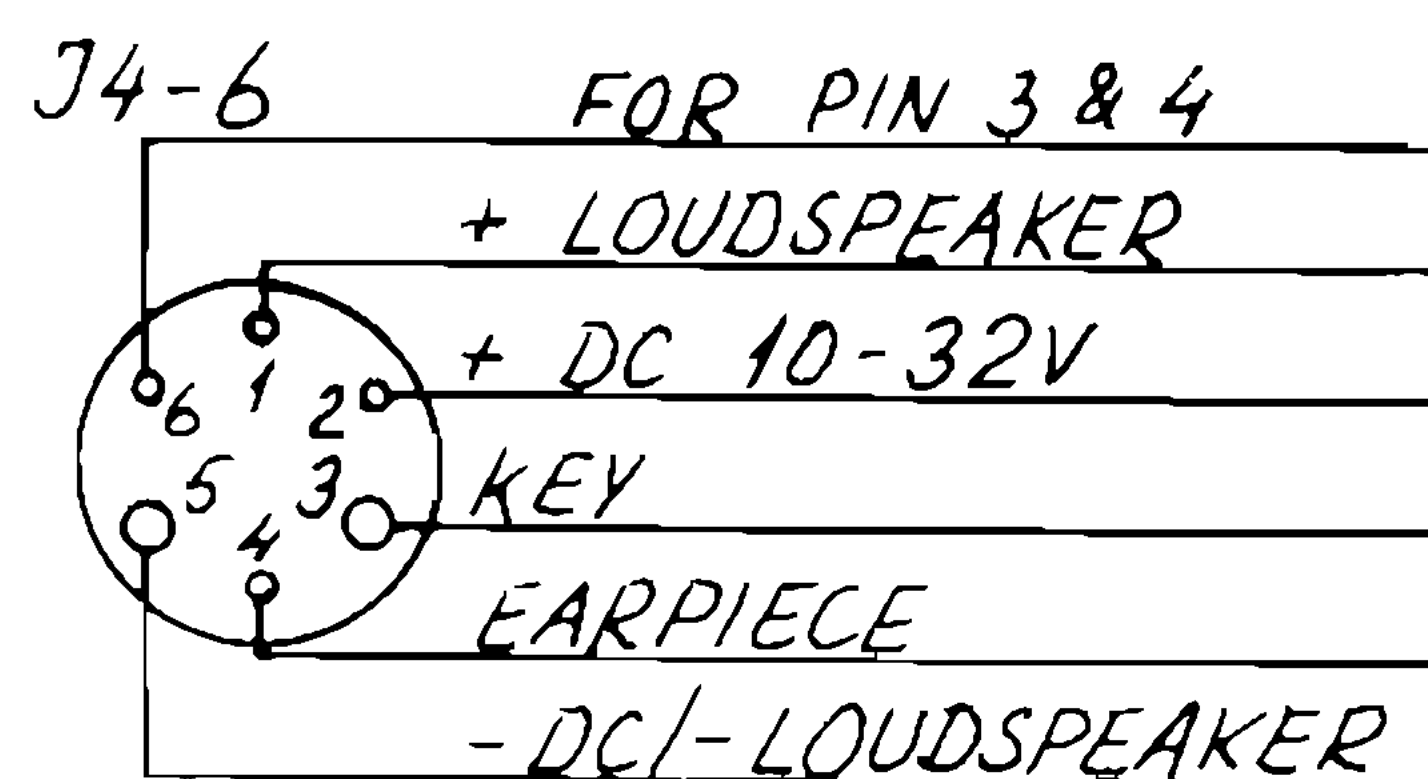
1. Connect the signal generator to aerial socket "1".
2. Connect the voltmeter to earpiece output.
3. Turn the RF-amplification control fully clockwise.
4. Turn the receiver on.
5. To measure earpiece output level in AM, FM and SSB mode, choose  $f_{RX}$ ,  $f_G$ , and  $V_G$  according to table 3.4.4.6.

### 3.4.2. Check of Power Supply cont.:

#### 10. Measuring set-up:



**NOTE!** The numbering of wires refers to R2022 power plug J4-6

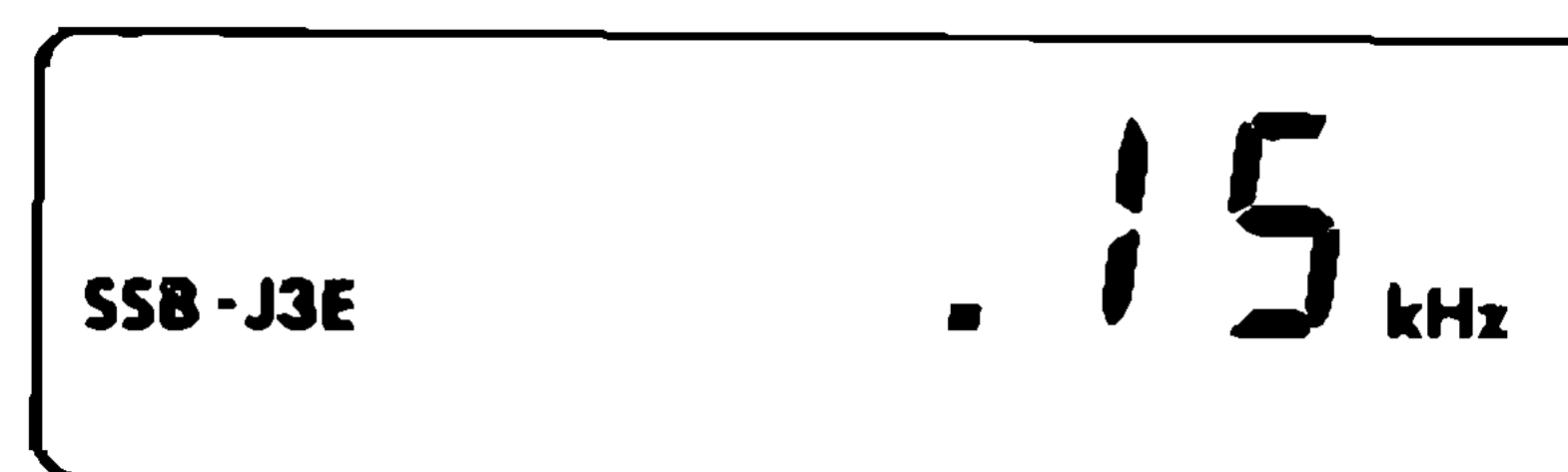


### 3.4.3. Check of Synthesizer

1. Turn the receiver on.
2. Key-in the following frequency
3. Connect a counter to TP5 and control the frequency to be 10.8408 MHz  $\pm$ 20 Hz.

**NOTE!** The receiver must have been turned on for at least 5 min. before controlling the frequency.

4. Key-in the following frequency
5. Press   and turn the tune knob clockwise until the display shows

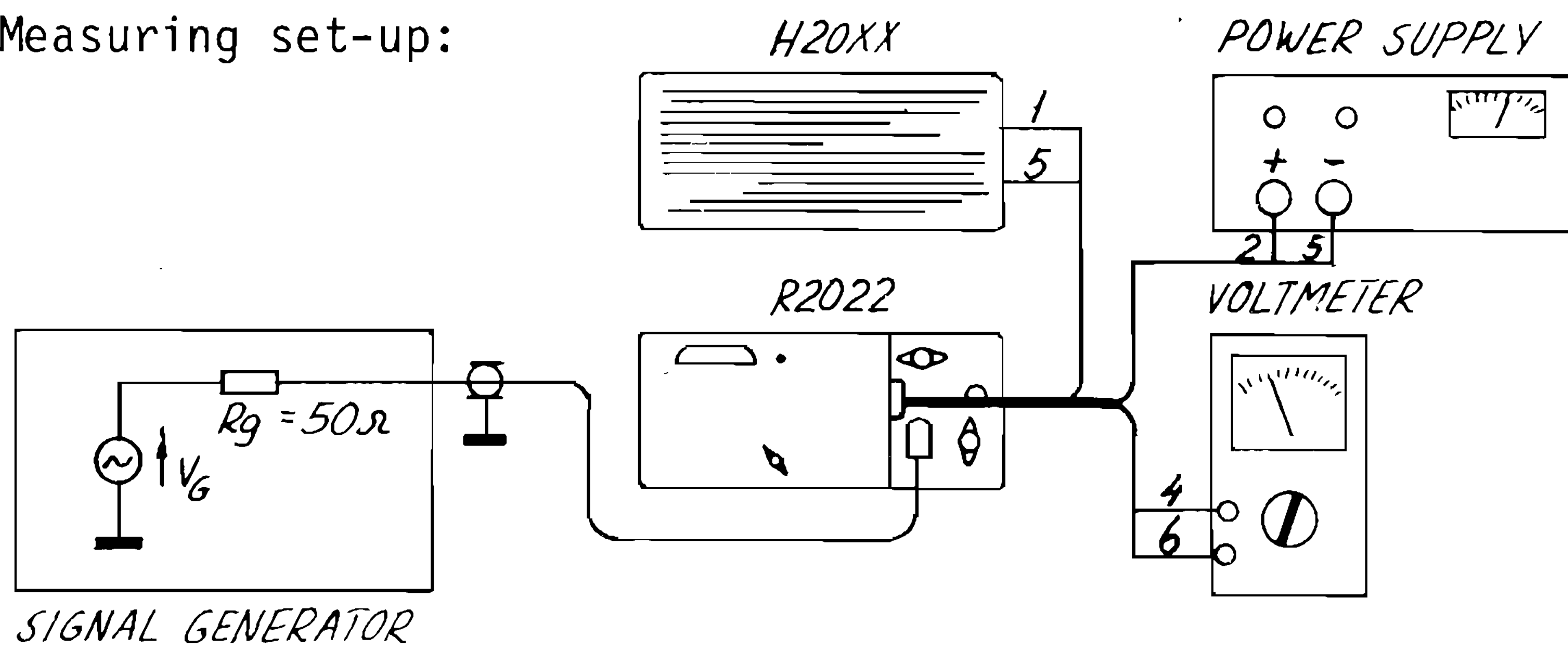


6. Measure the frequency on TP5.
7. Turn the tune knob counter clockwise and observe that the frequency on TP5 can be varied in steps of 10 Hz.
8. Press  .
9. Turn the tune knob and observe that the frequency on TP5 can be varied in steps of 100 Hz.
10. Key-in the following frequency       .

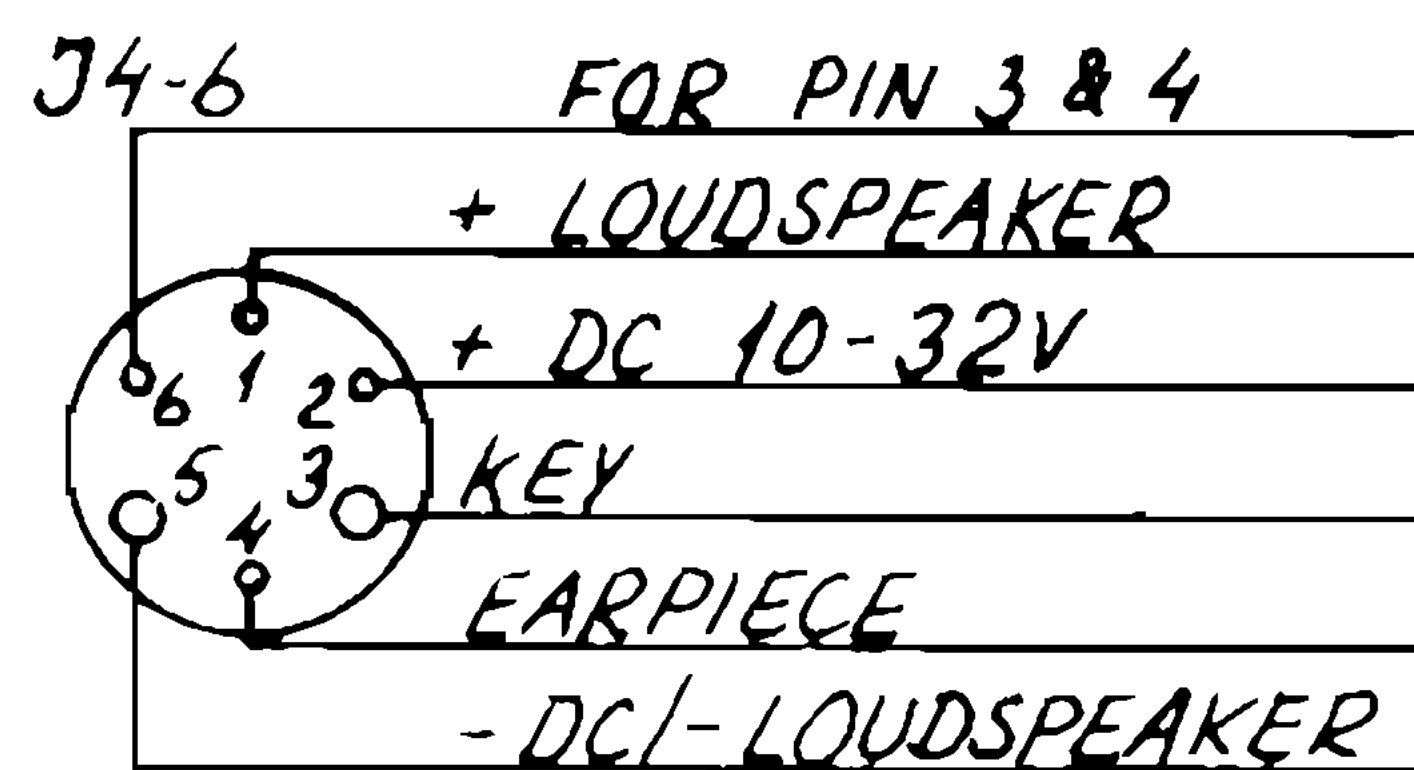


### 3.4.4. Check of Detector Circuit cont.:

#### 6. Measuring set-up:



**NOTE!** The numbering of wires refers to R2022 power plug J4-6



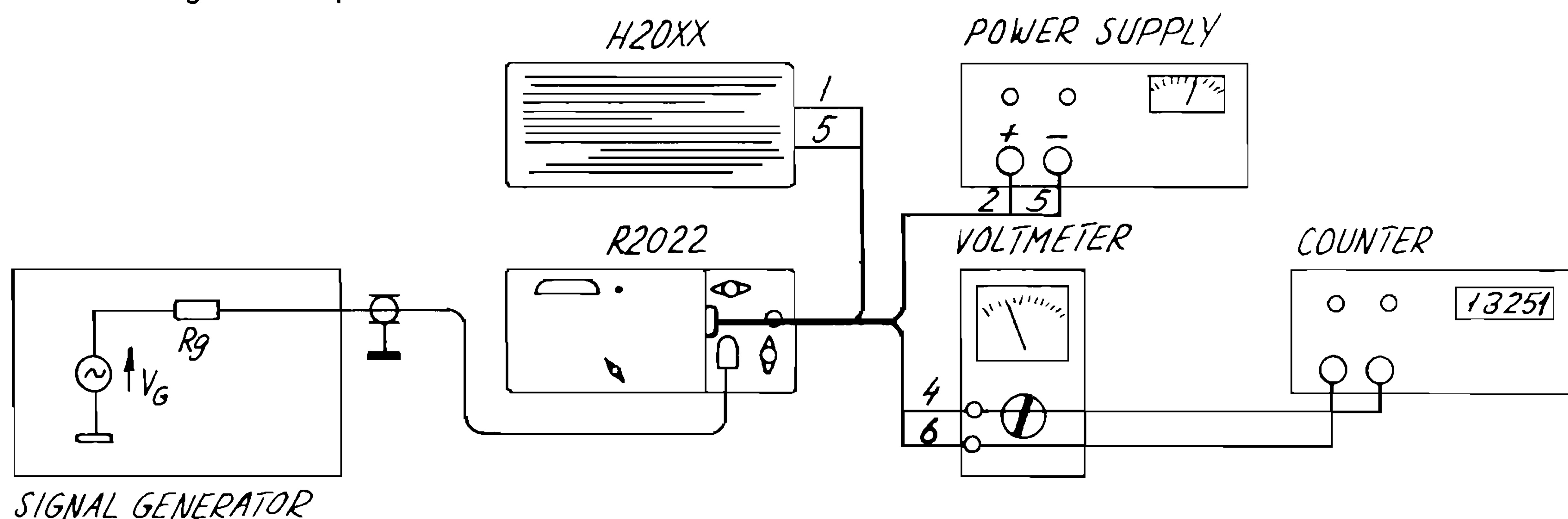
Signal Generator			R2022		Earpiece output
$f_G$	$V_G$ (EMF) MODE		$f_{RX}$	MODE	
2182 kHz	60 dB/uV	AM-modulated 30% with 1 kHz	2182 kHz	AM	60 mV <sub>RMS</sub> - 115 mV <sub>RMS</sub>
2183 kHz	60 dB/uV	CW	2182 kHz	SSB	0.4V <sub>RMS</sub> - 0.8V <sub>RMS</sub>
88 MHz	60 dB/uV	FM-modulated +/-22.5 kHz with 1 kHz	88 MHz	FM	46 mV <sub>RMS</sub> - 84mV <sub>RMS</sub>

### 3.4.5. Check of AF-Response in SSB-Mode

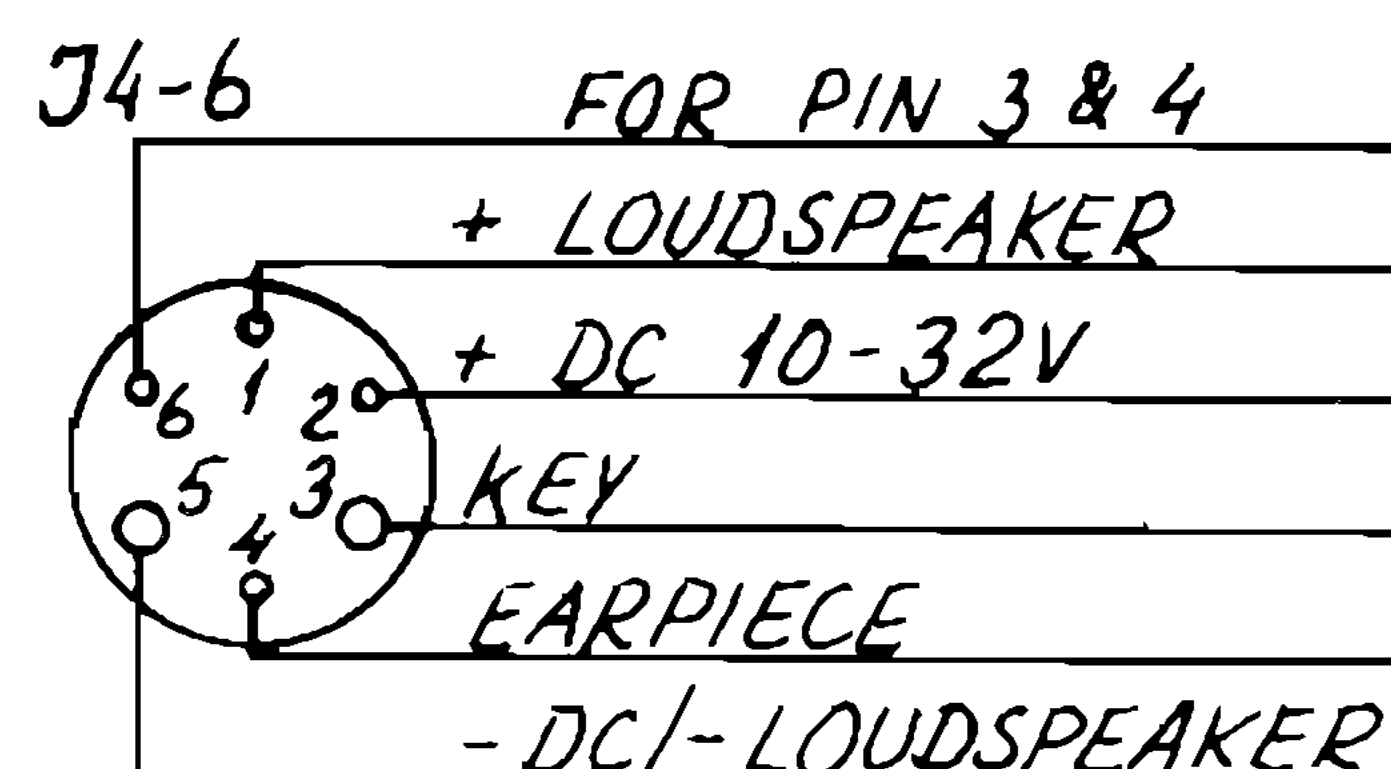
1. Execute 3.4.4.1, 3.4.4.2, 3.4.4.3 and 3.4.4.4.
2. Connect the counter to earpiece output.
3. Choose  $f_{RX}$ ,  $f_G$ , and  $V_G$  according to table 3.4.5.9.
4. Read the earpiece output level.  
Be sure that the AF-signal frequency is approx. 1 kHz.
5. Press **shift** **AGC** and adjust the RF-amplification control until the earpiece level found in 3.4.5.4 is achieved.
6. Adjust  $f_G$  to find maximum earpiece level.

### 3.4.5. Check of AF-Response in SSB-Mode cont.:

7. If necessary readjust the RF-amplification control until the earpiece level found in 3.4.5.4 is achieved.
8. Adjust  $f_G$  until the AF-signal frequency is 2700 Hz and control that the earpiece level is reduced less than 6 dB compared to the level found in 3.4.5.4.
9. Execute 3.4.5.8 but with AF-signal frequency of 350 Hz instead.
10. Measuring set-up:



**NOTE!** The numbering of wires refers to R2022 power plug J4-6



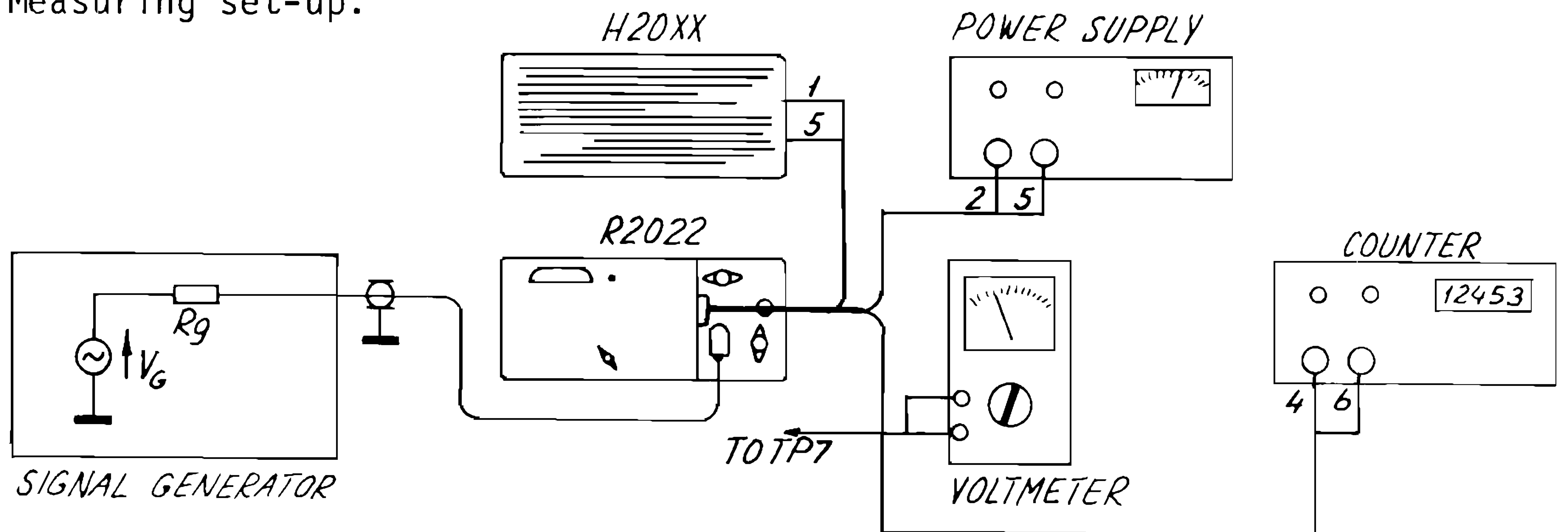
Signal generator			R2022	
$f_G$	$V_G$ (EMF)	MODE	$f_{RX}$	MODE
2183 kHz	60 dB/uV	CW	2182 kHz	SSB

### 3.4.6. Check of IF-Selectivity (SSB-Mode)

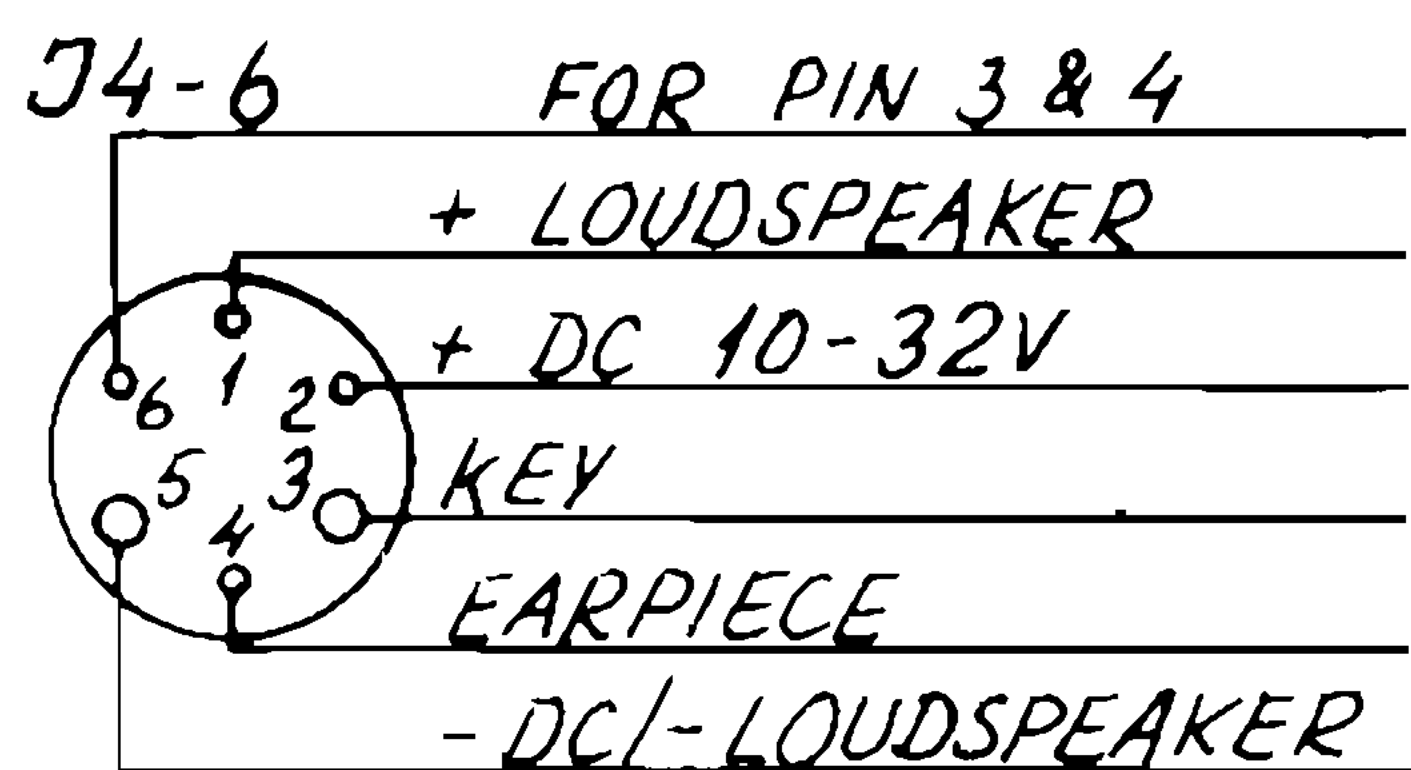
1. Connect the signal generator to aerial socket "1".
2. Connect the voltmeter to TP7.
3. Connect the counter to earpiece output.
4. Turn RF-amplification control fully clockwise.
5. Turn the receiver on.
6. Choose  $f_{RX}$ ,  $f_G$ , and  $V_G$  according to table 3.4.6.7. Be sure that the AF-signal frequency is approx. 1 kHz.

### 3.4.6. Check of IF-Selectivity (SSB-Mode) cont.:

#### 7. Measuring set-up:



**NOTE!** The numbering of wires refers to R2022 power plug J4-6



Signal generator			R2022	
$f_G$	$V_G$	MODE	$f_{RX}$	MODE
2183 kHz	13 dB/uV	CW	2182 kHz	SSB

8. Measure the voltage on TP7.
9. Increase  $V_G$  with 10 dB.
10. Key-in the following frequencies

and control in each case the voltage on TP7 to be above the value found in 3.4.6.8.

11. Execute 3.4.6.6 - 3.4.6.8.
12. Increase  $V_G$  with 35 dB.
13. Key-in the following frequencies

and control the voltage on TP7 to be less than the value found in 3.4.6.11.

### 3.4.7. Check of IF-Selectivity (AM-Mode)

1. Execute 3.4.6.1. - 3.4.6.6.
2. Press
3. Measure the voltage on TP7.
4. Increase  $V_G$  with 10 dB.
5. Key-in the following frequencies  
         and

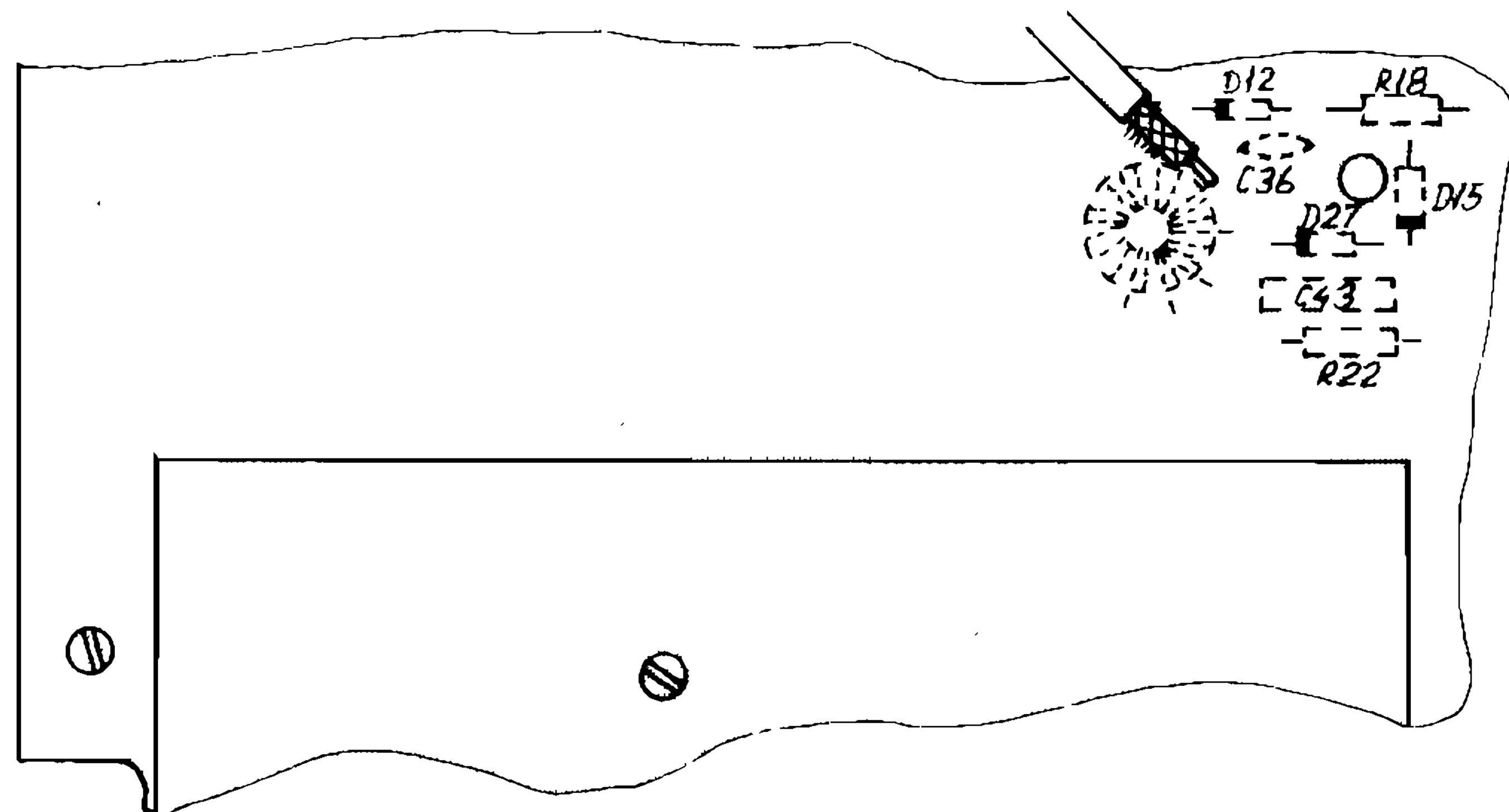
and control in each case the voltage on TP7 to be above the value found in 3.4.7.3.

6. Execute 3.4.7.1. - 3.4.7.3.
7. Increase  $V_G$  with 35 dB.
8. Key-in the following frequencies  
         and

and control in each case the voltage on TP7 to be smaller than the value found in 3.4.7.3.

### 3.4.8. Check of AGC-Response

1. Connect the oscilloscope to TP7 through passive probe.
2. Turn RF-gain fully clockwise.
3. Connect the signal generator to mixer input TP8 through a coaxial cable mounted as shown below.

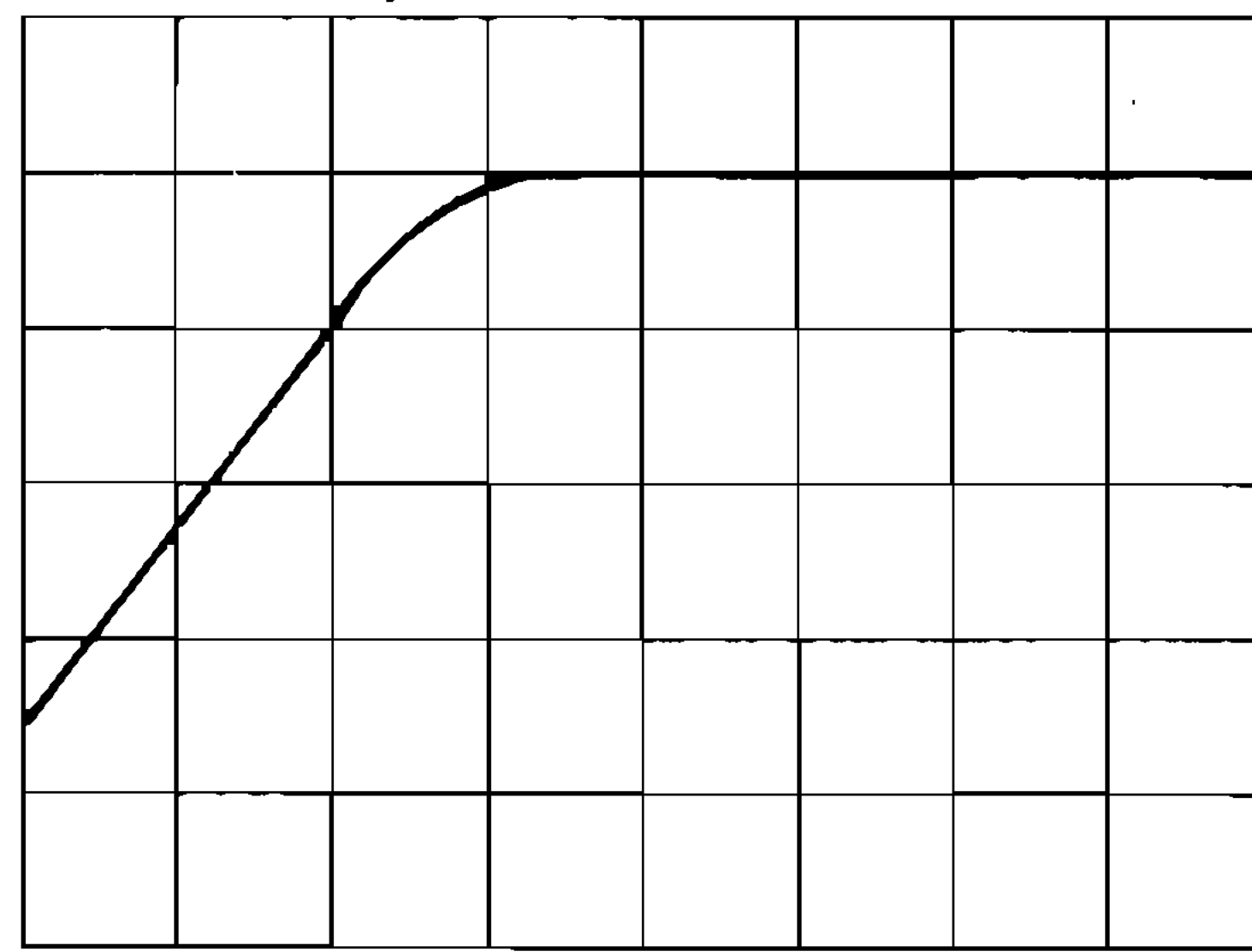


4. Turn the receiver on.
5. To check the dynamic response of the AGC, choose  $f_{RX}$ ,  $f_G$  and  $V_G$  according to table 3.4.8.16.

### 3.4.8. Check of AGC-Response cont.:

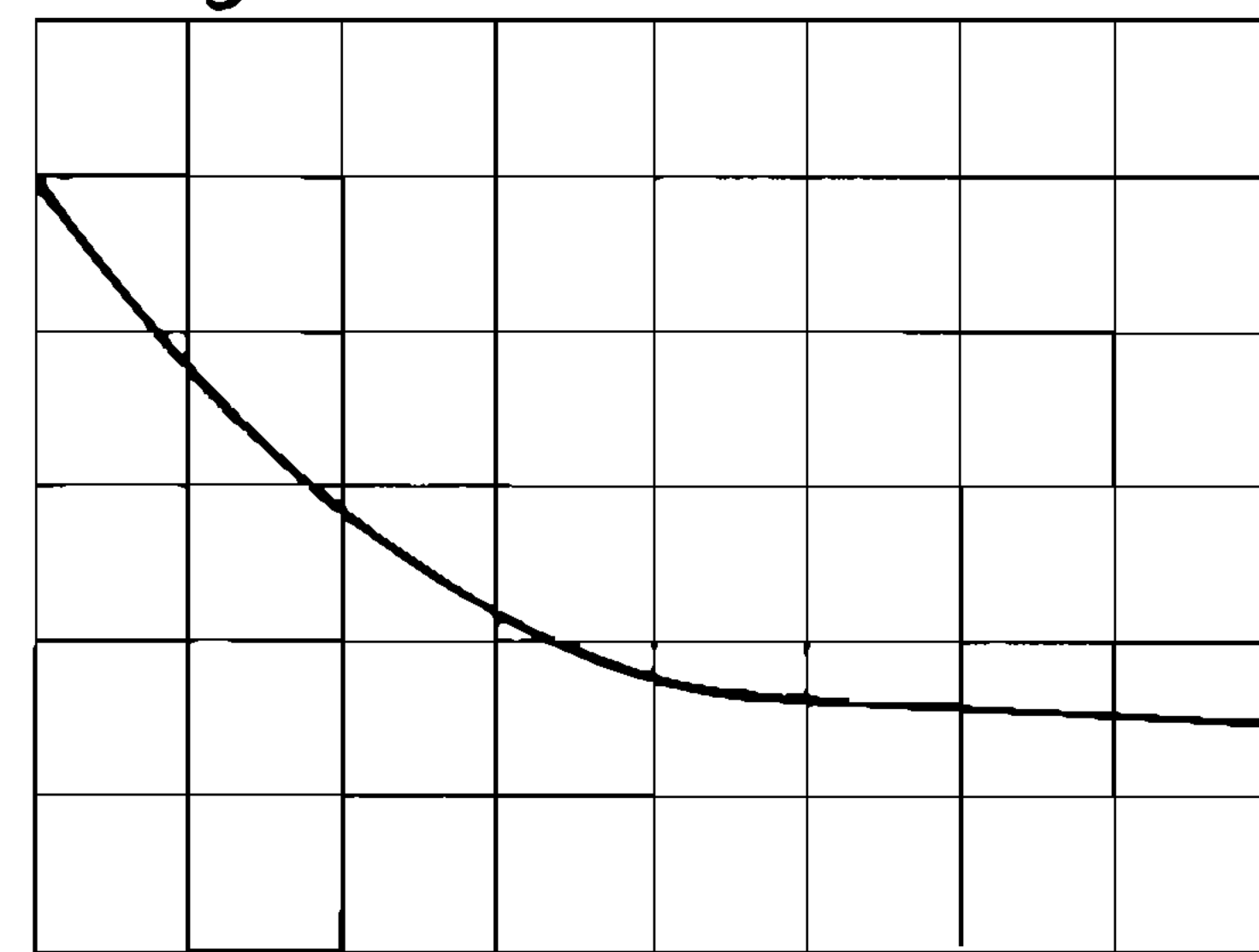
6. By connection and disconnection of key, mute wire and ground wire, both led out into the power cable, the necessary change in signal level to the IF-amp. is made, and the AGC-response can be measured with the oscilloscope and must be similar to the responses shown below.
7. Execution of 3.4.8.5 - 3.4.8.6 is carried out both in AM and SSB mode.
- 8.

AGC Responce  
Attack AM-mode



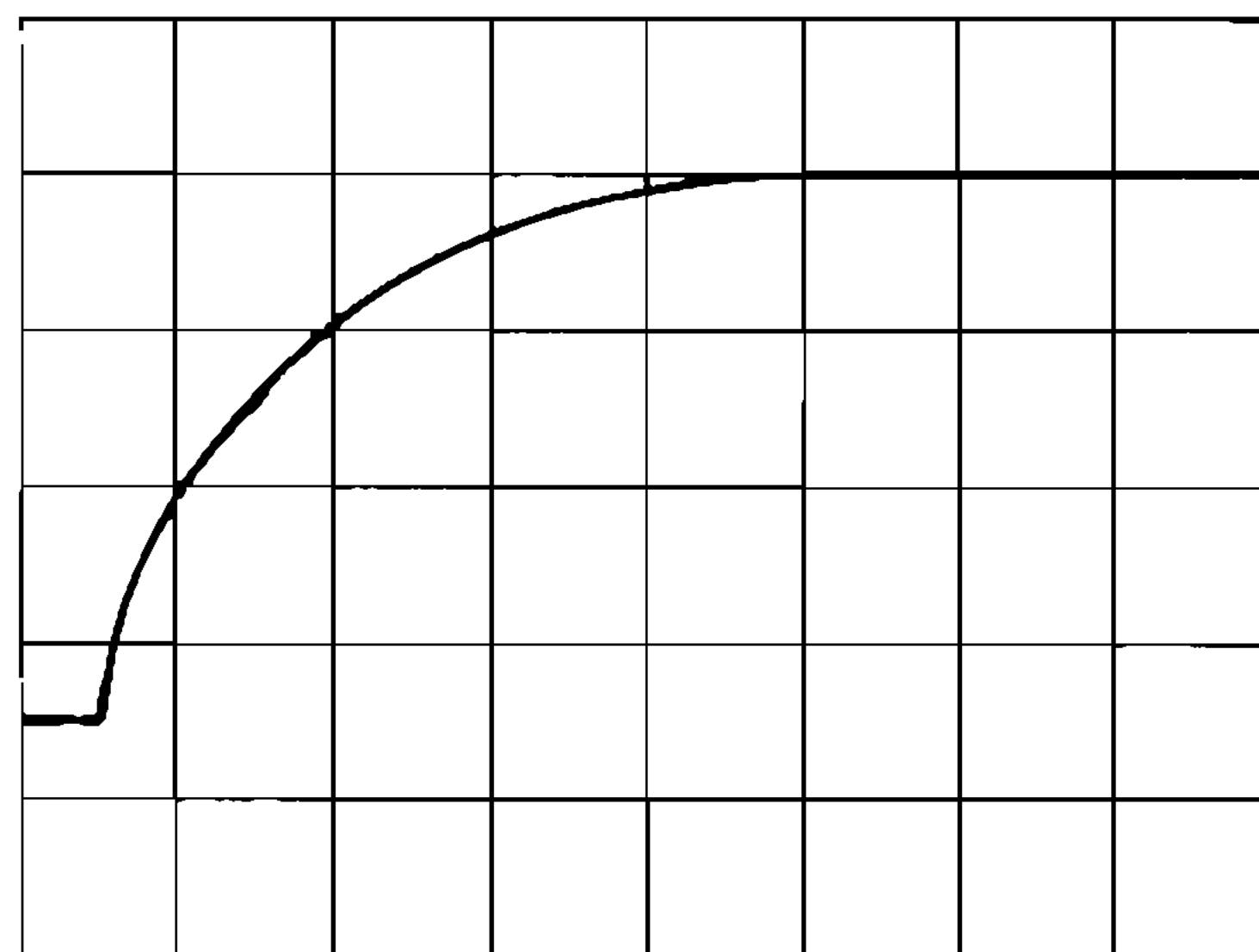
50mV/DIV  
5msec/DIV

AGC Responce  
Decay AM-mode



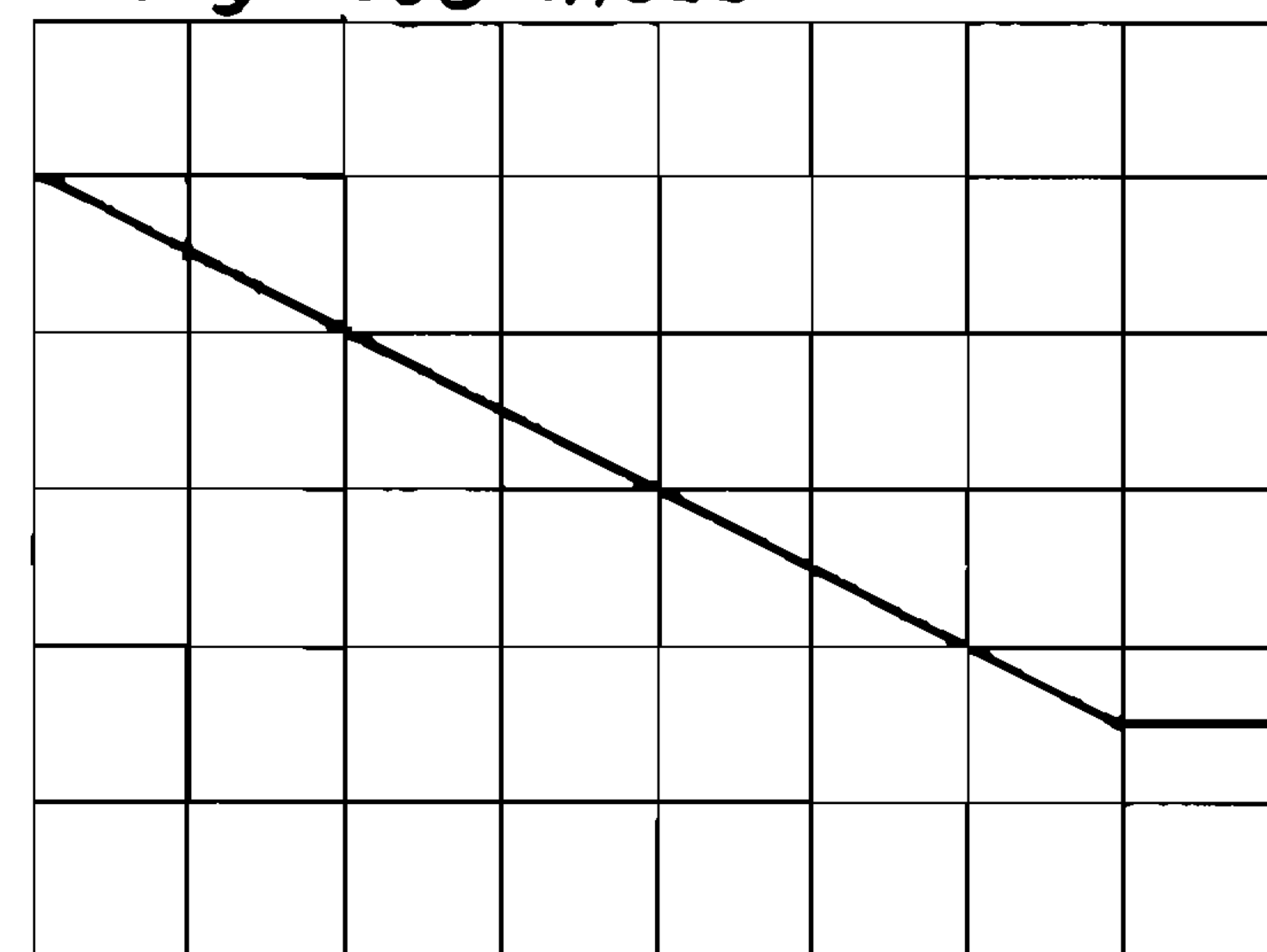
50mV/DIV  
50msec/DIV

AGC Responce  
Attack SSB-mode



50mV/DIV  
0.5msec/DIV

AGC Responce  
Decay SSB-mode

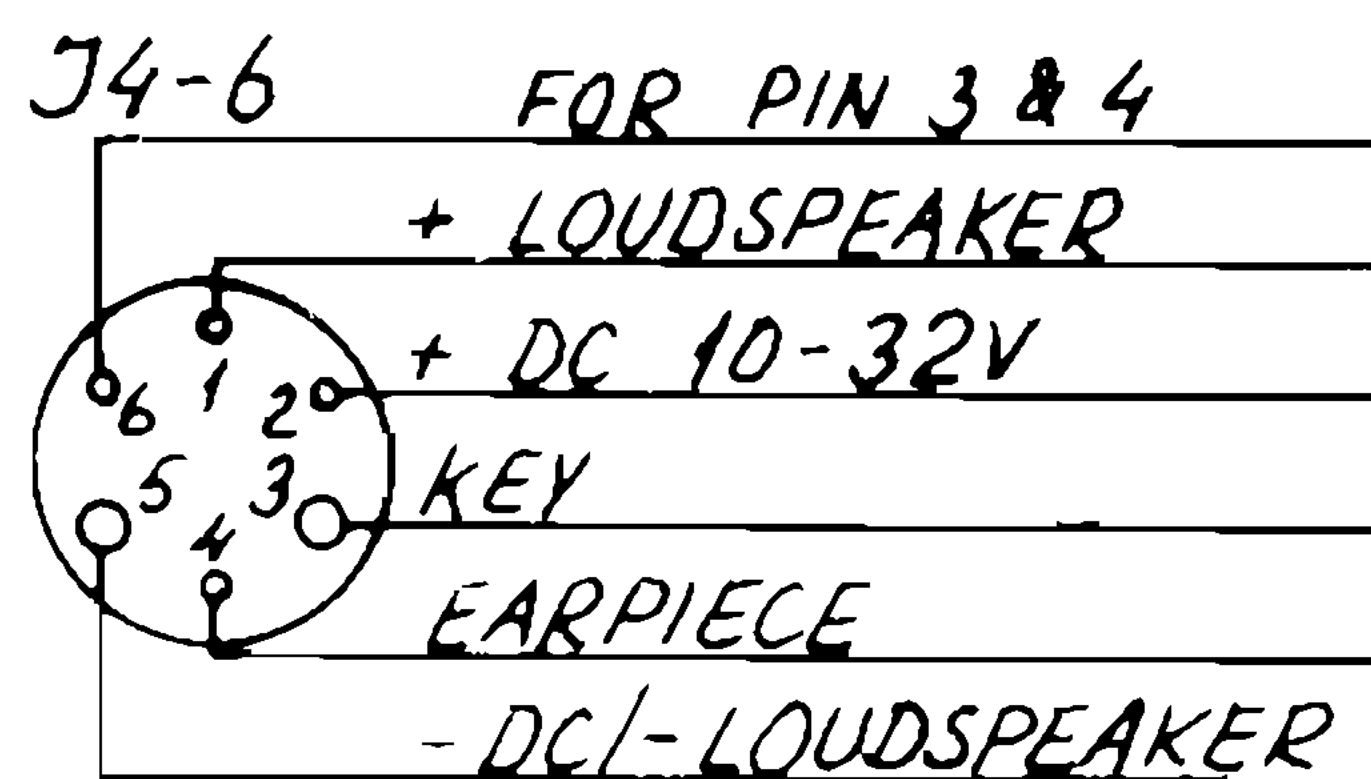
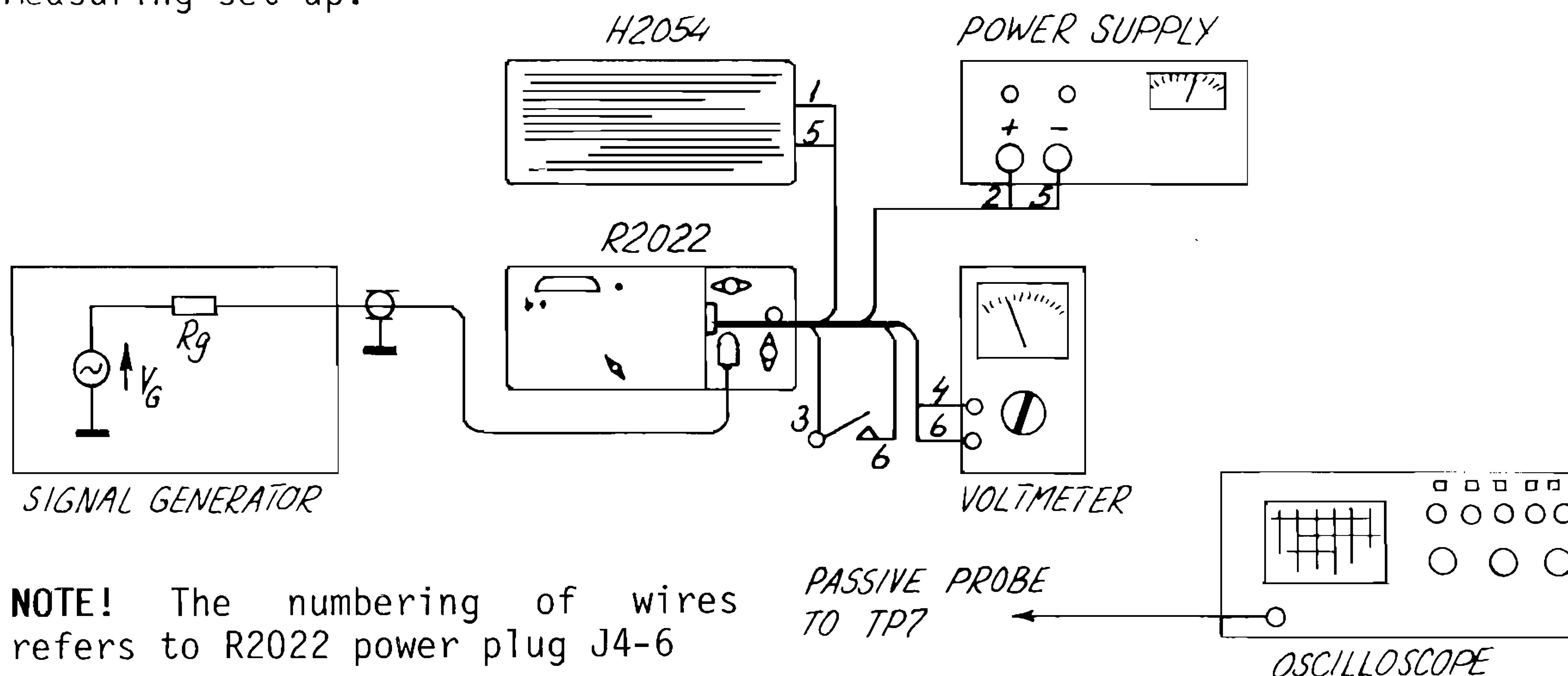


50mV/DIV  
0.5 sec

9. Remove the coaxial cable from the mixer input.
10. Connect the signal generator to aerial socket "1".
11. Connect a voltmeter to earpiece output.
12. Choose  $f_{RX}$  and  $f_G$  according to table 3.4.8.16.
13. Adjust  $V_G$  until SND/N from the receiver is 20 dB and observe the earpiece output level.  
**Note!** For measurement of the SND/N look-up this manual, section 3.4.11.1. - 3.4.11.7.
14. Increase  $V_G$  with 70 dB and notice that the earpiece output level is increased less than 7 dB.
15. The execution of 3.4.8.12. - 3.4.8.14. is carried out both in AM and SSB mode.

### 3.4.8. Check of AGC-Response cont.:

#### 16. Measuring set-up:



Signal generator			R2022	
$f_G$	$V_G$	MODE	$f_{RX}$	MODE
2182 kHz	60 dB/uV	AM-modulated	2182 kHz	AM
2183 kHz	60 dB/uV	CW	2182, kHz	SSB

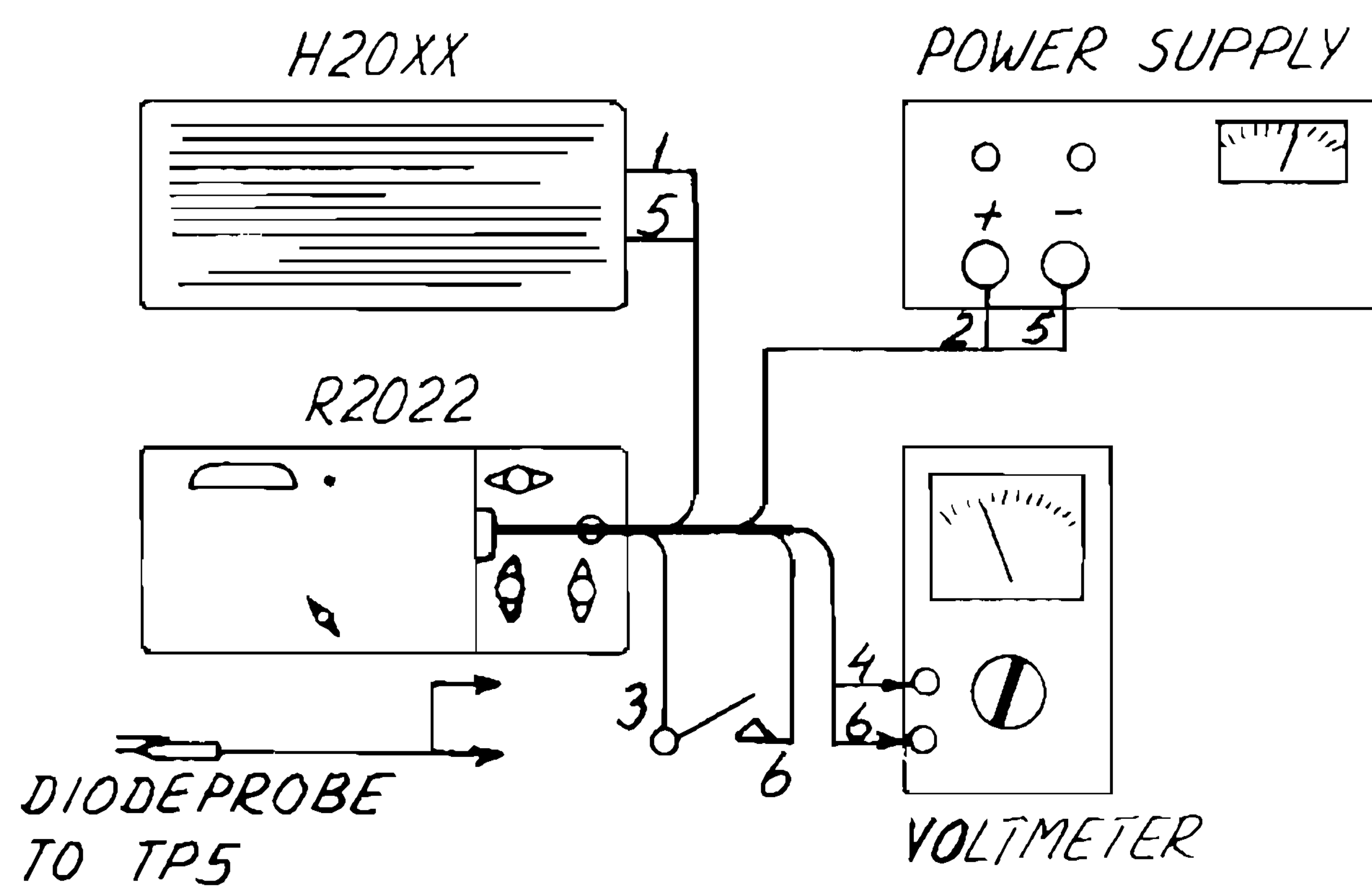
### 3.4.9. Check of Key Mute Function

1. Connect an ohmmeter between aerial socket "2" and receiver ground.
2. Check that the resistance is approx. 0 ohm when the receiver is off, and approx. 100 kohm when it is turned on.
3. Connect the ohmmeter between aerial socket "1" and receiver ground.
4. Execute 3.4.9.2.
5. Connect the diode probe to TP5.
6. Connect a voltmeter to earpiece output.
7. Programme the receiver for aerial configuration one aerial duplex (look-up the manual, section 2.5.).
8. Connect the key mute wire and the ground wire both led out in the power cable.
9. Check that the signal on TP5 is 0 Volt and that aerial socket "1" is short-circuited to ground.

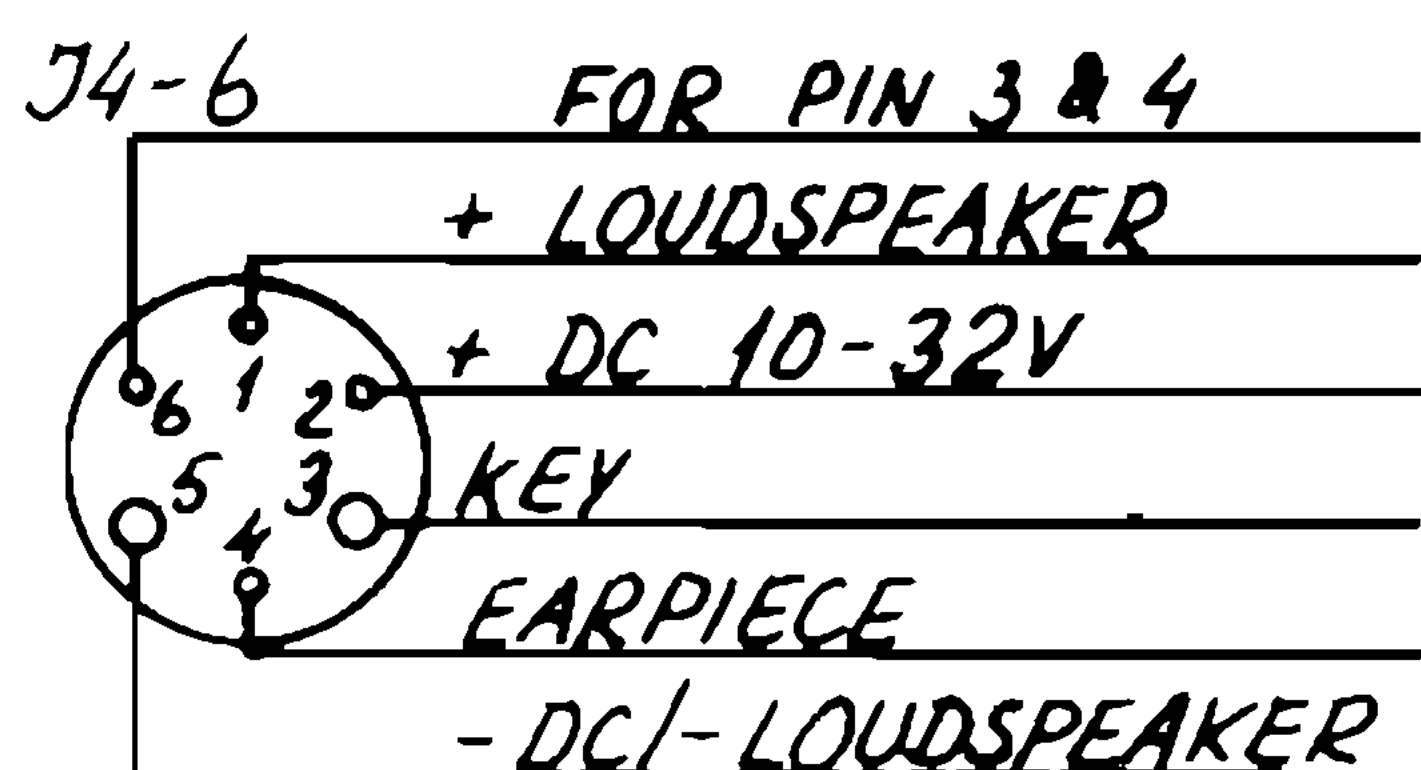


### 3.4.9. Check of Key Mute Function cont.:

10. Check that both the earpiece output and the loudspeaker are muted.
11. Disconnect the key mute wire and the ground wire.
12. Press 2182 shift mode duplex.
13. Press the tune knob.
14. Execute 3.4.9.8.
15. Check that the signal in TP5 is  $6V \pm 1V$  and that the resistance between aerial socket "1" and ground is approx. 100 kohm.
16. Check that the loudspeaker is muted while the earpiece output stays demuted.
17. Execute 3.4.9.11.
18. Measuring set-up:



**NOTE!** The numbering of wires refers to R2022 power plug J4-6



### 3.4.10. Sensitivity Measurements

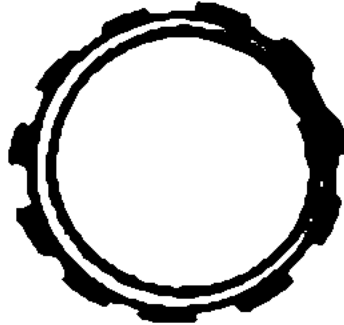

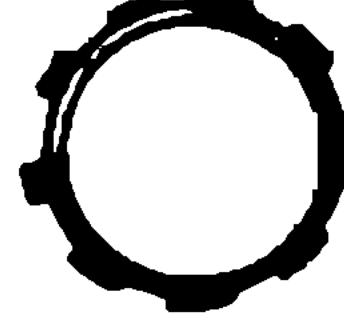
#### Simplex Filters

1. Connect the generator to aerial socket "1" through dummy load as specified in table 3.4.10.23.
2. Connect the voltmeter to earpiece output.
3. Turn the receiver on.
4. Programme the receiver for aerial configuration two aerial duplex. (Lookup this manual, section 2.5.).

### 3.4.10. Sensitivity Measurements cont.:

5. Choose receiver frequency  $f_{RX}$ , generator frequency  $f_G$  and generator output level  $V_G$  according to table 3.4.10.23.
6. Measure the signal to noise ratio  $SND/N$  on the earpiece output and check that it is above 20 dB.

#### Duplex Filter

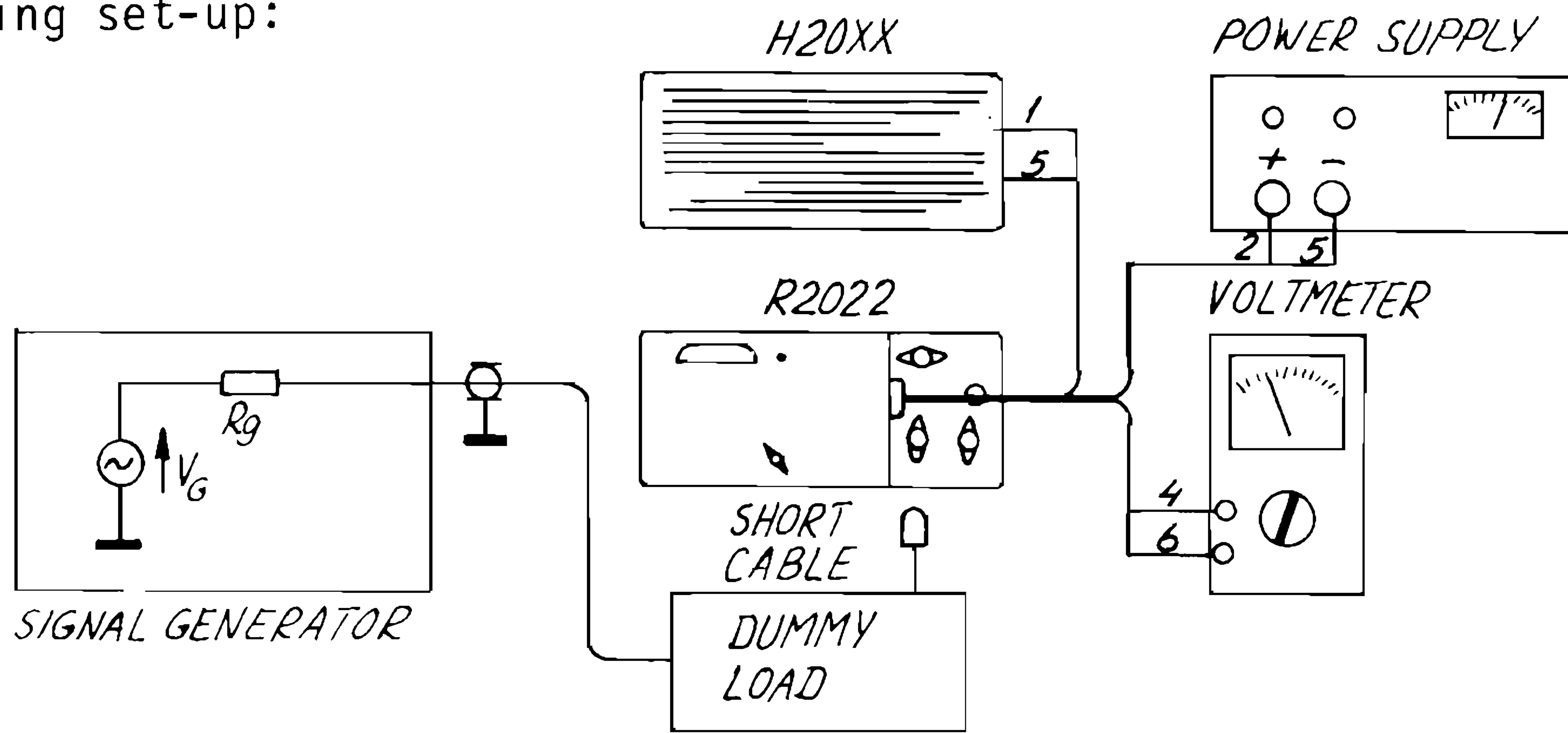
7. Connect the generator to aerial socket "1" through dummy load as specified in table 3.4.10.23.  
Before execution of the sensitivity measurements the duplex filter trimming capacitor C3-1 has to be tuned to the actual dummy load impedance namely 10 ohm in series with 250 pF.
8. Choose receiver frequency  $f_{RX}$ , generator frequency  $f_G$  and generator output level  $V_G$  as specified below.  
Be sure that the receiver AGC-circuit is activated and the RF-amplification control is turned fully clockwise.
9. Press the tune knob  and adjust for maximum meter deflection.
10. Adjust the trimming capacitor C3-1 for maximum meter deflection.
11. Repeat 3.4.9.9. - 3.4.9.10 until no further improvement is achieved.
12. Choose frequency  $f_{RX}$ , generator frequency  $f_G$  and generator output level  $V_G$  according to table.
13. Press the tune knob  and tune for maximum meter deflection.  
This step has to be executed every time a new receiver frequency is entered.
14. Measure the signal to noise ratio  $SND/N$  on the earpiece output and check that it is above 20 dB.
15. Connect the generator to aerial socket "2" through dummy load as specified in table 3.4.10.24.
16. Choose frequency  $f_{RX}$ , generator frequency  $f_G$  and generator output level  $V_G$  according to table 3.4.10.24.
17. Press the duplex button.
18. Press the tune knob  and tune for maximum meter deflection.  
Both 3.4.9.17. and 3.4.9.18. have to be executed every time a new receiver frequency is entered.
19. Measure the signal to noise ratio  $SND/N$  on the earpiece output and check that it is above 20 dB.

#### FM-Tuner

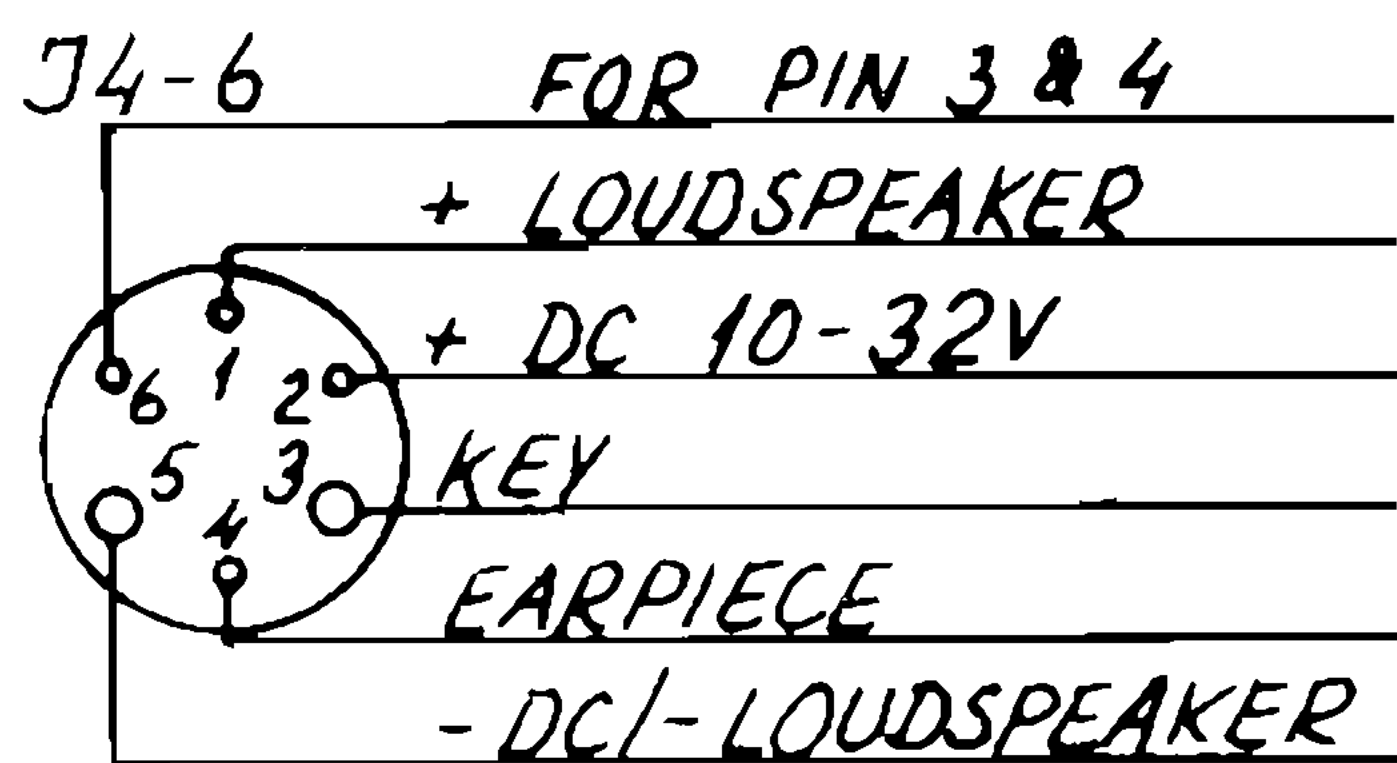
20. Connect the generator to aerial socket "FM" through dummy load as specified in table 3.4.10.25.
21. Choose receiver frequency  $f_{RX}$ , generator frequency and generator output level  $V_G$  according to table 3.4.10.25.
22. Measure the signal to noise ratio  $SND/N$  on the earpiece output and check that it is above 20 dB.

### 3.4.10. Sensitivity Measurements cont.:

Measuring set-up:



**NOTE!** The numbering of wires refers to R2022 power plug J4-6



	Signal Generator			Dummy load	R2022						
	$f_G$	$V_G$ (EMF)	MODE		$f_{RX}$	Mode	Filter used	Aerial socket used			
23.	140 kHz	30dB/uV see below	AM-mod. 30% with 1 kHz	50 ohm	140 kHz	AM/ Simp.	Simplex filters	"1"			
	230 kHz										
	380 kHz										
	390 kHz										
	800 kHz										
	1600 kHz										
24.	1611 kHz	16dB/uV	CW	10 ohm in series with 250pF	1610 kHz	SSB/ Simp.	Duplex filter	"2"			
	2201 kHz			2200 kHz							
	4500 kHz			4499 kHz							
	1611 kHz	6dB/uV see below		10 ohm in series with 250pF	1610 kHz	SSB/ Duplex	Duplex filter				
	2201 kHz				2200 kHz						
	3800 kHz				4499 kHz						
	24.	2201 kHz		6dB/uV see below		2200 kHz					
	25.	88 MHz		10dB/uV see below	FM-modu- lated +22 kHz with 1kHz	75 ohm	88 MHz		FM		"FM"
		102 MHz									
107 MHz											

**NOTE!** The figures for  $V_G$  are on the assumption that the dummy load is without any loss.

When using the dummy loads described in section 3.2. NECESSARY TEST EQUIPMENT, these figures have to be corrected with 20 dB, since the EMF-insertion loss is 20 dB.

### 3.4.11. Measurement of the Signal to Noise Ratio SND/N

#### AM/FM Mode

1. Choose  $f_{RX}$ ,  $f_G$ ,  $V_G$ , and degree of modulation  $M/f$ .
2. Notice the earpiece output level by means of a voltmeter.
3. Remove modulation from the generator signal and notice the decrease of the earpiece output level.  
The decrease expresses the signal to noise ratio.

#### SSB-Mode

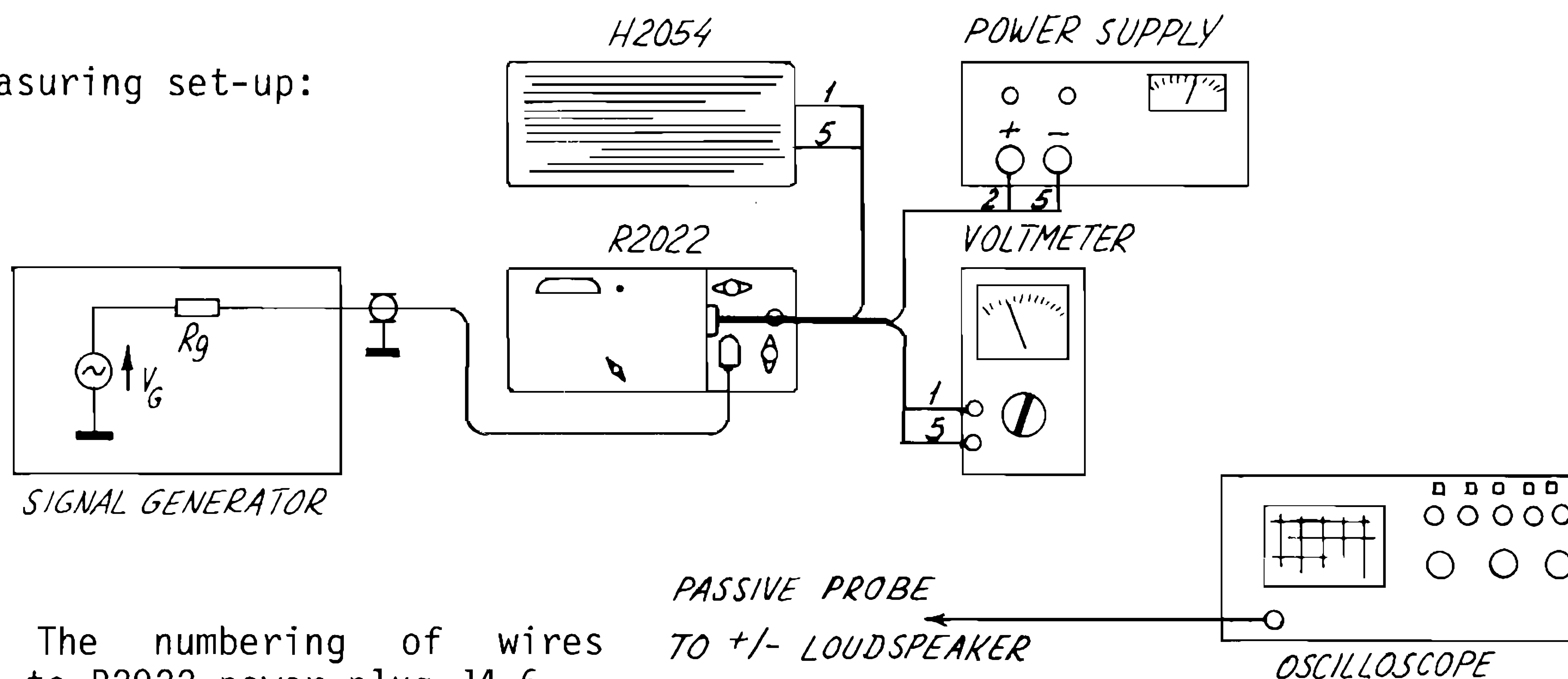
4. Choose  $f_{RX}$ ,  $f_G$  and  $V_G$ .
5. Notice the earpiece output level by means of a voltmeter.
6. Press shift AGC and adjust the RF-amplification control to achieve the earpiece level found in 3.4.11.6.
7. Remove the generator signal and notice the decrease of the earpiece level.  
The decrease expresses the signal to noise ratio.

### 3.4.12. Check of AF-Amplifier

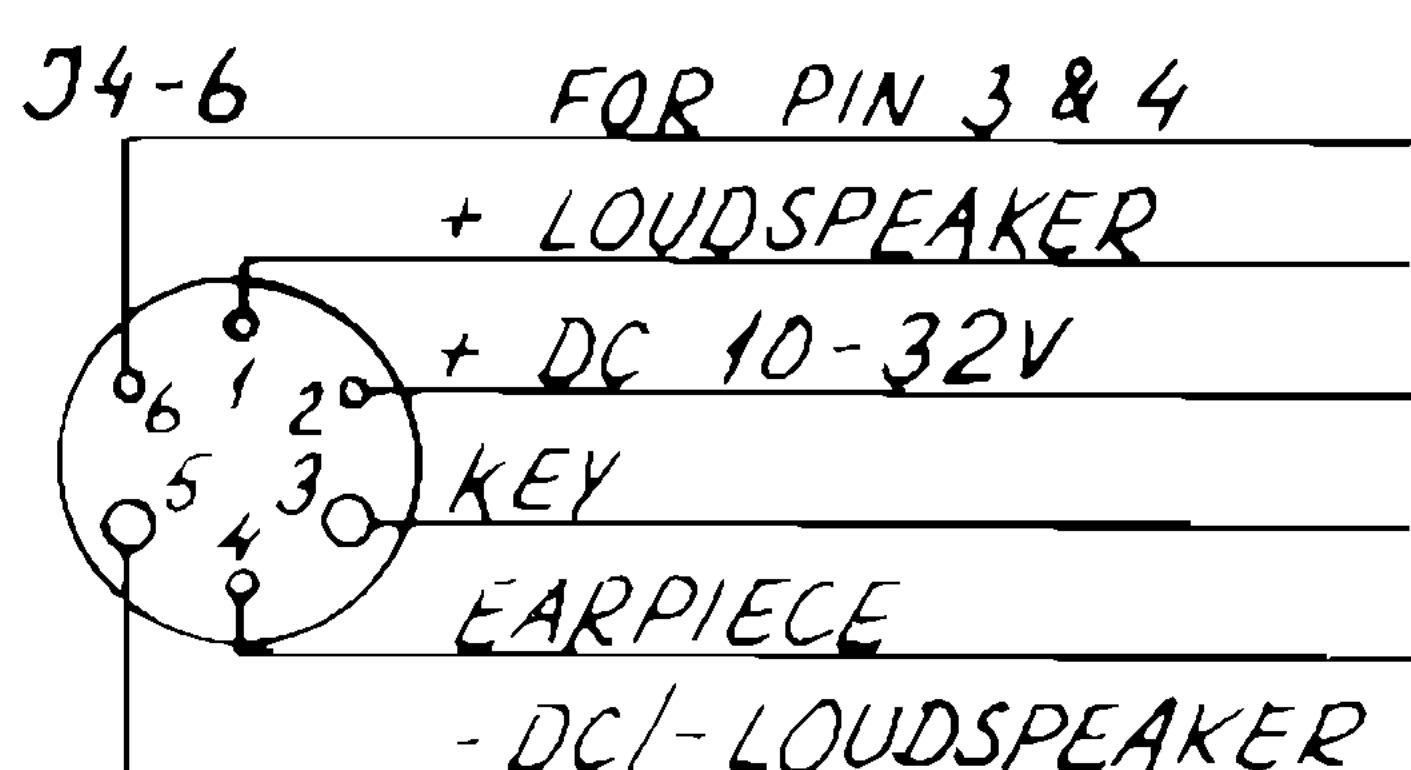
1. Connect loudspeaker H2054, H2074 or a resistor 8 ohm/16W to +/-loudspeaker located in the power cable.
2. Connect the oscilloscope to +/- loudspeaker located in the power cable.  
**Note!** Be sure that receiver ground is separated from -loudspeaker.
3. Connect the voltmeter to +/- loudspeaker located in the power cable.
4. Connect the signal generator to aerial socket "1".
5. Adjust the receiver supply voltage to be 32 Volt.
6. Turn the receiver on.
7. Choose receiver frequency  $f_{RX}$ , generator frequency  $f_G$  and generator output level  $V_G$  according to table 3.4.11.8.

### 3.4.12. Check of AF-Amplifier cont.:

8. Measuring set-up:



**NOTE!** The numbering of wires refers to R2022 power plug J4-6



Signal Generator			R2022	
$f_G$	$V_G$ (EMF)	Mode	$f_{RX}$	Mode
2183 kHz	60 dB/uV	CW	2182 kHz	SSB

9. Turn the AF-level control clockwise until the AF-amplifier starts clipping (measured on oscilloscope).
10. Check the AF-amplifier output level by means of the voltmeter to be more than 10  $V_{RMS}$ .
11. Remove modulation from the incoming RF-signal and check that the AF-amplifier output is decreased more than 50 dB compared to the value measured in step 3.4.11.10.

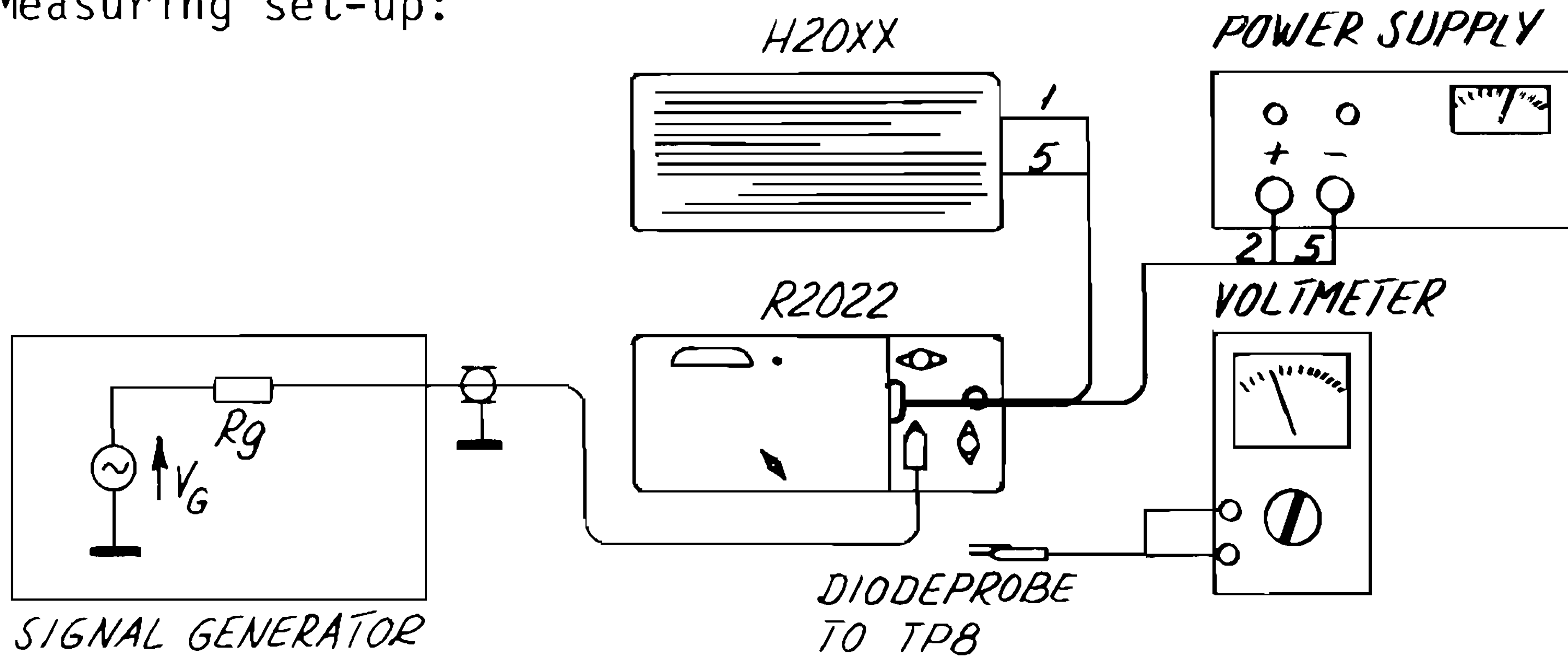
### 3.4.13. Check of Duplex Filter Tuning Range

1. Execute 3.4.10.7. - 3.4.10.11. for adjustment of the trimming capacitor C3-1.
2. Adjust the generator output  $V_G = 113$  dB/uV.
3. Press 2182.
4. Press the tune knob and turn the knob fully clockwise.
5. Connect the diode probe to TP8.
6. Adjust the generator frequency  $f_G$  until maximum mixer input voltage on TP8 is reached.

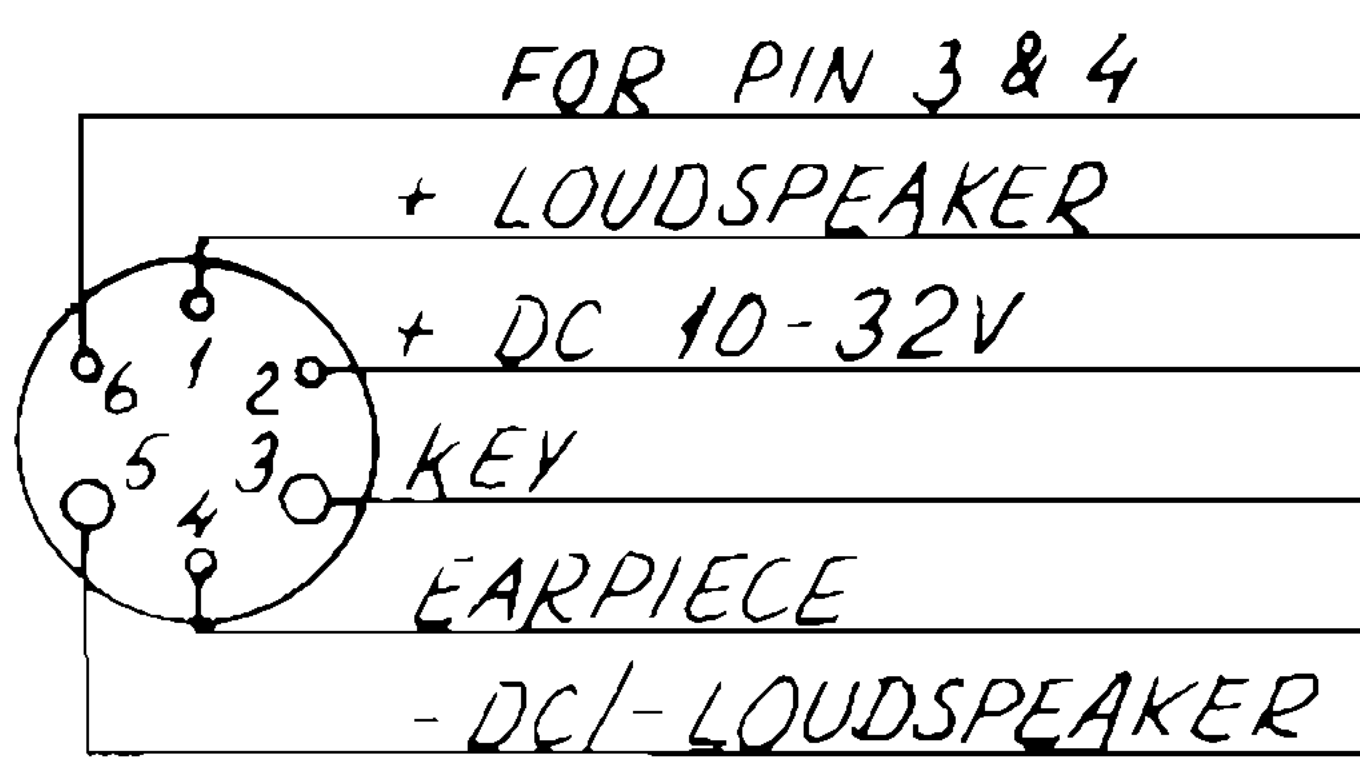


### 3.4.13. Check of Duplex Filter Tuning Range cont.:

7. Observe that the generator frequency  $f_G$  is above 4800 kHz.
8. Press the tune knob and turn the knob fully counter clockwise.
9. Execute 3.4.13.6.
10. Observe that the generator frequency  $f_G$  is below 1560 kHz.
11. If the duplex filter does not meet the specified limits in check points 7. and 10., it is necessary to execute 3.5.6. Adjustment of Duplex Filter.
12. Measuring set-up:



**NOTE!** The numbering of wires refers to R2022 power plug J4-6





### 3.5. ADJUSTMENT PROCEDURE

#### GENERAL

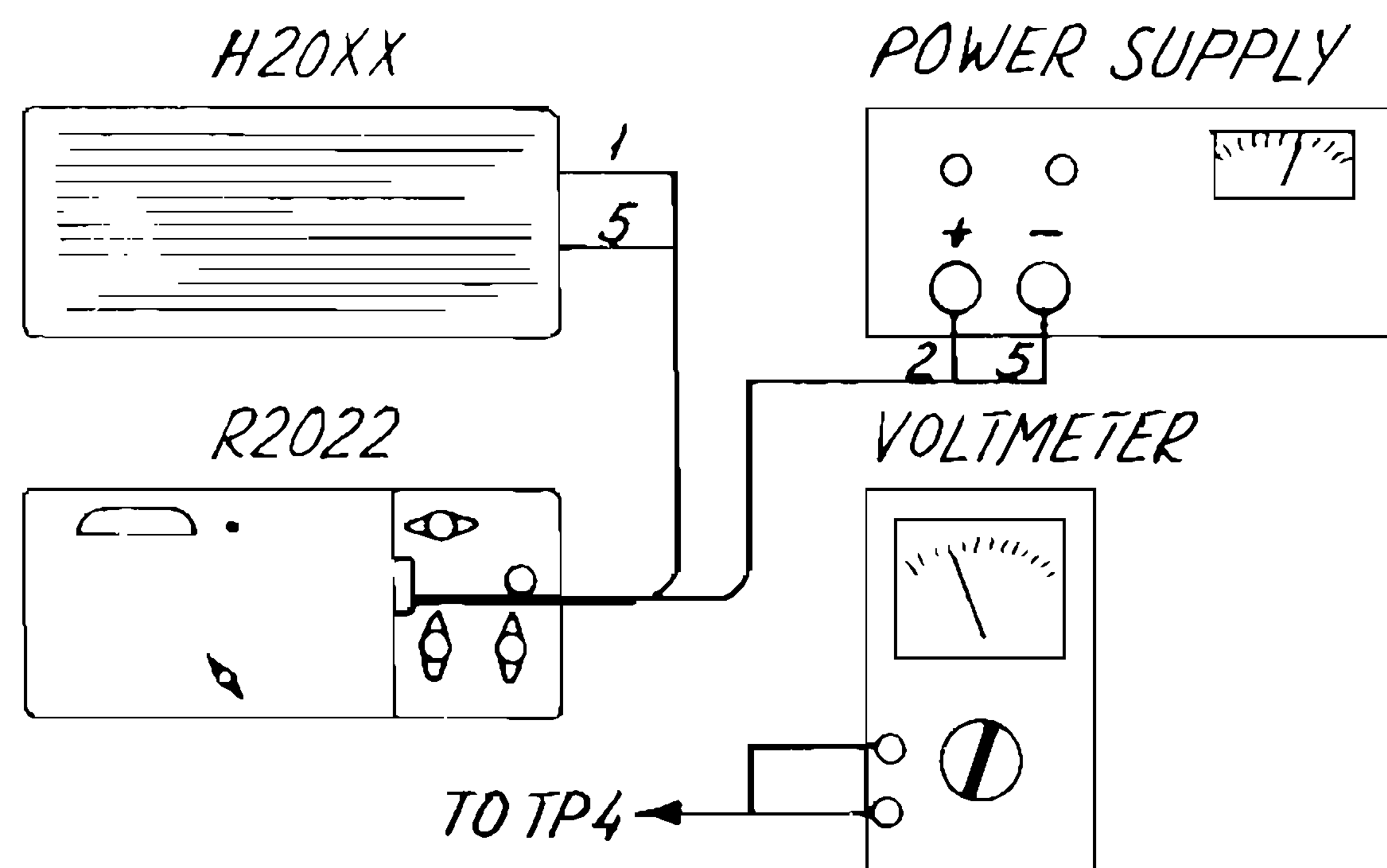
Before executing the adjustment procedure, remove covers, shields etc, to make it possible to perform the wanted adjustments.

The procedure has been worked out in a way which makes it possible to carry out one of the sections without having to carry out them all.

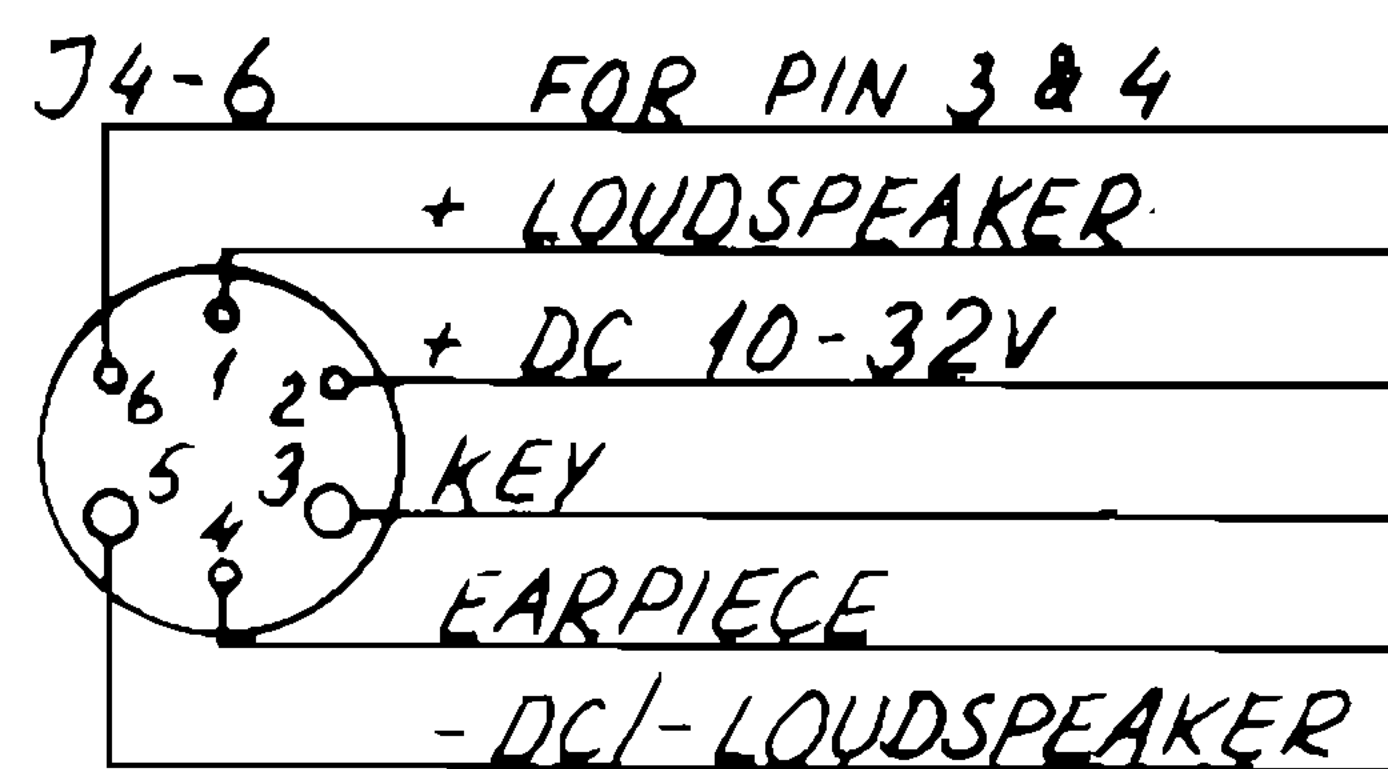
To locate the adjustable components referred to in the procedure, look-up "adjustment locations" in this manual.

#### 3.5.1. Adjustment of Power Supply

1. Adjust the receiver supply voltage to 24 Volt.
2. Turn the receiver on.
3. Connect the voltmeter to TP4.
4. Adjust R16-7 until voltage on TP4 is 5.1 Volt  $\pm$ 0.05 Volt.
5. Measuring set-up:



**NOTE!** The numbering of wires refers to R2022 power plug J4-6

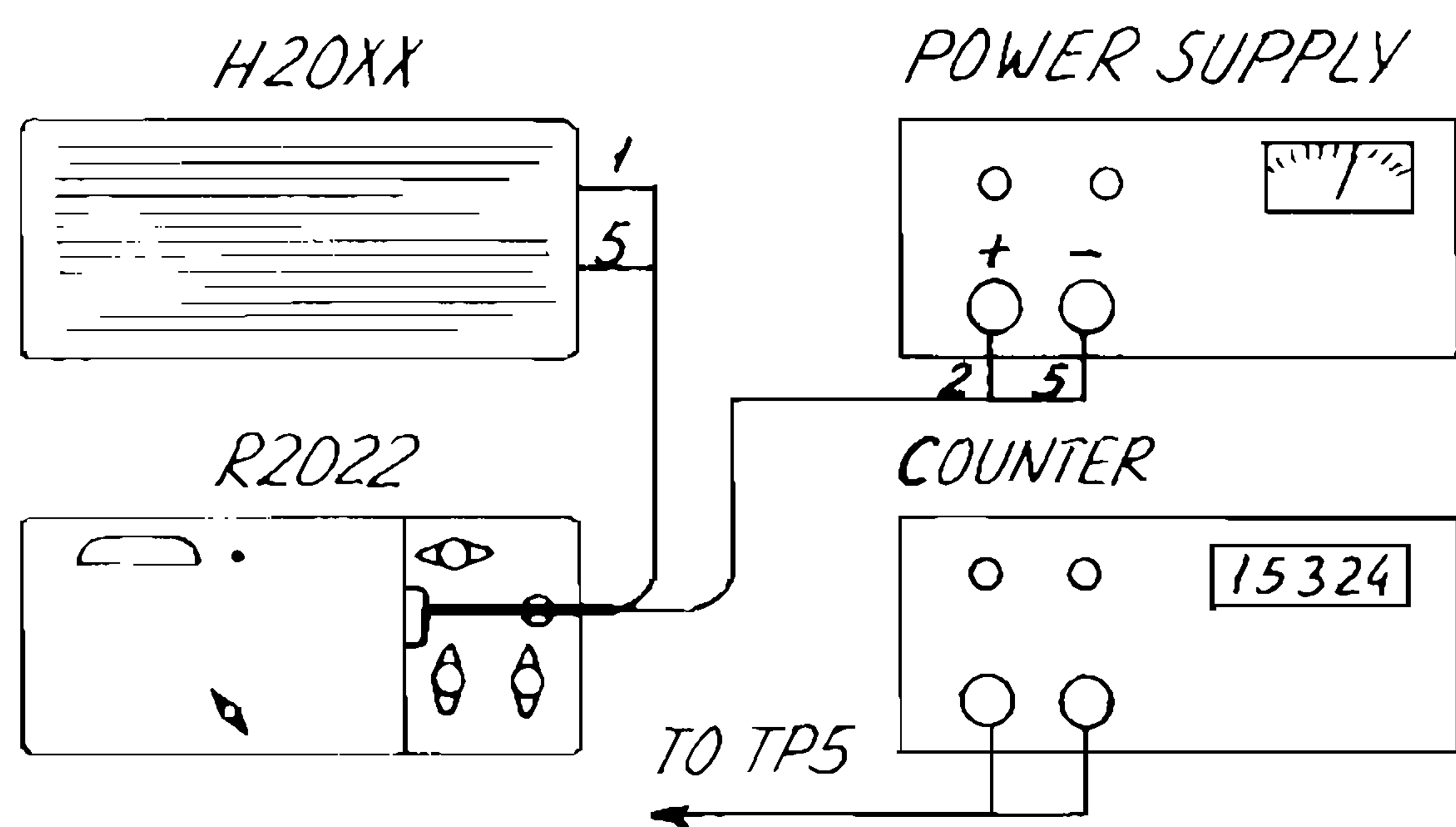


#### 3.5.2. Adjustment of Crystal Oscillator

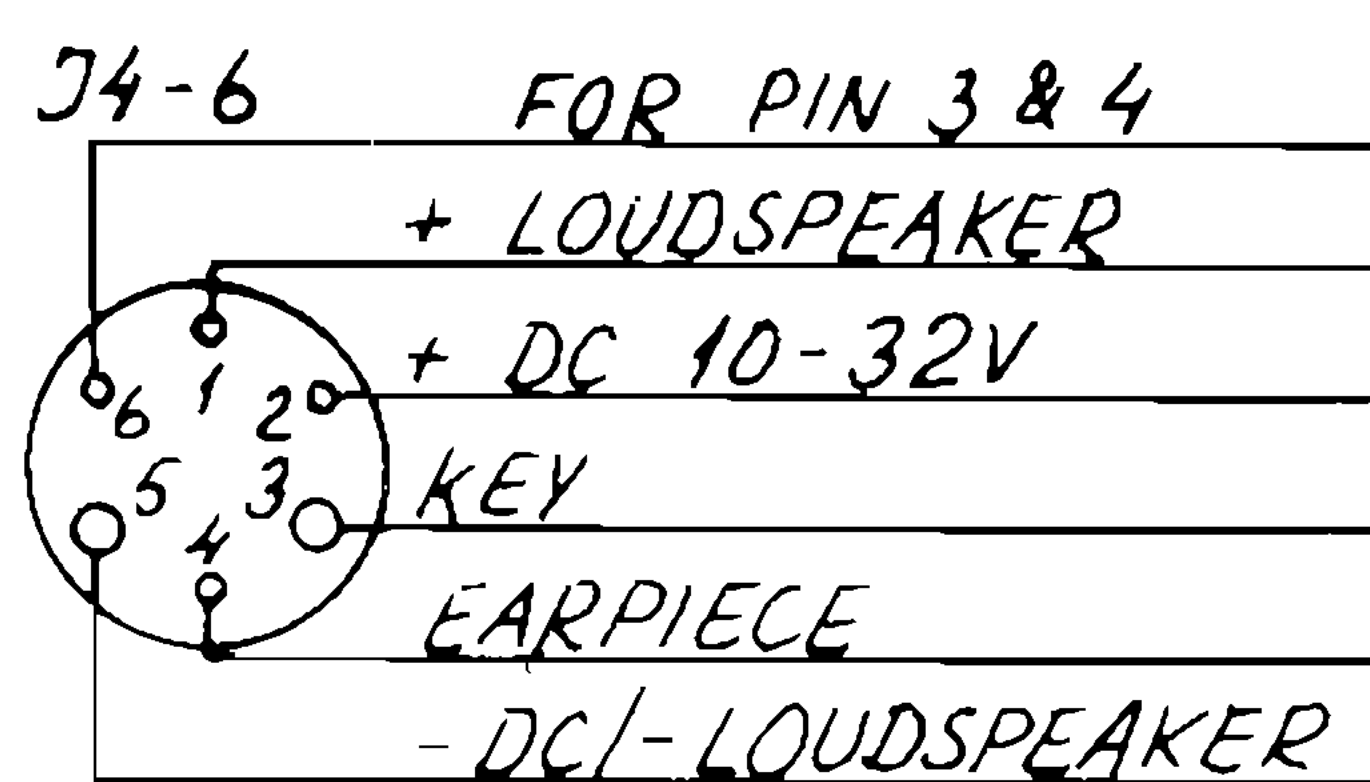
1. Connect the counter to TP5.
2. Turn the receiver on.  
**NOTE!** The receiver must be on for at least 5 minutes before adjustment.
3. Key-in the following frequency    .
4. Adjust C6-3 until the frequency on TP5 is 10,84080 MHz.

### 3.5. ADJUSTMENT PROCEDURE cont.:

#### 5. Measuring set-up:



**NOTE!** The numbering of wires refers to R2022 power plug J4-6

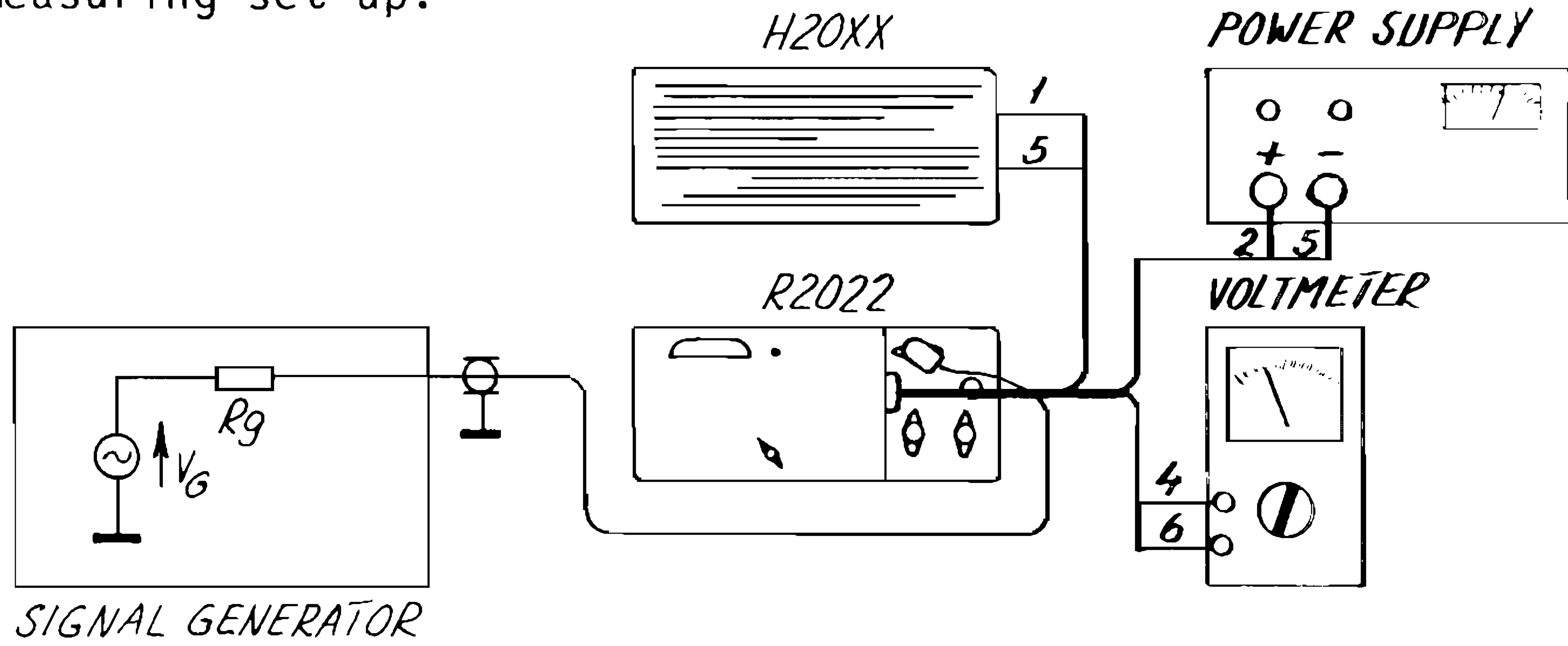


#### 3.5.3. Adjustment of Detector Coil

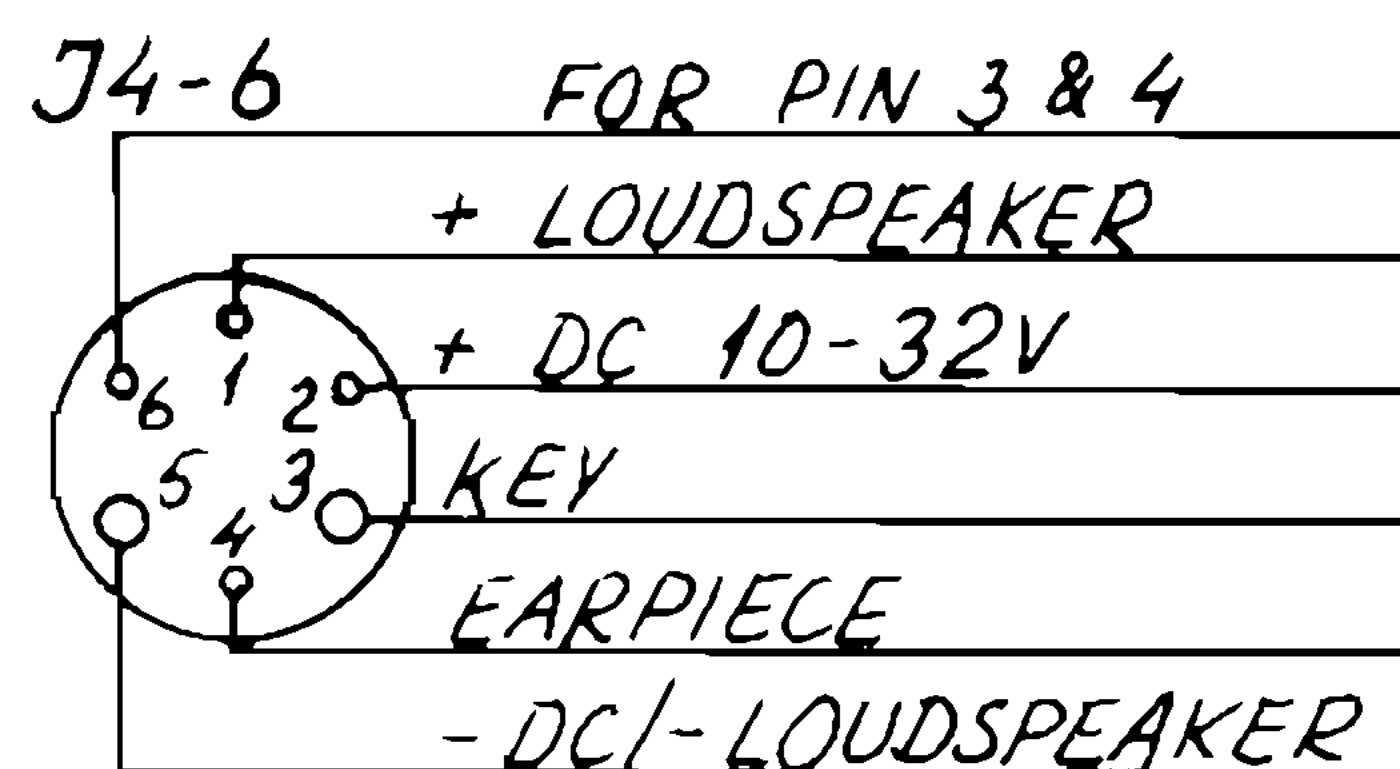
1. Connect the voltmeter to earpiece output.
2. Connect the signal generator to aerial socket "FM".
3. Turn the receiver on.
4. Choose receiver frequency  $f_{RX}$ , generator frequency  $f_G$  and generator output level according to table 6.
5. Adjust detector coil L4-2 to maximum earpiece output.

### 3.5.3. Adjustment of Detector Coil cont.:

#### 6. Measuring set-up:



**NOTE!** The numbering of wires refers to R2022 power plug J4-6



Signal Generator			R2022		Voltmeter
f <sub>G</sub>	V <sub>G</sub> (EMF)	Mode	f <sub>RX</sub>	Mode	
88 MHz	60 dB/uV	FM-mod. +75 kHz with 1 kHz	88 MHz	FM	0.15V <sub>RMS</sub> < V <sub>earp.</sub> < 0.30V <sub>PMS</sub>

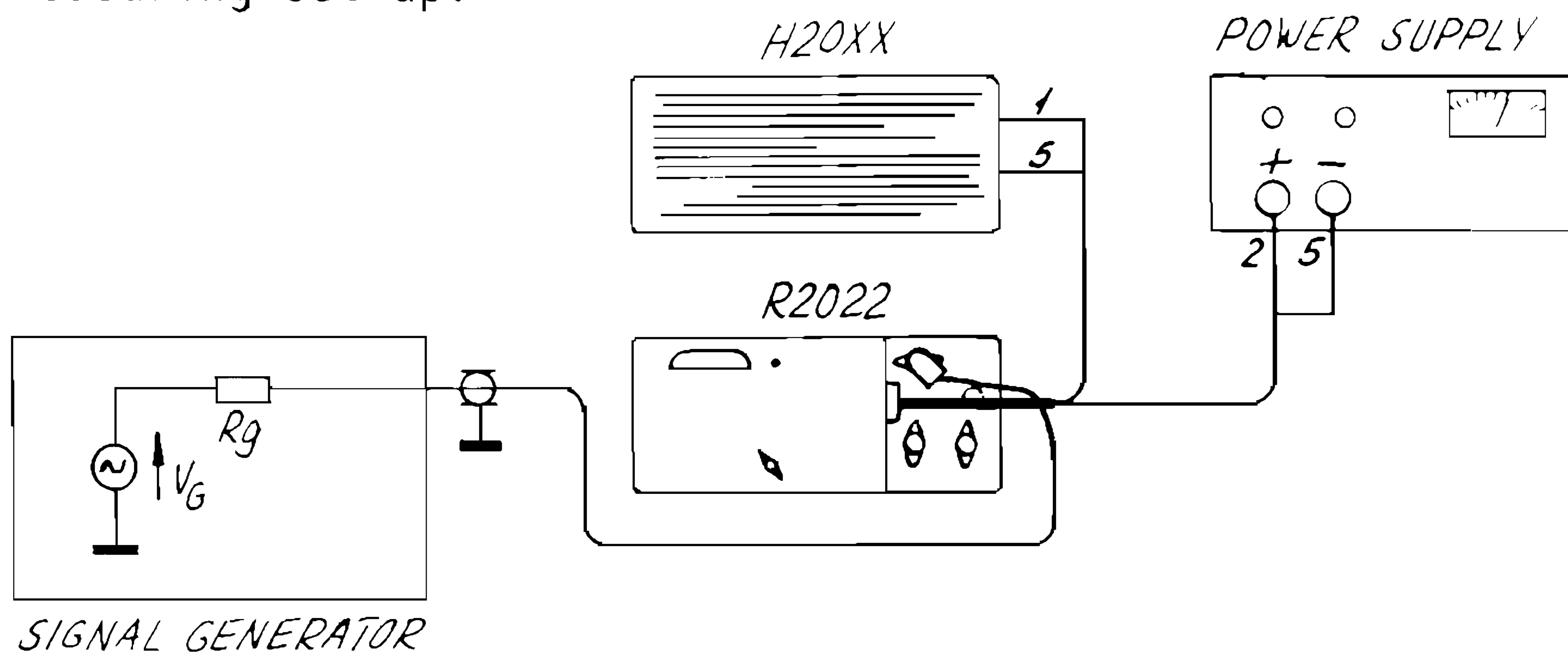
### 3.5.4. Adjustment of FM-Tuner

#### Adjustment of Mixer Transformer TR5-1.

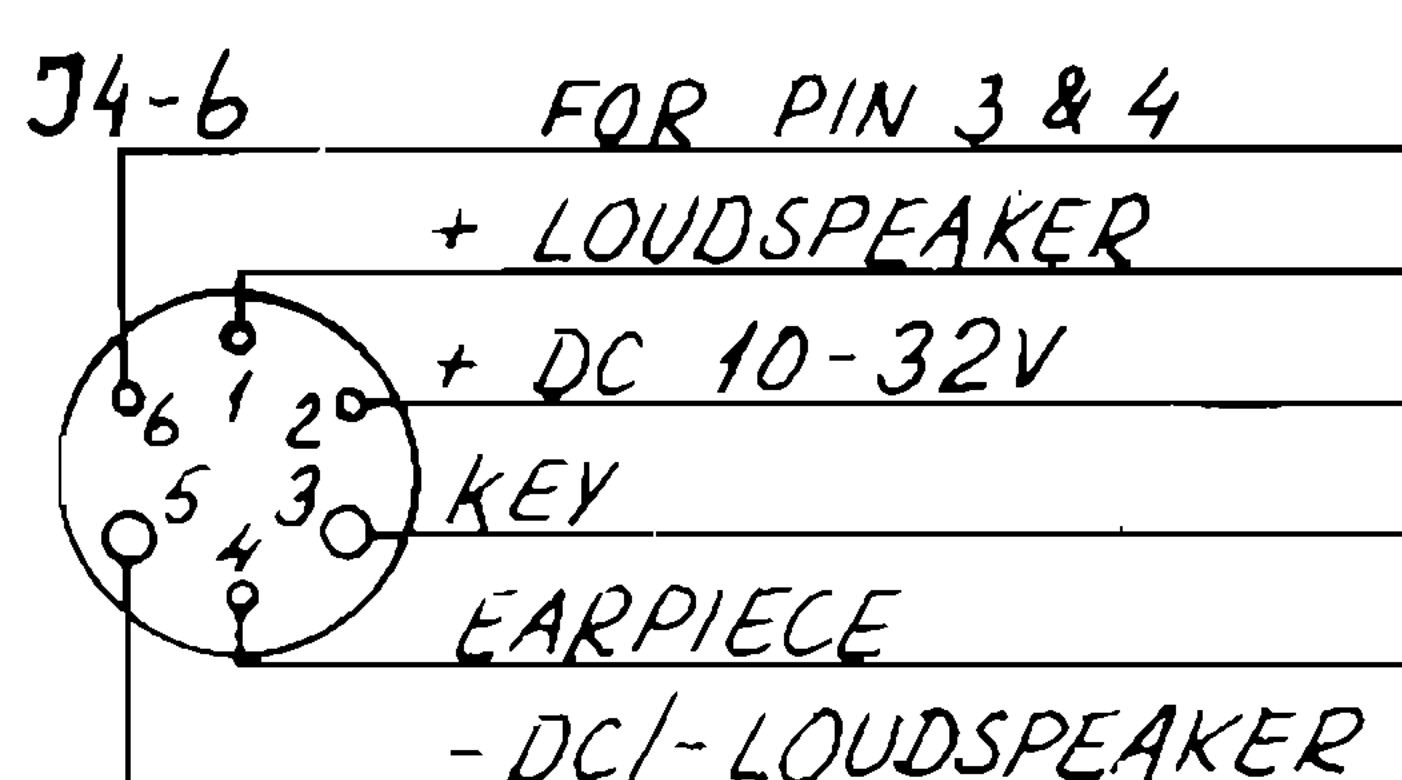
1. Connect the signal generator to aerial socket "FM".
2. Turn the receiver on.
3. Choose receiver frequency f<sub>RX</sub> and signal generator f<sub>G</sub> according to table 7.
4. Adjust generator output level V<sub>G</sub> until signal strength meter deflection is approx. 2.
5. Tune the transformer TR5-1 to maximum meter deflection.
6. Execute 4. and 5. until no further improvement can be achieved.

### 3.5.4. Adjustment of FM-Tuner cont.:

#### 7. Measuring set-up:



**NOTE!** The numbering of wires refers to R2022 power plug J4-6



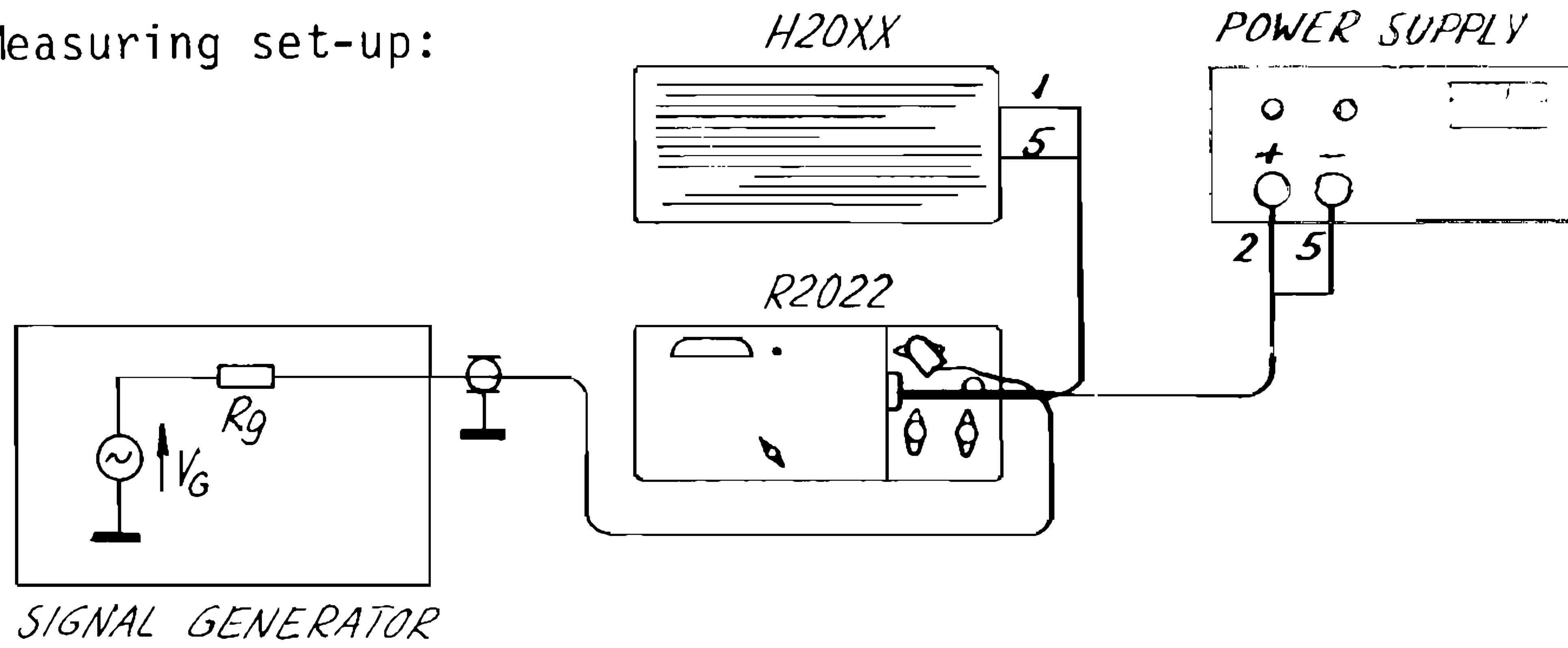
Signal Generator			R2022		
$f_G$	$V_G$	Mode	$f_{RX}$	Mode	
88 MHz		CW	88 MHz	FM	Tuning of TR5-1

#### Adjustment of Transformers TR1-1, TR6-1 and Trimming Potentiometer R35-4.

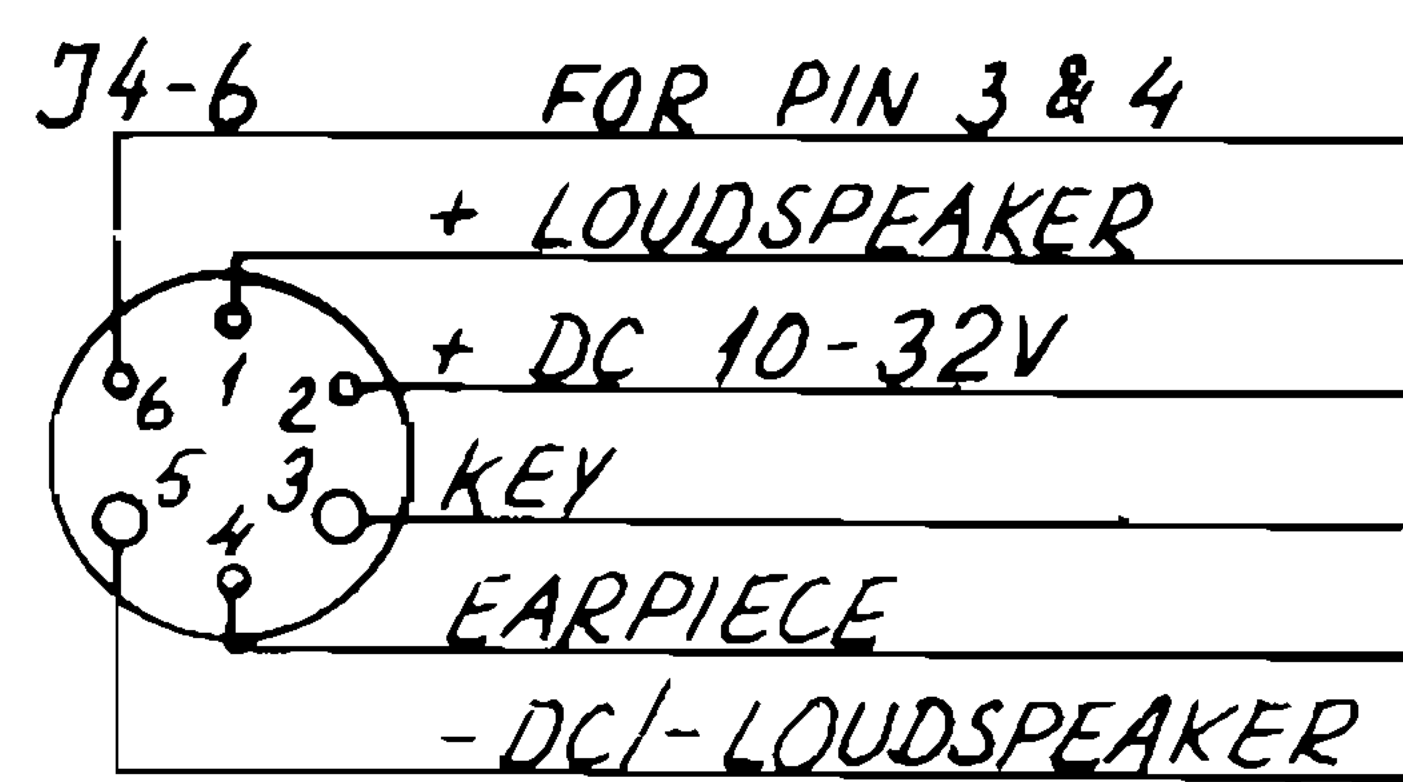
8. Execute 1. and 2.
9. Choose receiver frequency  $f_{RX}$  and signal generator frequency  $f_G$  according to table 18.
10. Adjust generator output level  $V_G$  until signal strength meter deflection is approx. 2.
11. Tune TR1-1 and TR6-1 to maximum meter deflection.
12. Execute 10. and 11. until no further improvement can be achieved.
13. Choose receiver frequency  $f_{RX}$  and generator frequency  $f_G$  according to table 18.
14. Adjust generator output level  $V_G$  until signal strength meter deflection is approx. 2.
15. Tune the trimming potentiometer R35-4 to maximum meter deflection.
16. Execute 14. and 15. until no further improvement can be achieved.
17. Execute the instructions 9. - 12. and 13. - 16. until no further improvement can be achieved.

### 3.5.4. Adjustment of FM-Tuner cont.:

18. Measuring set-up:



**NOTE!** The numbering of wires refers to R2022 power plug J4-6



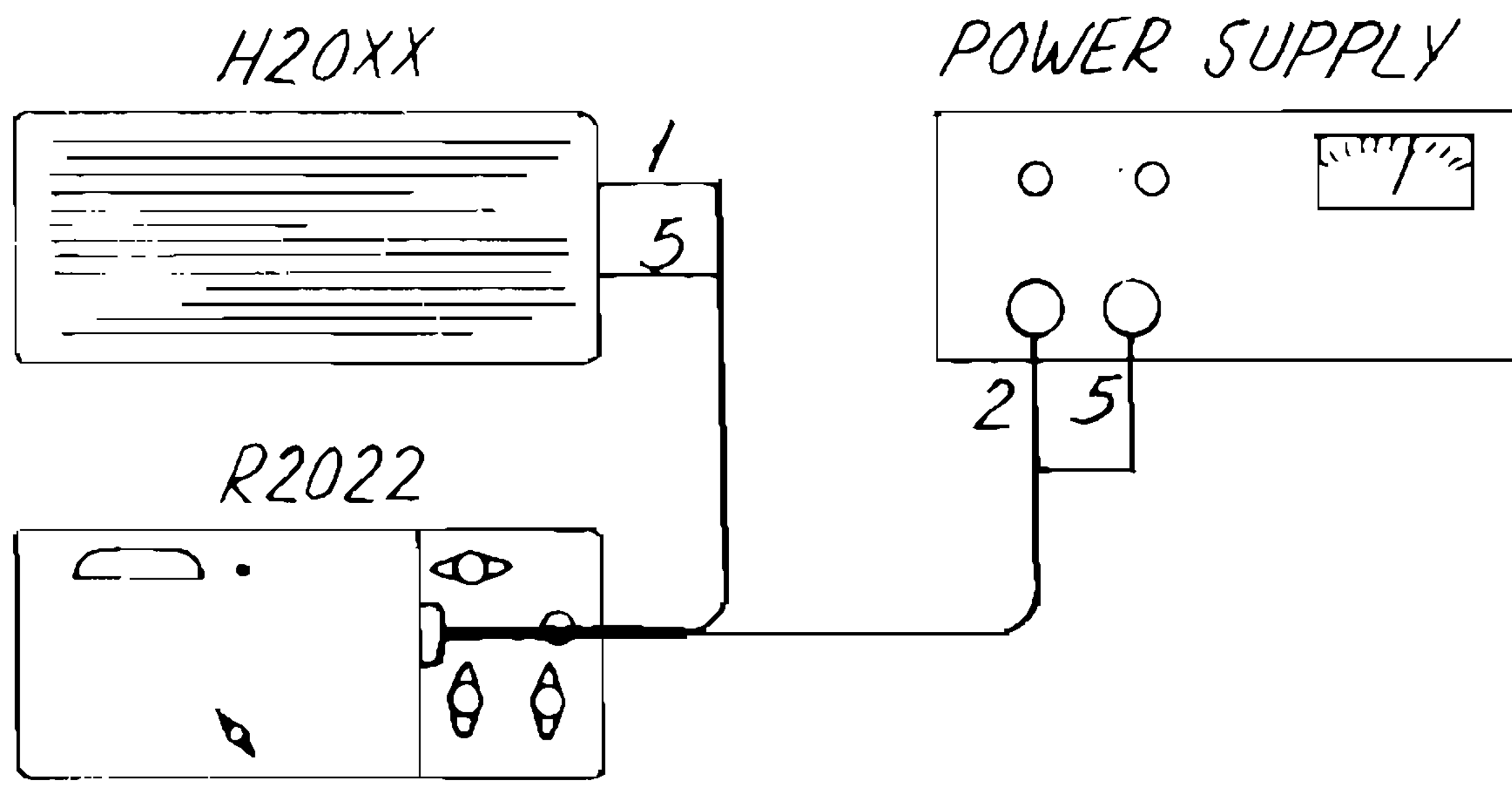
Signal Generator			R2022		
$f_G$	$V_G$	Mode	$f_{RX}$	Mode	
88.5 MHz		CW	88.5 MHz	FM	Adjustment of TR1-1 and TR6-1
104 MHz		CW	104 MHz	FM	Adjustment of R35-4

### 3.5.5. Adjustment of IF-Selectivity Trimming Capacitor C55-1

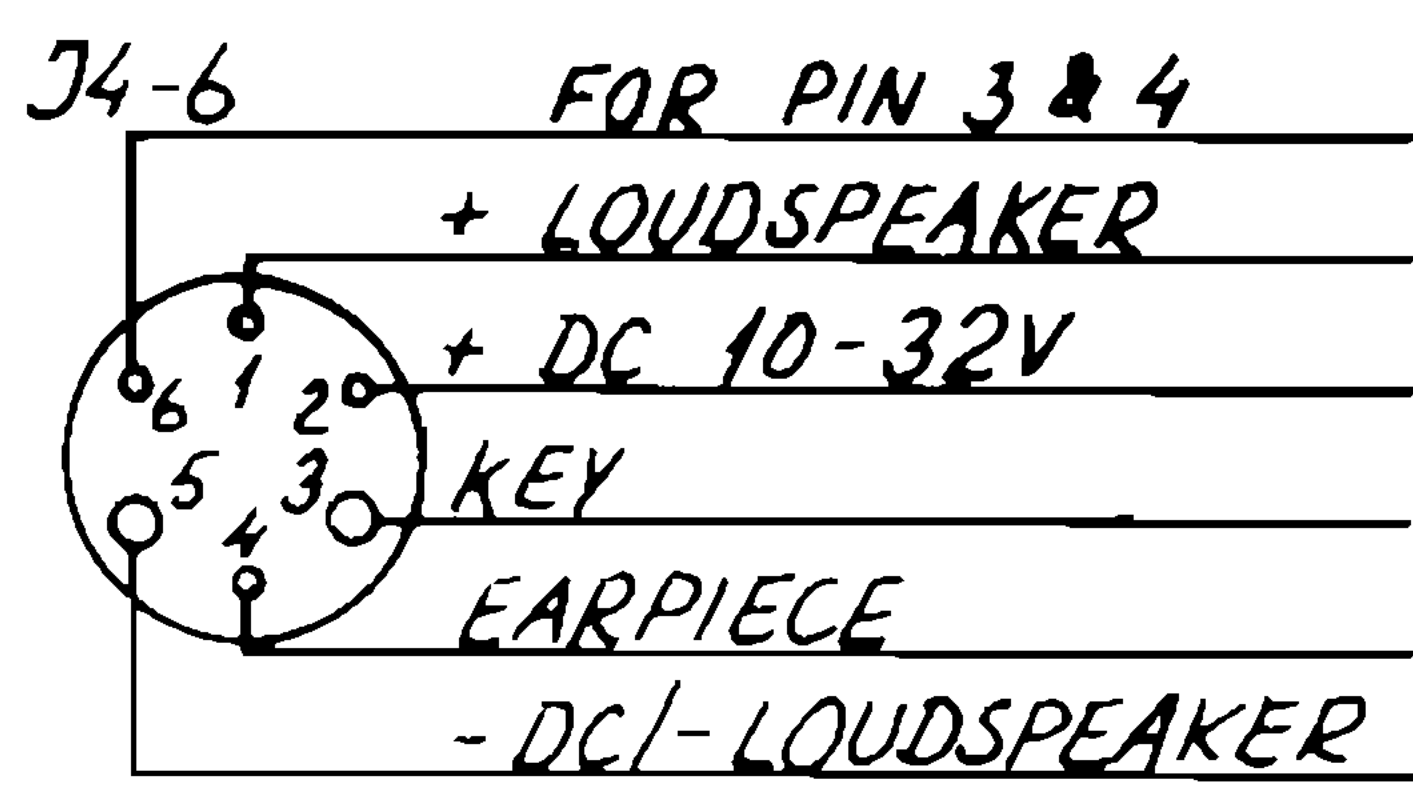
1. Turn the receiver on.
2. Press 2182.
3. Press the tune knob and tune the meter deflection to approx. 2.
4. Keep the noise generator activated and adjust the trimming capacitor C55-1 for maximum meter deflection.

### 3.5.5. Adjustment of IF-Selectivity Trimming Capacitor C55-1 cont.:

#### 5. Measuring set-up:



**NOTE!** The numbering of wires refers to R2022 power plug J4-6

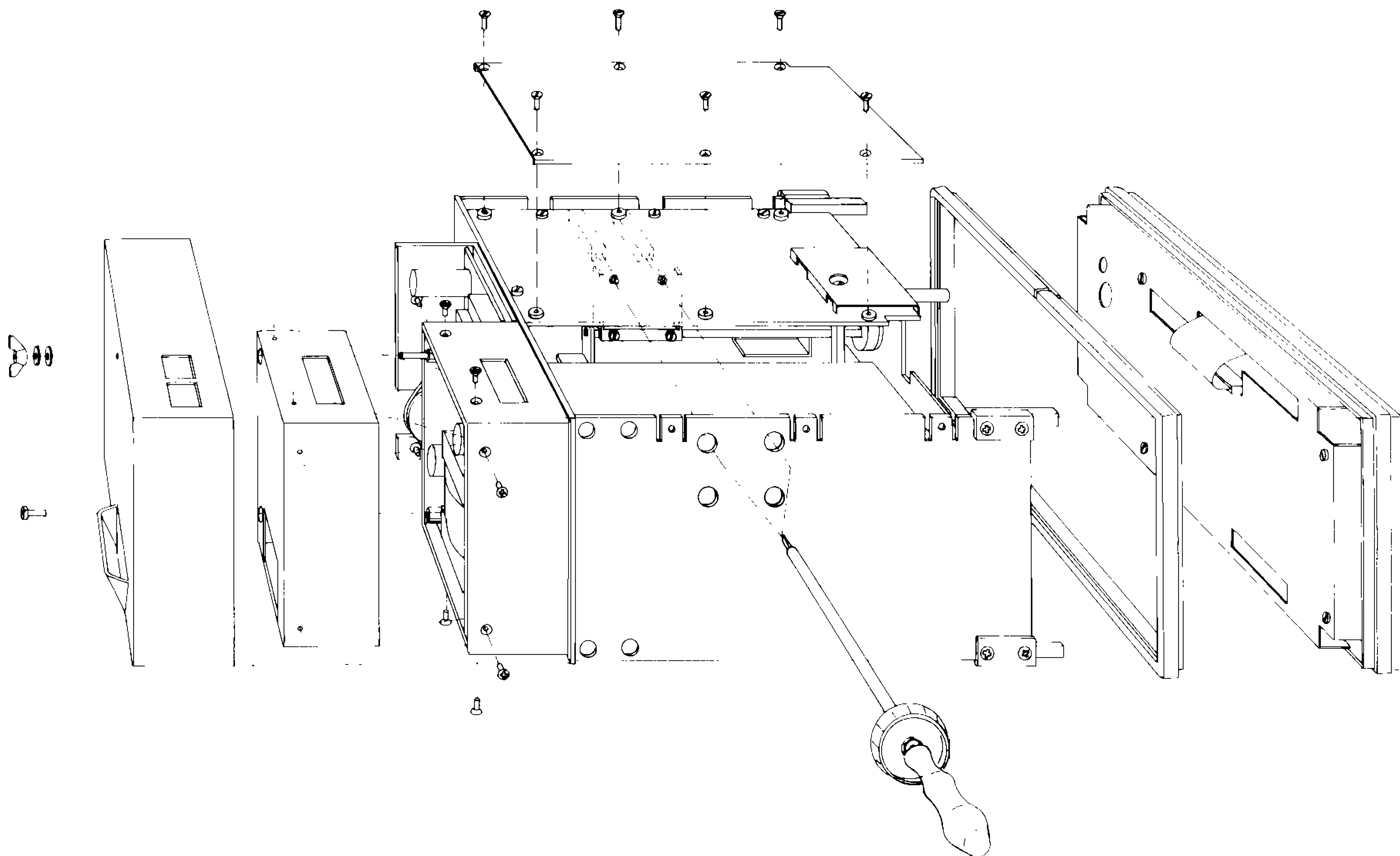


R2022		
f <sub>RX</sub>	Mode	
2182 kHz	AM	Tuning of C55-1



### 3.5.6. Adjustment of Duplex Filter

**Note!** To adjust the duplex filter it is necessary to require a special tool for the adjustment of the ferrite cores in the filter coils. This tool is available under the type No. 700931 and is described in section 3.2.

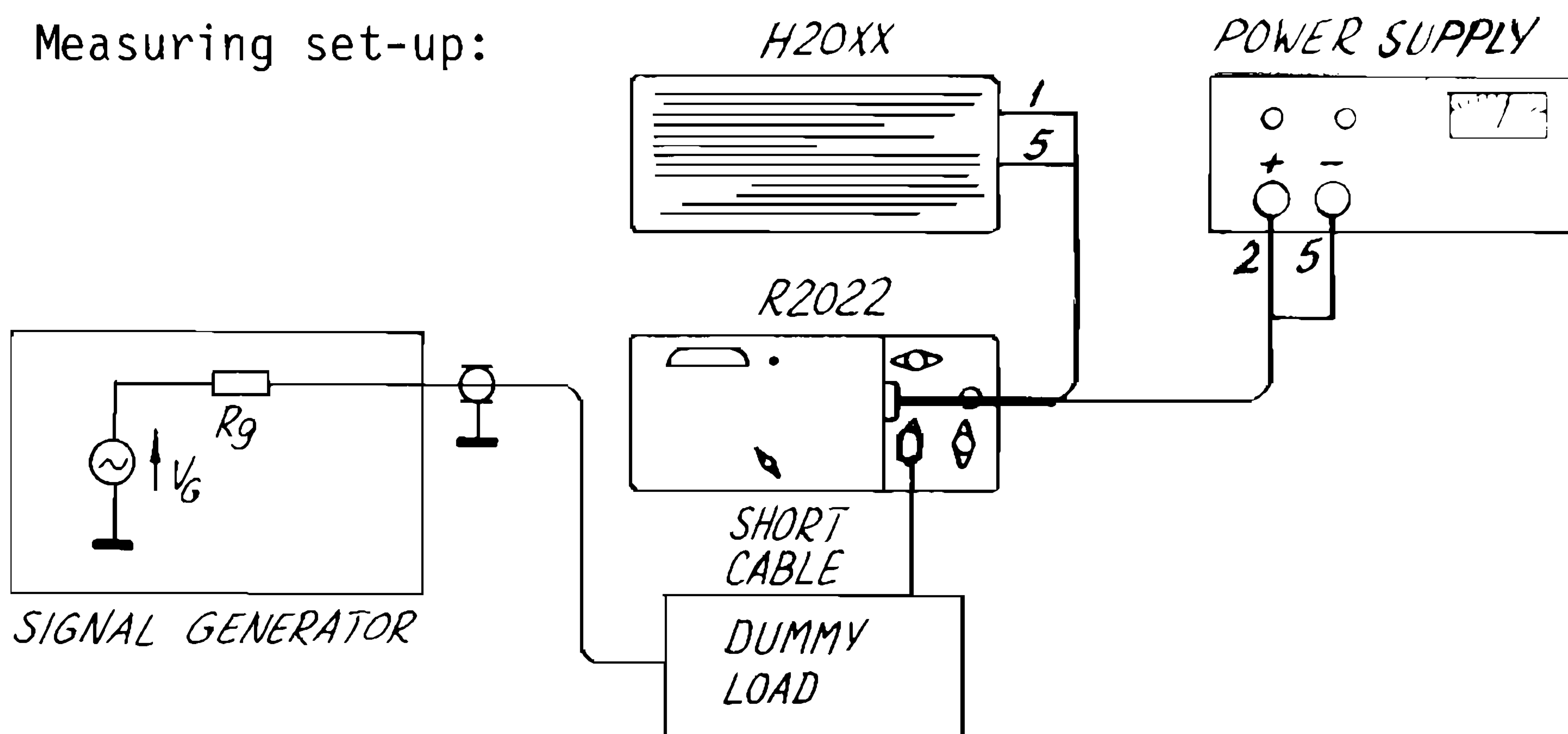


1. Turn the receiver on.
2. Key-in the following frequency      , press the tune knob and turn the knob fully clockwise.
3. Keep the noise generator activated and the tune knob in fully clockwise position and adjust L3-1 by means of H700931 to maximum meter deflection.  
**Note!** the ferrite cores are locked with counter nuts which have to be loosened before adjustment.
4. Key-in the following frequency      , press the tune knob and adjust the knob for maximum meter deflection.
5. Key-in the following frequency      .
6. Activate the noise generator by pressing the tune knob. Keep the noise generator activated and avoid turning the tune knob while adjusting L3-1 for maximum meter deflection.  
After adjustment, lock the adjusted core with the counter nut.
7. Connect the signal generator to aerial socket "1" through 10 ohm/250 pF dummy load.
8. Choose receiver frequency  $f_{RX}$  and generator frequency  $f_G$  according to table 20.
9. Press the tune knob and tune for maximum meter deflection.

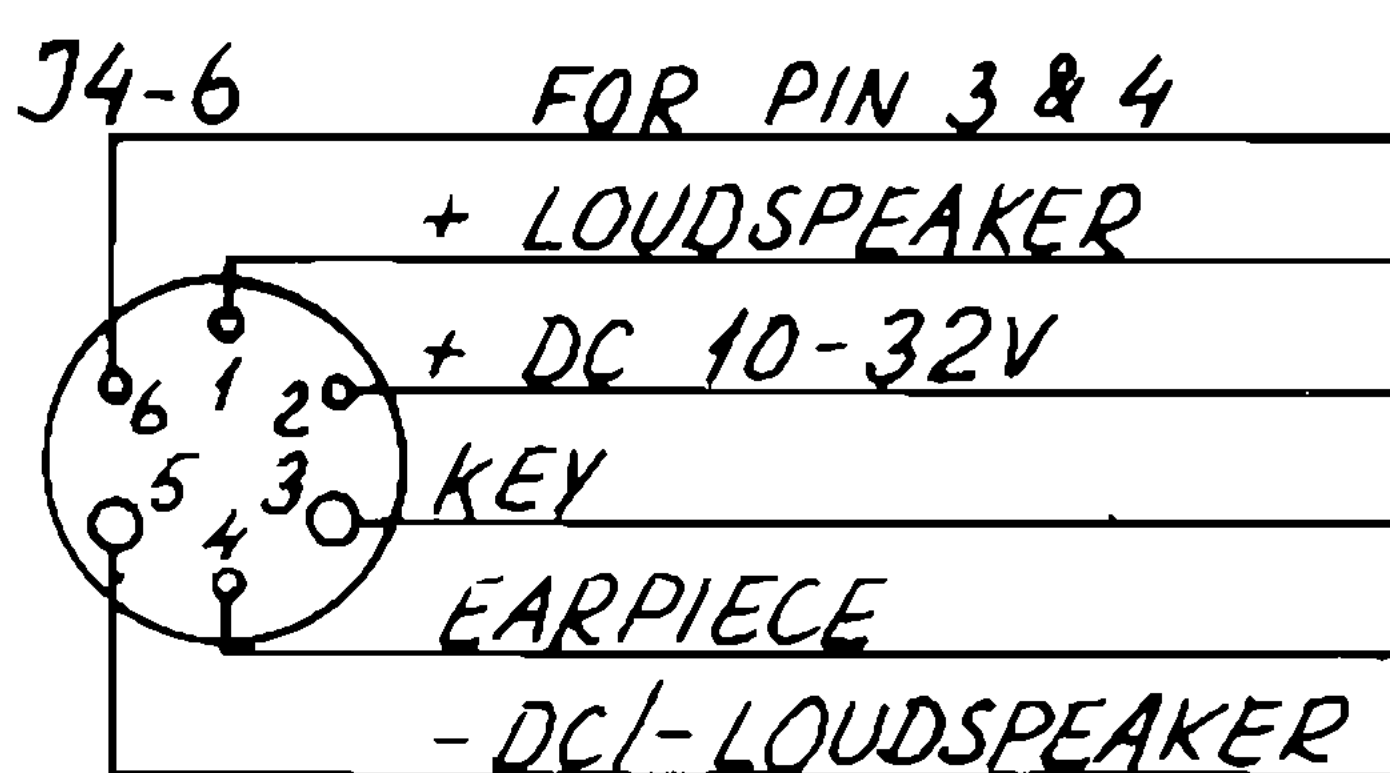
### 3.5.6. Adjustment of Duplex Filter cont.:

10. Adjust generator output level  $V_G$  to meter deflection 2.
11. Adjust L1-1 to maximum meter deflection.
12. Execute 9. - 11. until no further improvement occurs.
13. Choose receiver frequency  $f_{RX}$  and generator frequency  $f_G$  according to table 20.
14. Press the tune knob and tune for maximum meter deflection.
15. Adjust generator output level  $V_G$  to meter deflection 2.
16. Adjust the trimming capacitor C3-1 to maximum meter deflection.
17. Execute 14. - 16. until no further improvement occurs.
18. Execute 8. - 12. and 13. - 17. until no further improvement can be obtained.
19. Lock the adjusted ferrit core with the counter nut.

20. Measuring set-up:



**NOTE!** The numbering of wires refers to R2022 power plug J4-6



Signal Generator			R2022		
$f_G$	$V_G$	Mode	$f_{RX}$	Mode	
3800 kHz		CW	3800 kHz	AM	Adjustment of L1-1
1650 kHz		CW	1650 kHz	AM	Adjustment of C3-1

## 3.6. NECESSARY ADJUSTMENT AND CHECK AFTER REPAIR

### GENERAL

After repair of the receiver it may be necessary to do some adjustments and checks.

The range of these adjustments and checks can only be decided by the person who has done the repair and this manual section must only be looked upon as a guide.

Any repair must, as mentioned previously, be followed by a function check after assembling the receiver.

### FRONT-END (MODULE 1)

#### After a Change of the Module

Execute 3.5.4.1. - 2., 3.5.4.13. - 16. Adjustment of FM-tuner, and perform 3.4.10.7. - 14. Sensitivity Measurements, 3.4.13. Check of Duplex Filter Tuning Range, and execute 3.7. Function Check.

#### Repair in FM-Tuner

Execute 3.5.4. Adjustment of FM-Tuner and perform 3.4.10. Sensitivity Measurements.

#### Repair in Simplex Filters

Perform 3.4.10. Sensitivity Measurements.

#### Repair in Duplex Filter

Execute 3.5.6. Adjustment of Duplex Filters and perform 3.4.10. Sensitivity Measurements, and 3.4.13. Check of Duplex Filter Tuning Range.

#### Repair in Mixer (T6-1 and T7-1) and IF-Selectivity (FL2 and FL3)

Execute 3.5.5. Adjustment of IF-Selectivity and perform 3.4.10. Sensitivity Measurements, 3.4.6. Check of IF-Selectivity (SSB-Mode) and 3.4.7. Check of IF-Selectivity (AM-mode).

### IF-AMP., DET., AGC & AF PRE.AMP. (MODULE 2)

#### After a Change of the Module

Execute 3.7. Function Check.

#### Repair in IF-Amp. and AGC-Circuitry

Perform 3.4.4. Check of Detector Circuit, 3.4.8. Check of AGC-Response.

#### Repair on Detector Circuit

Execute 3.5.3. Adjustment of Detector Coil, perform 3.4.4. Check of Detector Circuit.

#### Repair in AF-Filter and AF-PRE.AMP.

Perform 3.4.5. Check of AF-Response in SSB-Mode, 3.4.4. Check of Detector Circuit and 3.4.12. Check of AF-Amp.

### 3.6. NECESSARY ADJUSTMENT AND CHECK AFTER REPAIR cont.:

#### FREQUENCY SYNTHESIZER (MODULE 3)

After a Change of the Module  
Execute 3.7. Function Check.

#### PROCESSOR UNIT (MODULE 4)

After a Change of the Module  
Execute 3.5.4.1. - 2., 3.5.4.13. - 16. Adjustment of FM-Tuner and perform  
3.7. Function Check.

Repair in Processor Unit  
Perform 3.4. Performance Check.

#### CONVERTER UNIT (MODULE 5)

After a Change of the Module  
Perform 3.4.2. Check of Power Supply.

Repair in Converter Unit  
Perform 3.4.2. Check of Power Supply.

#### AF AMP. & FILTER UNIT (MODULE 7)

After a Change of the Module  
Perform 3.4.2. Check of Power Supply.

Repair on CISPR- and Supply Voltage Filters  
Perform 3.4.2. Check of Power Supply.

Repair in Power Supply Loop Amplifier (IC1)  
Execute 3.5.1. Adjustment of Power Supply and perform 3.4.2. Check of Power  
Supply.

## 3.7. FUNCTION CHECK

### GENERAL

The function check is a simple test which makes it probable that the receiver is functioning, but it is not to compare with a complete performance check.

No covers have to be removed to perform the check and there is no need for test equipment.

The function check must always be executed when the receiver has been assembled after repair.

1. Check of keyboard and display is done by executing 3.4.1.1. - 3.4.1.48.
2. Connect an antenna to aerial socket "1".
3. Key-in a known broadcast station frequency in the range of 140 kHz - 385 kHz.
4. Notice that the detected AF-signal is heard from the loudspeaker.
5. Press   and notice that no distortion of the loudspeaker signal caused by receiver frequency error occurs.
6. Key-in a known broadcast station frequency in the range of 385 kHz - 1605 kHz.
7. Execute 3.7.4. and 3.7.5.
8. Key-in a known coastal station frequency in the range of 3049 kHz - 4500 kHz.
9. Notice that the detected AF-signal is heard from the loudspeaker and that no distortion caused by receiver frequency error occurs.
10. Key-in a known coastal station frequency in the range of 1605 kHz - 3048 kHz.
11. Execute 3.7.9.
12. Press the tune knob and adjust to maximum meter deflection.
13. Notice the detected AF-signal from the loudspeaker.
14. Programme the receiver for aerial configuration "two aerial duplex". (Look-up manual section XX).
15. Connect the antenna to aerial socket "2".
16. Press the  button, and press the tune knob and adjust to maximum meter deflection.
17. Notice the detected AF-signal from the loudspeaker.
18. Provide key mute signal through short-circuiting of the key mute and the ground wire, both located in the power cable.
19. Notice that loudspeaker is muted and the earpiece stays demuted.



### 3.7. FUNCTION CHECK cont.:

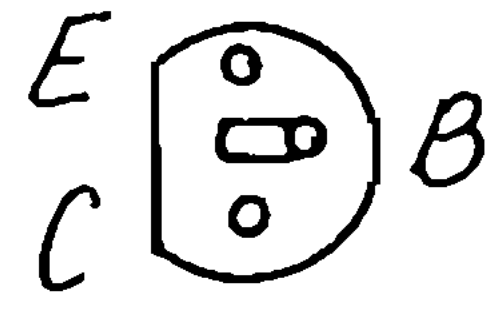
20. Disconnect the key mute wire and the ground wire.
21. Press duplex button.
22. Execute 3.7.18.
23. Notice that both loudspeaker and earpiece are muted.
24. Execute 3.7.20.
25. Connect the antenna to aerial socket "FM".
26. Key-in a known broadcast station frequency in the range 87.2 MHz - 107.9 MHz.
27. Notice that detected AF-signal is heard from the loudspeaker.



# 3.8. PIN CONFIGURATIONS

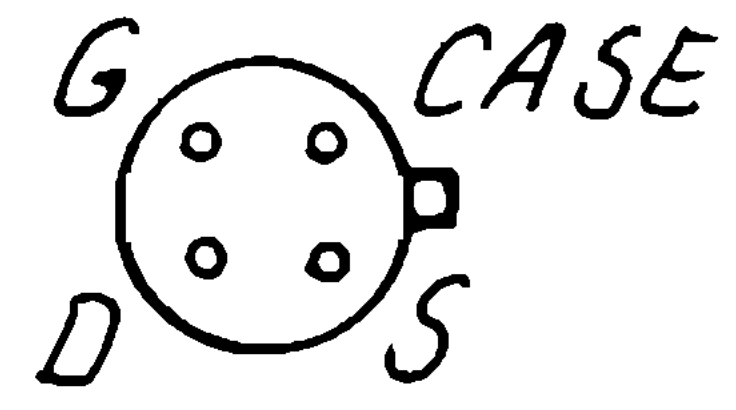
## TRANSISTORS

BOTTOM VIEW



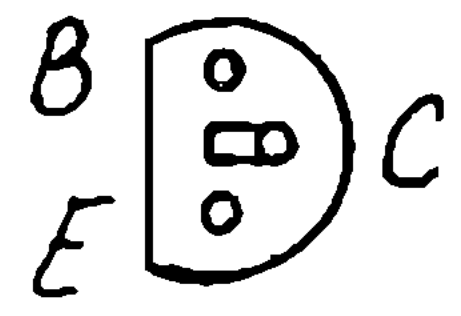
BC548  
BC557  
BC558  
BC559  
BC33B  
BC328  
BF506

BOTTOM VIEW



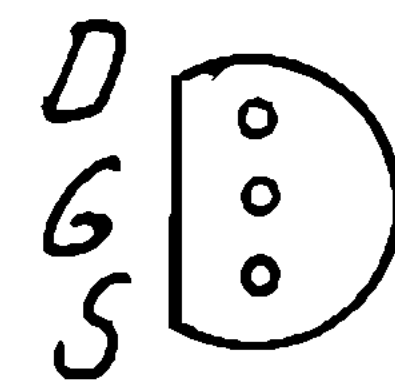
SD210DE

BOTTOM VIEW



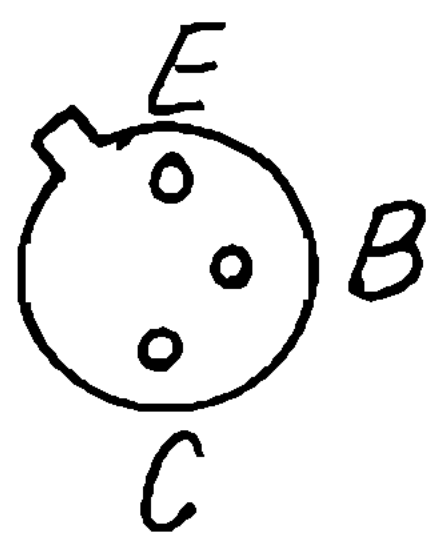
BC640

BOTTOM VIEW



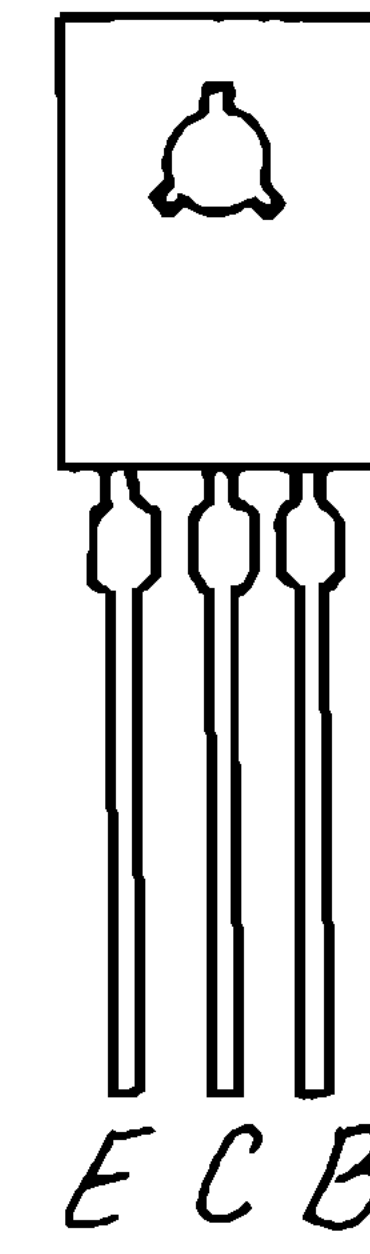
TM00044-3  
TM00044-2  
TM00044-1

BOTTOM VIEW



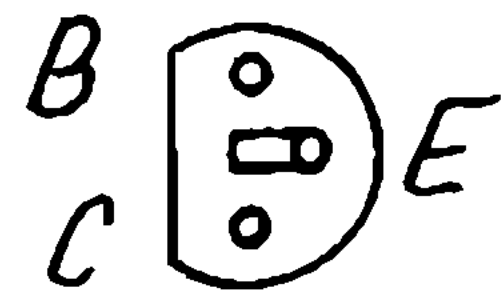
BFW17A

FRONT VIEW



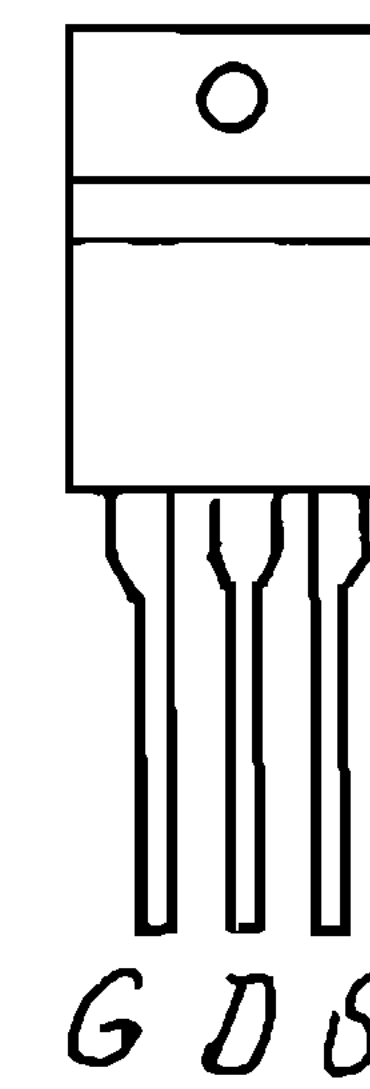
BD139

BOTTOM VIEW



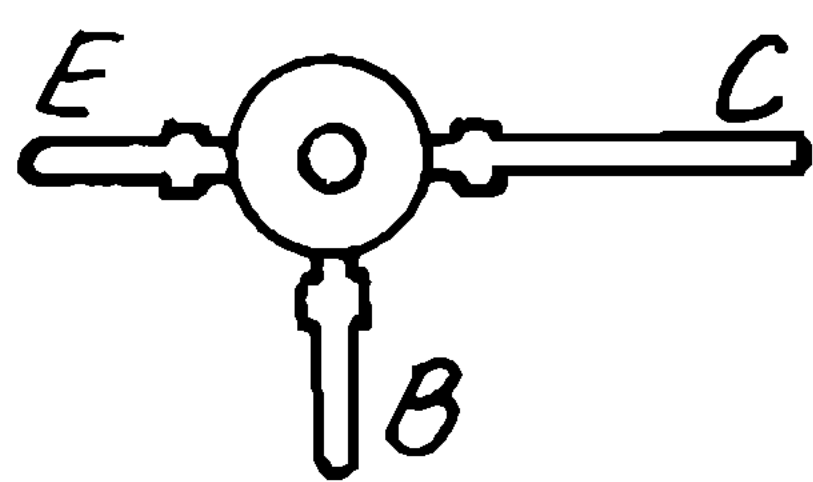
BF199  
MPS 3640

FRONT VIEW



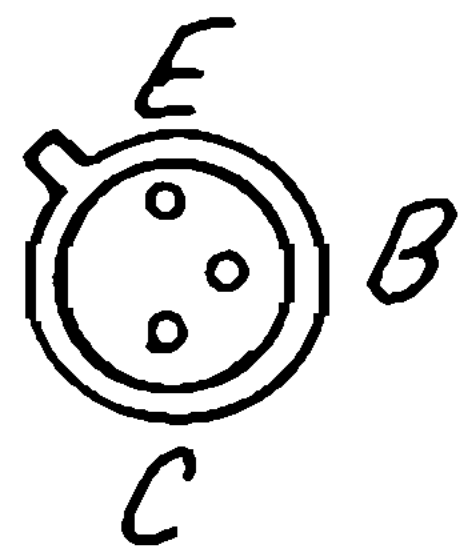
BUZ 21

TOP VIEW



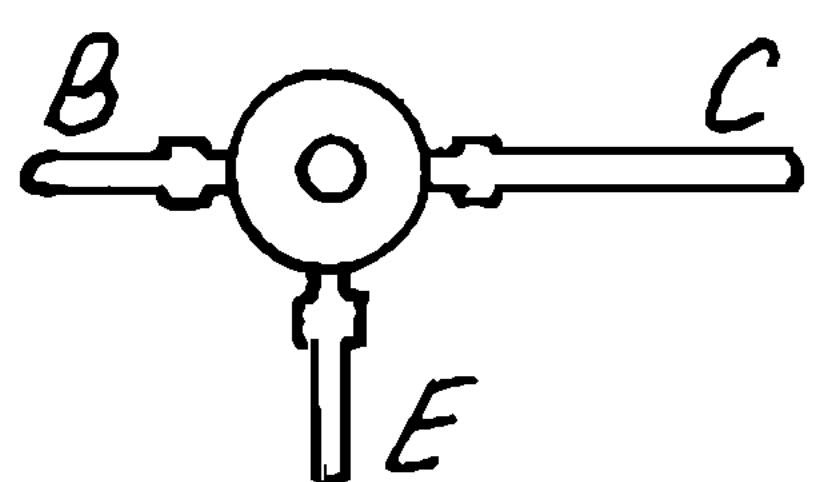
BF479

BOTTOM VIEW



2N2369A

TOP VIEW

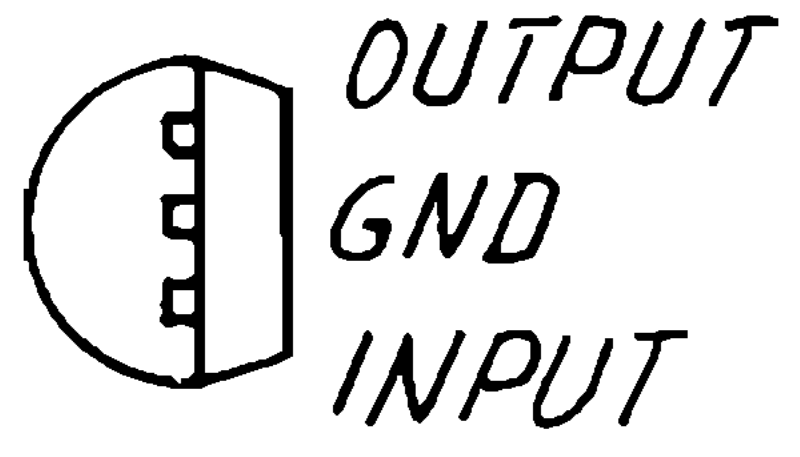


BFW92A

### 3.8. PIN CONFIGURATIONS cont.:

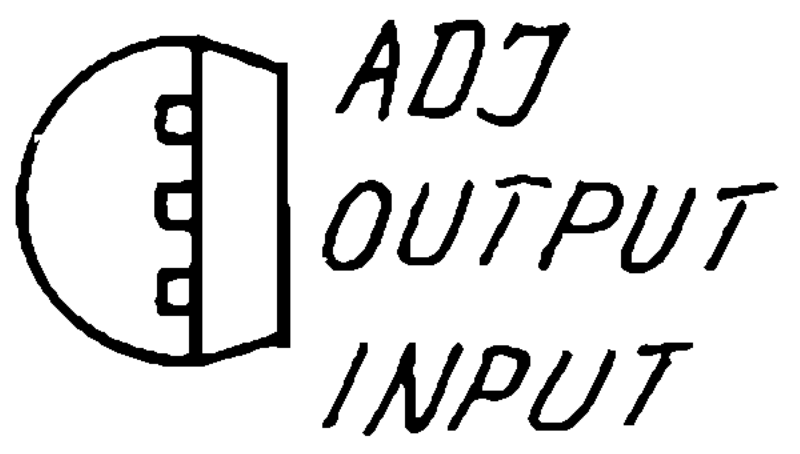
#### INTEGRATED CIRCUITS

BOTTOM VIEW



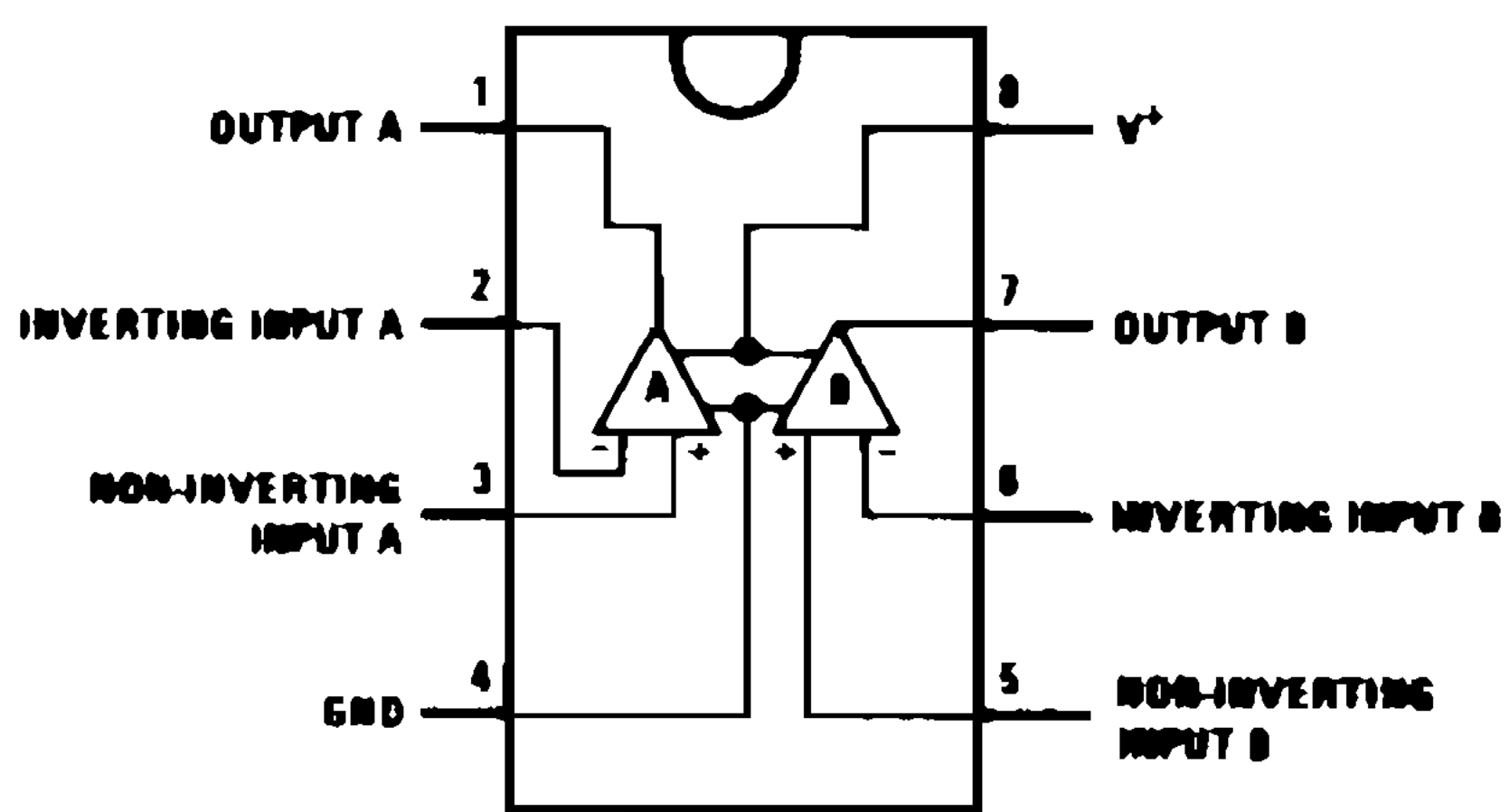
LM78L15ACZ  
LM78L12ACZ  
MC78L05ACP

BOTTOM VIEW

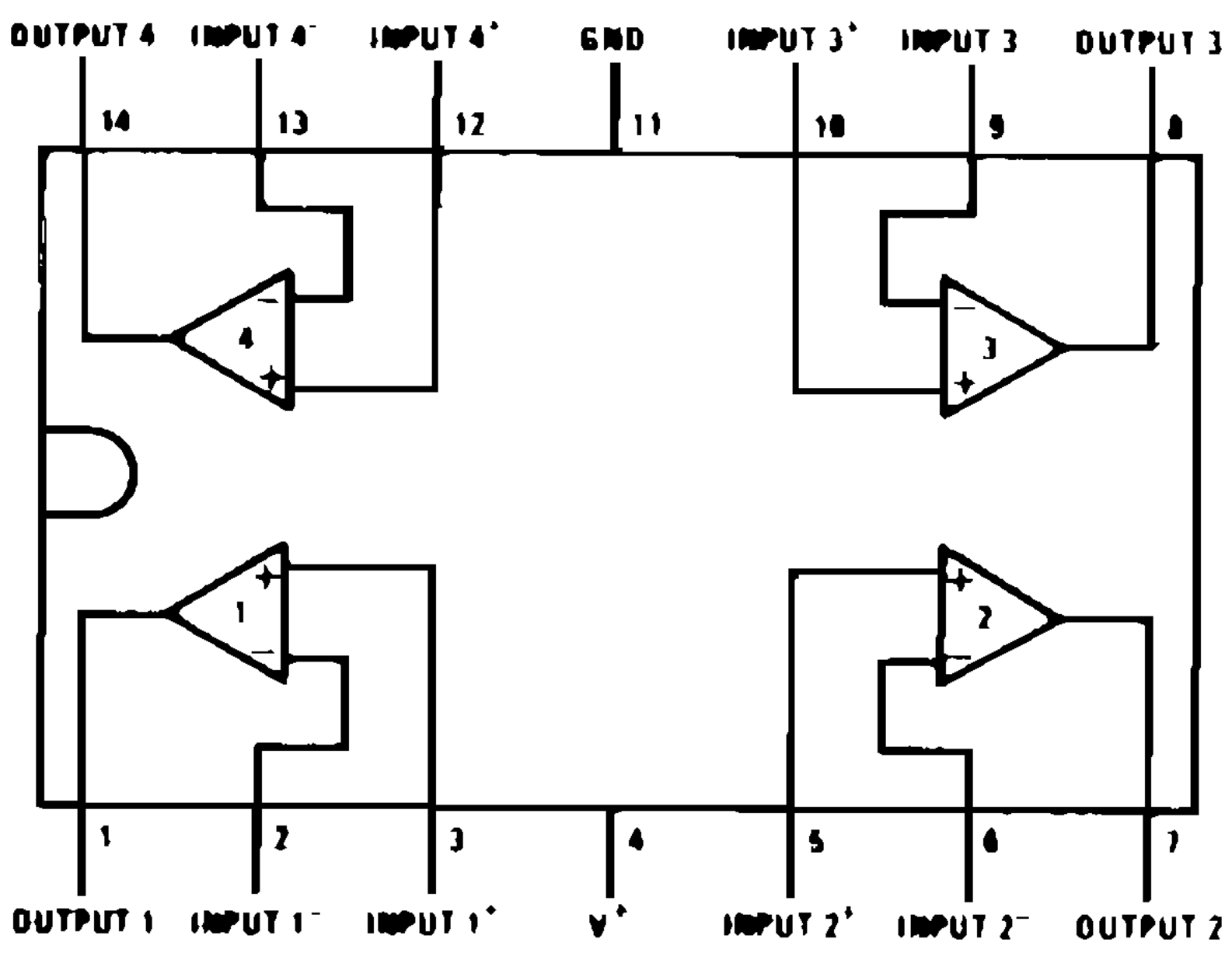


LM317LZ  
LM337LZ

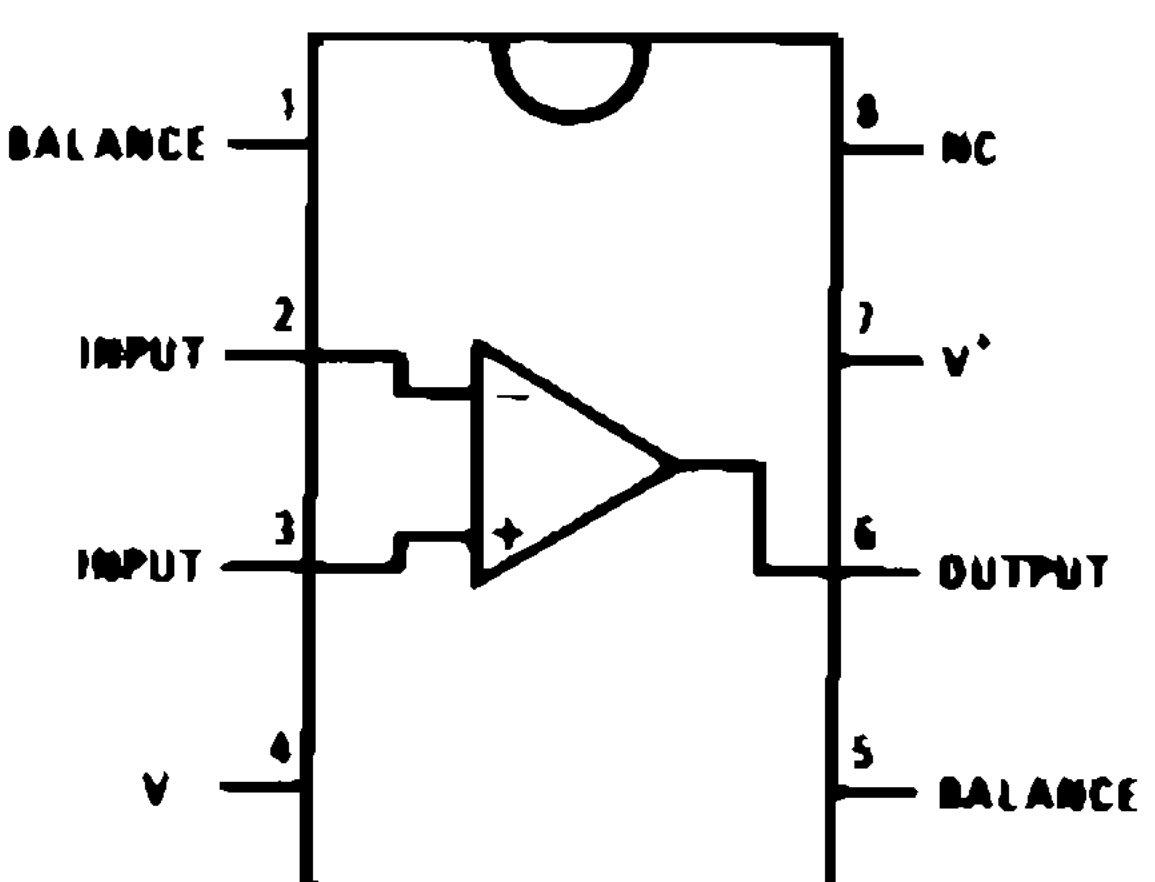
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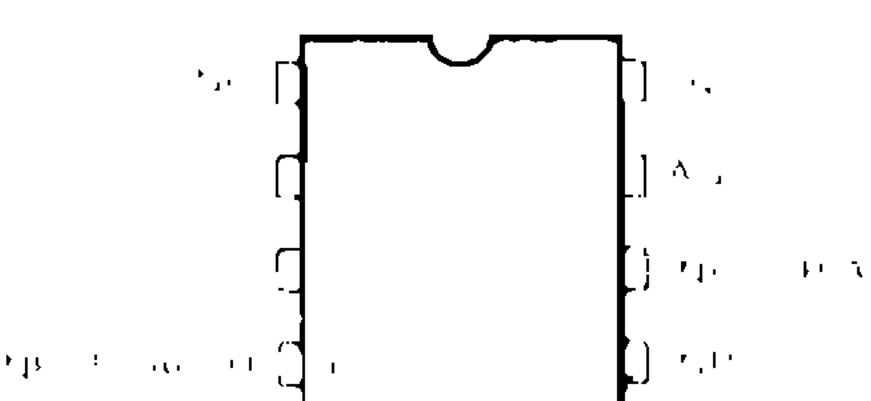
LM324



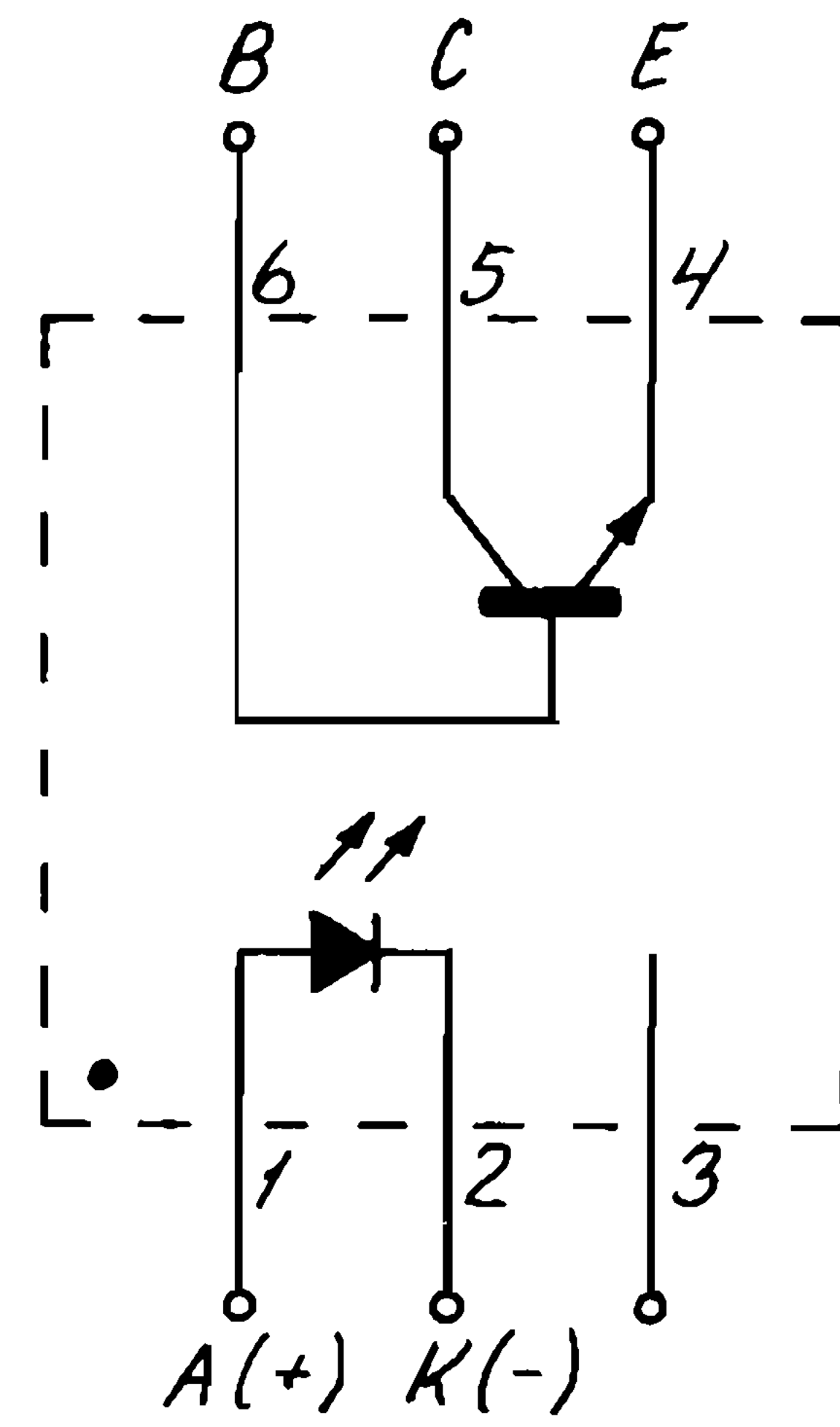
LF356N



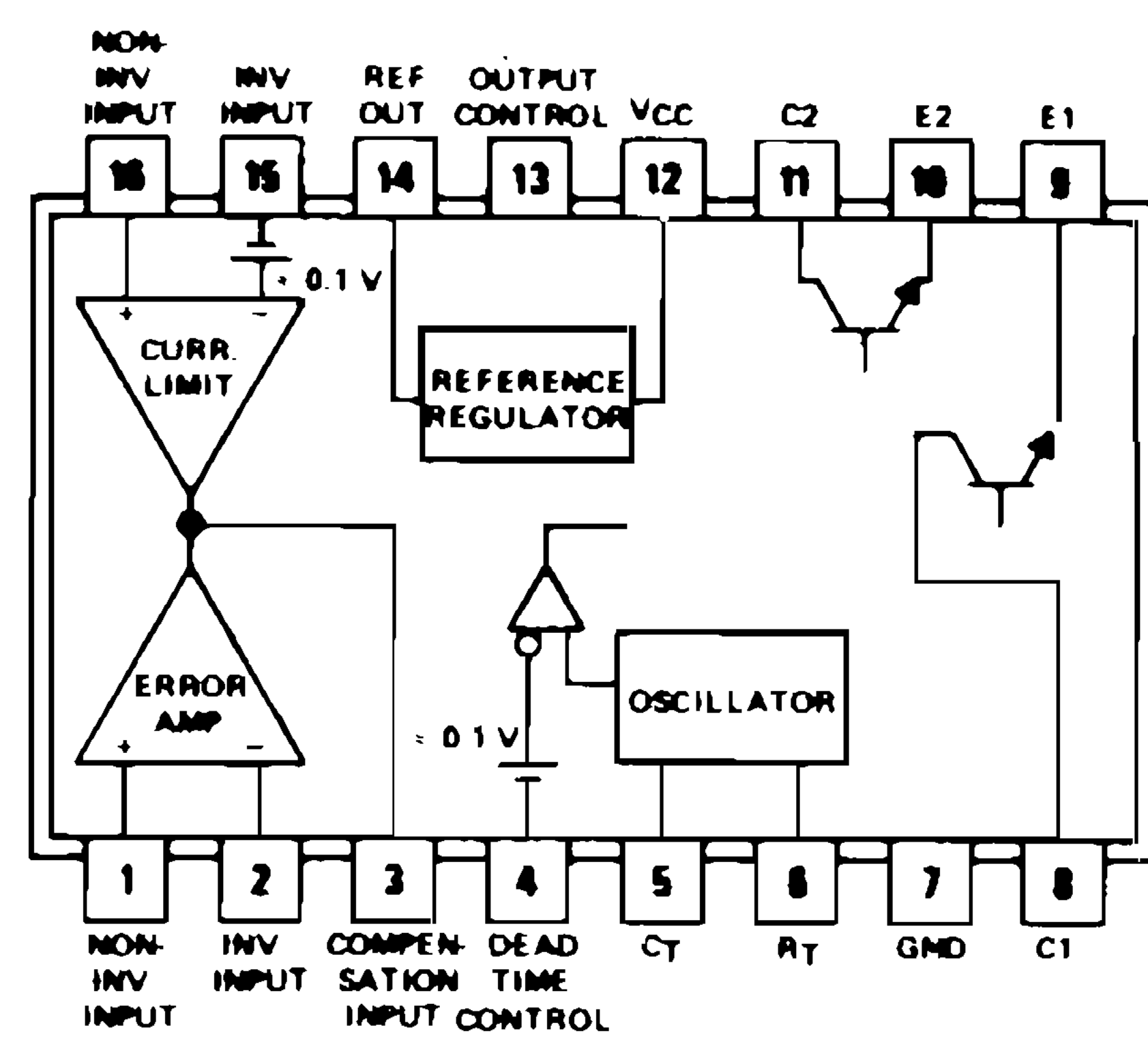
SL1612



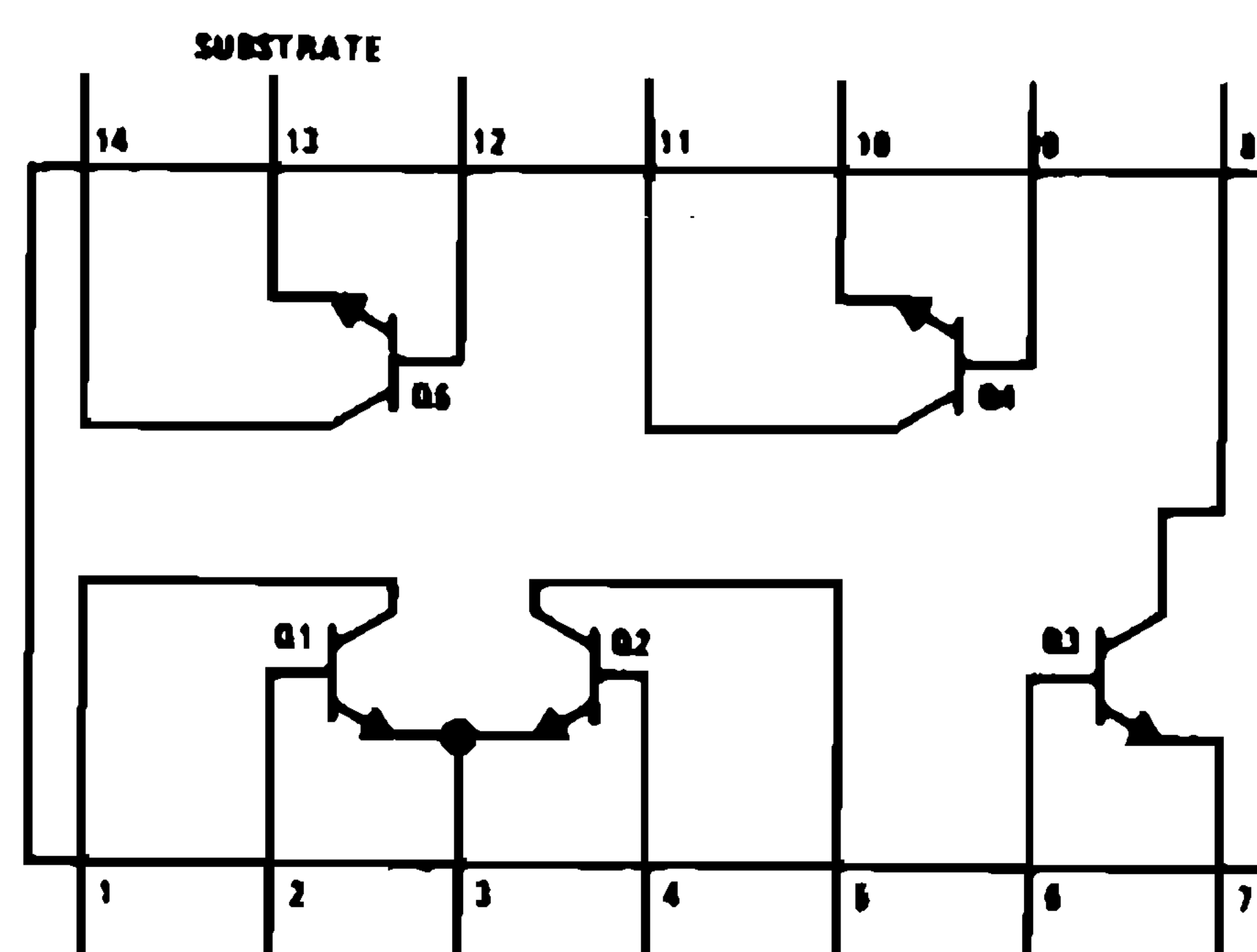
CNY17



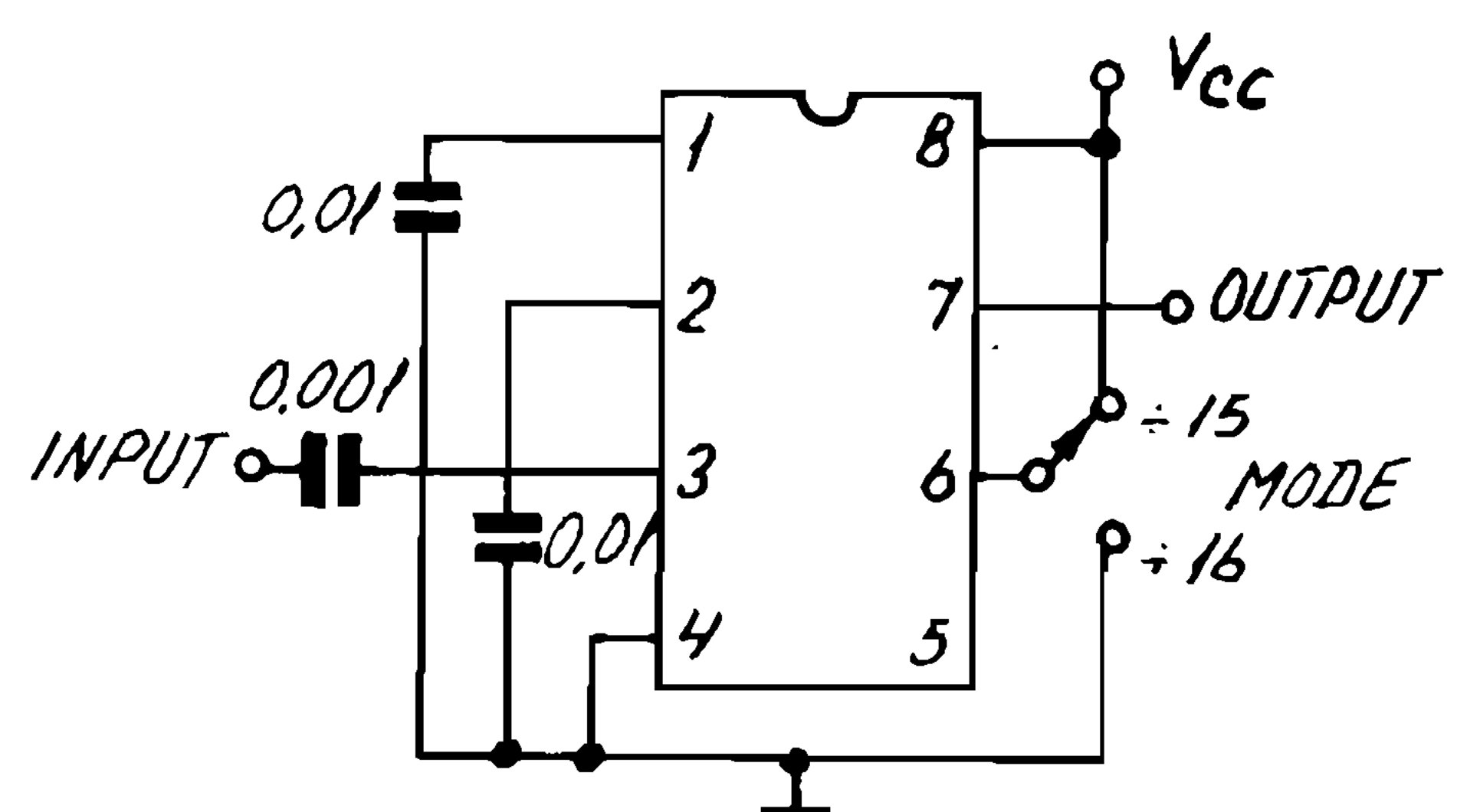
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LM3046N

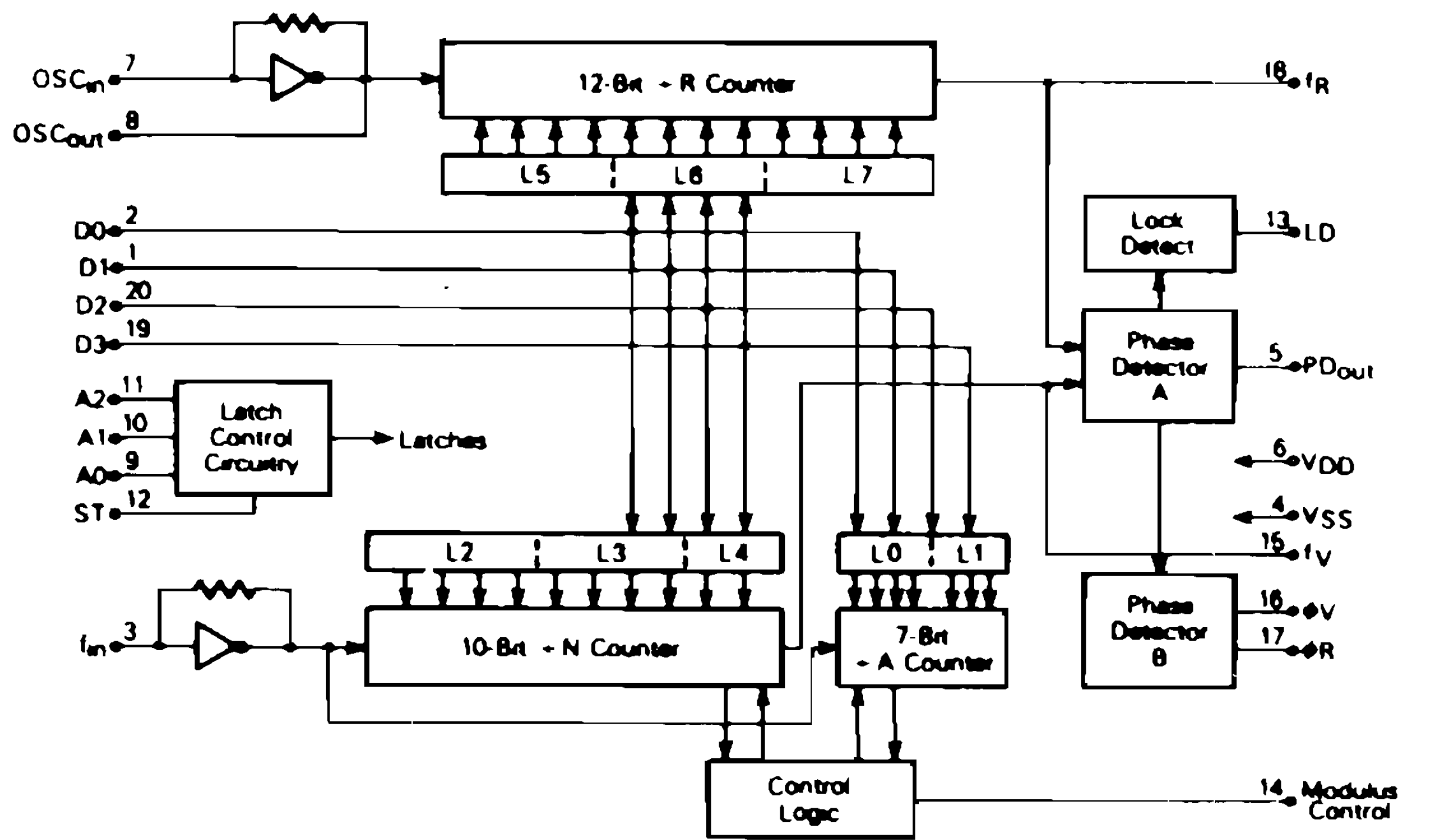
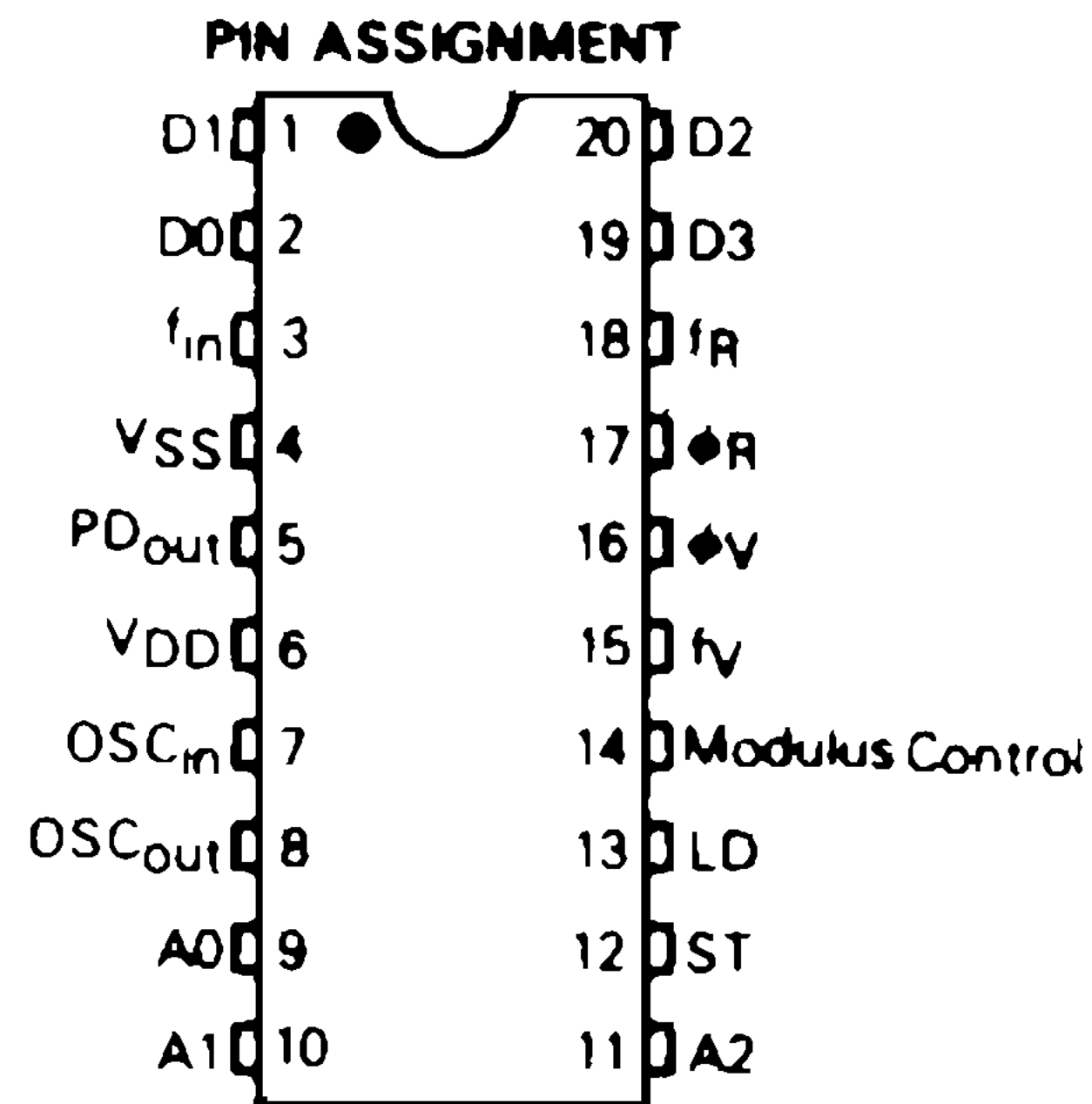


MC3393P

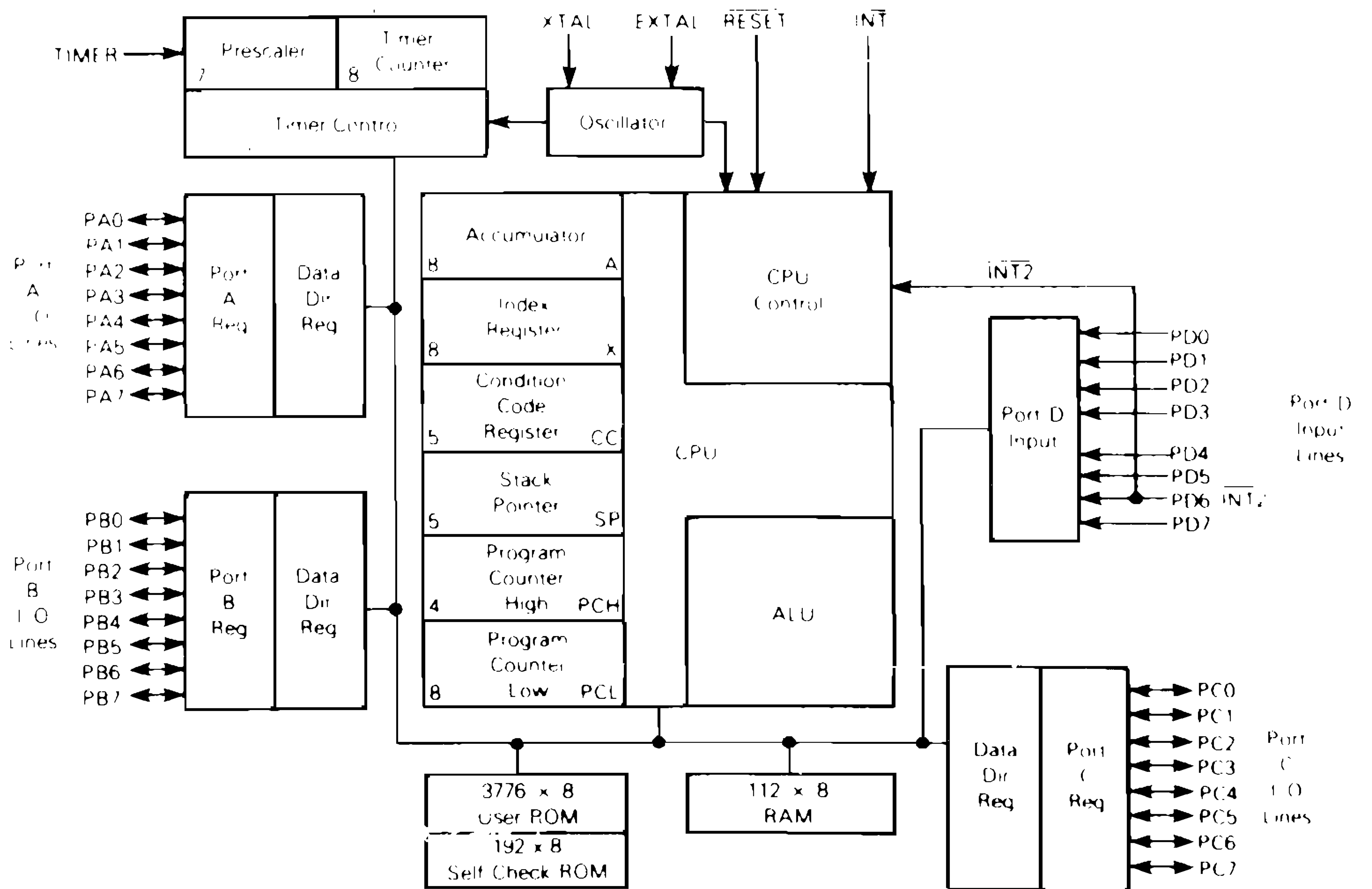
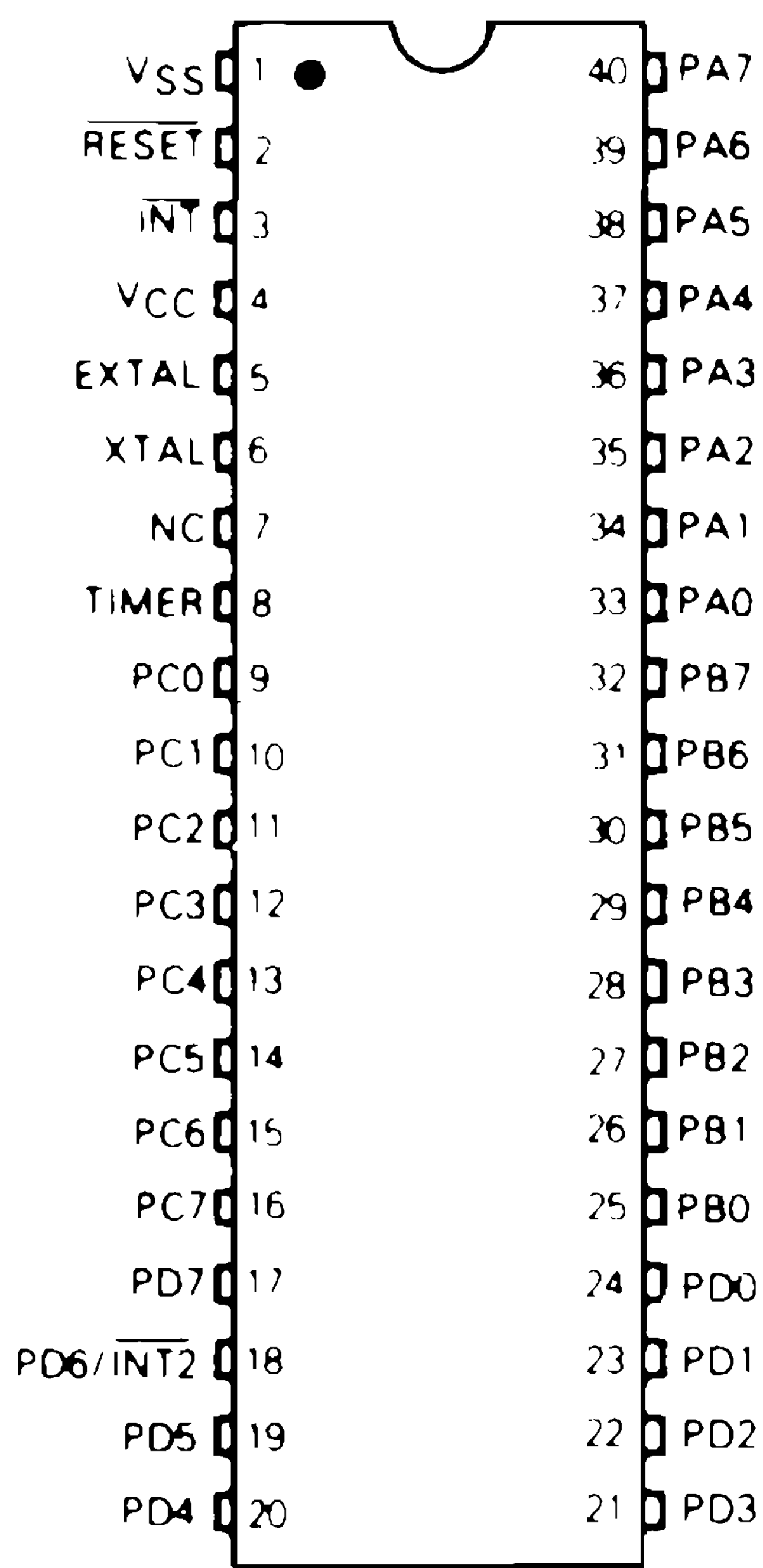


3.8. PIN CONFIGURATIONS cont.:

MC145146

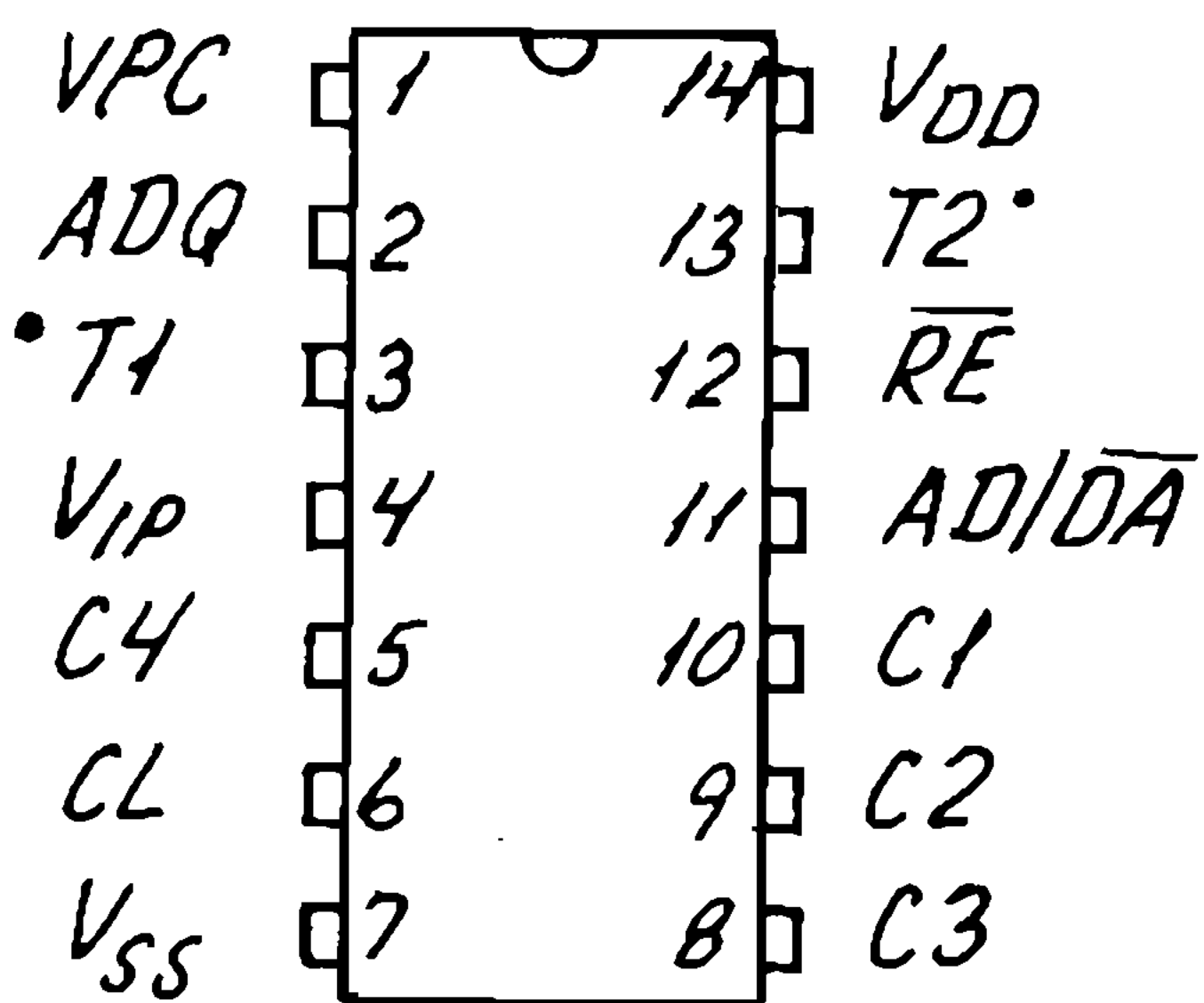


MC68705U3



R2022A

MCM2802 EEPROM

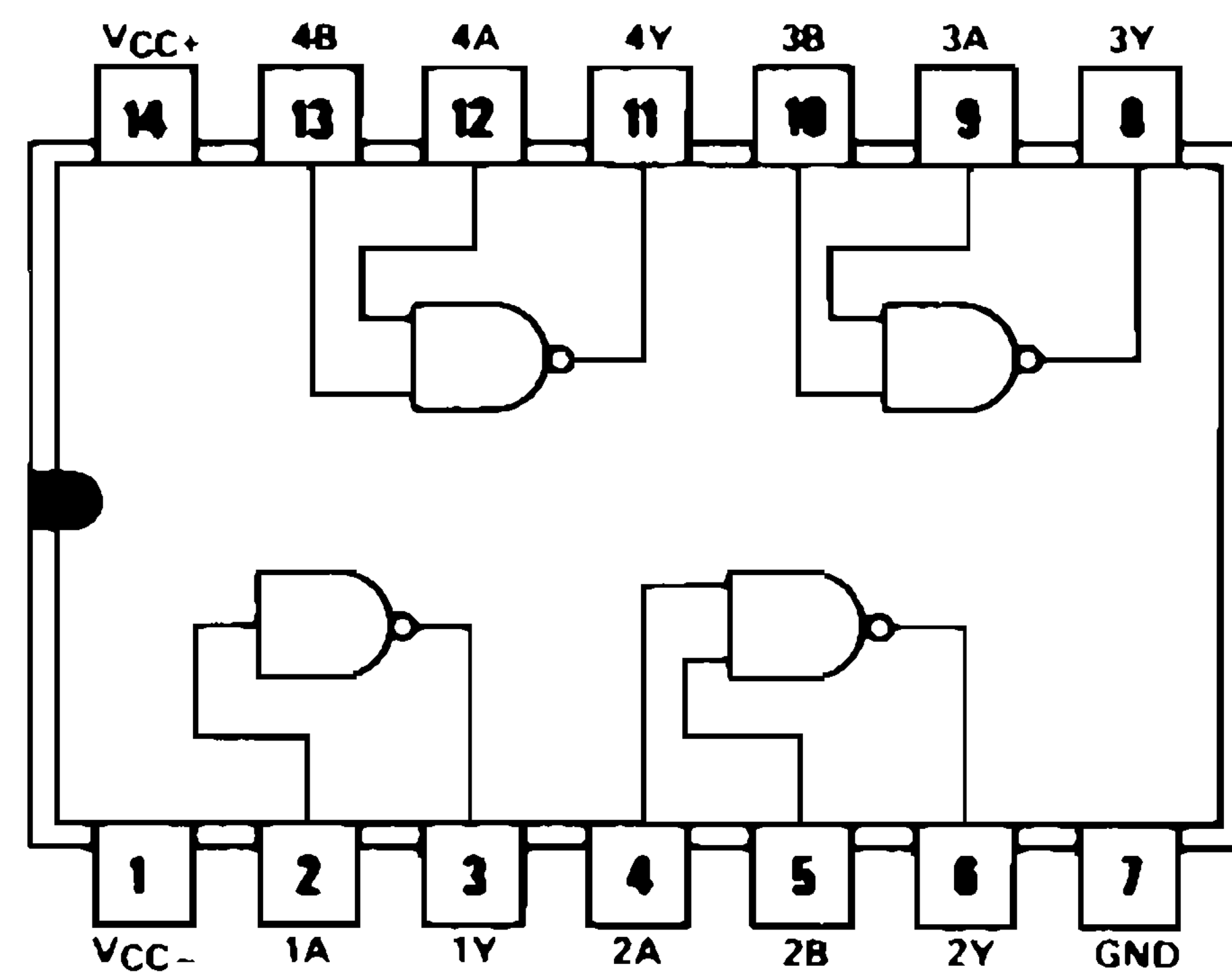


\* For normal operation, hardwired to VSS.

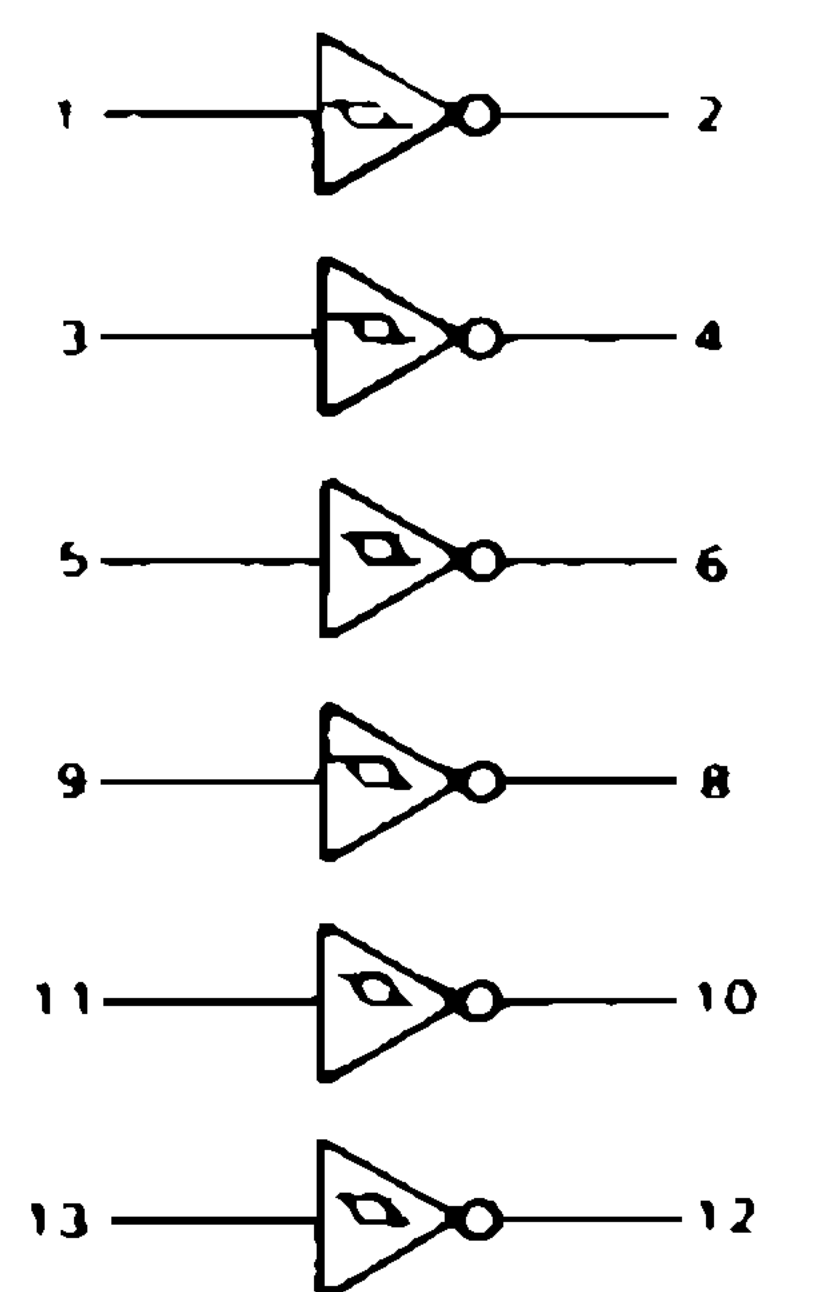
**PIN NAMES**

VPC Program Voltage Control  
 ADQ Address Input + Data Input/Output  
 T1, T2 Margin Testing  
 C1, C2, C3, C4 Chip Address 1 to 4  
 CL Clock  
 RE Reset  
 AD/DA Shift Register Select

SN75188N



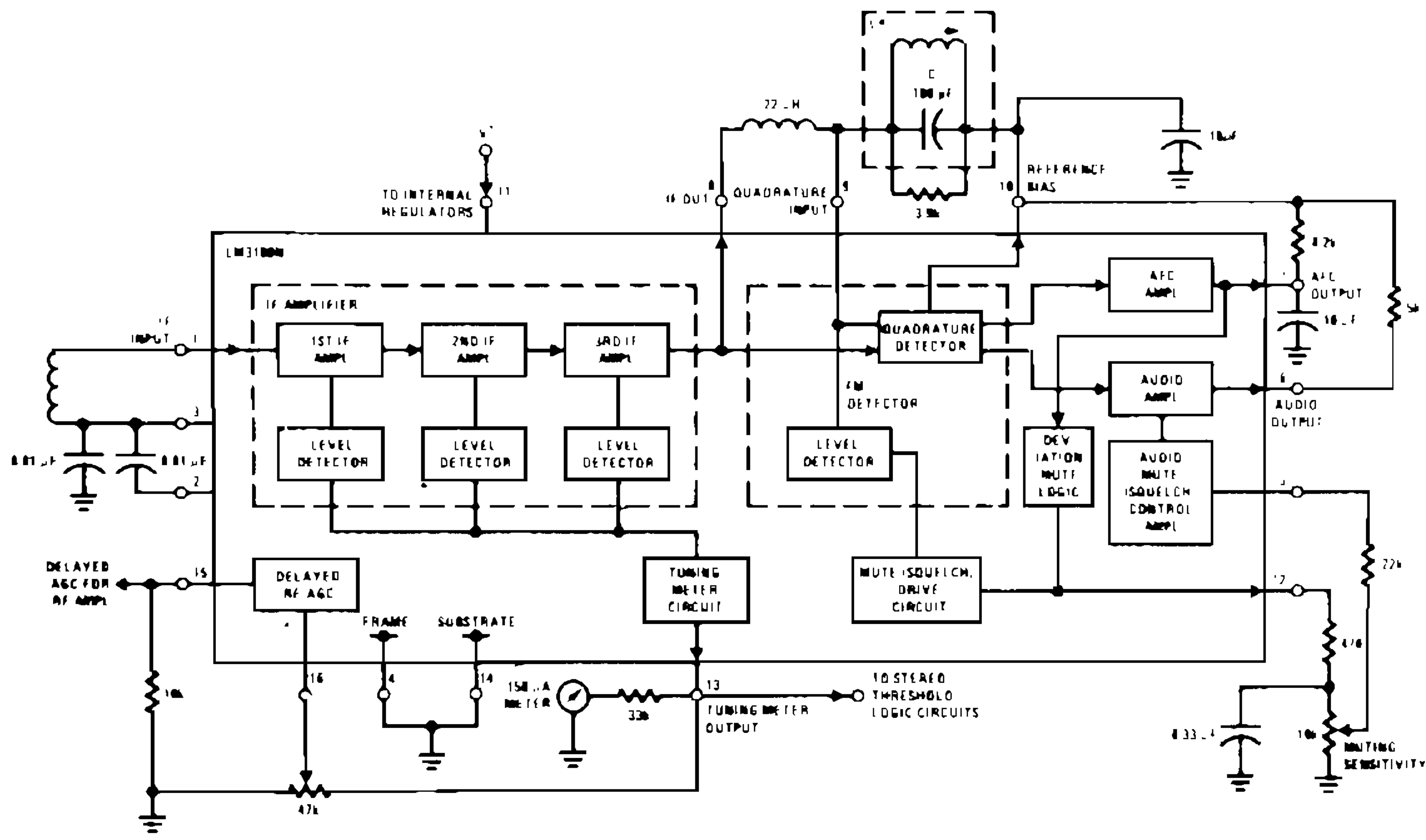
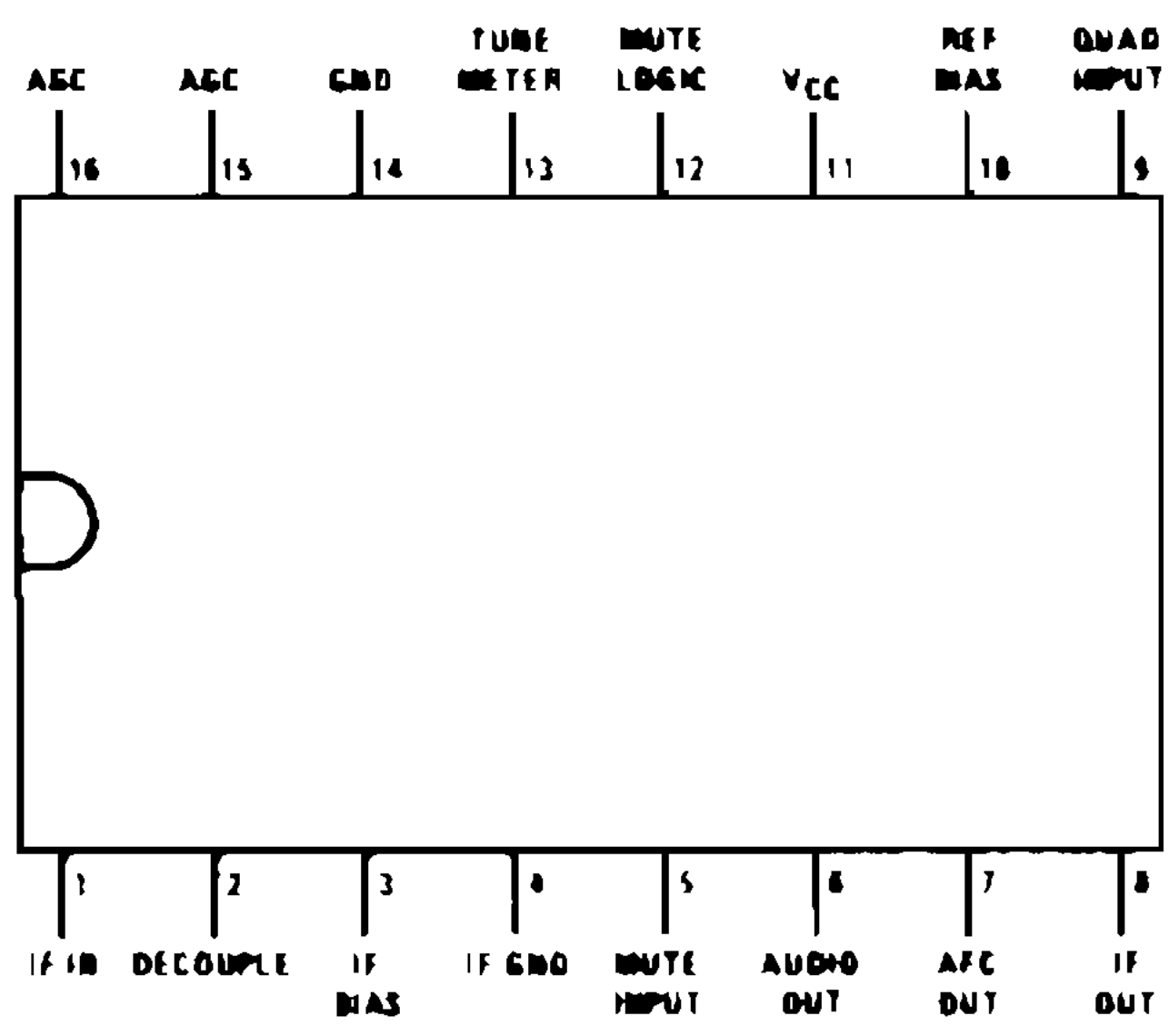
MC14584BCP



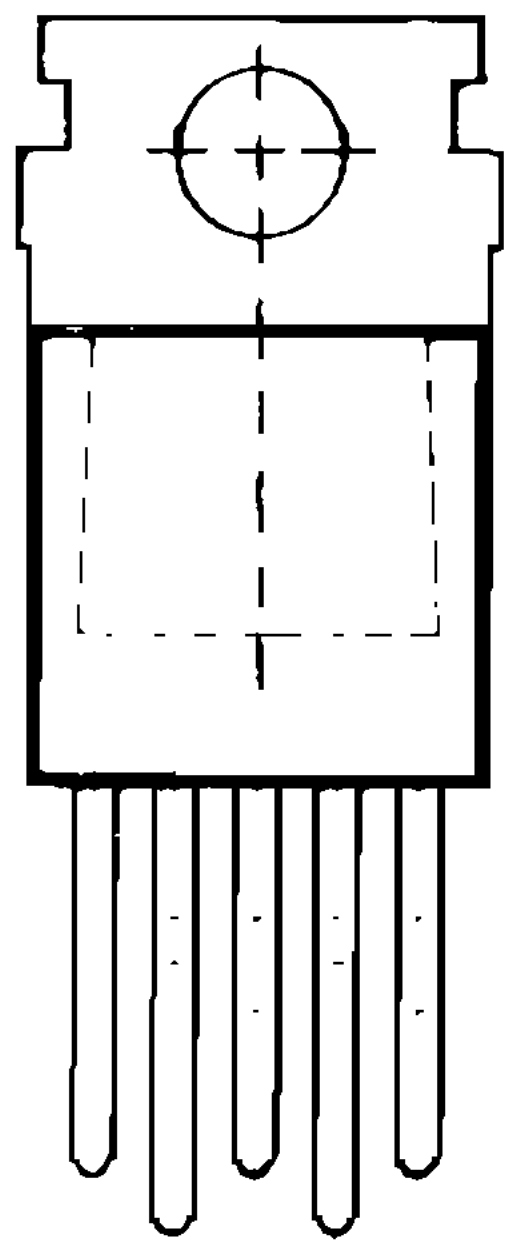
VDD - Pin 14  
 VSS - Pin 7

3.8. PIN CONFIGURATIONS cont.:

LM3189

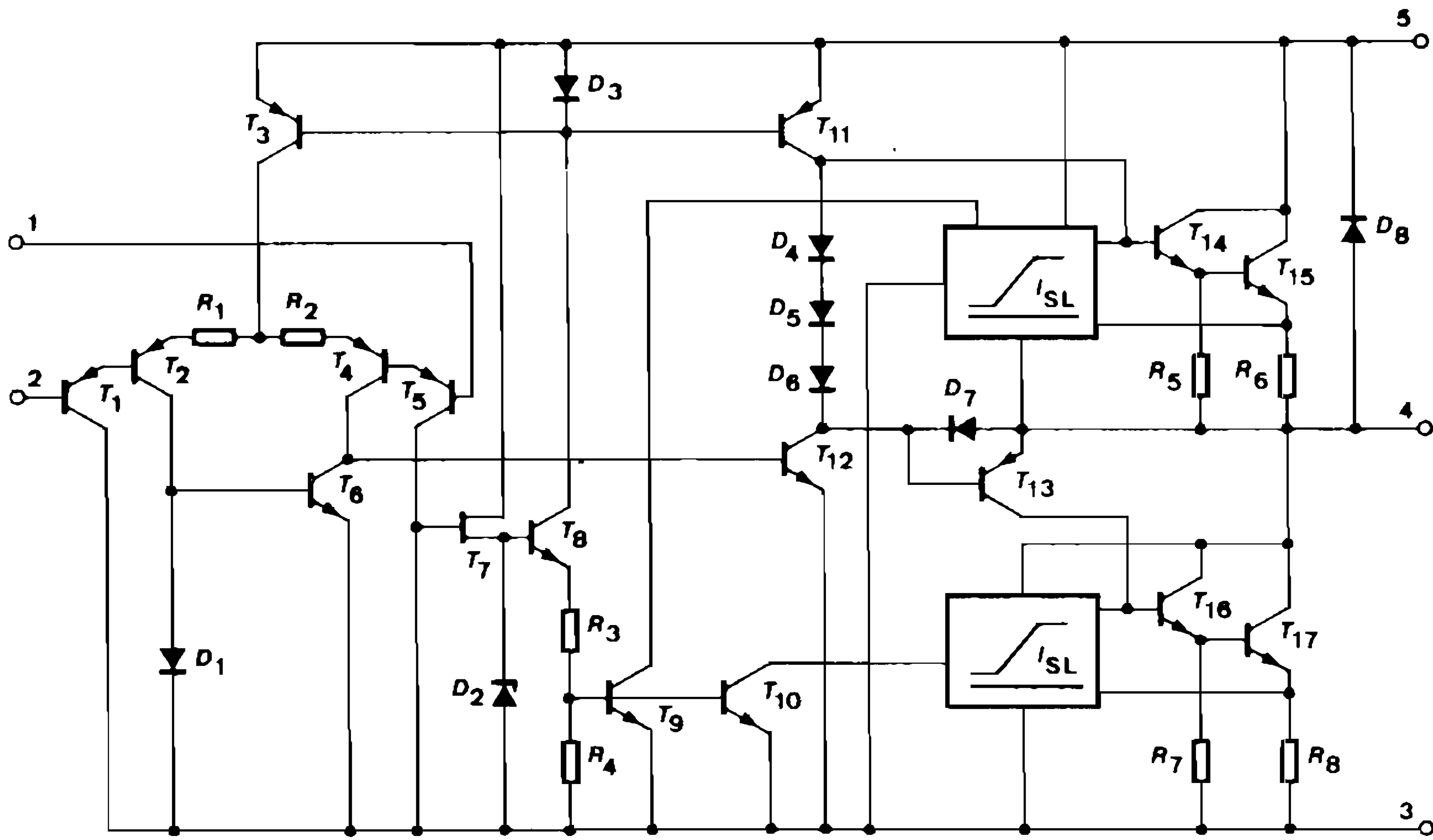


TDA2020

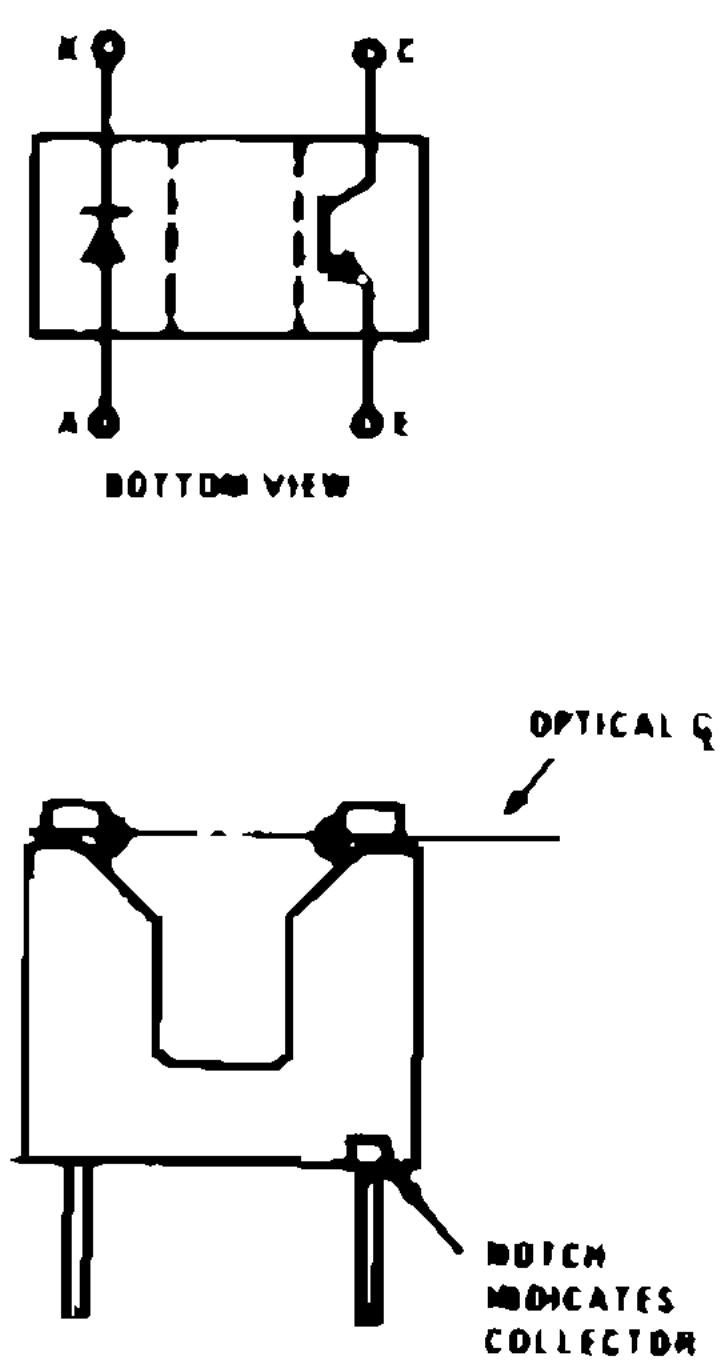


Supply voltage +  $V_S$   
Output  
Supply voltage -  $V_S$   
Inverting input  
Non-inverting input

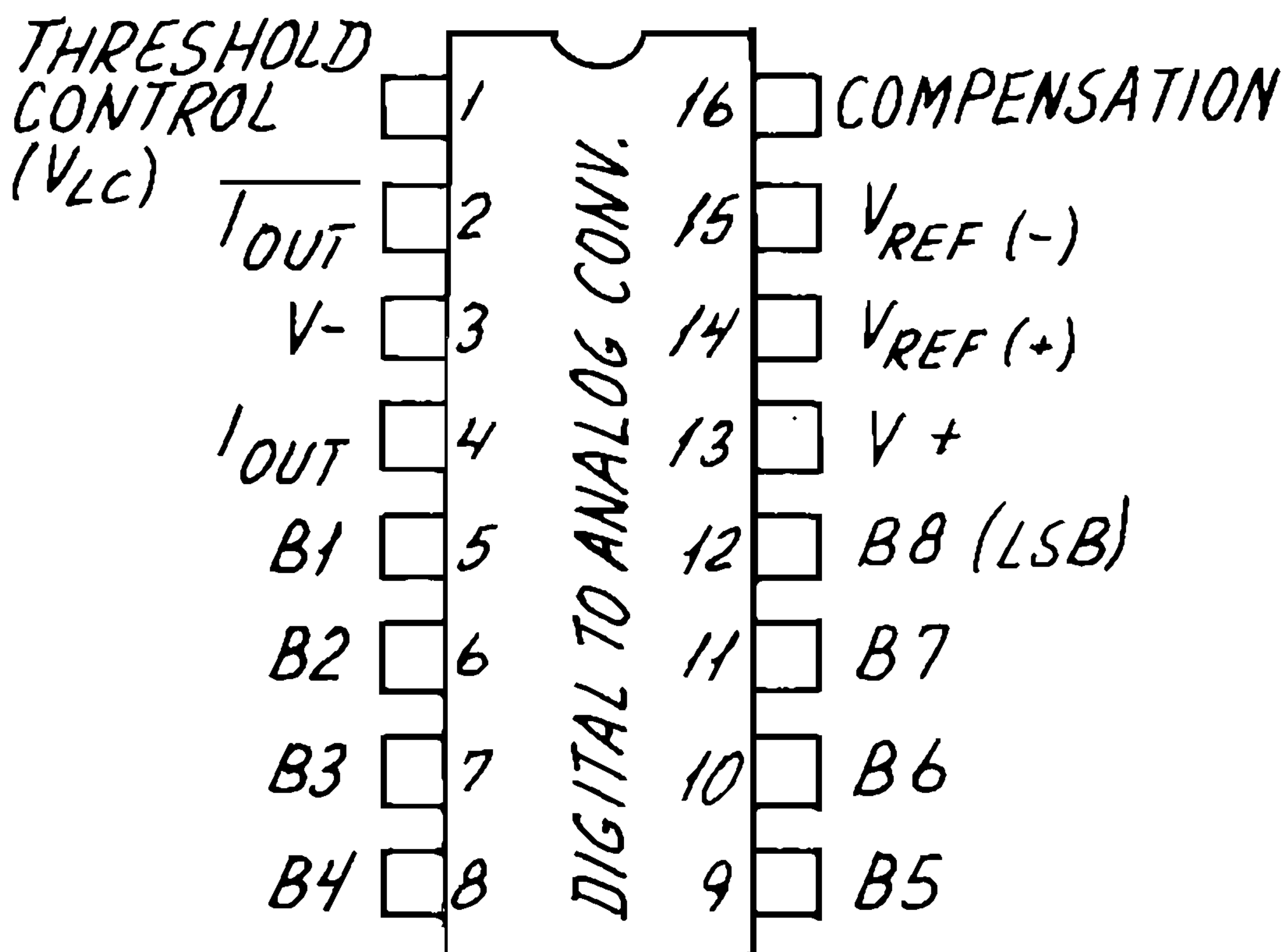
Pin 5  
Pin 4  
Pin 3  
Pin 2  
Pin 1



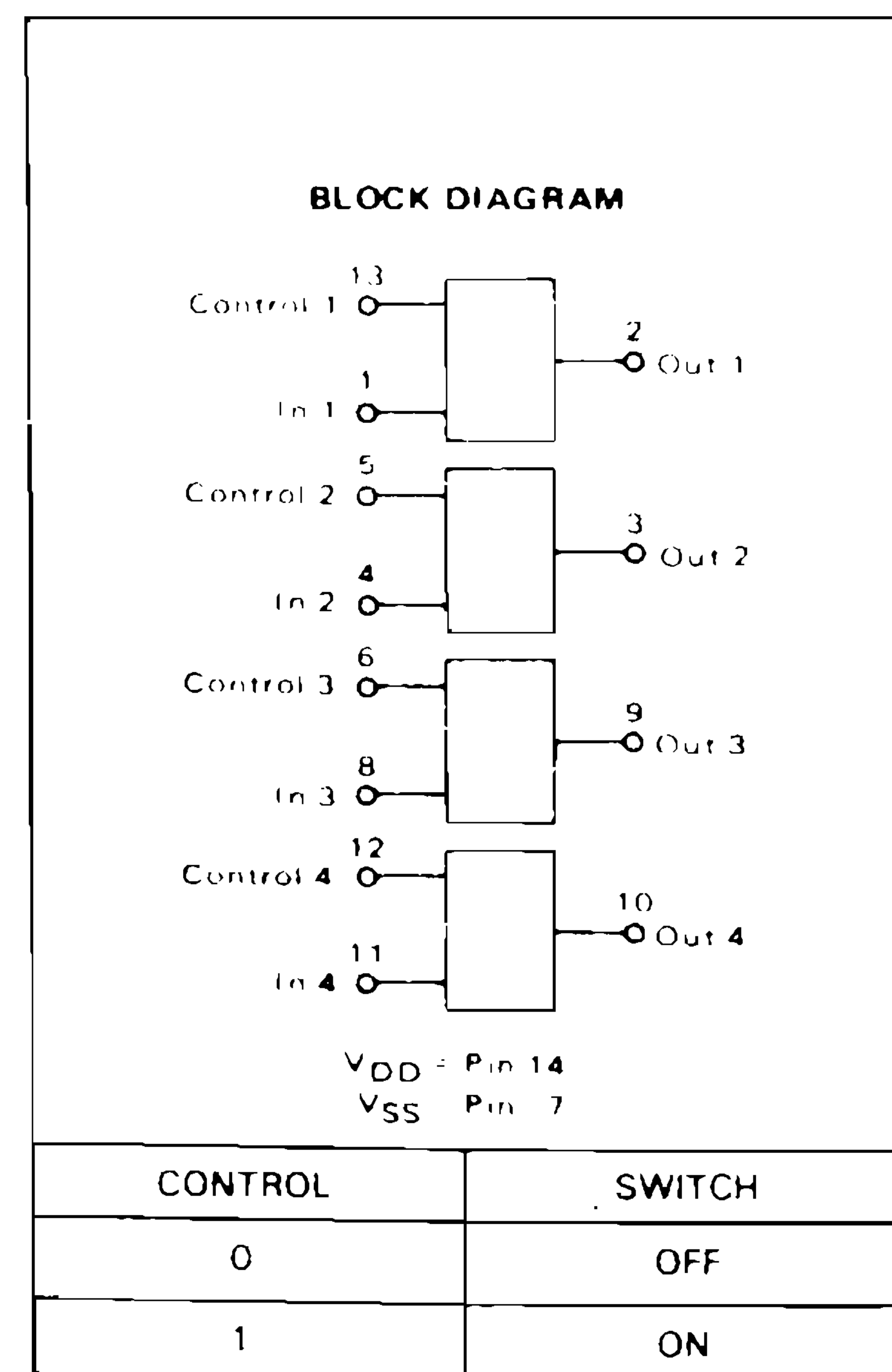
OPB825



DAC-08HP

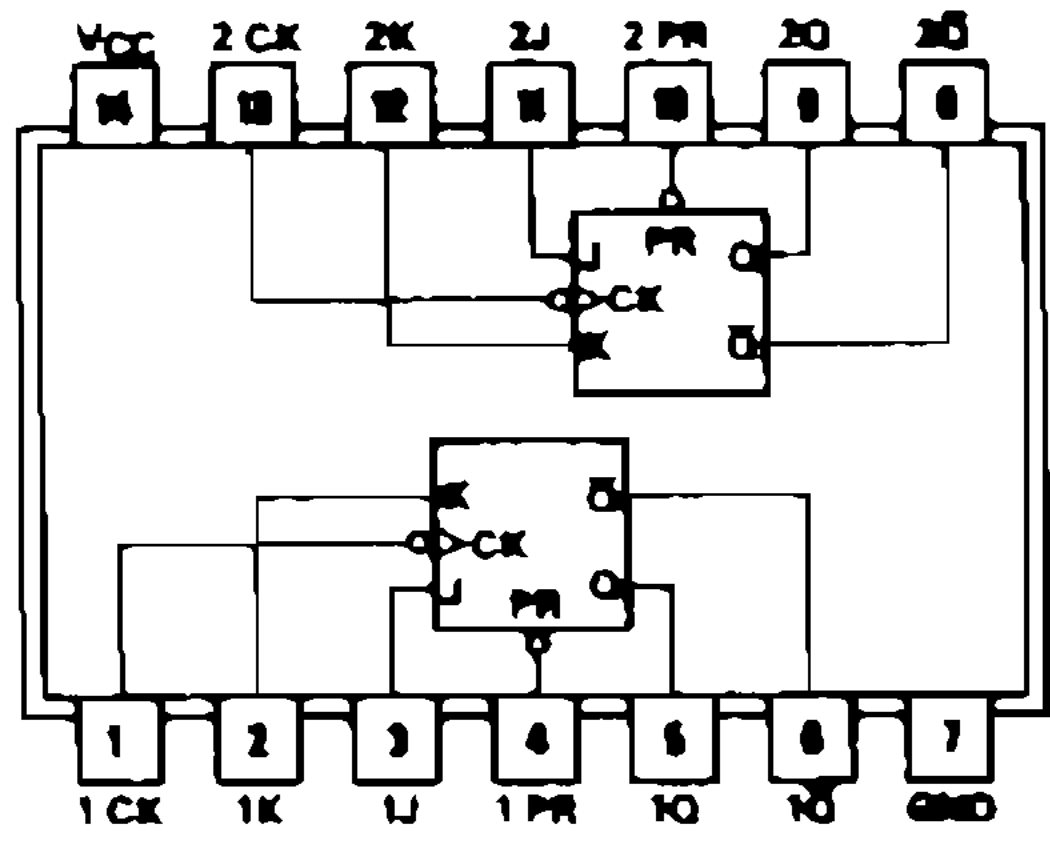


MC14016

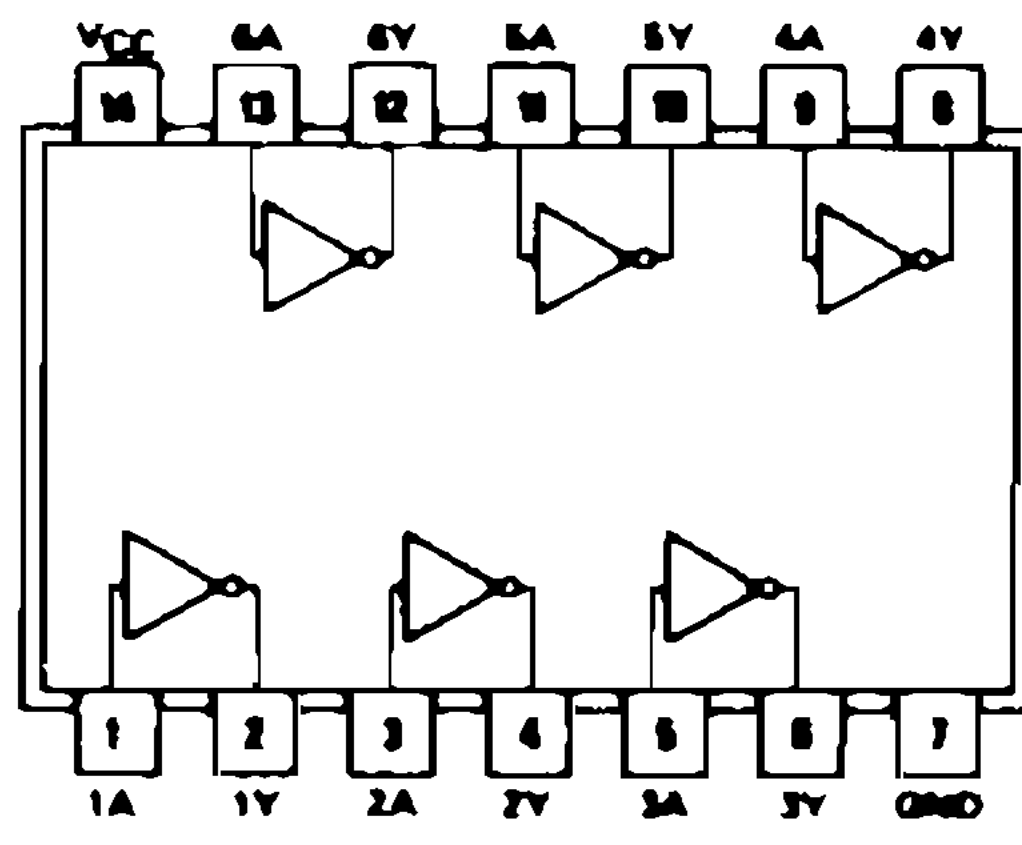


### 3.8. PIN CONFIGURATIONS cont.:

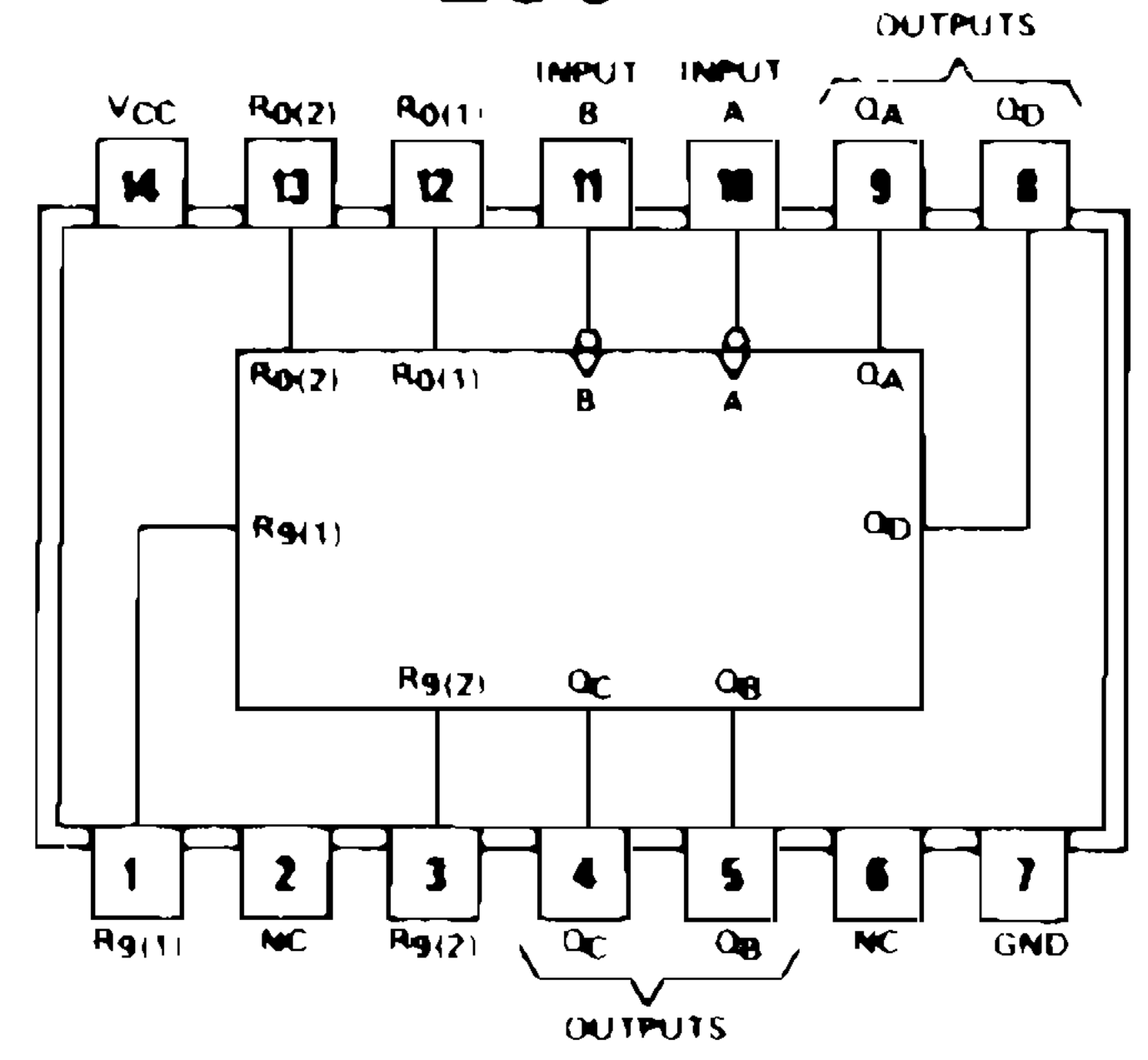
SN74LS113AN



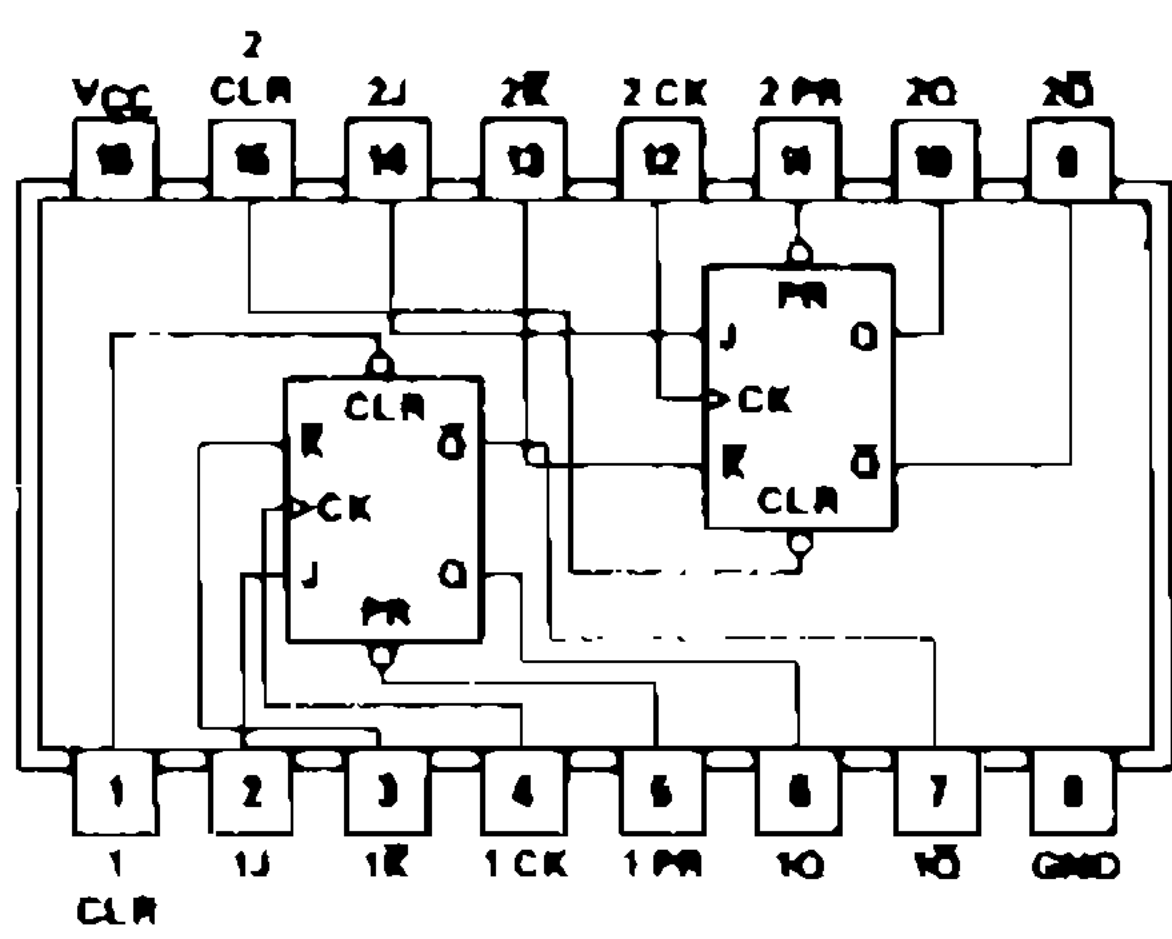
SN7406N



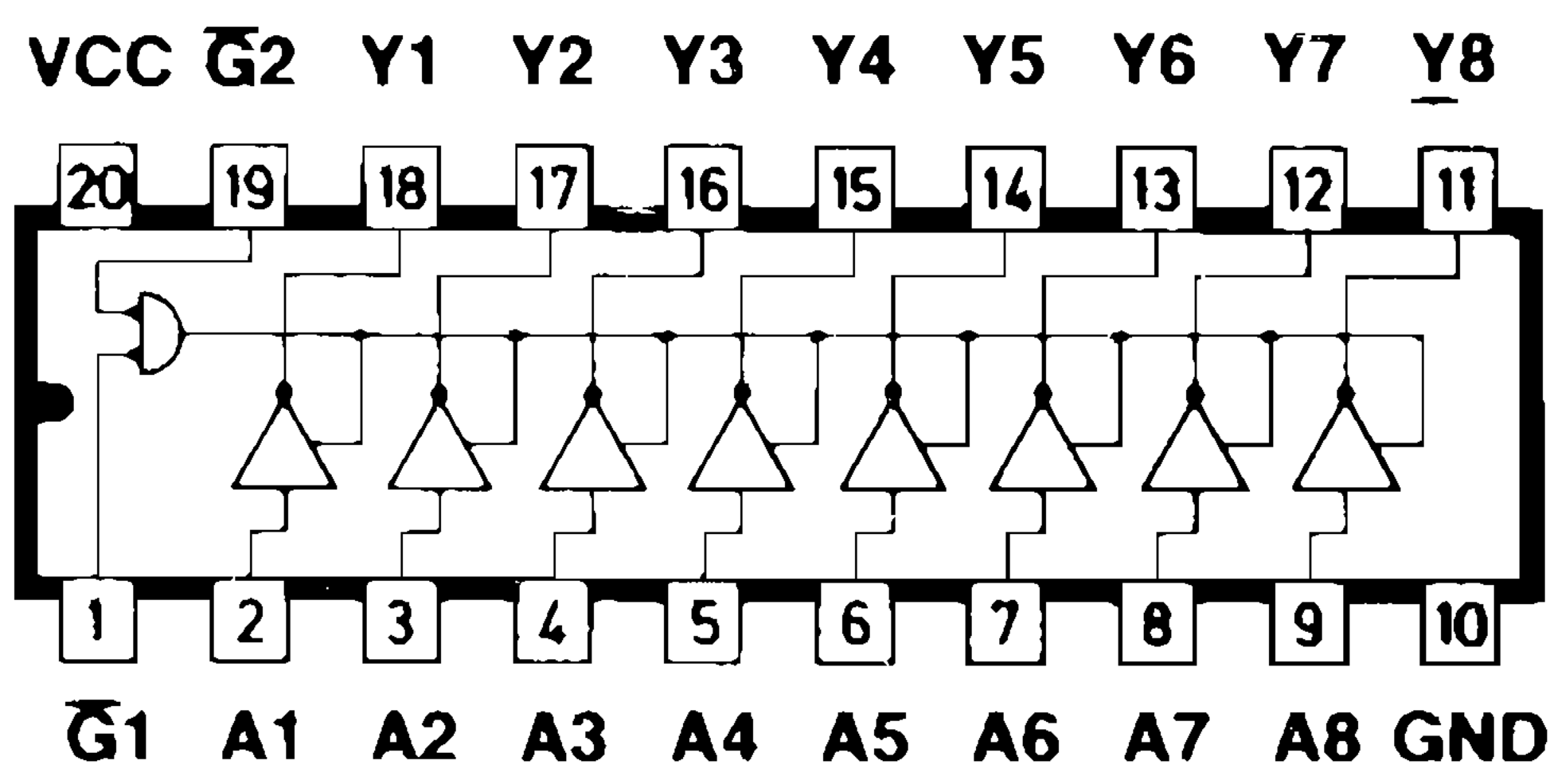
SN74LS290



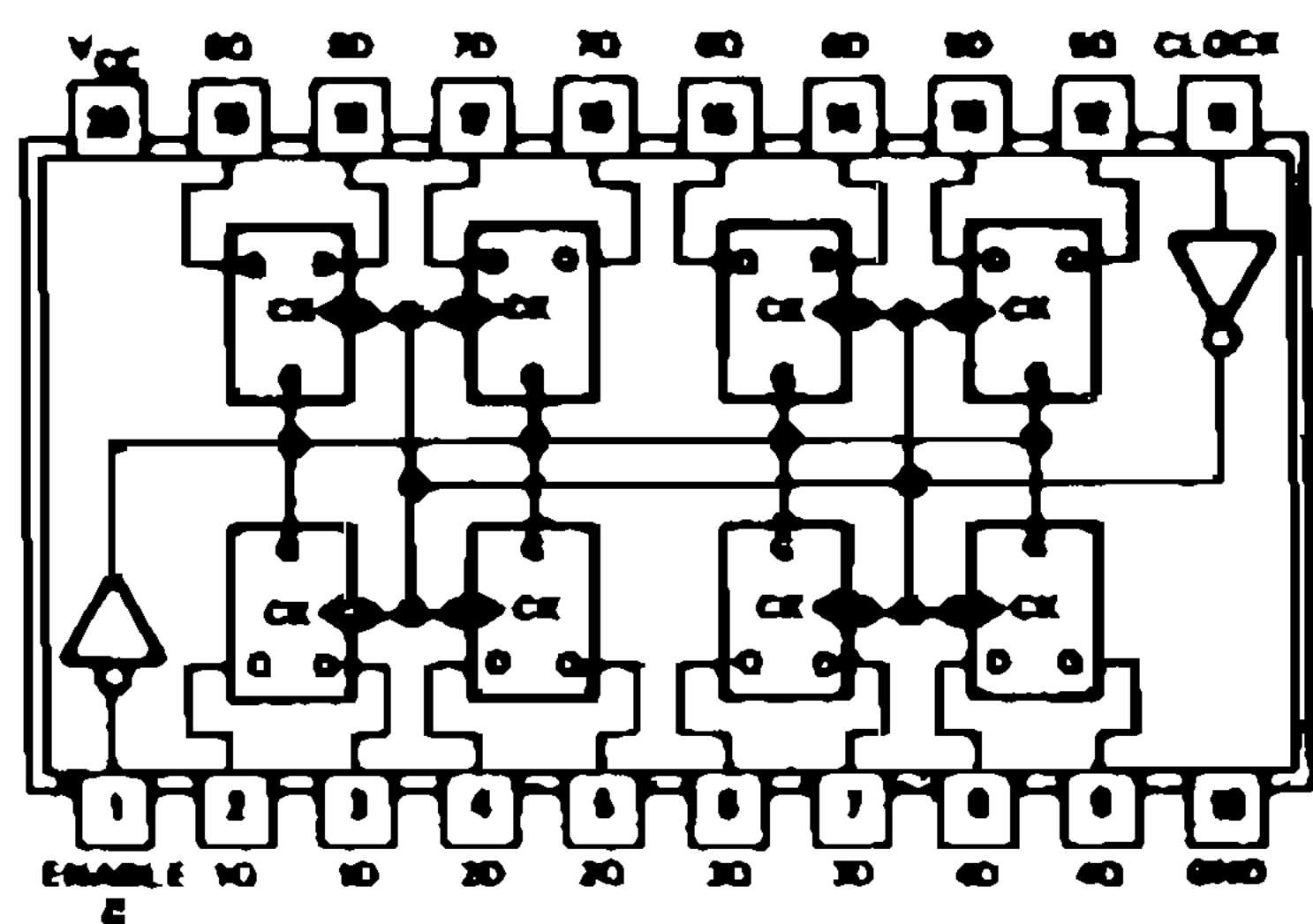
SN74LS109AN



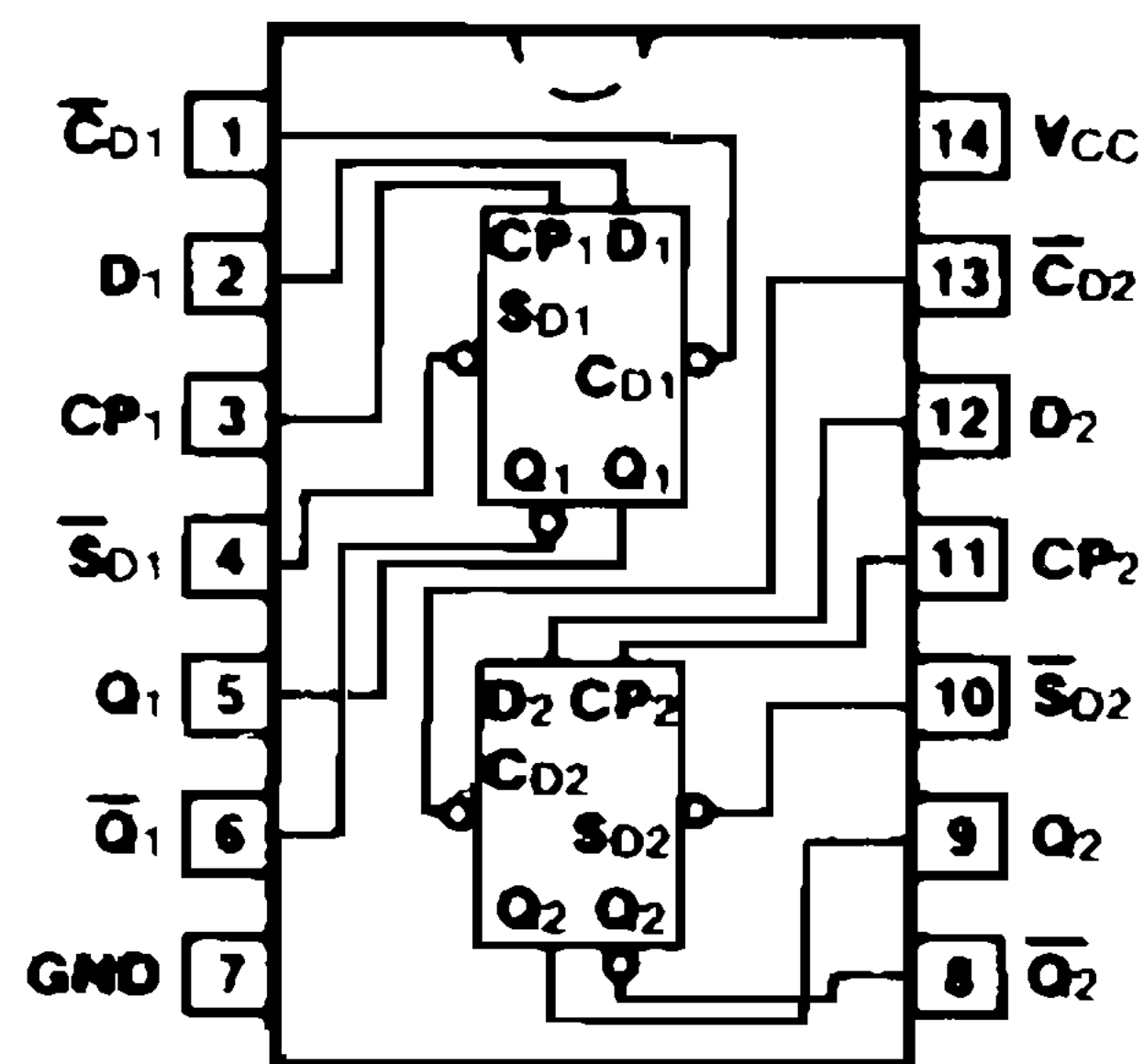
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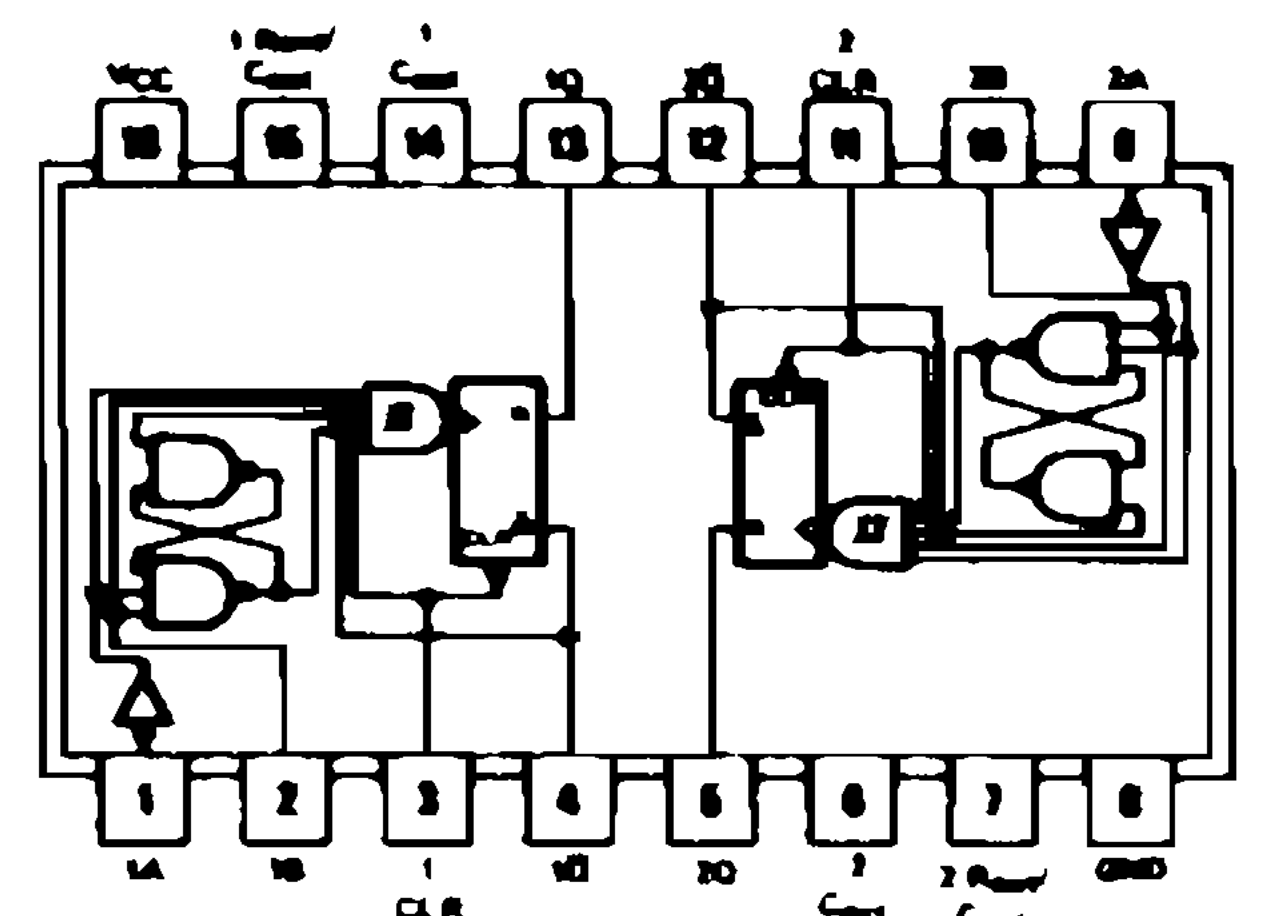
SN74LS377N



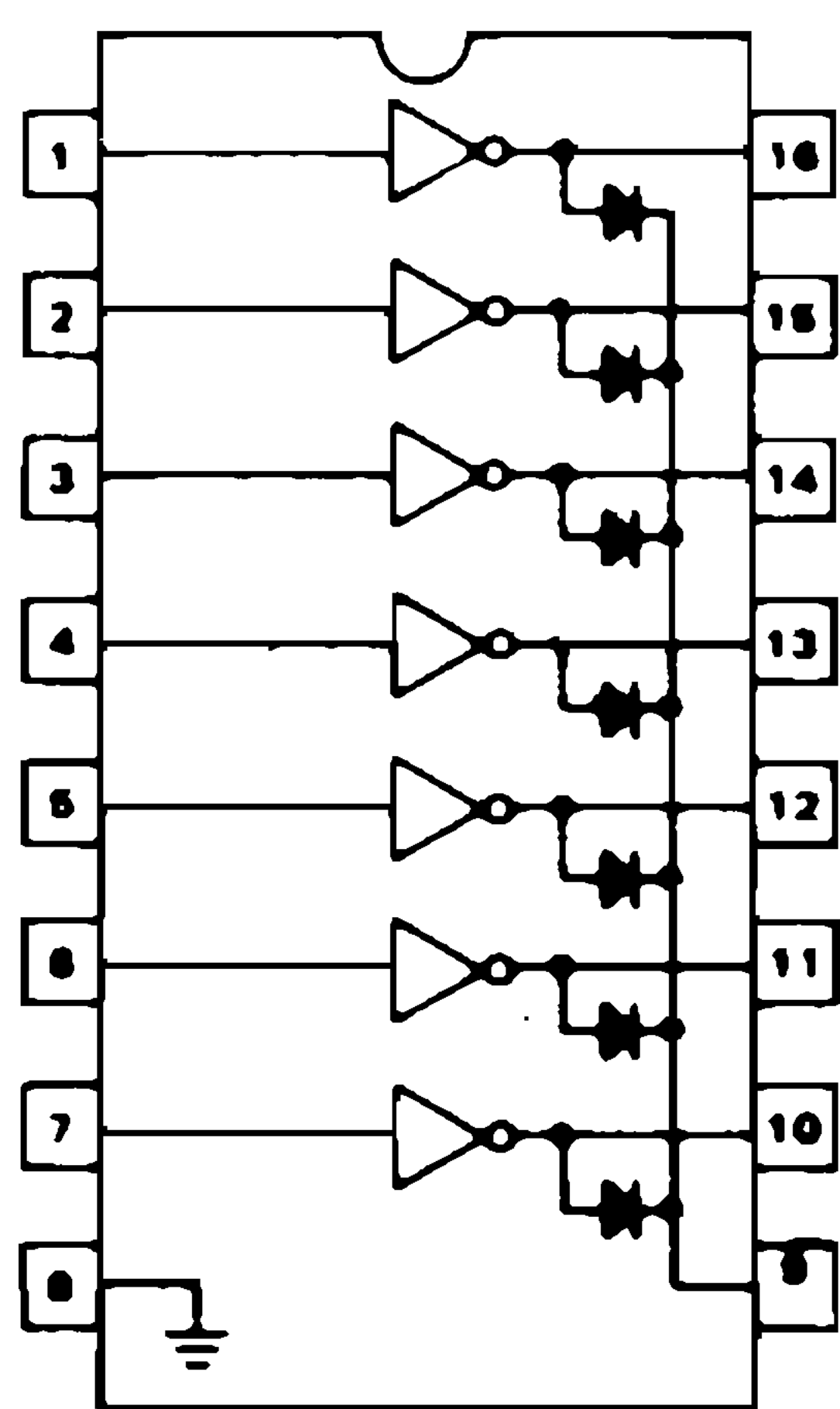
74F74



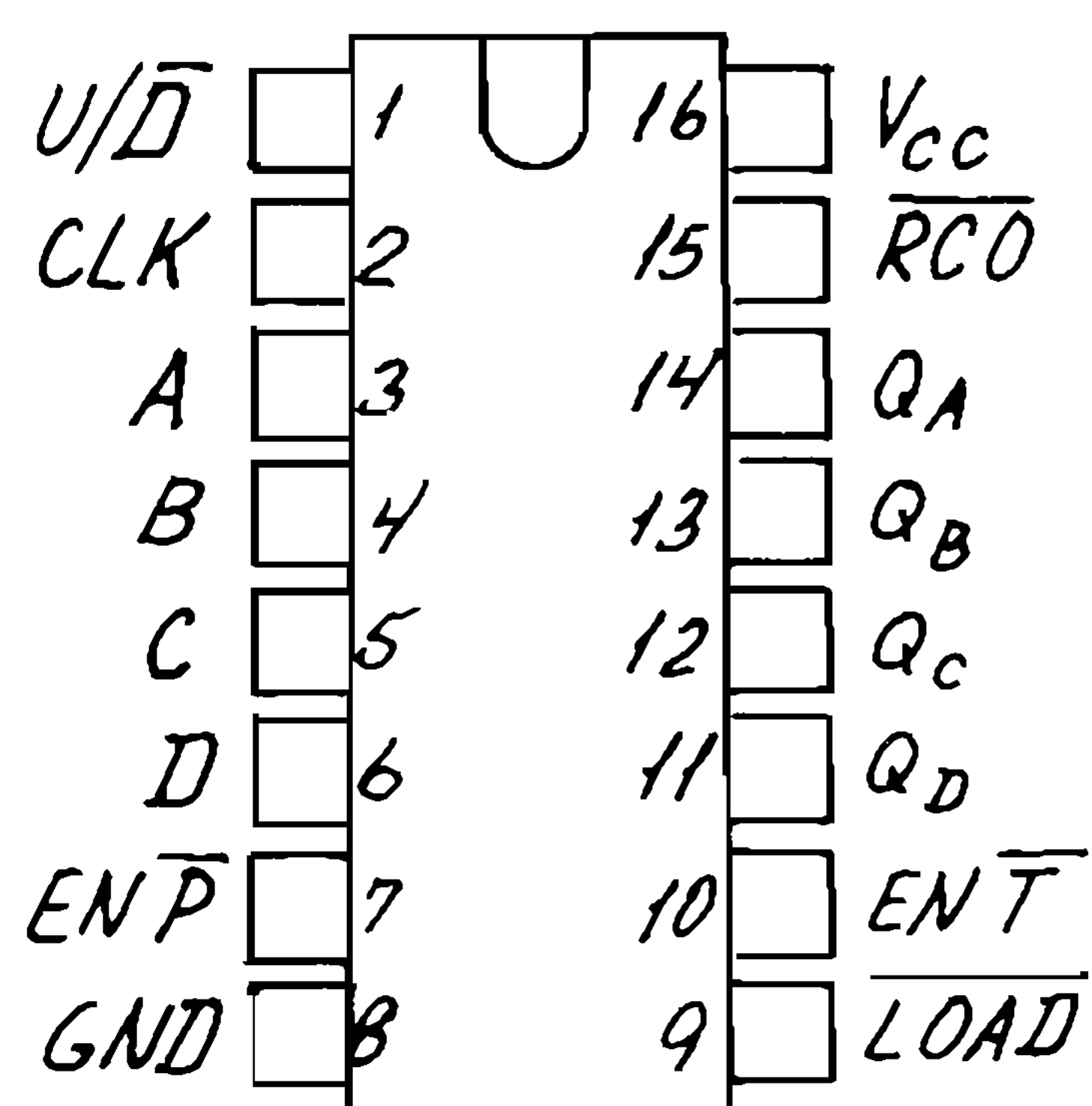
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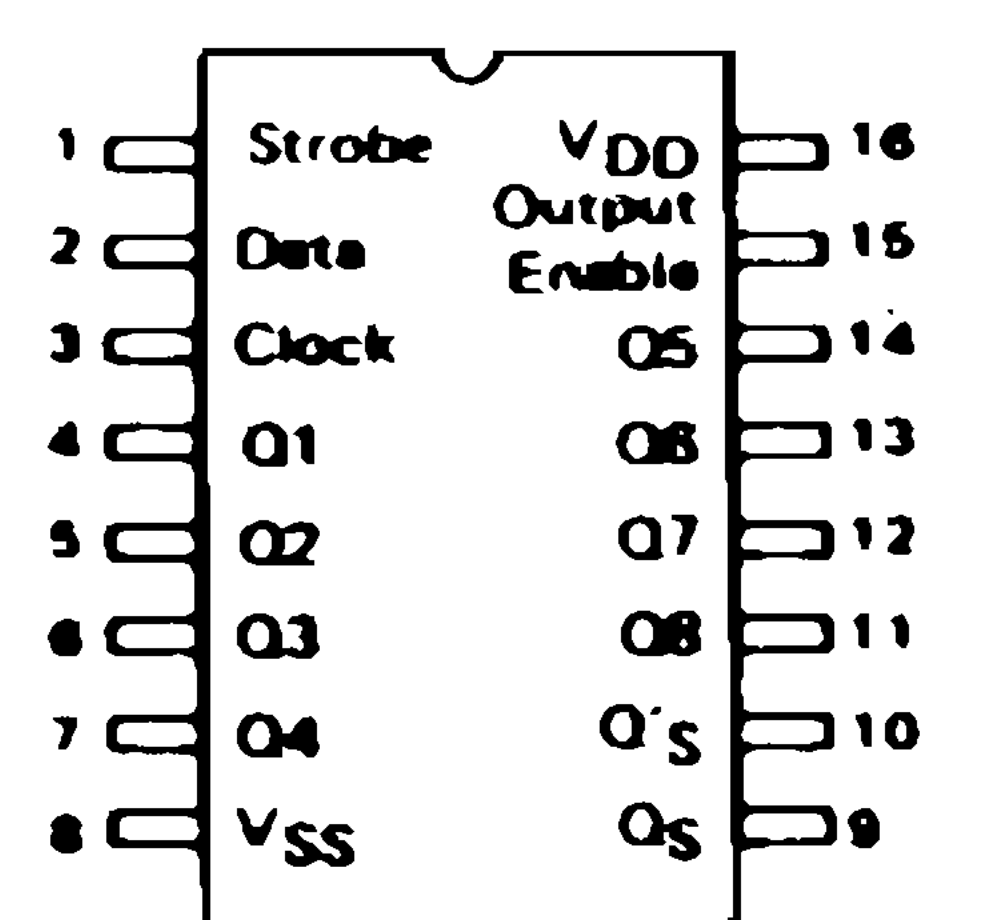
MC1413



SN74LS669N

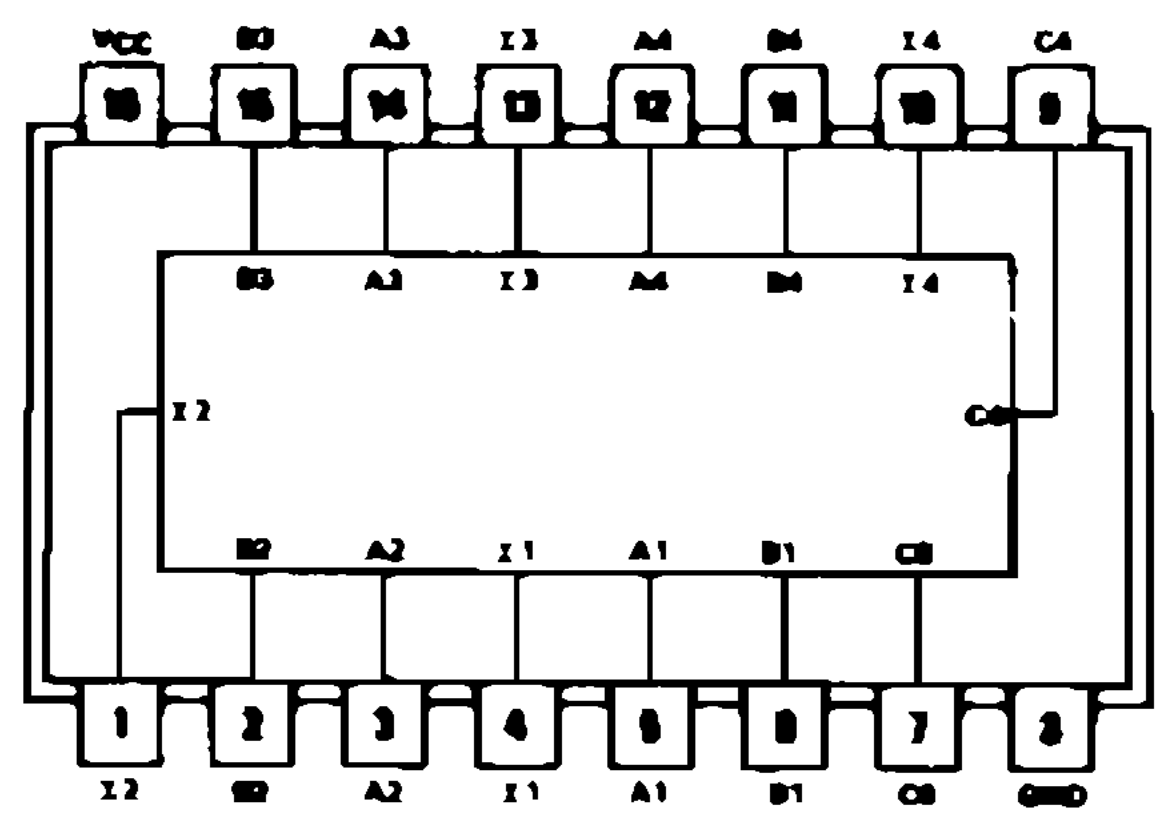


MC14094BCP

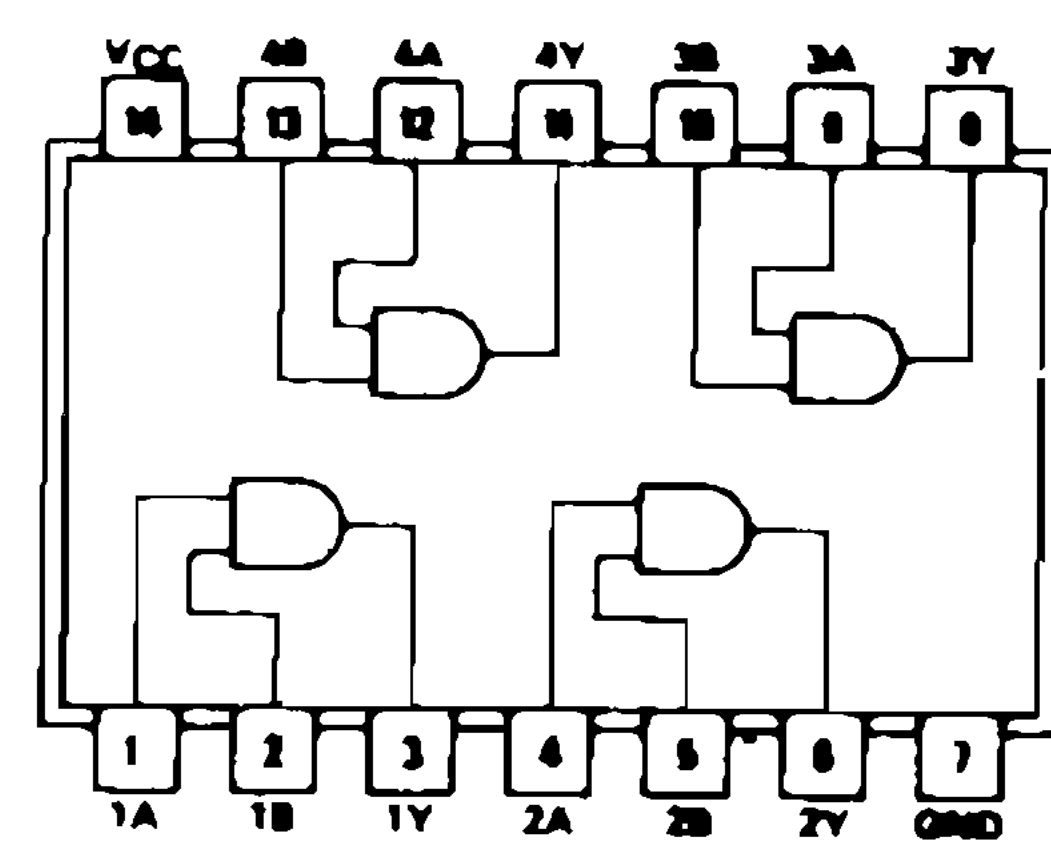


3.8. PIN CONFIGURATIONS cont.:

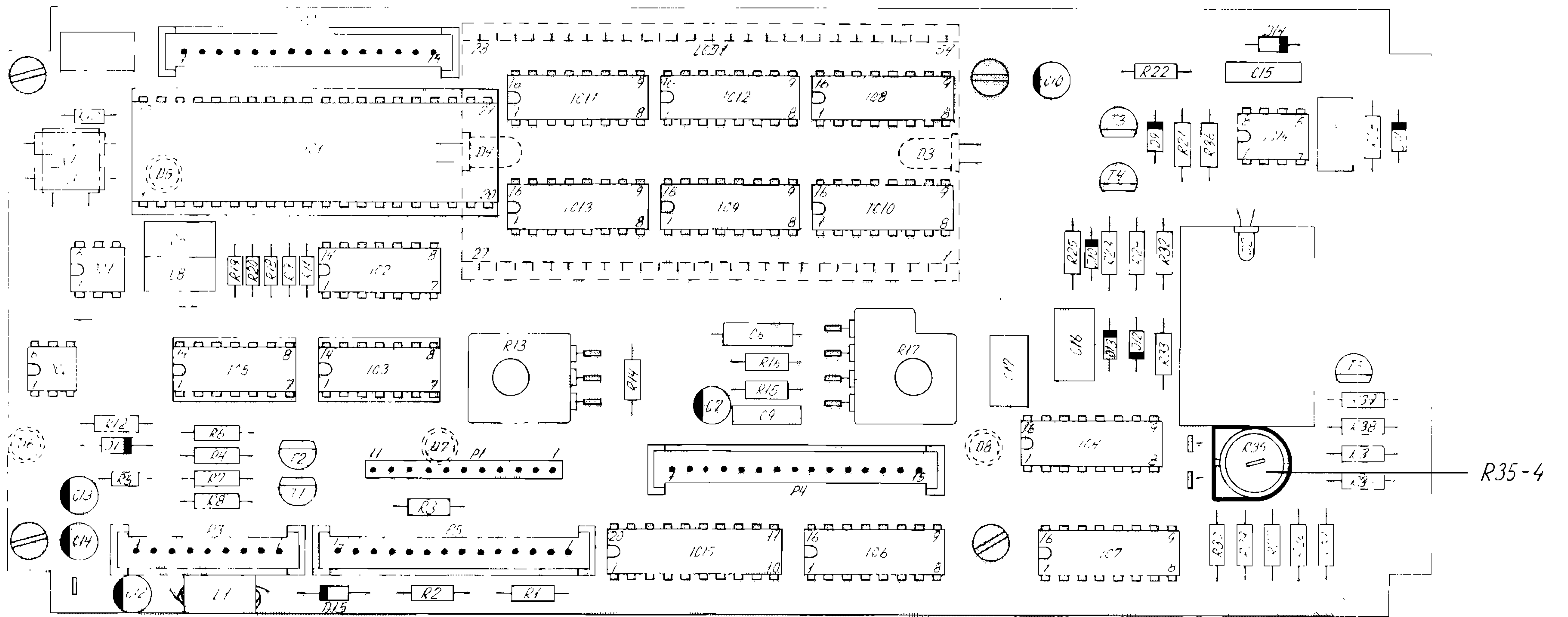
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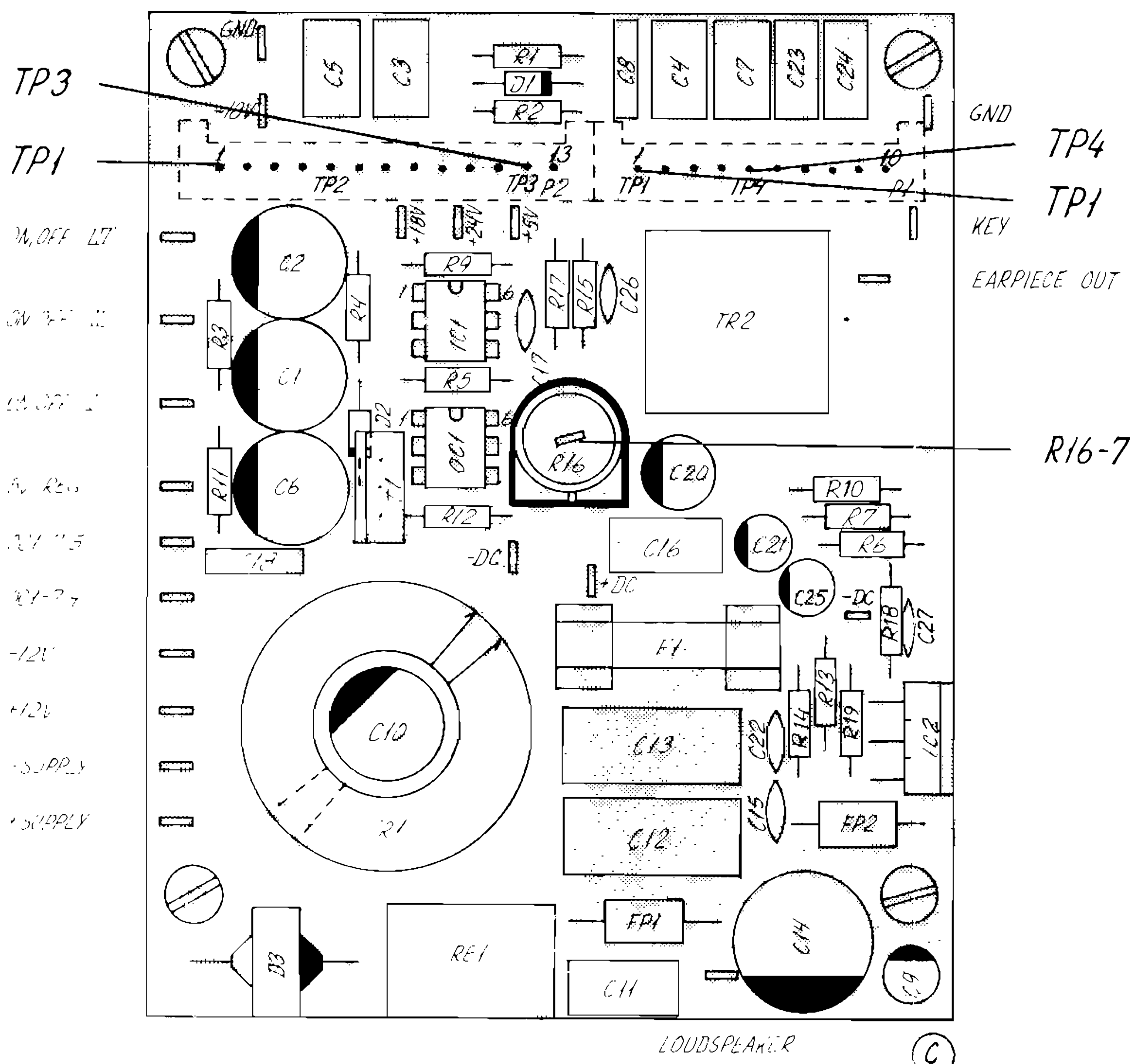
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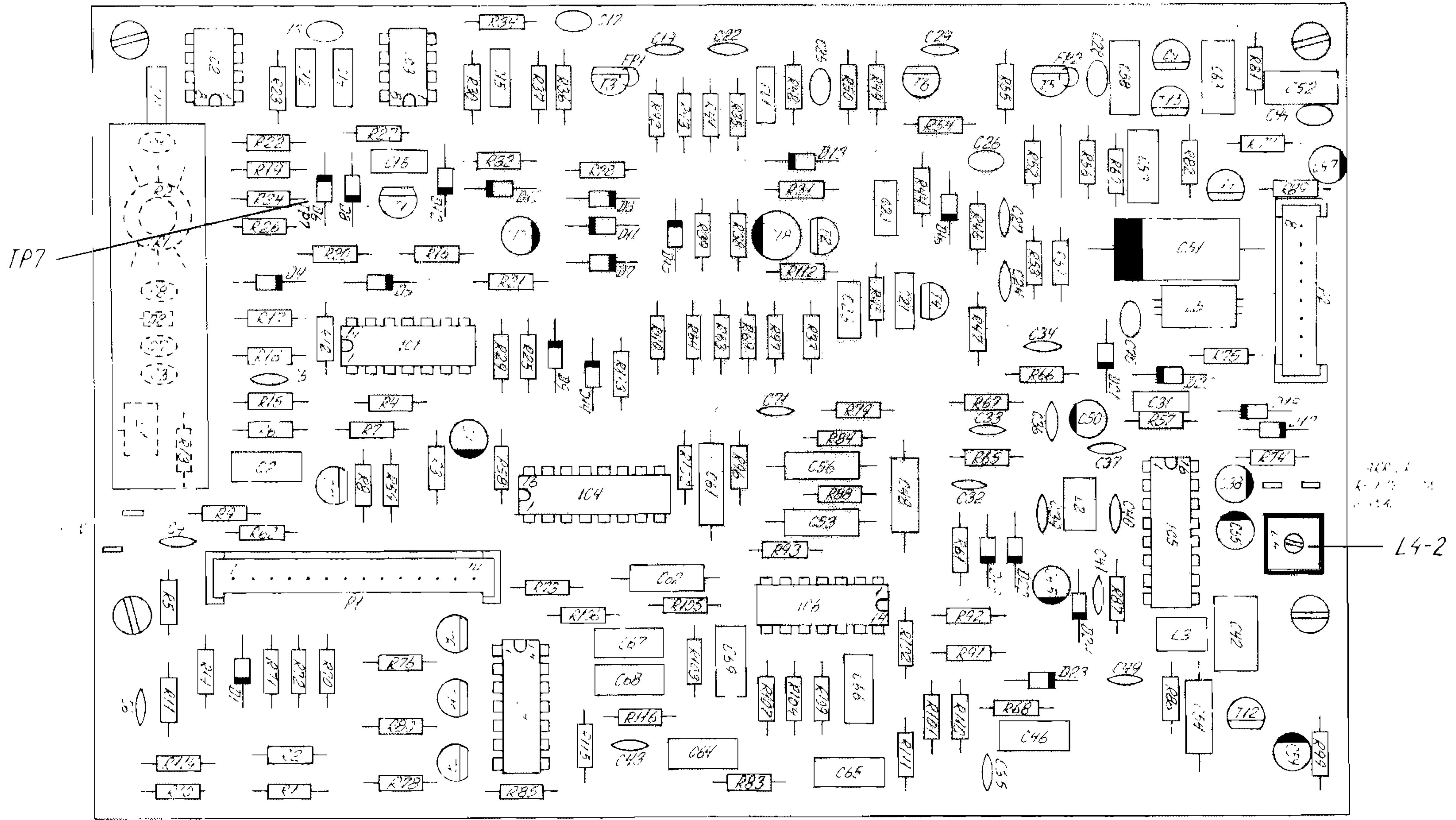




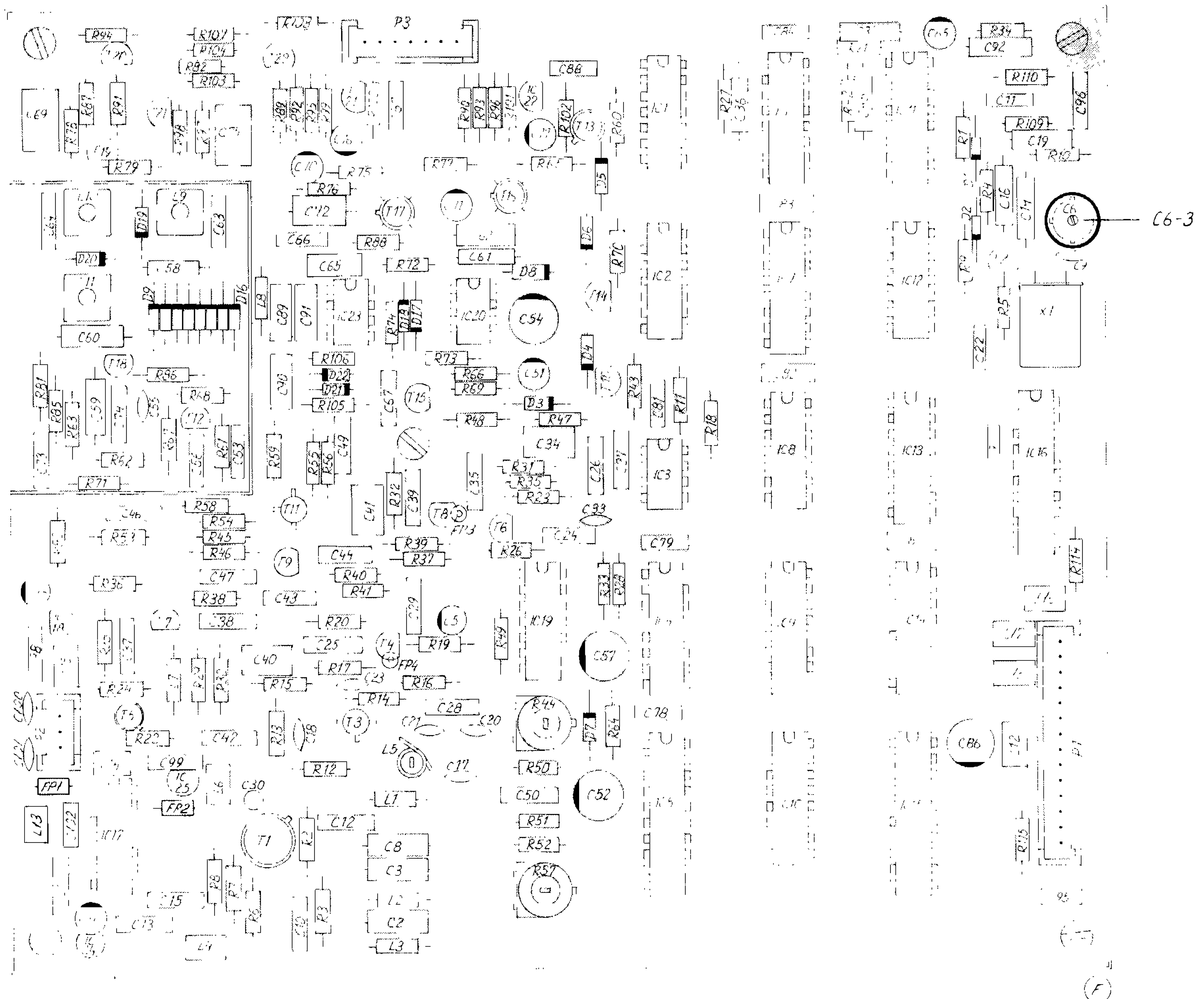
PROCESSOR UNIT (MODULE 4)



AF POWER AMP. & FILTER UNIT (MODULE 7)

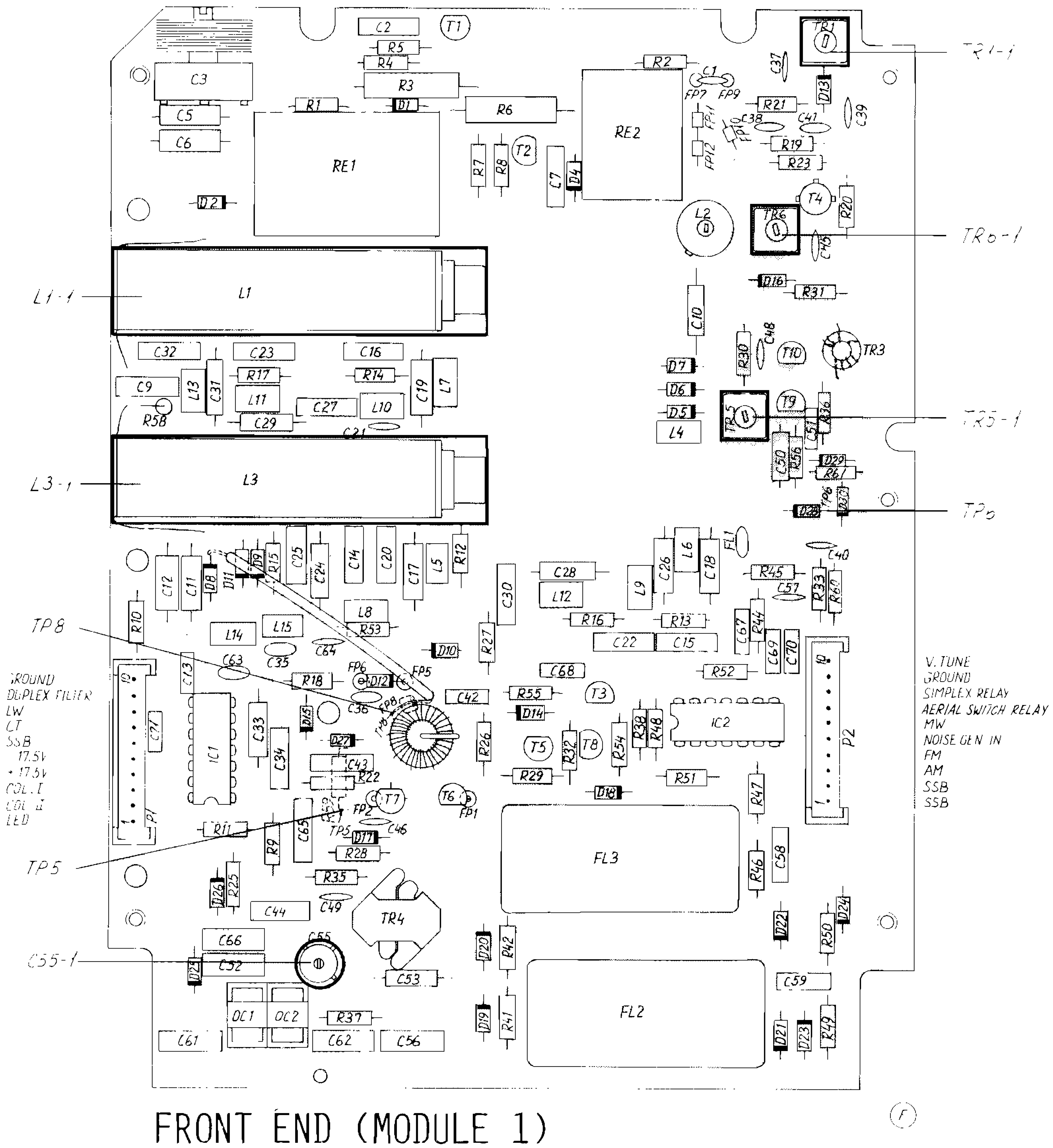
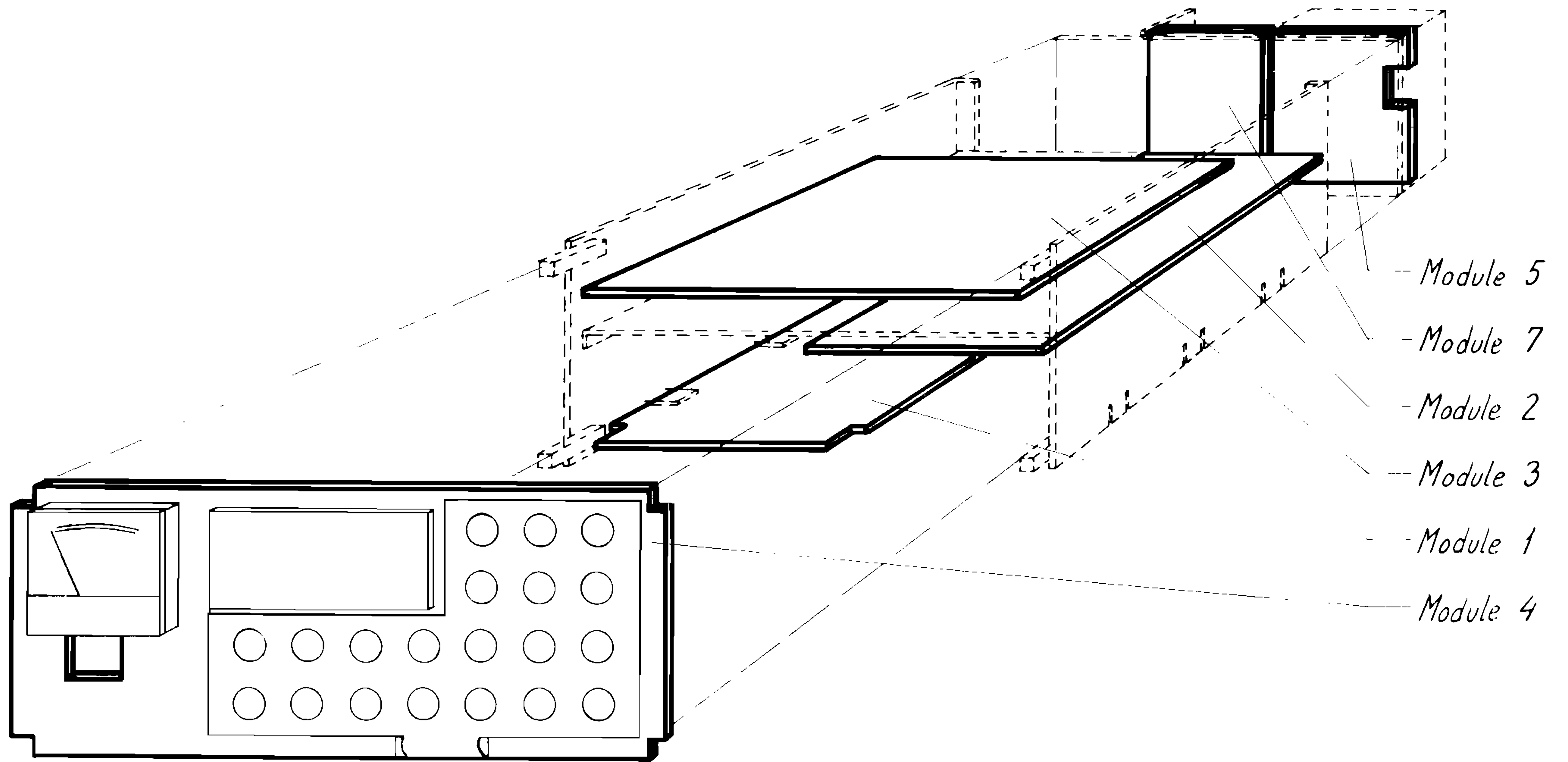


IF AMP., DET., AGC AND AF. PRE. AMP. (MODULE 2)



FREQUENCY SYNTHESIZER (MODULE 3)

### 3.9. ADJUSTMENT, TEST POINT & MODULE LOCATIONS



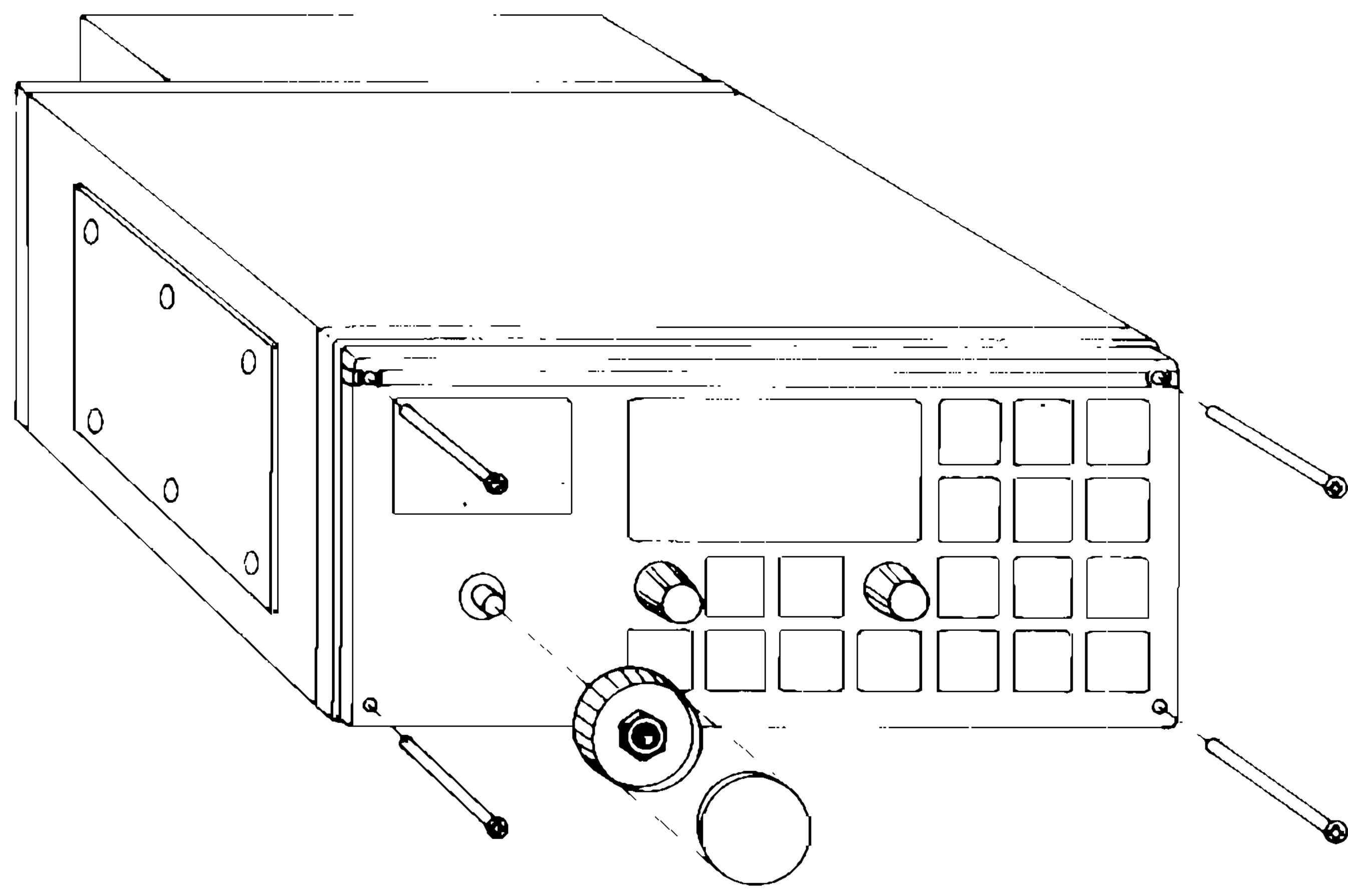
CONTENTS

4. MECHANICAL DISASSEMBLING

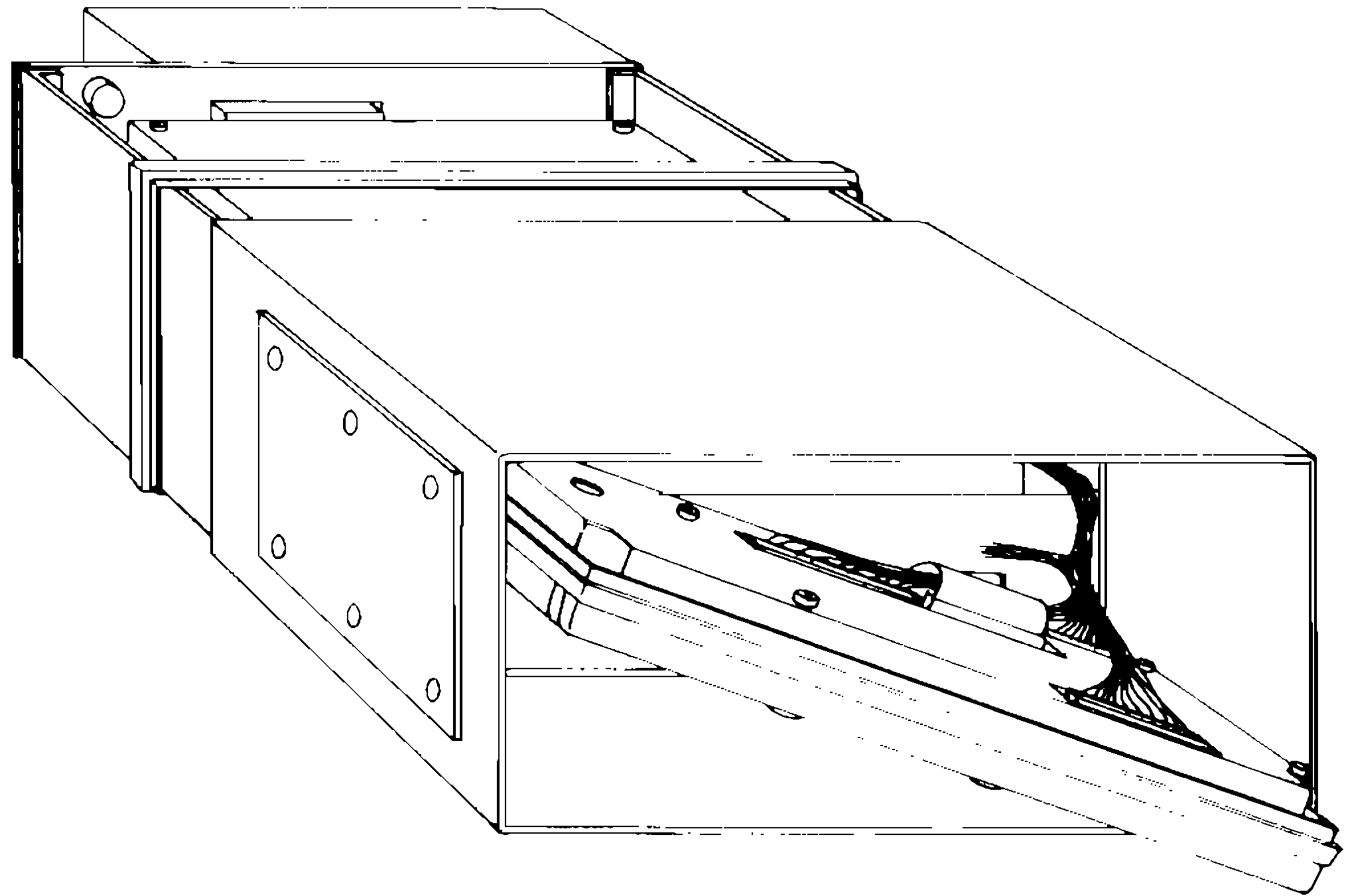


# 4. MECHANICAL DISASSEMBLING

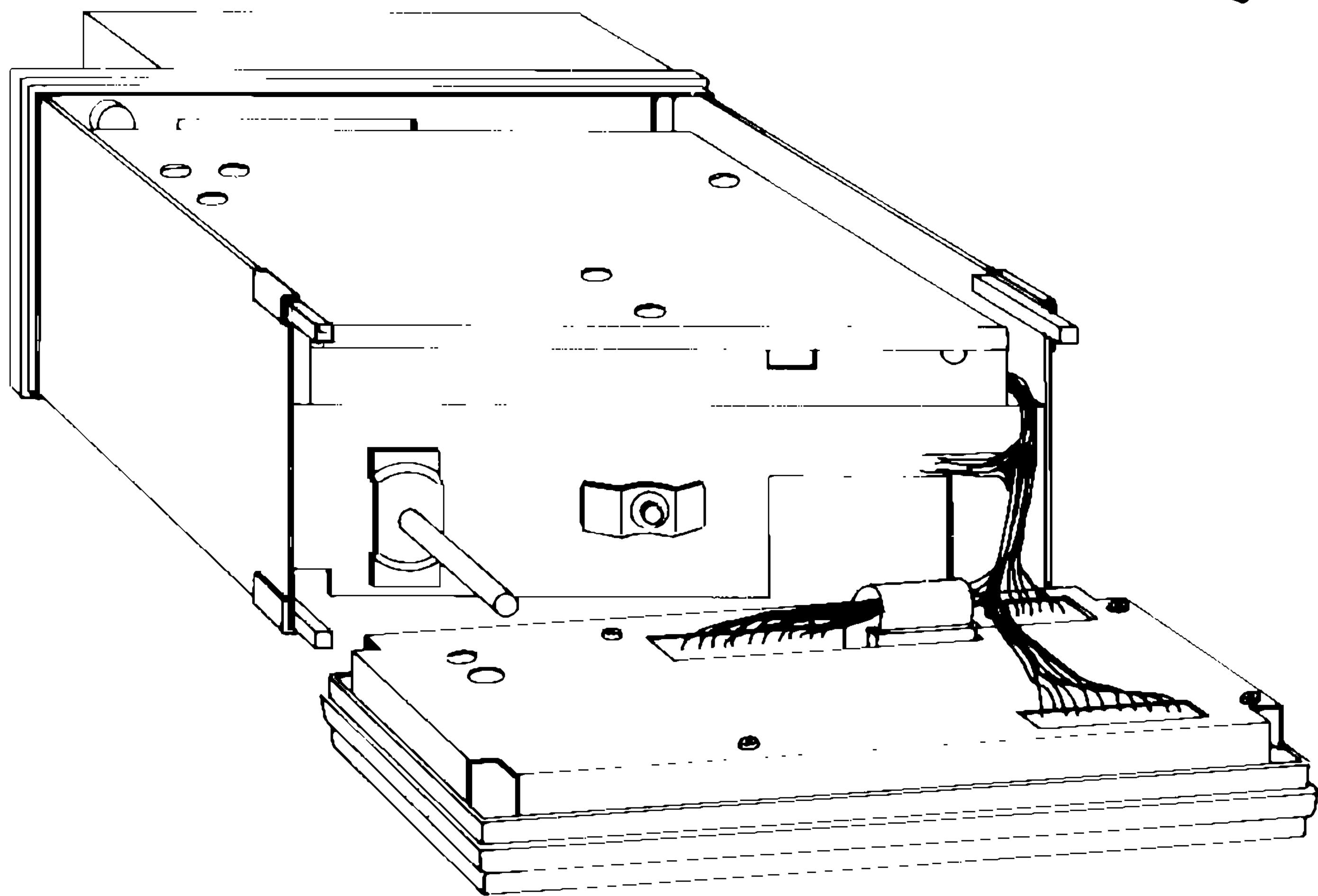
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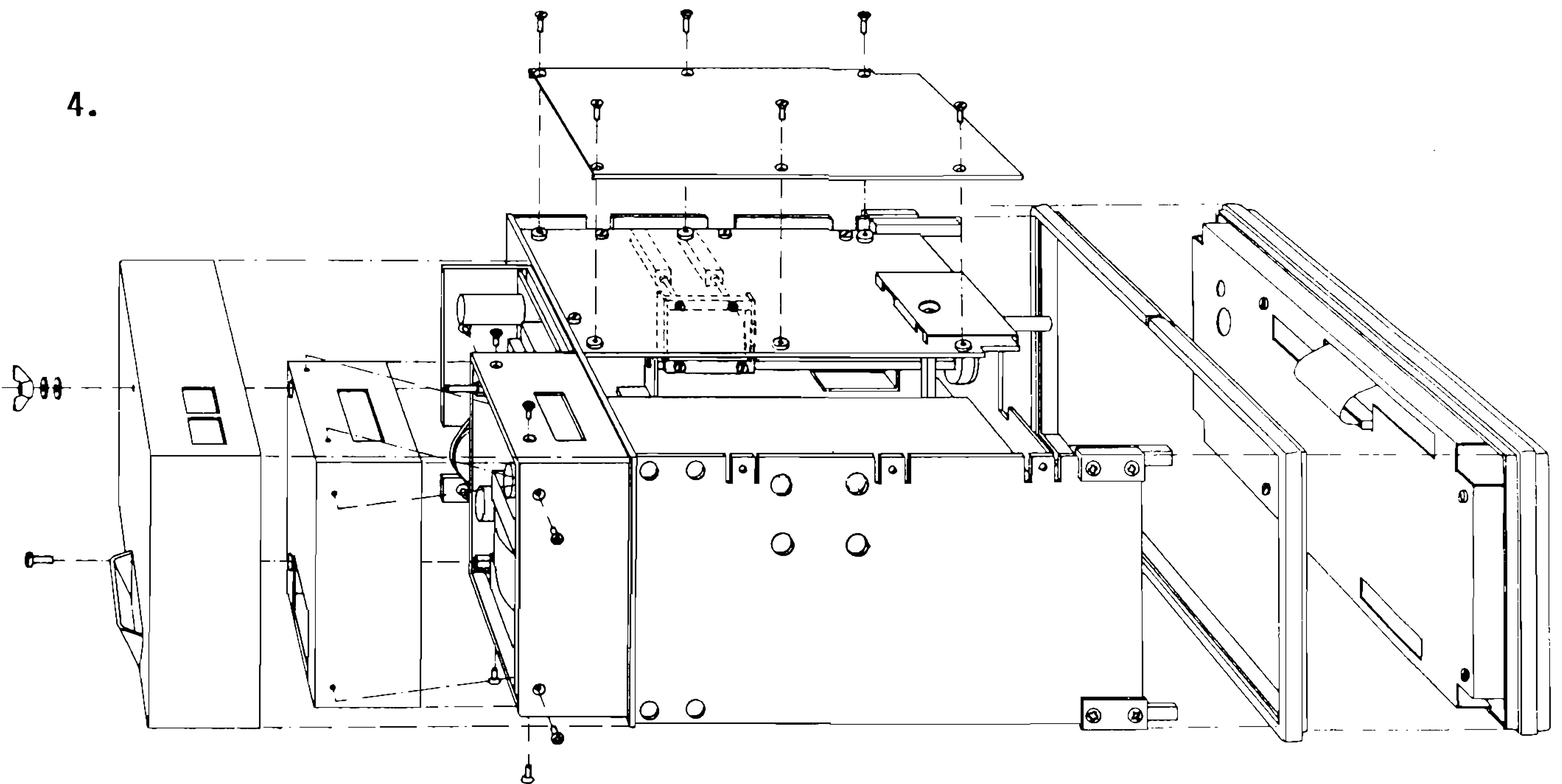
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3.



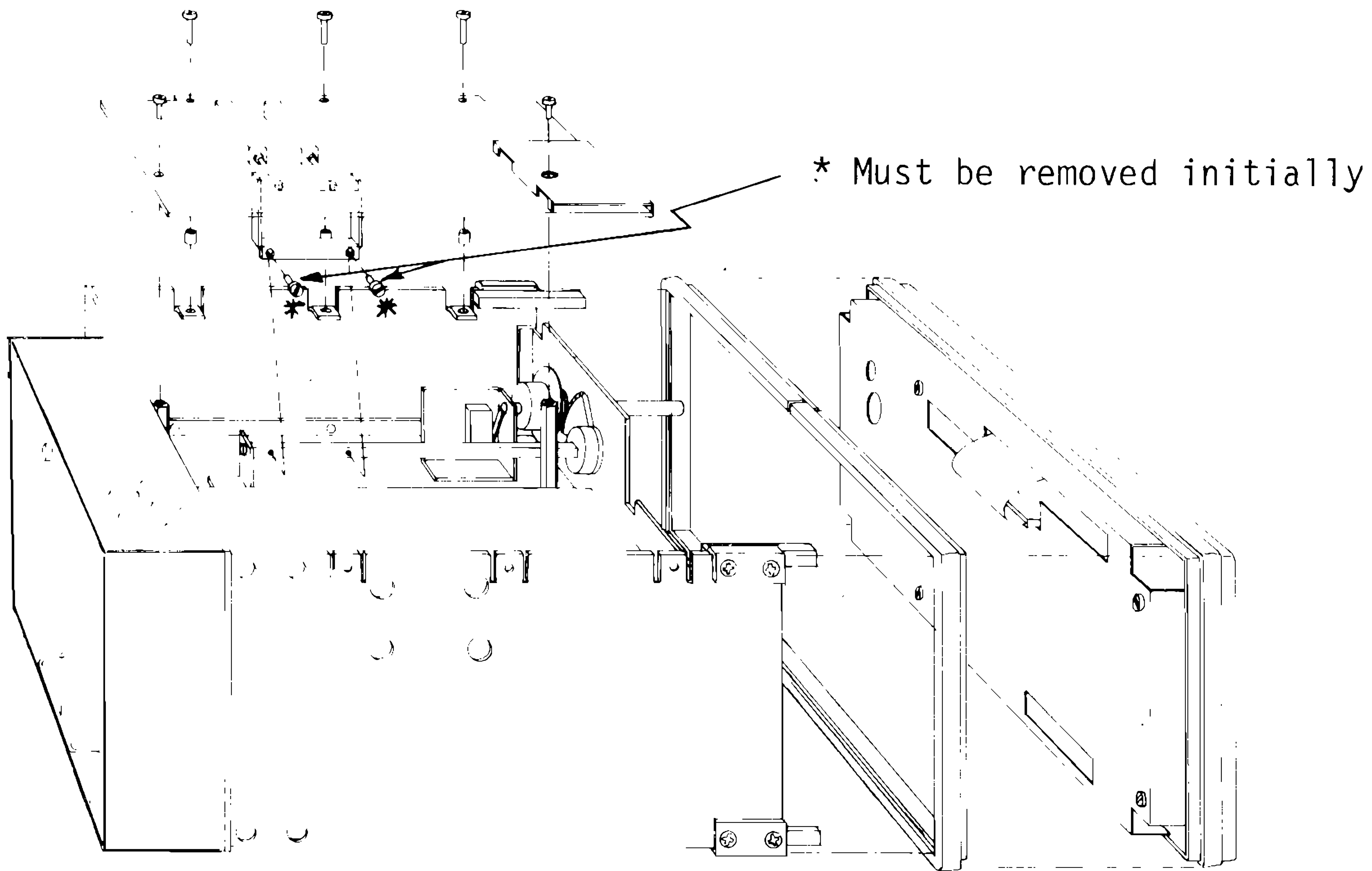
4.



R2022A  
4-0-24779I-III 4-0-25580

4. MECHANICAL DISASSEMBLING cont.:

HOW TO DISASSEMBLE THE FRONT END PCB





## CONTENTS

- 5. CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS
  - 5.1. FRONT END (MODULE 1)
  - 5.2. IF AMP. DET. AGC AND AF PRE.AMP. (MODULE 2)
  - 5.3. FREQUENCY SYNTHESIZER (MODULE 3)
  - 5.4. PROCESSOR UNIT (MODULE 4)
  - 5.5. CONVERTER UNIT (MODULE 5) AND AF AMP. AND FILTER UNIT (MODULE 7)
  - 5.6. WIRING DIAGRAM (INTERCONNECTION CABLE DIAGRAM) (MAIN CHASSIS MODULE 6)

## 5. CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS

### 5.1. FRONT END (MODULE 1)

This unit contains the following parts:

- Aerial Switch and Simplex Relay
- Truth Table for Aerial Switch
- Duplex Filter and Noise Generator
- Simplex Filters
- Mixer and Crystal Filters
- FM Tuner and IF Filter
- Miscellaneous

#### AERIAL SWITCH AND SIMPLEX RELAY

The aerial signal enters the receiver via the aerial socket(s) "1" - "2". The switching between duplex and simplex filters takes place by means of RE1 controlled from the microprocessor and T1.

The simplex relay is controlled from the microprocessor and T2.

#### TRUTH TABLE FOR AERIAL SWITCH

Aerial programming	Filter	Socket "1"	Socket "2"	RE1	RE2	D8	D12
One Aerial Simplex	Simplex	ON	Duplex	ON	ON	OFF	ON
	Duplex	ON	⊥	OFF	ON	ON	OFF
One Aerial Duplex	Simplex	ON	Duplex	ON	ON	OFF	ON
	Duplex	ON	⊥	OFF	ON	ON	OFF
Two Aerial Duplex	Simplex	ON	Duplex	ON	ON	OFF	ON
	Duplex	Simplex	ON	ON	ON	ON	OFF

#### DUPLEX FILTER AND NOISE GENERATOR

The aerial signal enters the duplex filter through the protection resistor R3 and the aerial tuning capacitor C3, which is a part of the tuning capacitor for L1, and leaves the capacitive coupled filter at the impedance transformer C11 and C12. The reversed biased diode D2 is part of the aerial coil protection circuit.

The noise generator consist of D14 and T3, which is switched on and off by means of a 10.24 kHz square wave signal activated by the switch S1-6.

## 5.1. FRONT END (MODULE 1) cont.:

### **SIMPLEX FILTERS**

The aerial signal enters the simplex filters through the HP filter consisting of L2, C10 and L4 and leaves the filter at the diodes D5, D6 or D7. D3 is part of the aerial coil protection circuit. There are three filters, namely the LW LP filter consisting of C17, L8 and C24, the MW BP filter consisting of L6, C18, L9, C26, C28 and L12 and the CT BP filter consisting of L7, C19, L10, C21, L11, C29, C31 and L13.

The signal is fed on through D9, D10, or D11 to an LP filter consisting of L14, C63, C33, L15, C35 and C36 through D12 to the mixer.

The switching in and out is controlled by the microprocessor IC1 (LW, CT) and IC2 (MW).

### **MIXER AND CRYSTAL FILTERS**

From the input selectivity the signal is fed to the double balanced mixer through the balanced transformer TR2 to the FET mixer T6 and T7. The local oscillator signal from the buffer transistor T1-3 is fed into the sources of the FET's. D15, C46 and D17 are the self bias circuit for the mixer. The difference frequency at the drains of the FET's is filtered out in the tuned circuit TR4, C53 and C55 and led through one of the two high order monolithic crystal filters FL2 and FL3 to the IF amplifier. The filter selection is controlled by the microprocessor IC1 and IC2.

### **FM TUNER AND IF FILTER**

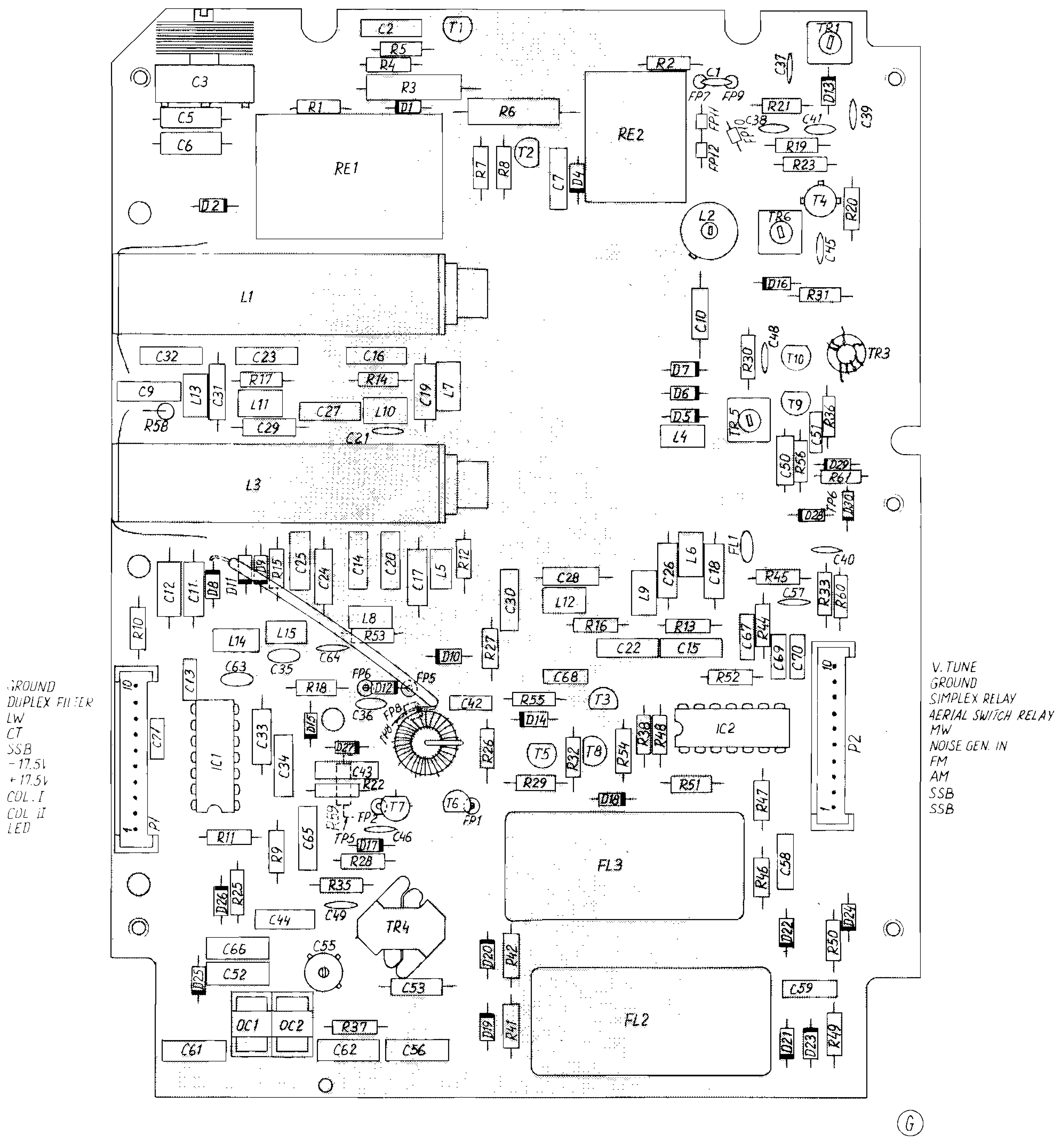
The aerial signal is led through the tuned input transformer TR1, C37, C39 and capacitance diode D13 to the tuned RF amplifier T4. The amplified signal is led through the tuned collector transformer TR6, C45 and capacitance diode D16 to the double balanced mixer, consisting of the balanced transformers TR3, TR5, and the two FET's T9 and T10. The local oscillator signal L02 is fed into the sources of T9 and T10 through the diode attenuators D29, D28, and D30. The attenuator attenuates the L0-signal when the FM-tuner is not in use.

The difference frequency between the RF-signal and the L0-signal is created in the mixer and filtered out in the tuned circuit TR5 and C50 and led through the ceramic resonator filter FL1 to the IF-amplifier.

The selection of FM-mode is done by the microprocessor unit through IC2, T5 and T8.

### **MISCELLANEOUS**

OC1 and OC2 are optocouplers giving pulses when tuning wheel is rotated in the TUNE or CLARIF. mode.

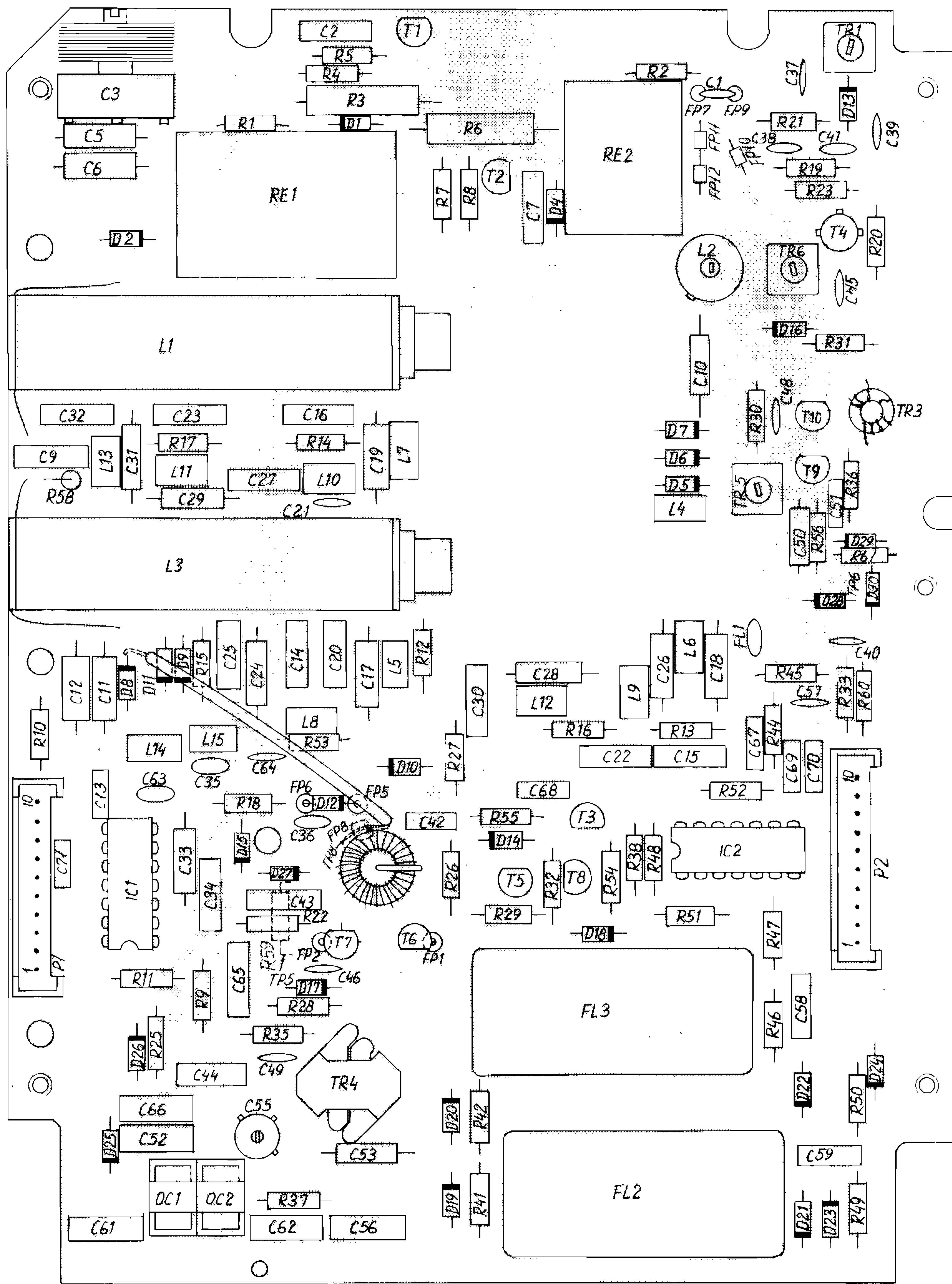


View from component side with lower side tracks.



R2022 C 4-6-24153 G

GROUND  
DUPLIX FILTER  
LW  
CT  
SSB  
-17.5V  
+17.5V  
COL. I  
COL. II  
LED

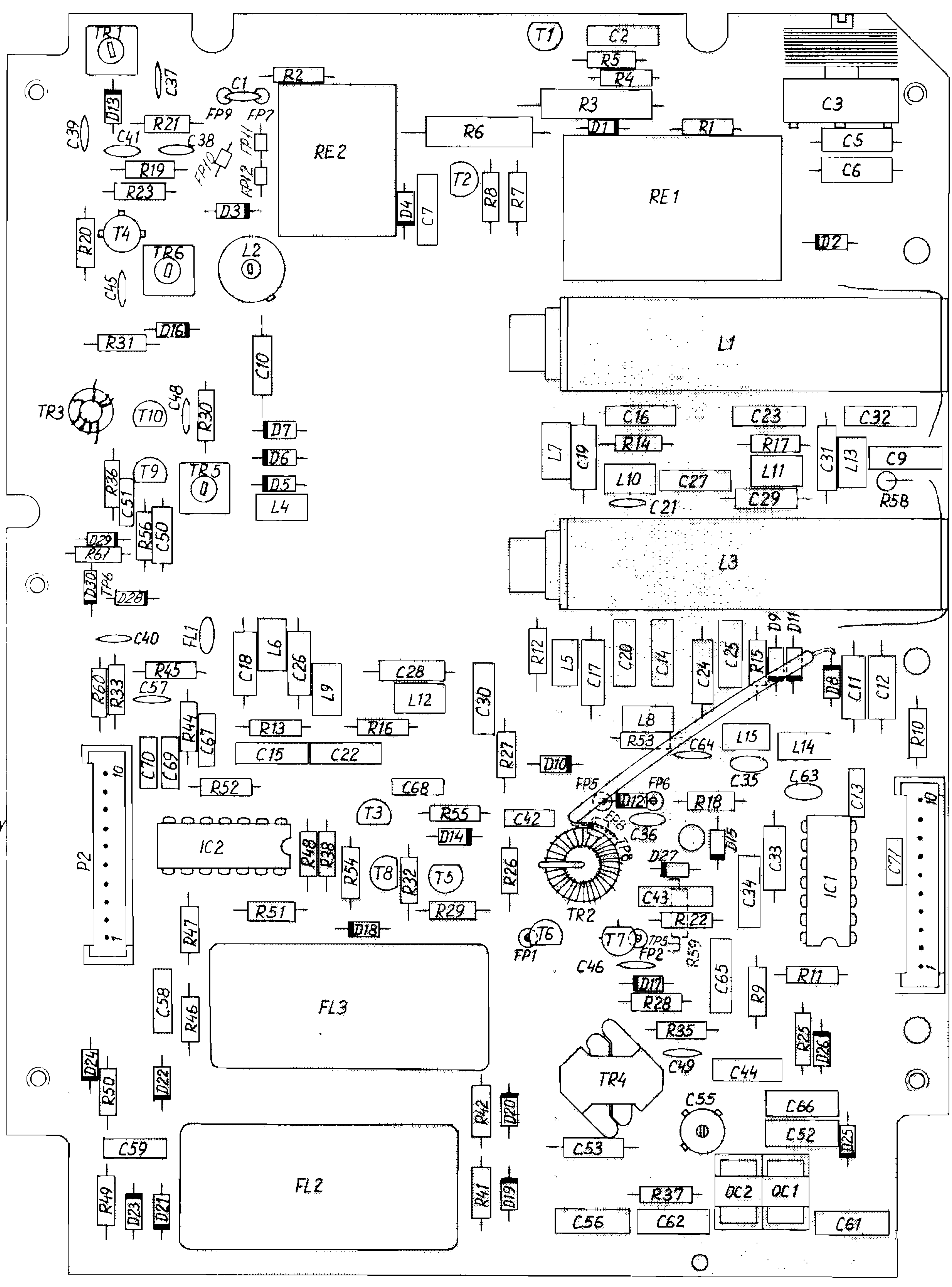


V. TUNE  
GROUND  
SIMPLEX RELAY  
AERIAL SWITCH RELAY  
MW  
NOISE GEN. IN  
FM  
AM  
SSB  
SSB

View from component side with upper side tracks.

V. TUNE  
GROUND  
SIMPLEX RELAY  
AERIAL SWITCH RELAY  
MW  
NOISE GEN. IN  
FM  
AM  
SSB  
SSB

GROUND  
DUPLEX FILTER  
LW  
CT  
SSB  
-17.5V  
+17.5V  
COL. I  
COL. II  
LED.



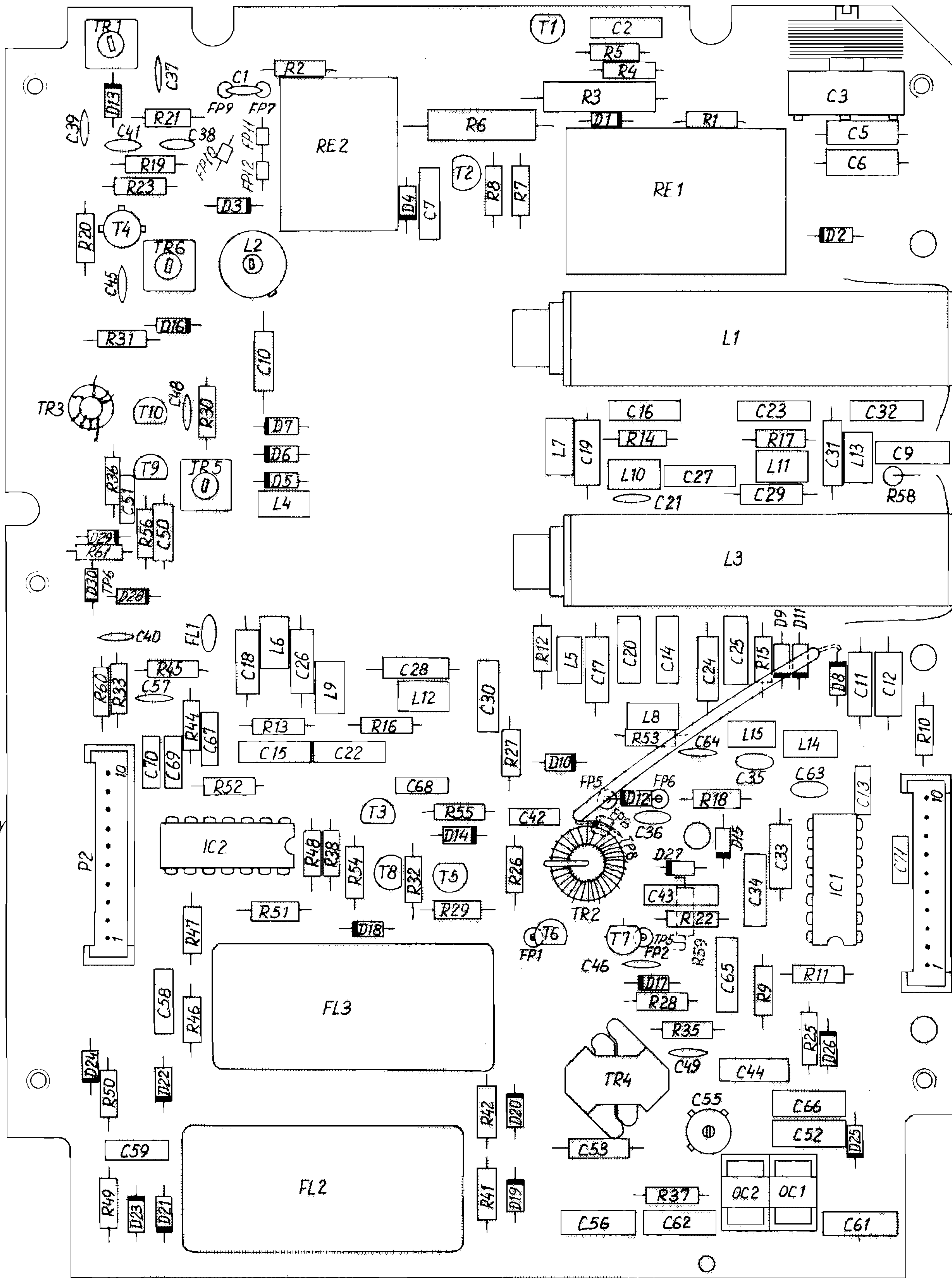
6

View from soldering side with upper side tracks.



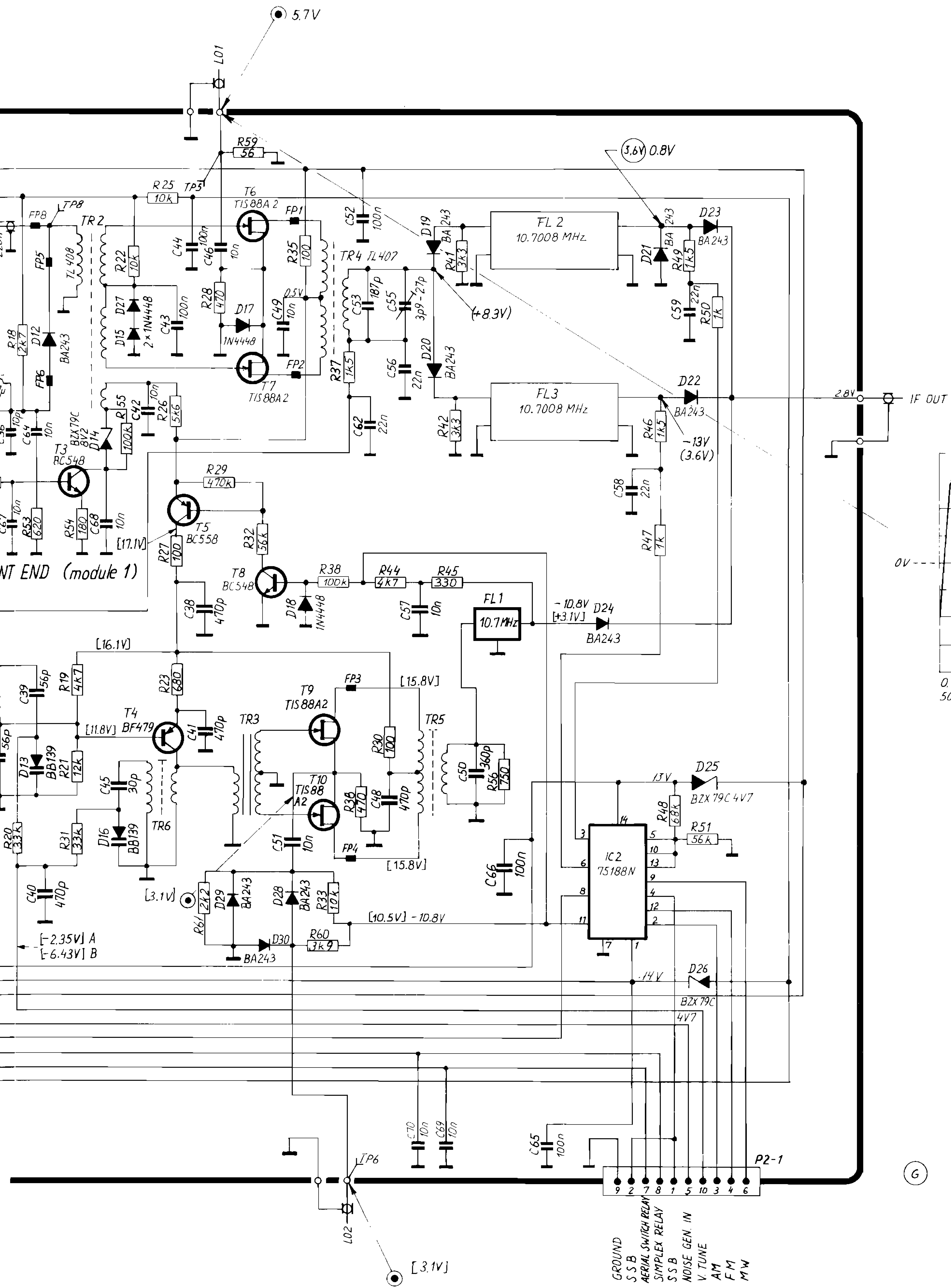
V TUNE  
 GROUND  
 SIMPLEX RELAY  
 AERIAL SWITCH RELAY  
 MW  
 NOISE GEN. IN  
 FM  
 AM  
 SSB  
 SSB

GROUND  
 DUPLEX FILTER  
 LW  
 CT  
 SSB  
 -17.5V  
 +17.5V  
 COL. I  
 COL. II  
 LED.

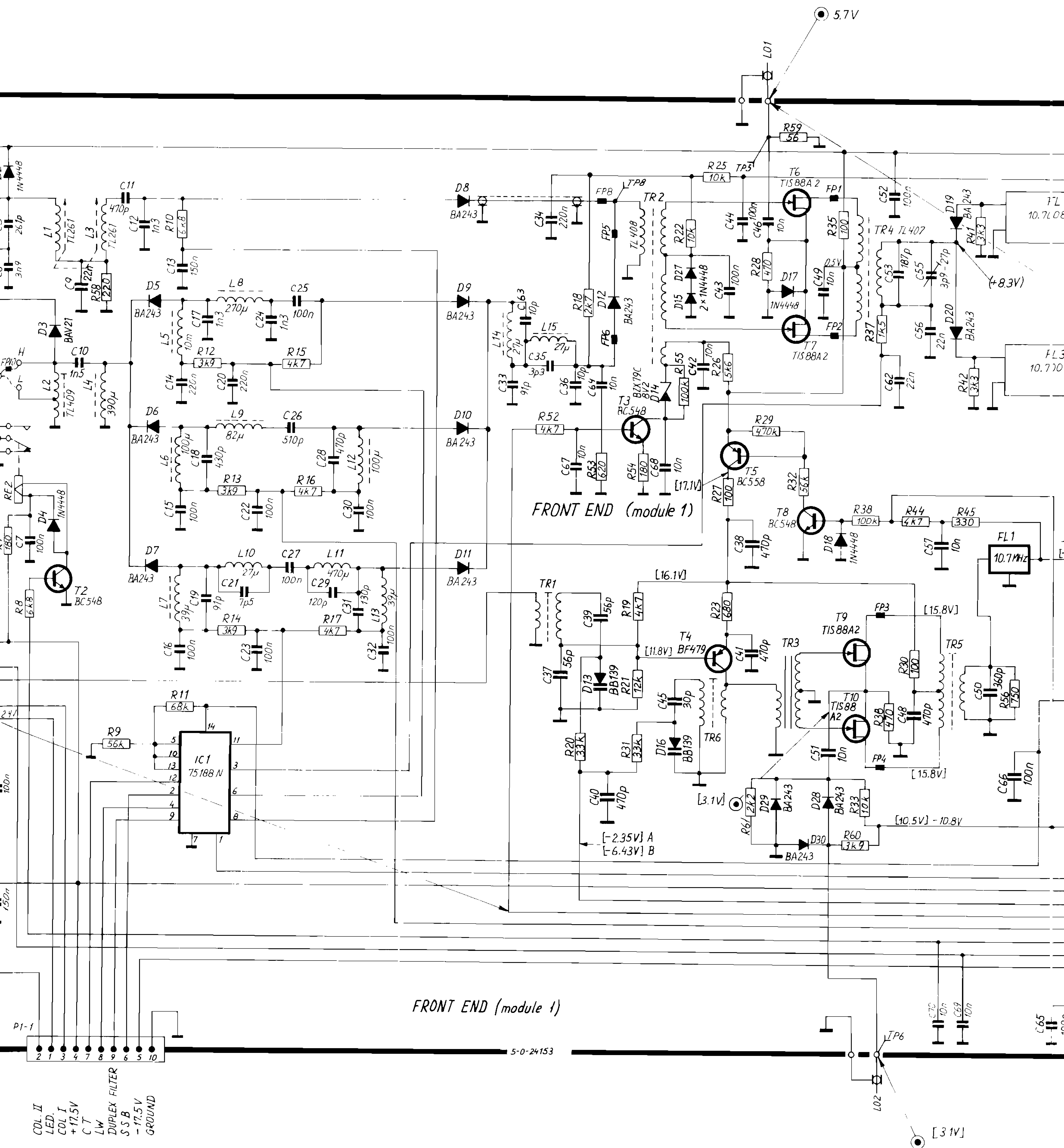


View from soldering side with lower side tracks.

FRONT END (MODULE 1)



FRONT END (MODULE 1)



FRONT END (module 1)

5-0-24153

- PI-1
- COL. II
- LED.
- COL. I
- +17.5V
- C.T.
- LW
- DUPLEX FILTER
- S.S.B
- 17.5V
- GROUND

[3.1V]





## 5.2. IF AMP., DET., AGC AND AF. PRE. AMP. (MODULE 2)

This unit contains the following parts:

- Pin Diode Attenuator
- IF Amp.
- AGC Generator
- Detector
- AF Filters
- AF. PRE. Amp.

### **PIN DIODE ATTENUATOR**

The IF signal is led from the front end into the pin diode attenuator, consisting of R114, R10, R11, R15, and D2 through transformer TR1 and led out by transformer TR2 into the IF amp.

The attenuation level is controlled by the AGC voltage, which is led into IC1a, where it is filtered out and amplified. IC1a then provides the voltage which determines the diode current in D2. With increasing AGC voltage the diode current decreases and the attenuation level increases and vice versa.

### **IF AMP.**

From the pin diode attenuator the signal is fed on to IC2 and from IC2 to IC3. Both these integrated circuits are operational amplifiers. The actual voltage gain in both amplifiers is controlled by the AGC voltage applied to pin 7. From IC3 the signal is led into an amplifier built-up around T3 and further on to the ceramic filter FL1.

This filter FL1 reduces the noise bandwidth to approx. 300 kHz. From the ceramic filter the signal is fed on to a common collector amplifier T6, which buffers the detector circuits.

### **AGC GENERATOR**

From the ceramic filter FL1 the signal is fed on to a common emitter amplifier T5. The voltage gain in this amplifier determines through the AGC system the magnitude of the IF-amp. output from FL1.

From T5 there are two different ways to generate the necessary AGC voltage, depending on whether AM/FM mode or SSB mode is chosen.

All mode shifts etc. in the AGC system are controlled by the microprocessor through IC4.

RF-gain voltage is added to the AGC system through D4 and contemporary led to IC1d, which compares RF-gain voltage with AGC voltage and generates the scan control signal.

## 5.2. IF AMP., DET., AGC AND AF.PRE.AMP. (MODULE 2) cont.:

### SSB-AGC

From the amplifier T5 the signal is fed on to transistor T4, which together with R44, C20, R45 and C21 forms a magnitude detector. The voltage on R44 and C20 is led right on to the gain controllable circuits IC2 and IC3 through D13, R28, D10 and T1 and ensures fast control of the AGC level in the system. Together with the fast AGC-system a slow control of the AGC level is activated by the detector output voltage, which is fed on to the voltage follower IC1b through R31. IC1b buffers the charging of C10 through R25 and D9. The voltage on D10 is amplified by IC1c and led through D3 to the cathode of D13, where it is added to the actual voltage level from the detector. The fast AGC system ensures noise immunity and the slow AGC system will decrease distortion caused by the AGC of an SSB-signal.

### AM/FM-AGC

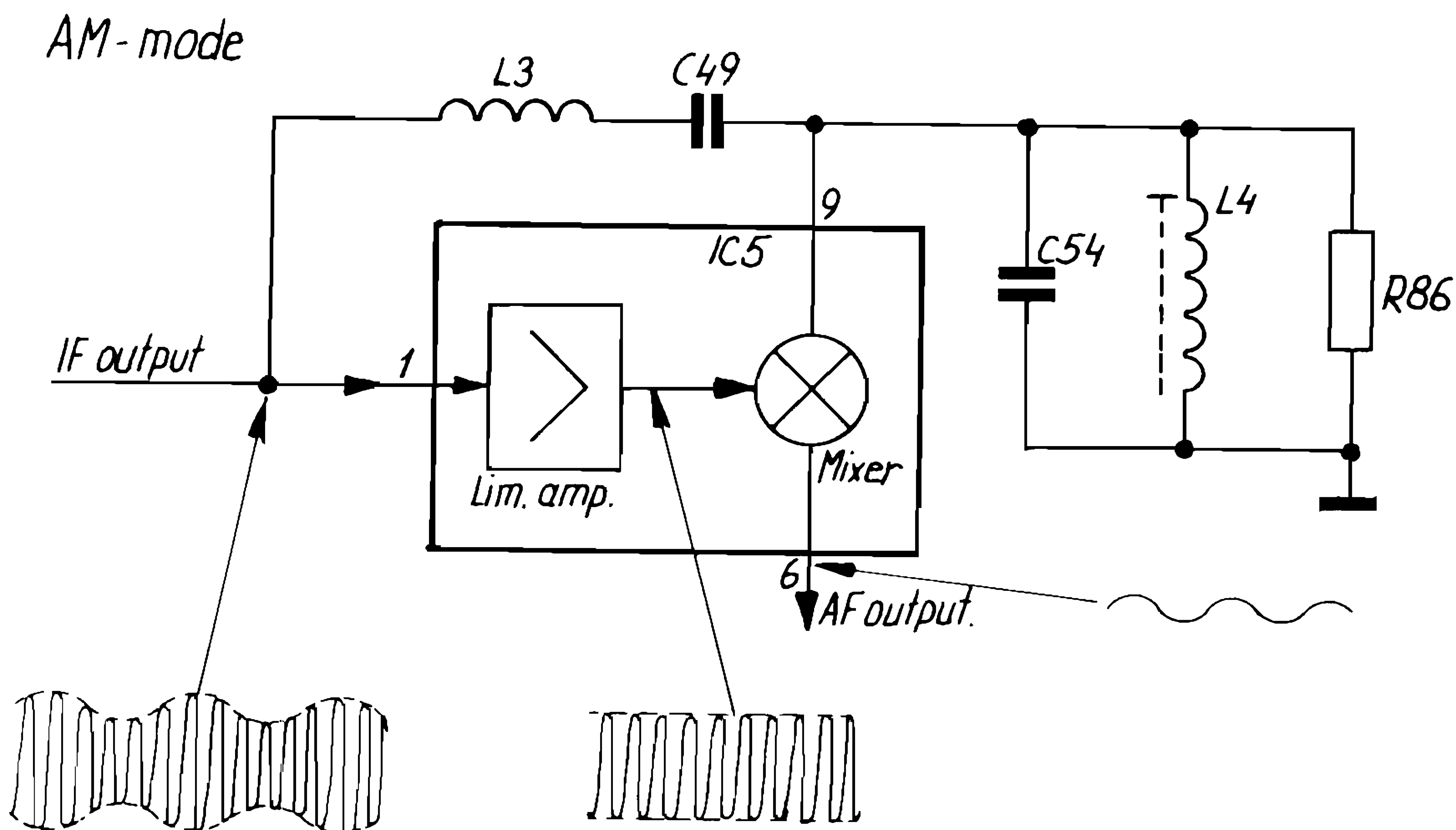
When chosen AM/FM-AGC C18 is connected parallel to C20 through T2. This decreases both rise and fall time for the AGC system, so modulation compression does not occur. The slow SSB-AGC is disabled by applying high voltage to pin 6 IC1b through D14.

### DETECTOR

The detector circuit is built up around IC5, and through the diode arrangement D17 - D24 it is made possible to demodulate A3, A3H, A3A, A3J and FM using the same detector circuit.

Through microprocessor control there are 3 different detector modes to select, these are shown and explained in principle below.

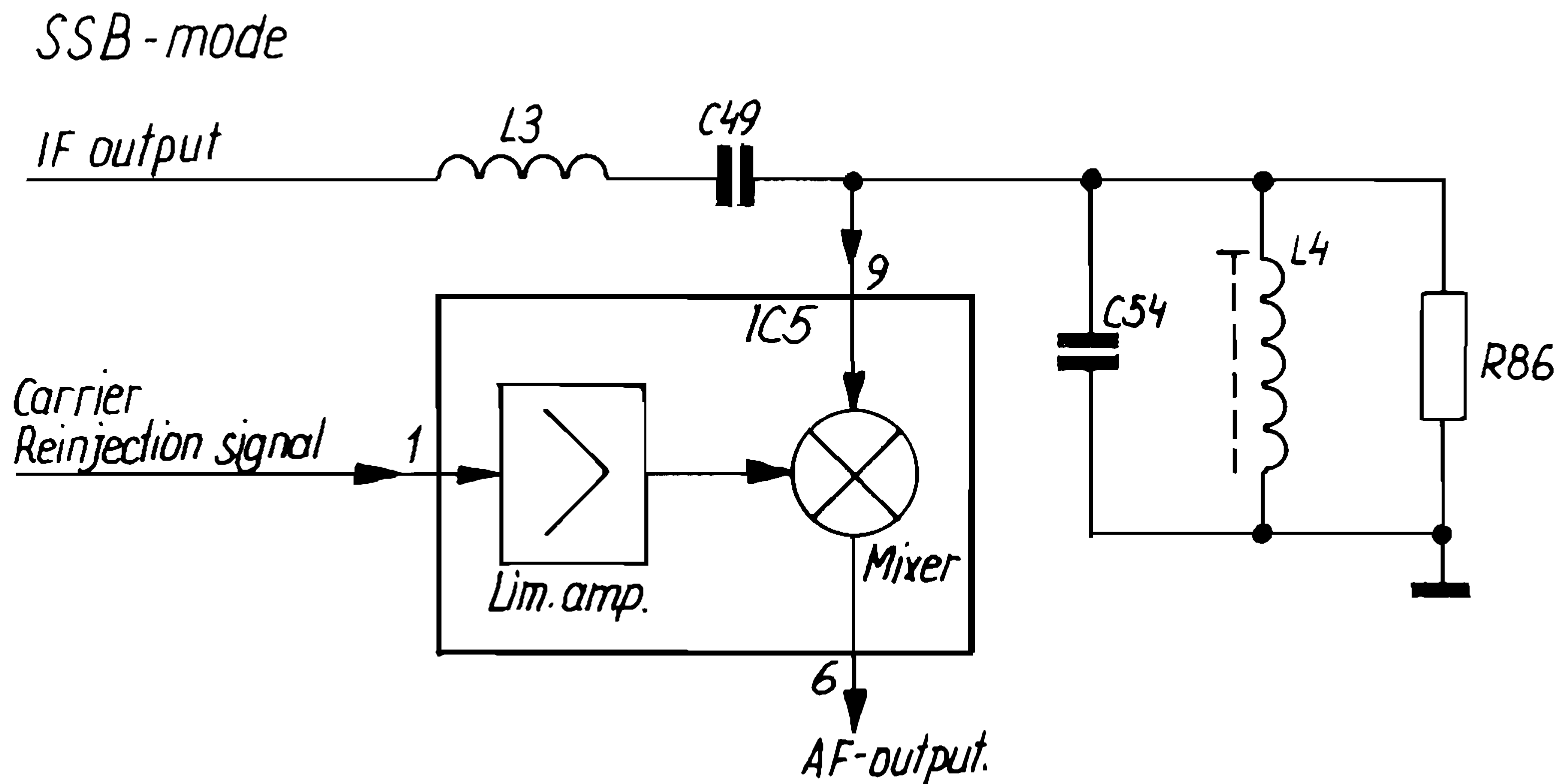
IC5 features a muting facility controlled by microprocessor through applying voltage to pin 5.



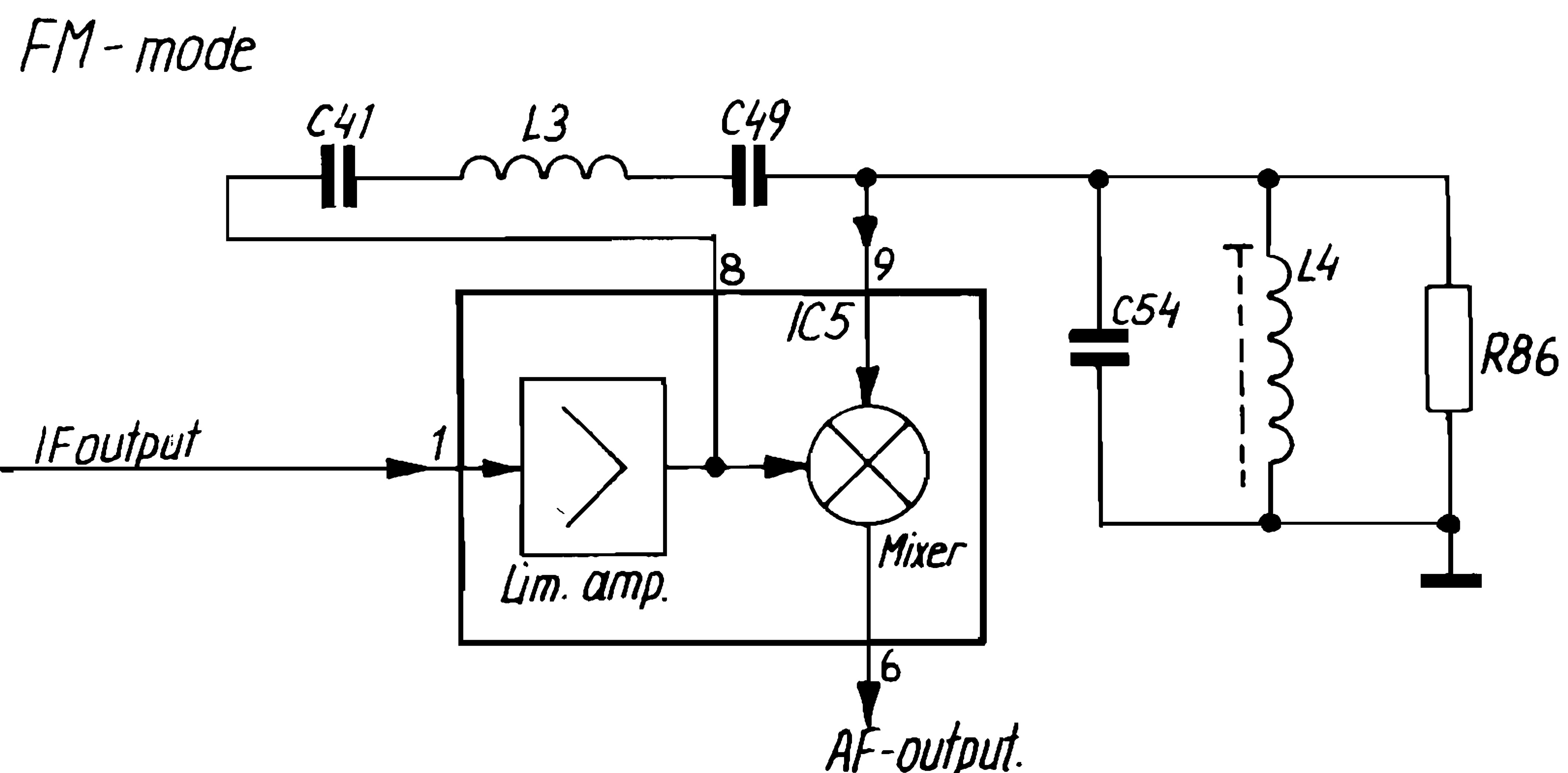


5.2. IF AMP., DET., AGC AND AF.PRE.AMP. (MODULE 2) cont.:

In AM-mode the principle is to remove the modulation from the IF-signal through the limiting amplifier and leave just the carrier signal. This signal is then mixed with the original IF-signal to create the wanted AF out.



In SSB-mode the carrier reinjection signal is simply mixed with the IF-signal, and the AF-signal is then created. The IF-signal is fed on into the mixer through pin 9, so it is possible to maintain the amplitude information in it.



In FM-mode the IF-signal is led into pin 1 IC5. The limiting amplifier removes amplitude modulation from the signal. A phase difference between the signal on pin 8 and the signal on pin 9 proportional to frequency difference between the IF-signal frequency and the resonance frequency of C54 and L4 is created, and this phase difference is detected in the mixer and the AF out signal created.

## 5.2. IF AMP., DET., AGC AND AF.PRE.AMP. (MODULE 2) cont.:

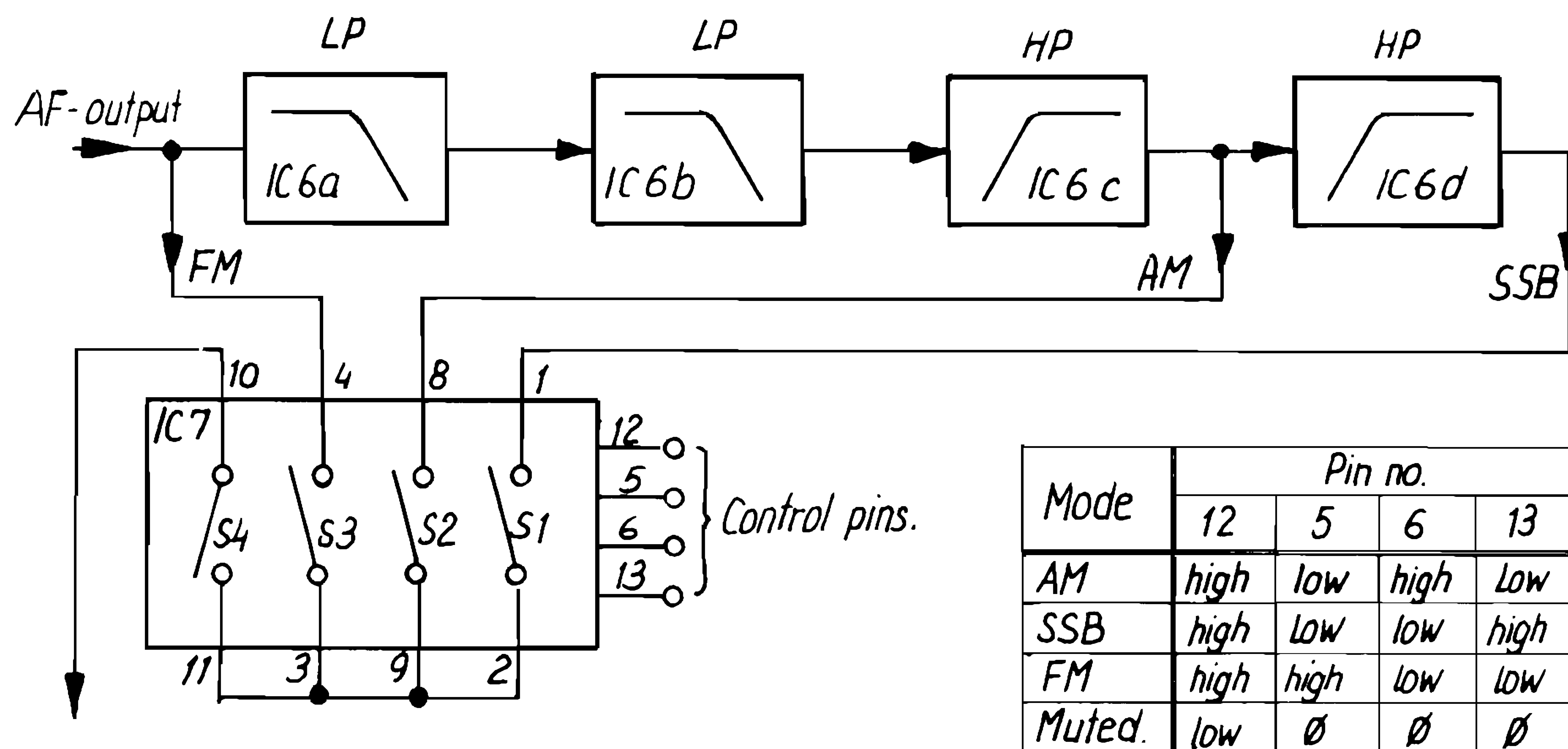
TRUTH TABLE FOR DIODE ARRANGEMENT

	D17	D18	D19	D20	D21	D22	D23	D24
AM	OFF	ON	OFF	OFF	ON	ON	OFF	ON
FM	OFF	ON	OFF	OFF	ON	OFF	ON	OFF
SSB	ON	OFF	ON	ON	OFF	OFF	OFF	ON

### AF FILTERS

To reduce white noise from the non-tuned IF-amp. in AM and SSB-mode, 4 active AF filters are built in, as shown below, which are switched in and out by the multiplexer IC7.

The multiplexer is controlled by the microprocessor through T8, T9, T10, and IC4 depending on which receiver mode is chosen.



In SSB-mode the detector output enters the AF-filters through R79 and is led through all 4 filters by switching S1 on.

In AM-mode the signal is led out before the last AF-filter by switching S2 on.

In FM-mode the detector output is led through the multiplexer by switching S3 on and the AF-filters are disabled.

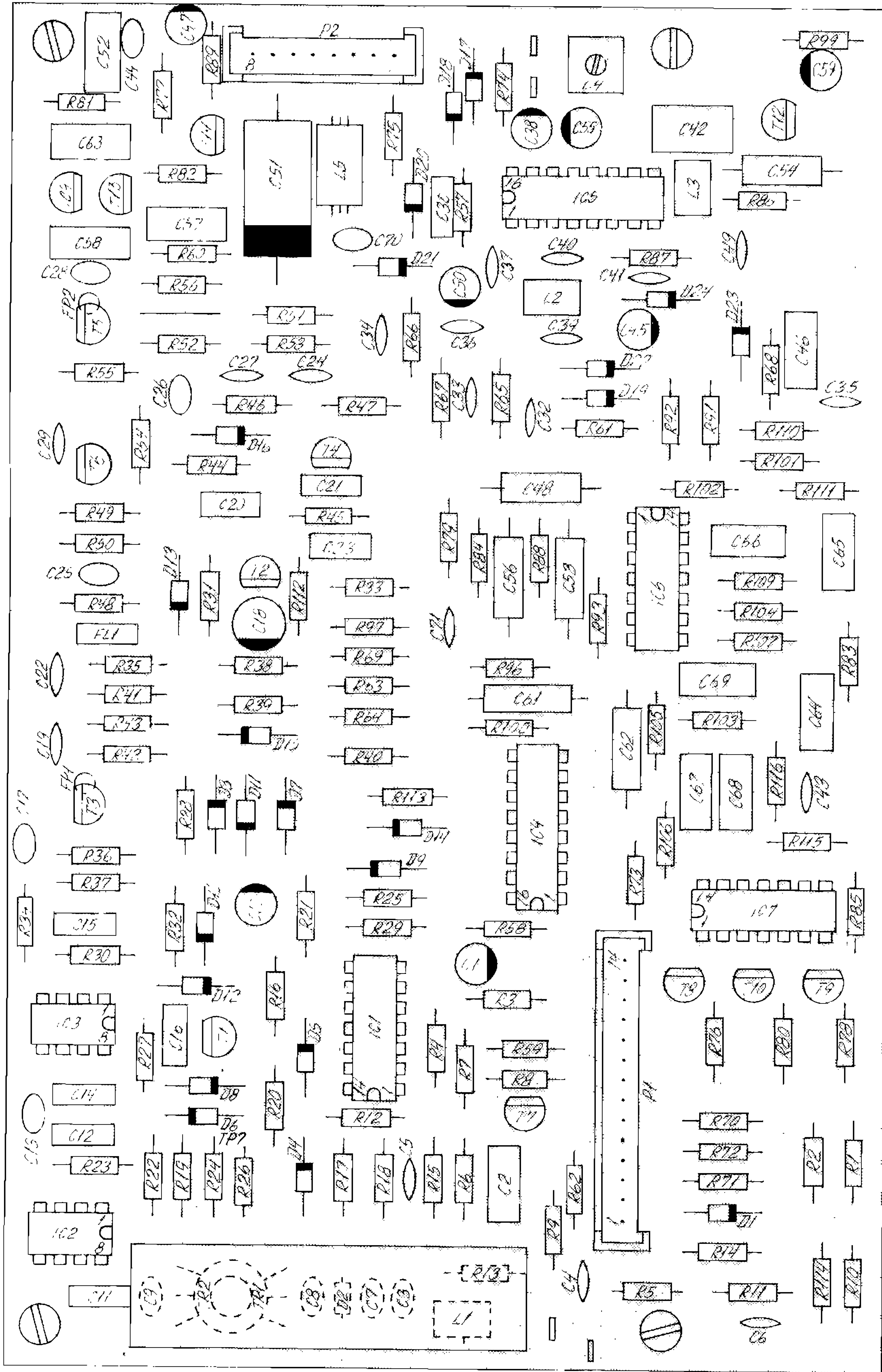
From pin 2, pin 9, pin 3, IC7 the signal is fed on to the earpiece amplifier T12. From pin 10 IC7 the signal is led to the AF-potentiometer located on the microprocessor PCB.

Multiplexer switch S4 is used to mute AF-signal to the AF-potentiometer. When S4 is switched off, muting of the external loudspeaker is implied without muting the earpiece.

### AF. PRE. AMP.

From the AF-potentiometer located on microprocessor PCB the signal is fed into T13 and then led on to T14, which buffers the AF power amplifier placed on AF-AMP. and FILTER UNIT (module 7) PCB.

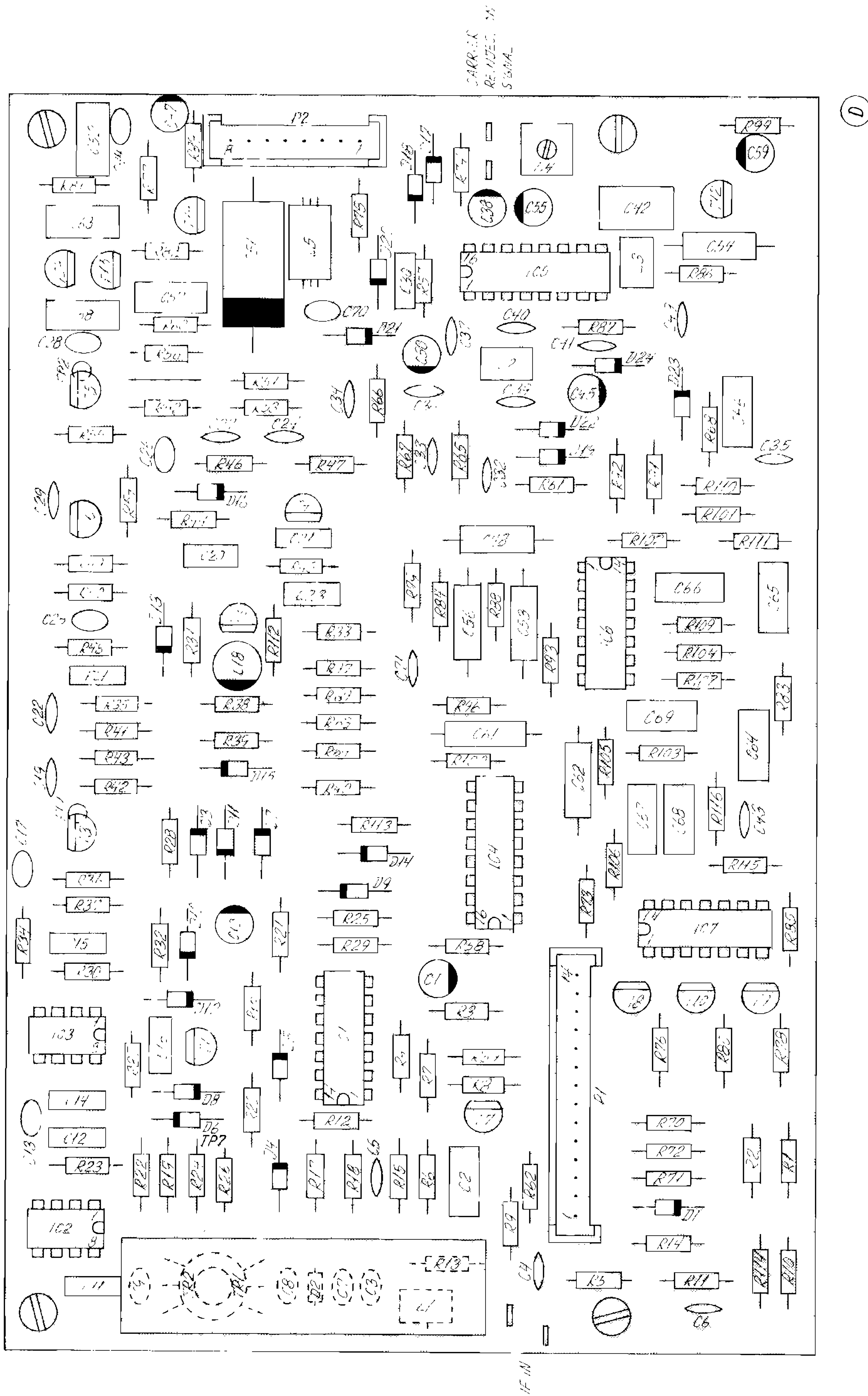
CARRIER  
RE-VIDEO IN  
SIGNAL



(D)

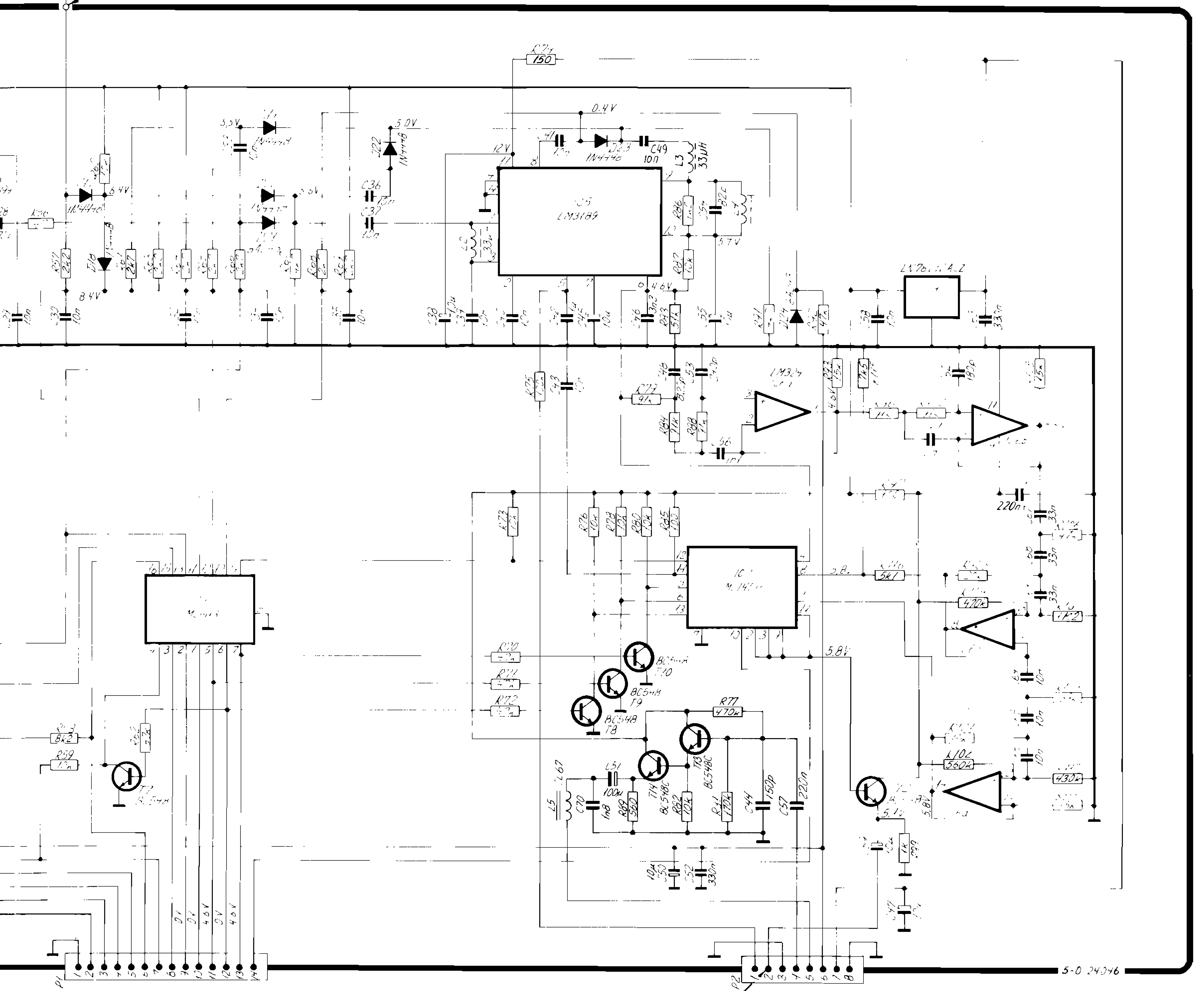
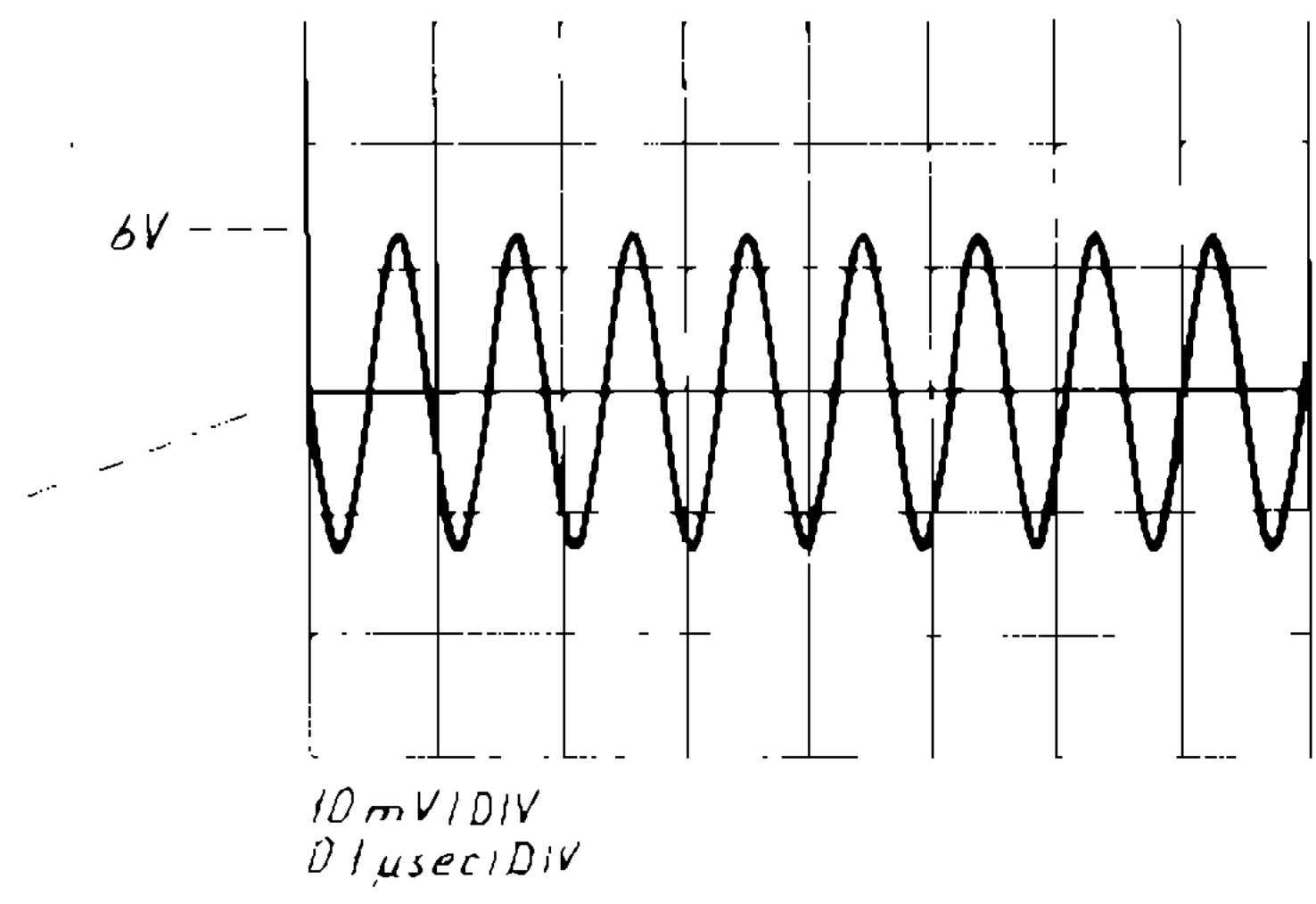
View from component side with upper side tracks.

IF AMP., DET., AGC & PRE AMP. (MODULE 2)



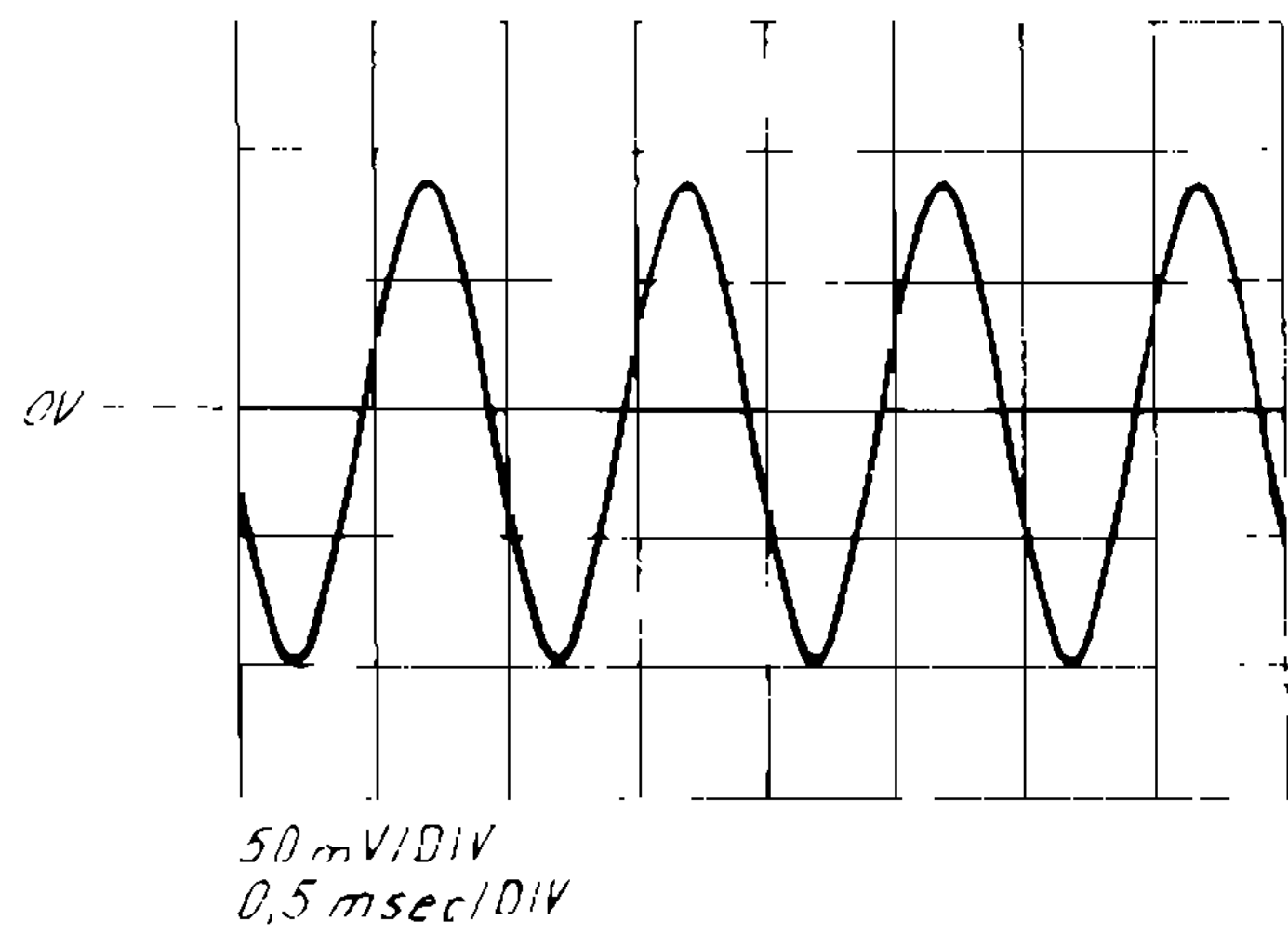
View from component side with lower side tracks.





5-0 24046

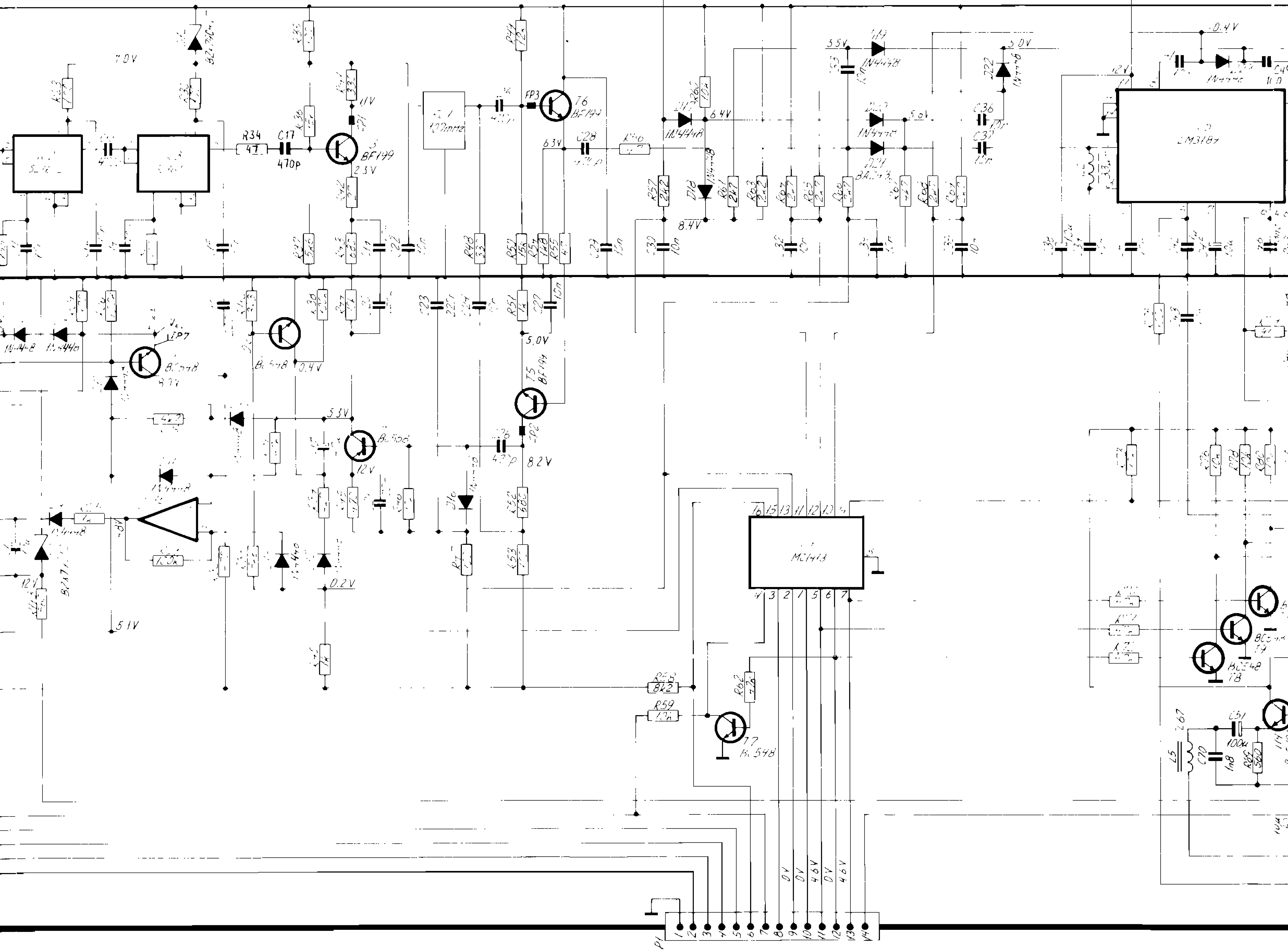
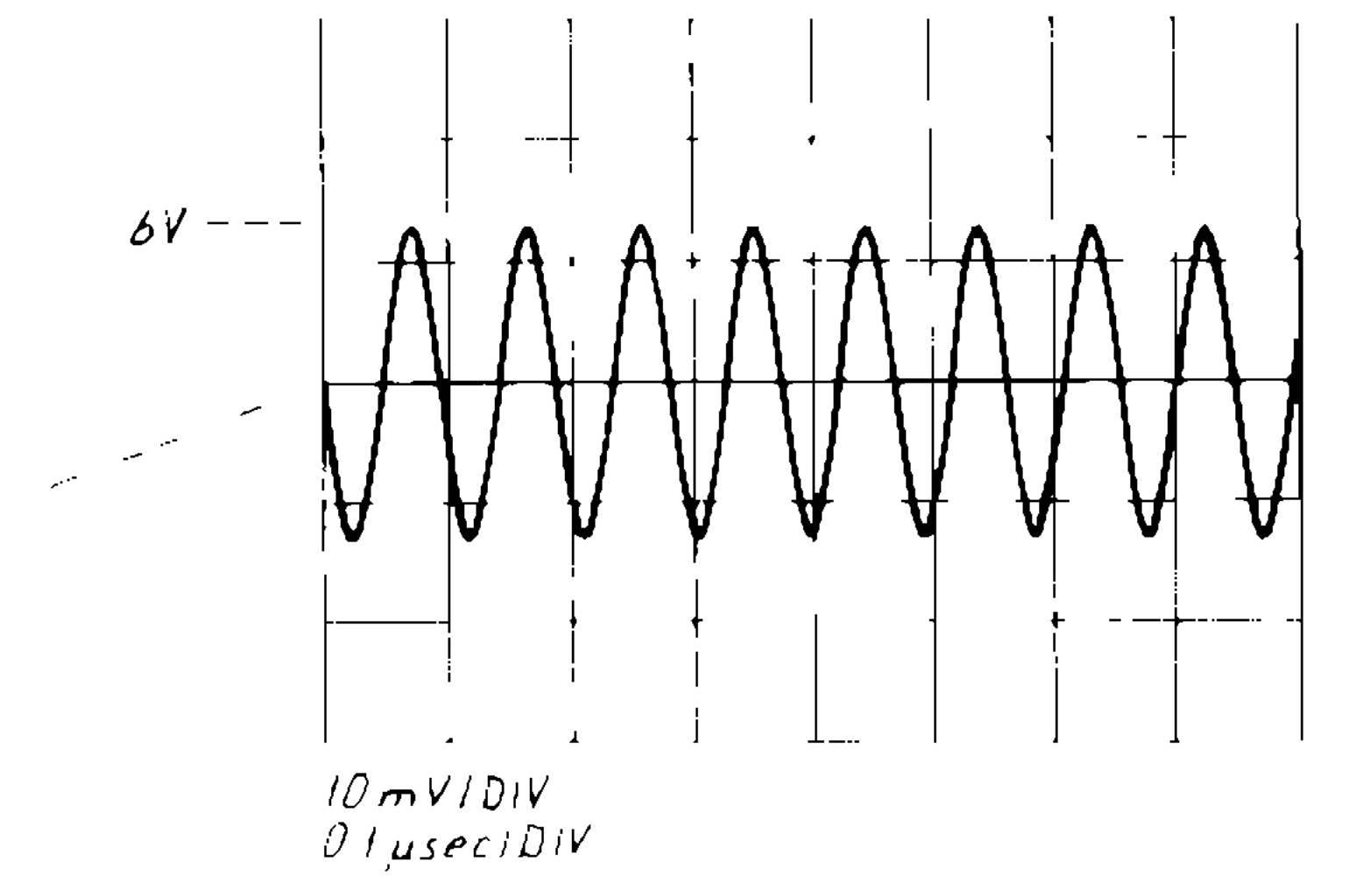
- AF GROUND
- ME RE
- ME RE
- RF-1
- SCA'S TEST POINT
- RF-2
- 5
- AF-1
- AF-2
- AF-3
- AF-4
- AF-5
- AF-6
- AF-7
- AF-8
- AF-9
- AF-10
- AF-11
- AF-12
- AF-13
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- AF-96
- AF-97
- AF-98
- AF-99
- AF-100



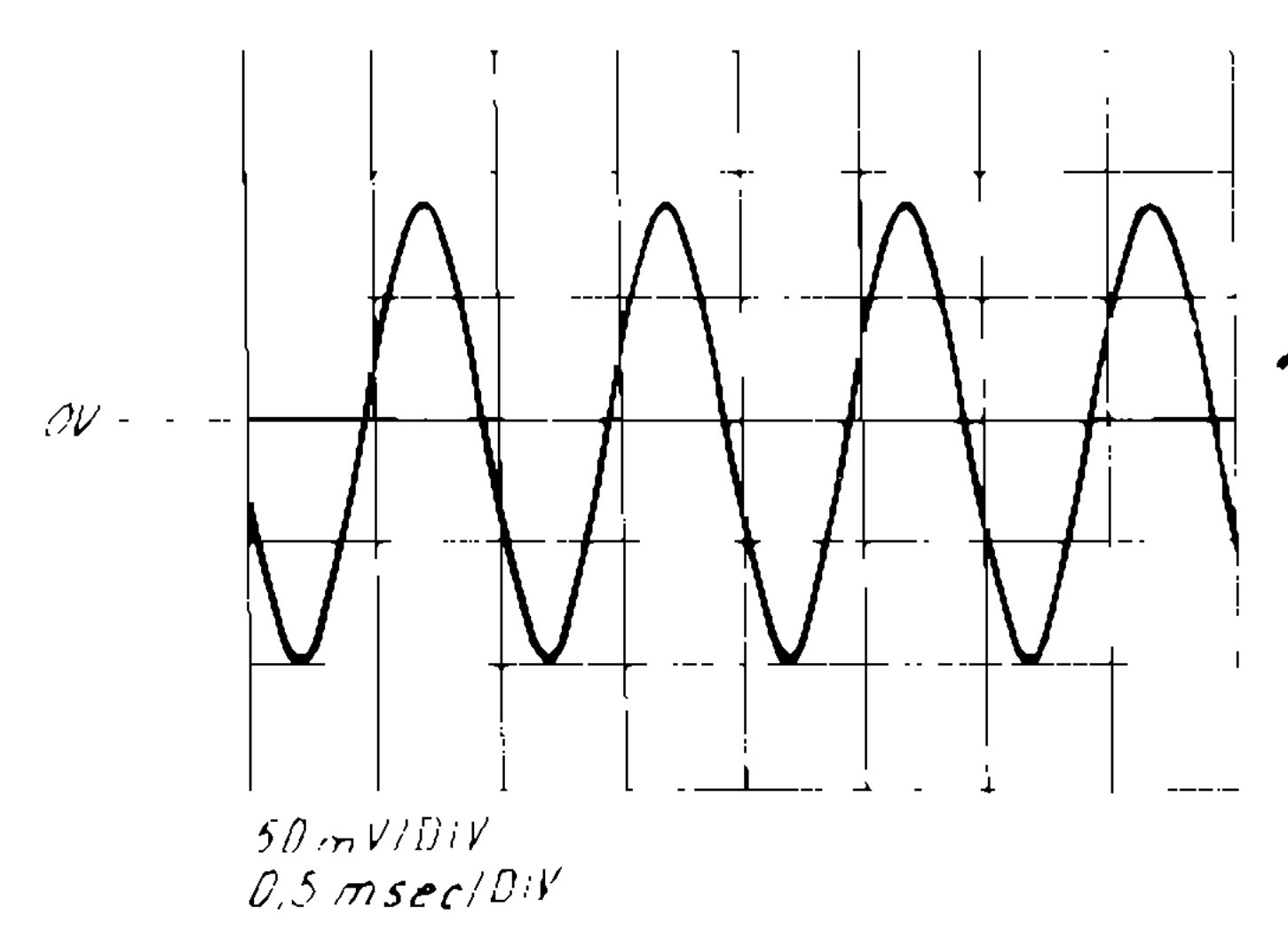
- DETECTOR MUTE
- BARBERE JUIT
- AF-101
- AF-102
- AF-103
- AF-104
- AF-105
- AF-106
- AF-107
- AF-108
- AF-109
- AF-110
- AF-111
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- AF-198
- AF-199
- AF-200

IF AMP., DET., AGC & PRE AMP. (MODULE 2)

AGC & AF PRE AMP (module 2)



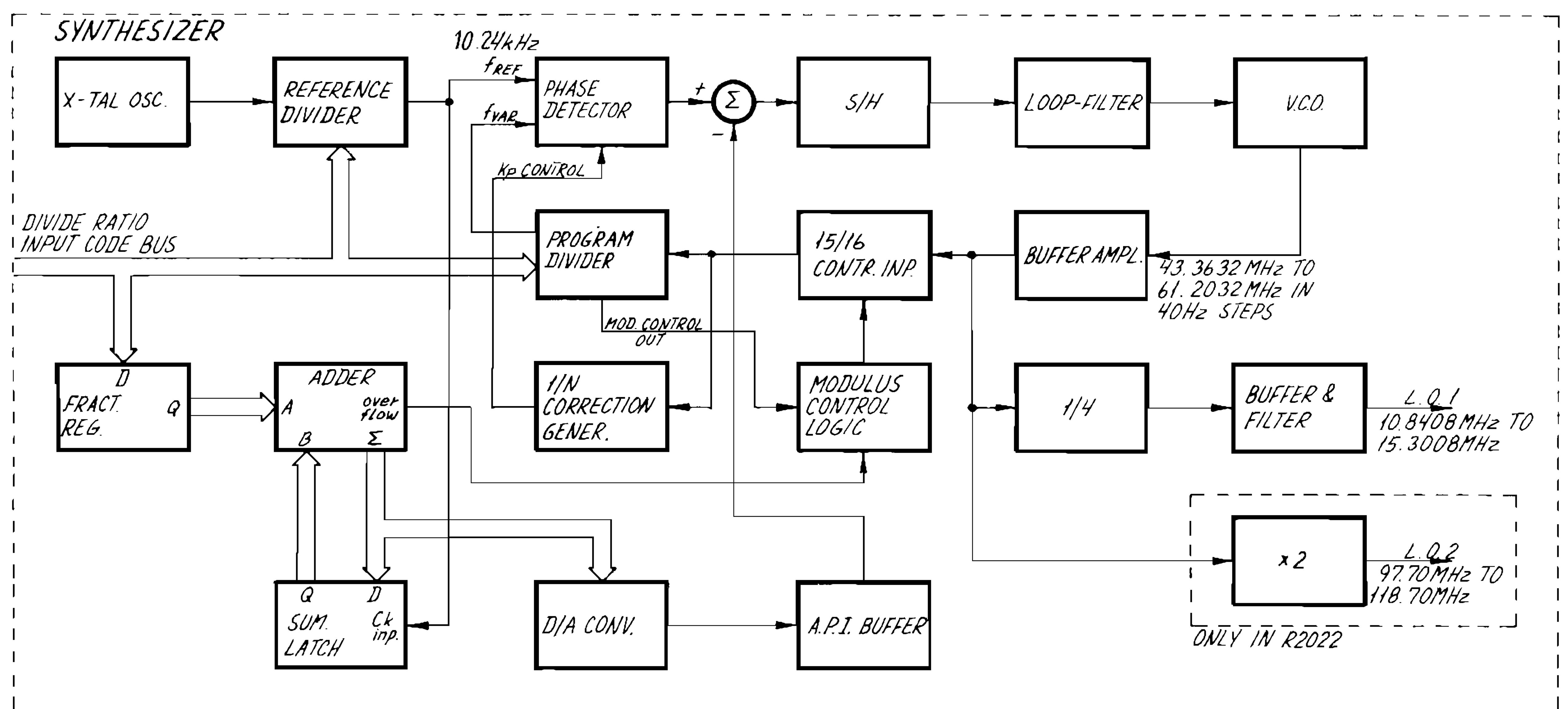
- 1 AF GND/MIC
- 2 + METRE
- 3 - METRE
- 4 RF IN
- 5 SCAL. CONTROL
- 6 RF OUT
- 7 5V
- 8 4-2-MUTE
- 9 4-2-OFF
- 10 RF-5A V OFF
- 11 AM
- 12 SSB
- 13 FV
- 14 AF OUT







## 5.3. FREQUENCY SYNTHESIZER (MODULE 3)



The synthesizer which is generating the needed L.O.-signals is working as a fractional synthesizer. This means that the division ratio in the loop divider can be a non-integer number, making it possible to get a frequency resolution at the output which is smaller than the reference frequency in the loop. In this synthesizer the reference frequency is 10.24 kHz and the frequency resolution in the loop is 40 Hz.

The loop reference frequency is generated by means of the crystal controlled oscillator built around T2 and the reference divider in IC16 followed by the divider IC12. So the reference output for the loop will be at pin 8 on IC12.

The synthesizer module comprises among other things the normal building blocks included in a phase-locked loop, VCO, a programmable divider, a phase detector, and a loop filter.

### VOLTAGE CONTROLLED OSCILLATOR

The VCO is built around transistors T12 and T18. Coil L11 alone or paralleled by L9 or L10 in combination with C60, C58, and capacitance diodes D9 - D16 form the main part of the frequency determining elements. So the VCO can be tuned by means of diodes D9 - D16, with increasing frequency for increasing control voltage. The VCO covers the frequency range from about 43 MHz to about 61 MHz in three bands.

### DIVIDER CIRCUIT

The programmable divider consists of a dual modulus divider IC3, dividing by 15/16 and a programmable divider included in IC16. The output pulses will be at pin 15 on IC16.

The integer part of the division ratio is determined by the number latched into IC16 and the fractional part by the number latched into IC15.

### 5.3. FREQUENCY SYNTHESIZER (MODULE 3) cont.:

When the division ratio is an integer, the divider works as a conventional dual modulus divider with the modulus control output from IC16 controlling IC13. When the division ratio includes a fractional part called F, the fraction accumulator IC5, 9, 10, and 15 in conjunction with IC7 increase the division ratio with 1 for every 1/F reference cycles, which means that the mean division ratio will be increased with the fraction F. By using an 8 bit accumulator and a reference frequency of 10.24 kHz =  $40 \times 2^8$  Hz, a synthesizer resolution of 40 Hz is reached.

The increase in division ratio by 1 is done by pulling the modulus control input, pin 6, on IC3 low for one output cycle of this divider; IC7 secures a correct timing in this cycle.

#### PHASE DETECTOR CIRCUIT

The phase/frequency detector is of the sample and hold type.

IC20 with C61, C62 forms an integrator. When a constant current is drawn through diode D8, the output voltage at pin 6 of IC20 will increase linearly with time. Diodes D6 and D8 constitute a switch controlled by flip-flop 1 in IC1 and level shifting transistor T13. When the output from the reference divider (pin 8 on IC12) goes high, the Q1 output (pin 5 on IC1) goes low, turning T13 off, so the constant current drawn by T14 is forced to flow through D8 with a linearly increasing output voltage of IC20 as a result. When the programmable divider delivers an output pulse, the flip-flop output (pin 5, IC1) changes back high, turning T13 on, which forces the current drawn by T14 to flow through D6, resulting in a constant output voltage at the integrator. The output voltage reached by IC20 is sampled by the sampling circuit formed by T17, C72, and IC23, every reference cycle.

The output voltage will be a measure of the phase difference between the reference signal and the variable divider output signal. If the input frequency/phase of the divider input increases, the integrator output voltage decreases, and vice versa.

The phase detector constant,  $V_{out}/\phi_{in}$ , is determined by C61, C62 and the current drawn through T14. Increasing current means increasing phase detector constant.

The current drawn through T14 is determined by the constant current sink, formed around IC19, and the diode switch with D3 and D4. The switch is controlled by counters IC13, 14 through flip-flop 2 in IC1 and level shifting transistor T10. By counting a constant number of output pulses from the prescaler IC3, in every reference cycle, the synthesizer output frequency variation is converted linearly to a duty-cycle variation of the square wave produced at pin 9 on IC1. By controlling the diode switch D3 and D4, and so the current through T14, with this square wave, the phase detector constant will increase proportional to the synthesizer output frequency, or the loop division ratio as you wish, and so keeping loop gain constant over the entire frequency range. The nominal value of the phase detector constant is adjusted by means of potentiometer R44.

IC6 and IC11 generate the necessary control pulses for the phase detector, which includes a short delay from the integrator has ramped up to the sample pulse to T17 is generated, followed by a short-circuit of integrating capacitors C61, C62 via T16, preparing the integrator to the next cycle.

#### LOOP FILTER

The loop filter is made up partly by the feed-back loop in the phase detector, via C65 and R72, and the low pass filter formed by C89, C91, R106, R105, and C90.

### 5.3. FREQUENCY SYNTHESIZER (MODULE 3) cont.:

#### ANALOG PHASE INTERPOLATOR

When a non-integer division ratio is used in the loop, some unwanted spurious sidebands, caused by the digitizing process, will appear at the VCO output. To reduce the level of these sidebands, a so-called A.P.I. (Analog Phase Interpolator) formed by the phase accumulator IC5, 9, 10 and 15 and D/A-converter IC4, generates a correction signal to the phase detector output.

The VCO control voltage is corrected by drawing the correction-current from IC4 through R73 via T15. The reference current for the D/A-converter is taken from the current-mirror formed around IC19, to get the correction term matched to the phase detector constant over the entire temperature range. The nominal value of the reference current is adjusted by means of the potentiometer R57.

#### OUTPUT SIGNAL CIRCUITS

The VCO signal is fed to the common buffer amplifier formed around T9 and T11. The amplifier output is split into three signal paths, i.e. to the loop divider through T6 and T8 and to the L.O.-1 output divider through T5 and T7 and to the L.O.-2 output doubler with T4 as a buffer amplifier and T3 as the doubling transistor.

The loop signal is fed to the fixed divide by 4 circuit formed by IC17, thus resulting in an output frequency range of about 10.7 MHz to about 15.2 MHz with 10 Hz resolution.

The divider output is amplified in T1 before the final filtering.

The carrier reinjection signal is taken from the crystal oscillator at the capacitive tap formed by C16 and C19.

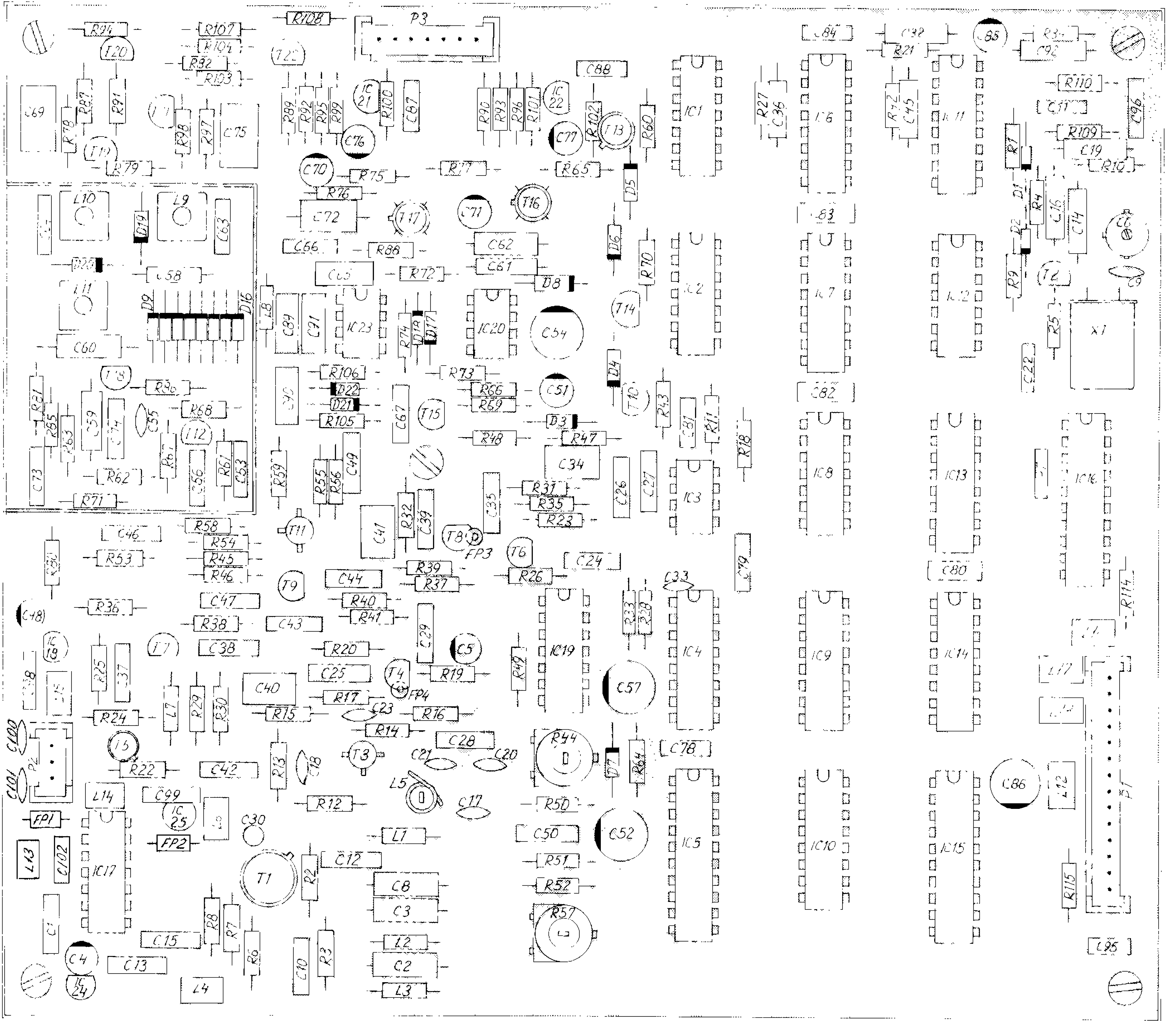
#### INTERNAL POWER SUPPLIES

Besides the above mentioned function determined blocks, the synthesizer board includes several internal voltage regulators with the filtering belonging to them.

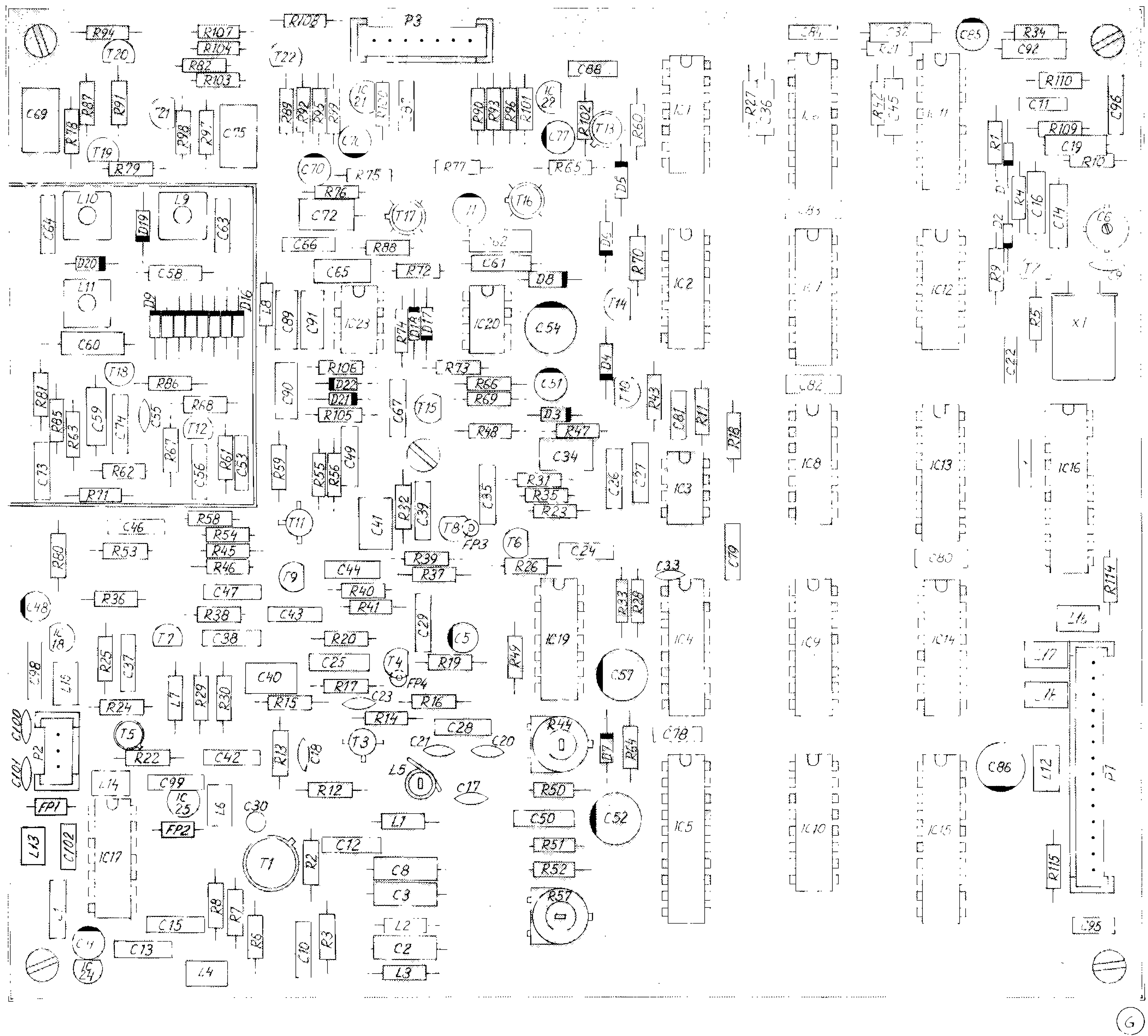
IC18, 24 and 25 are fixed regulators supplying respectively, VCO with buffer amplifier, L.O.-1 output amplifier and the fixed output divider.

IC21 and 22 are adjustable regulators, generating the internal +15.0V DC supply. By means of the resistor-sets R89, R92, R95, and R99 respectively R90, R93, R96, and R101, the appropriate resistor combination is selected to get an output voltage error below 1%.





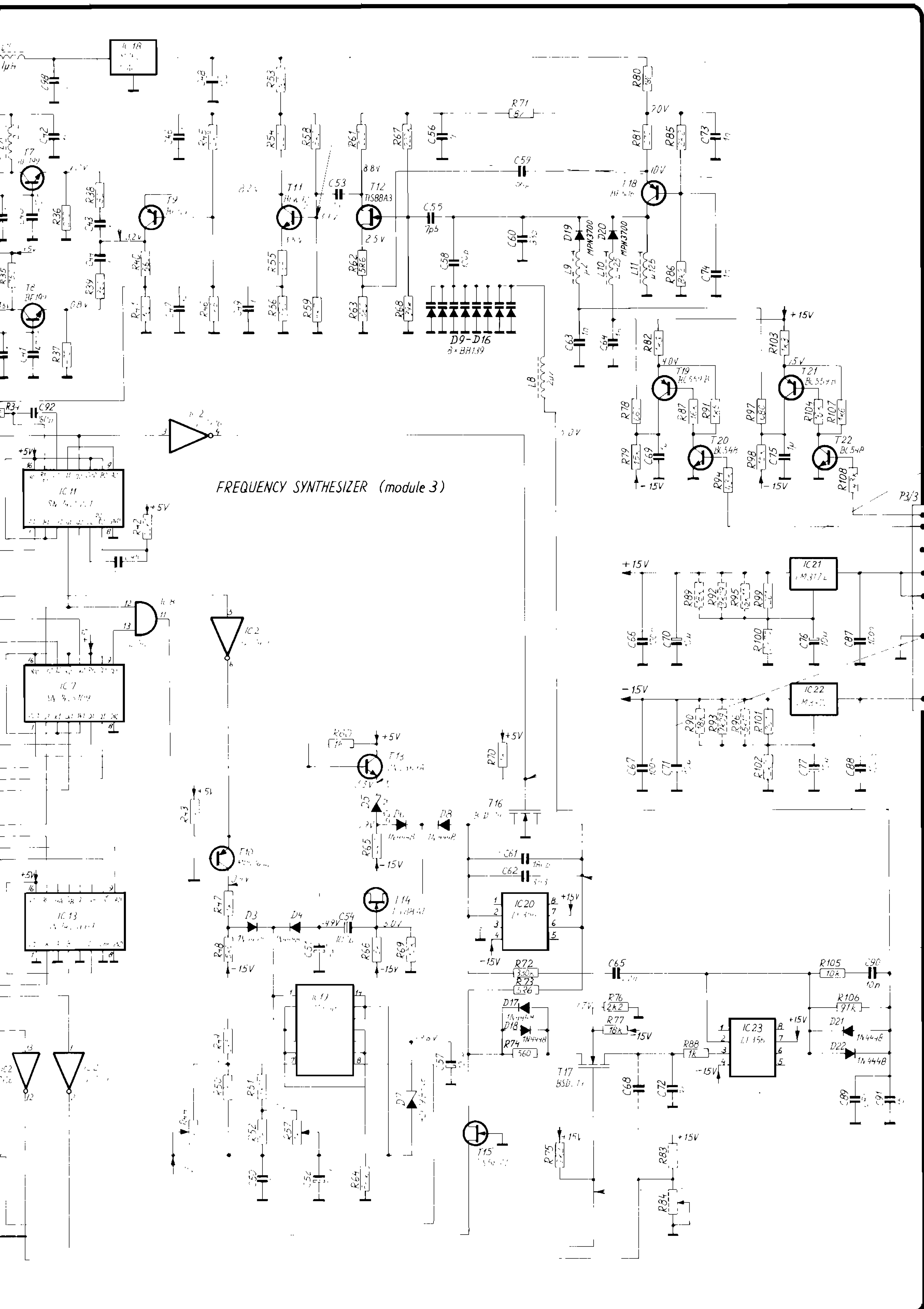
View from component side with lower side tracks.



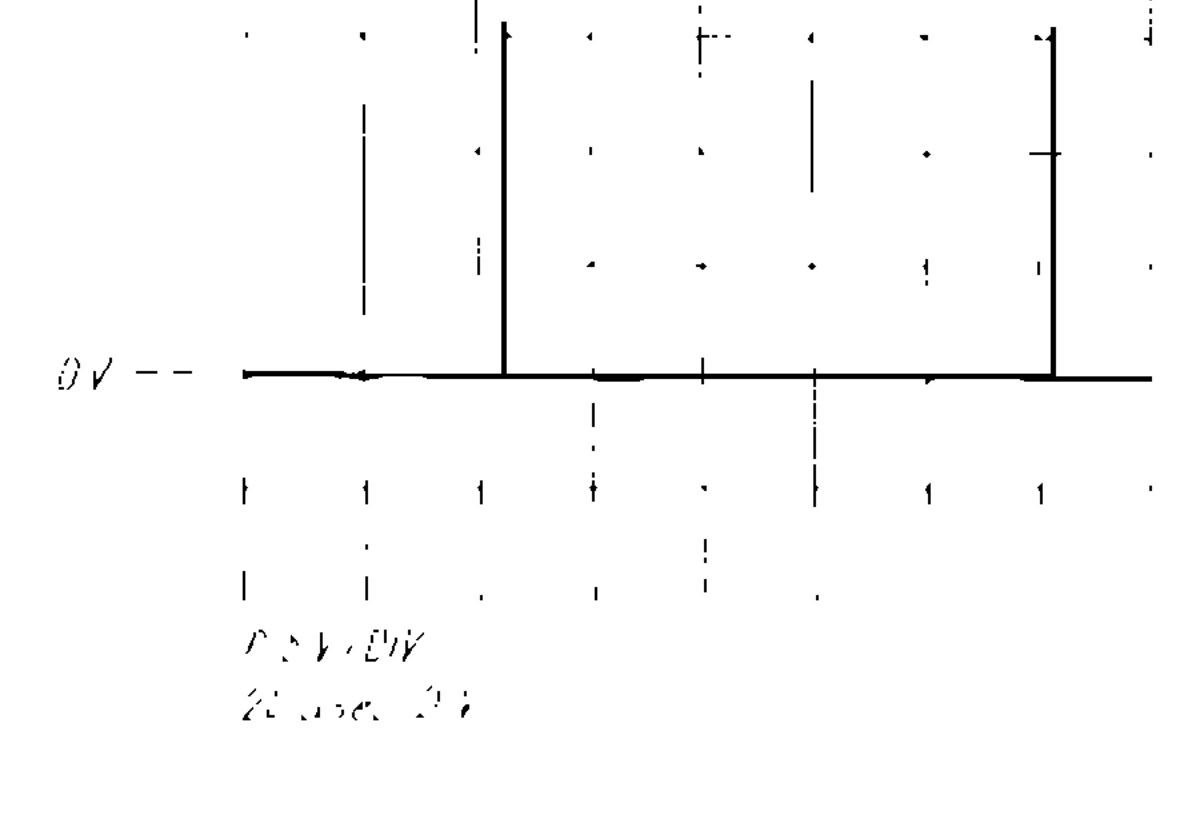
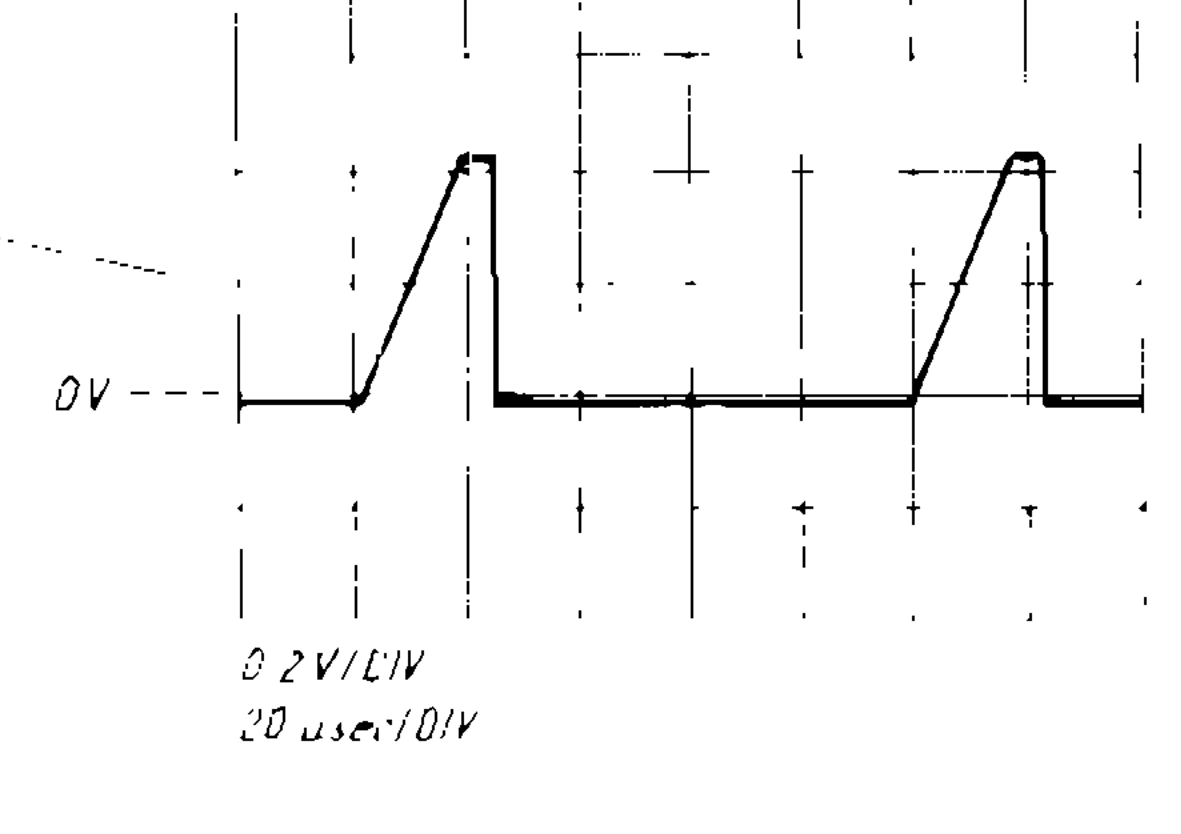
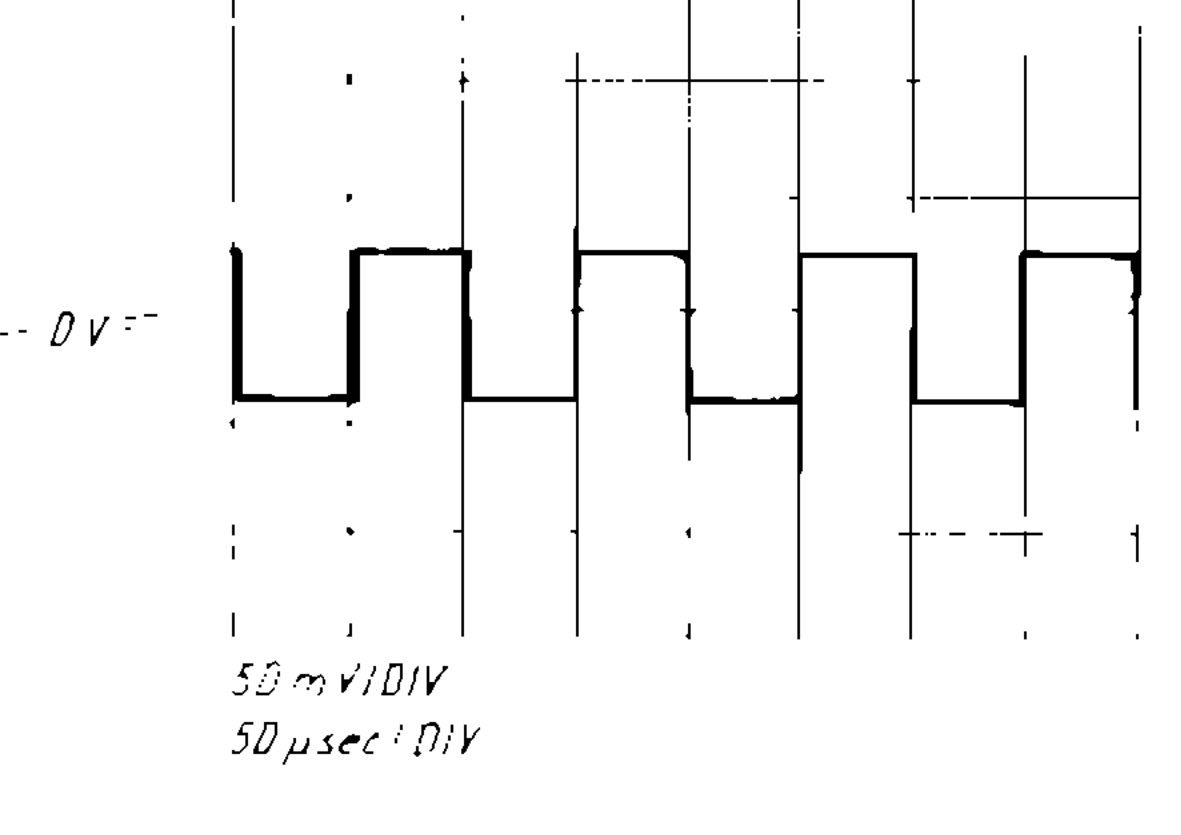
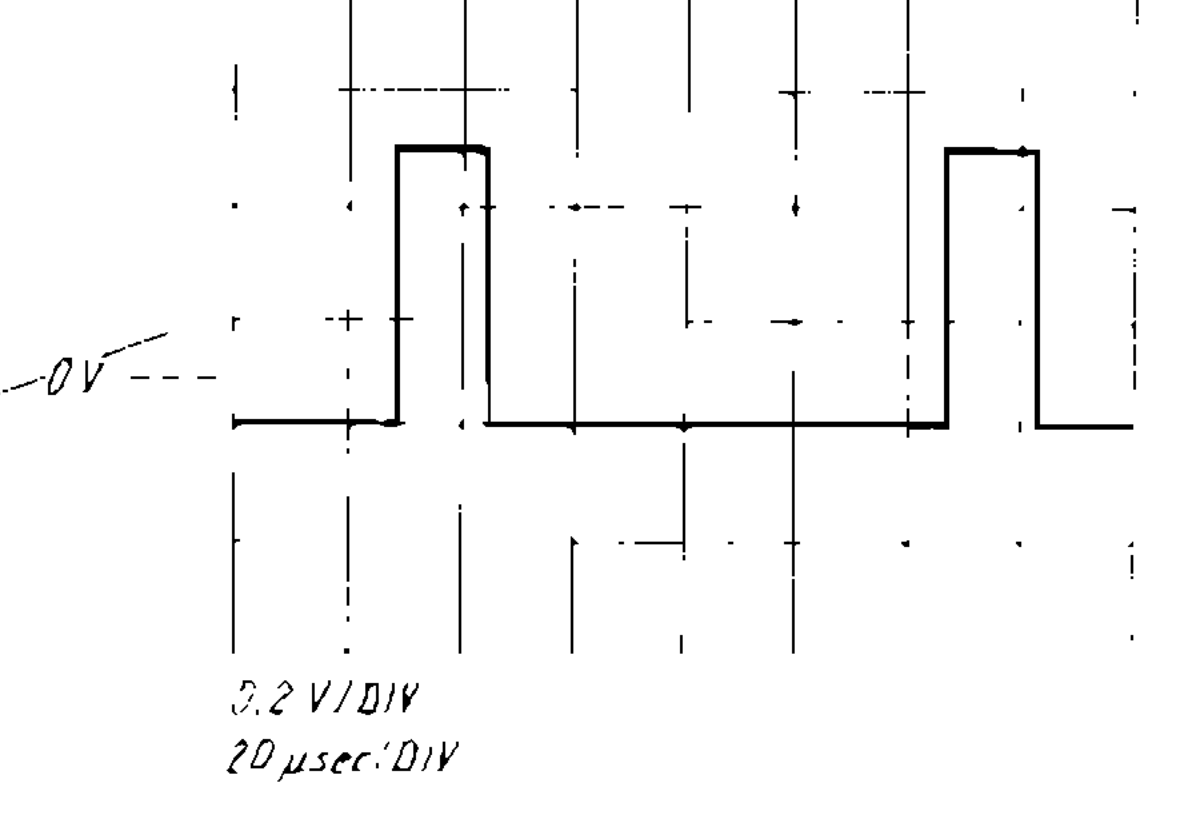
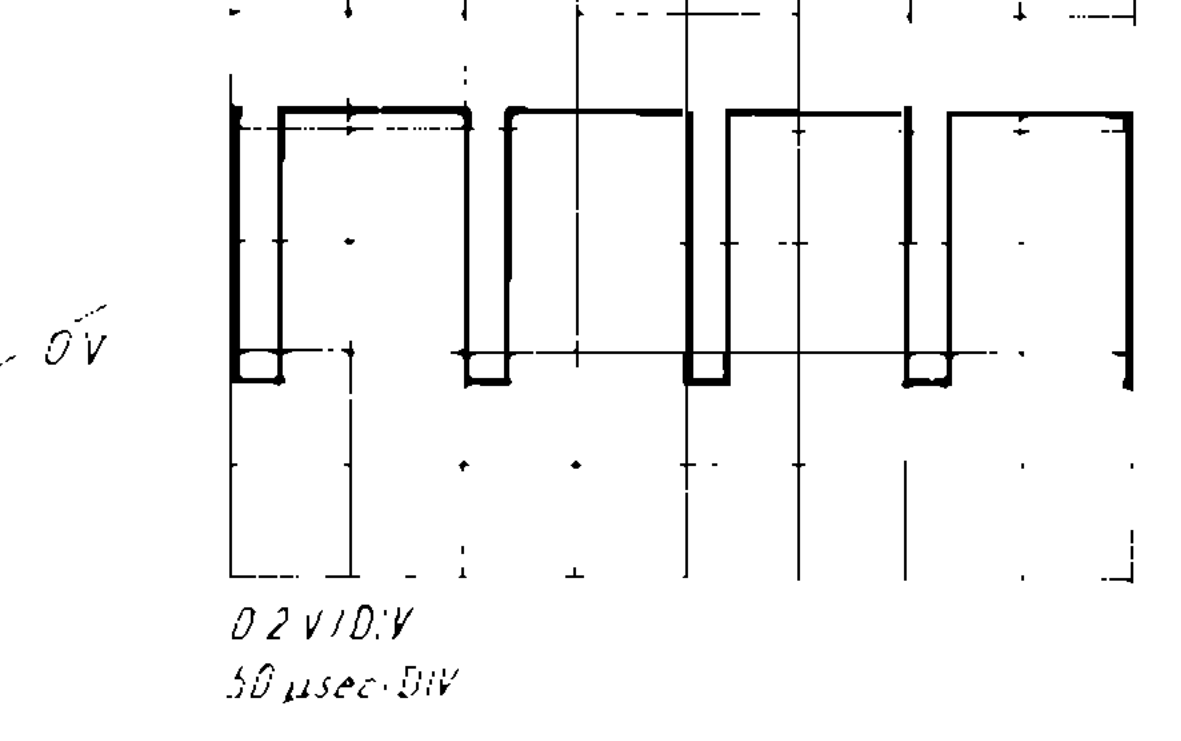
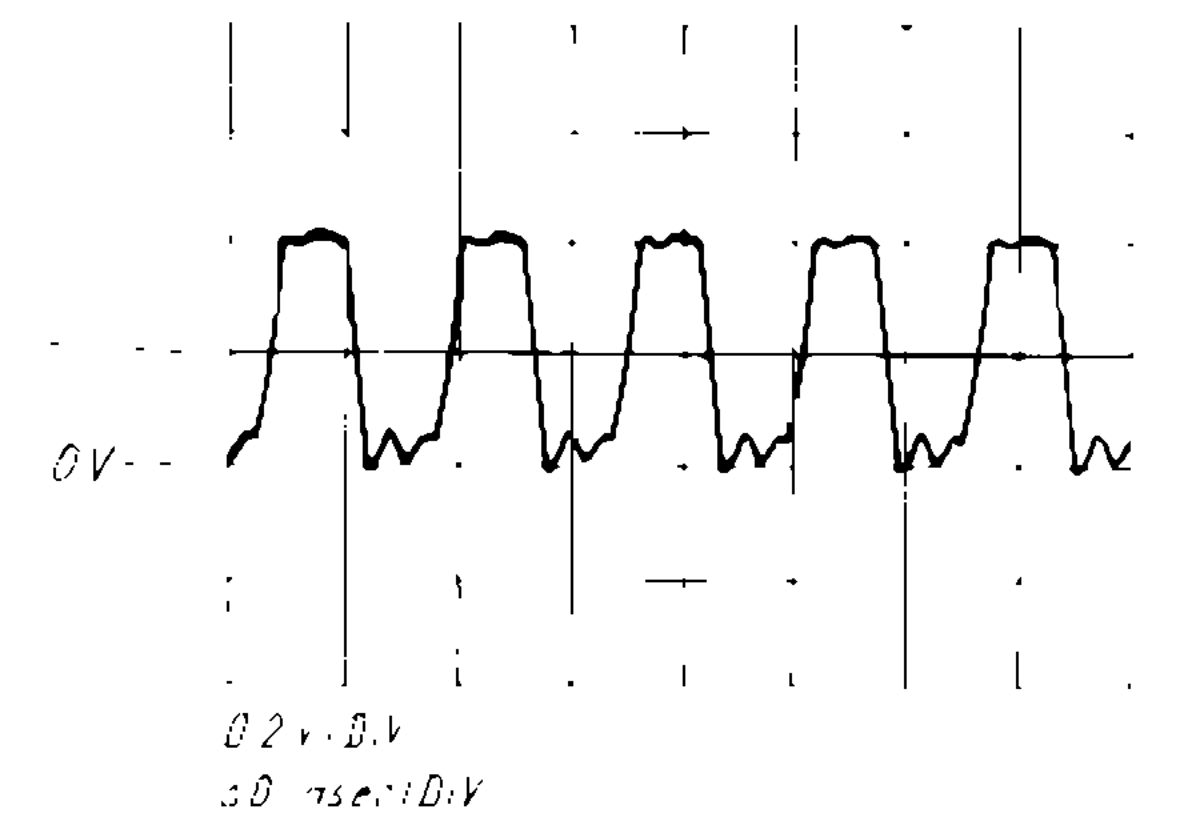
View from component side with upper side tracks.

FREQUENCY SYNTHESIZER (MODULE 3)



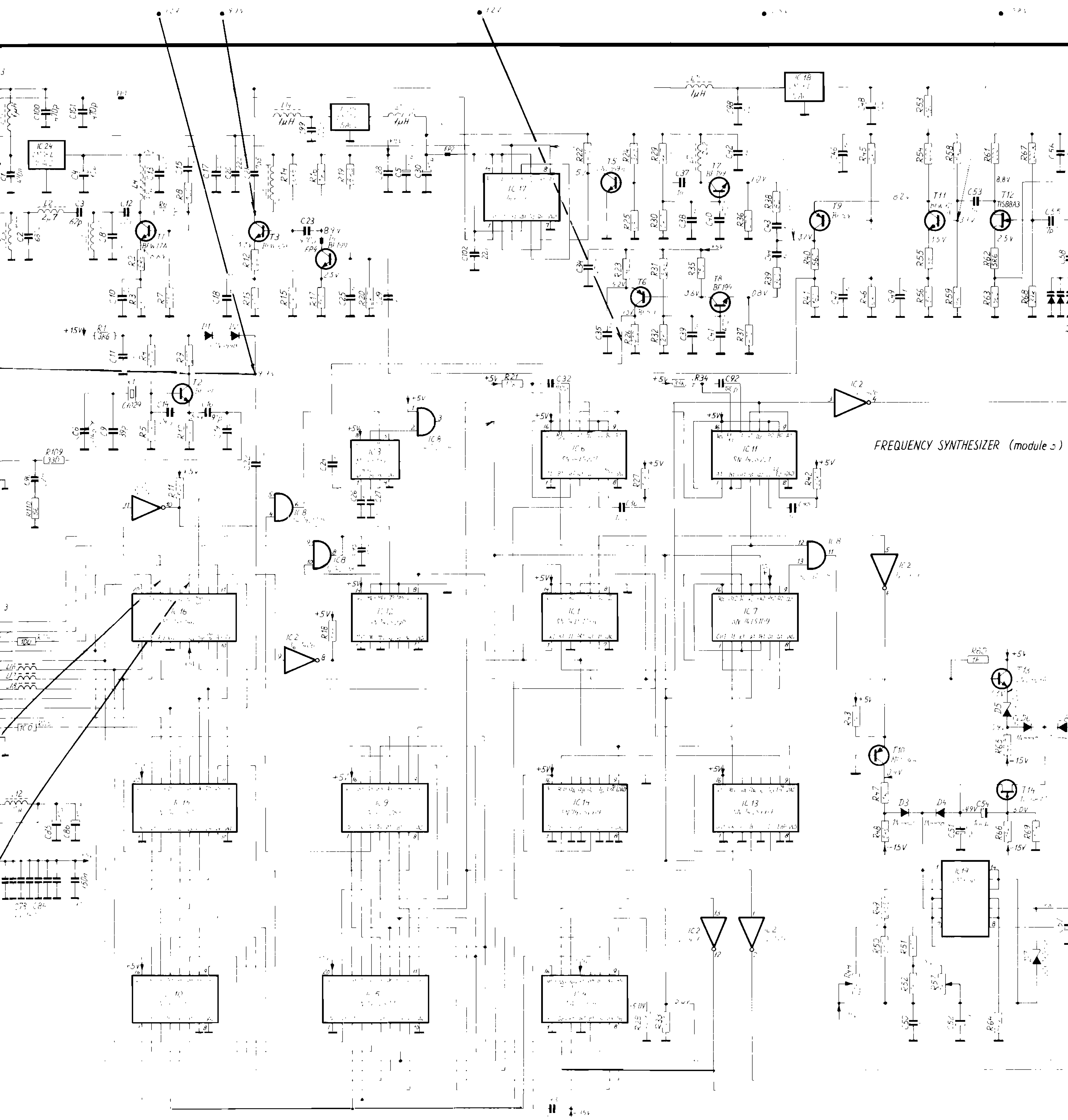


FREQUENCY SYNTHESIZER (module 3)



(F)

FREQUENCY SYNTHESIZER (MODULE 3)



st conditions.

illoscope input: Passive probe 10 Mohm/11pF

Voltmeter input: 10 Mohm

○: Diode probe measurements

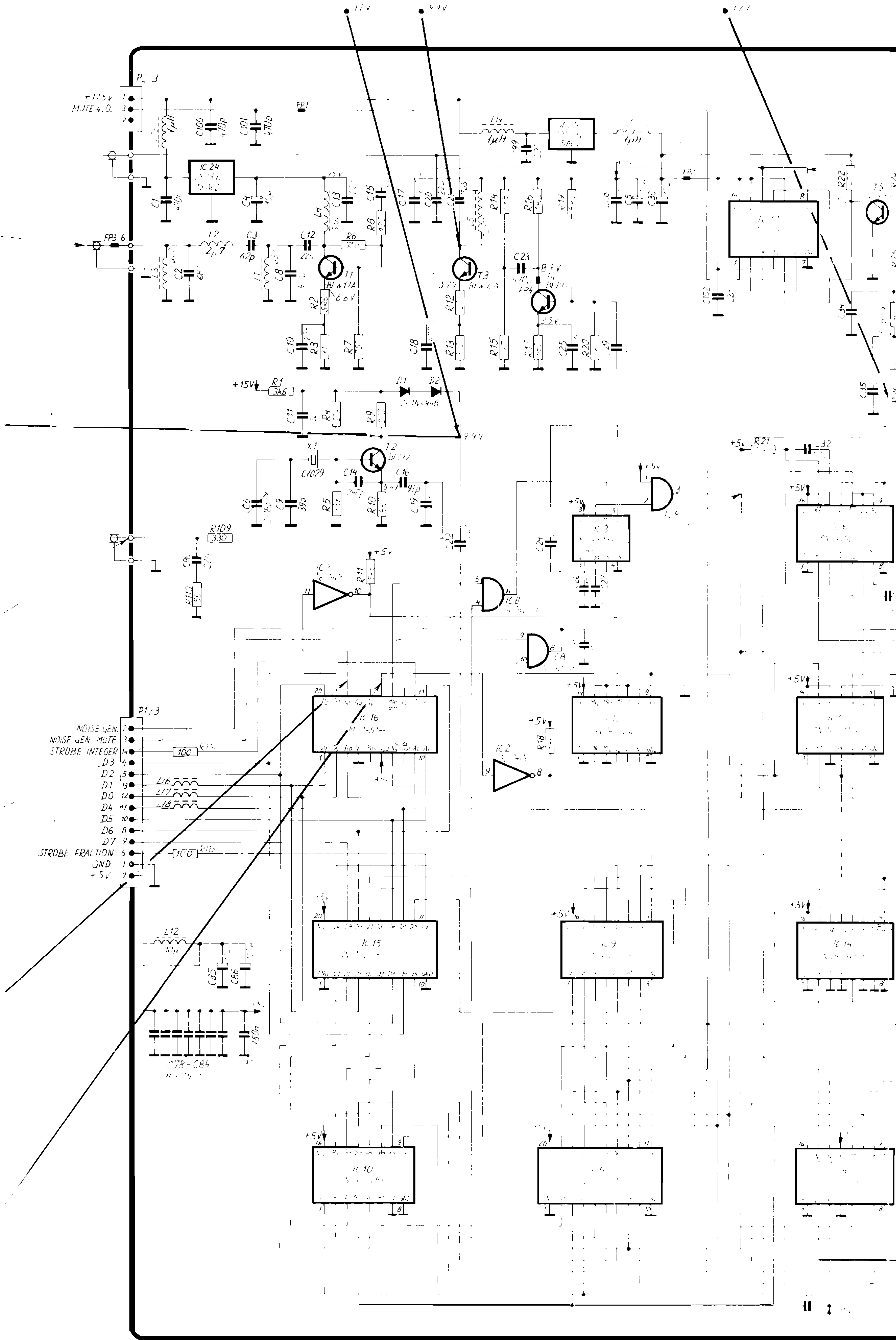
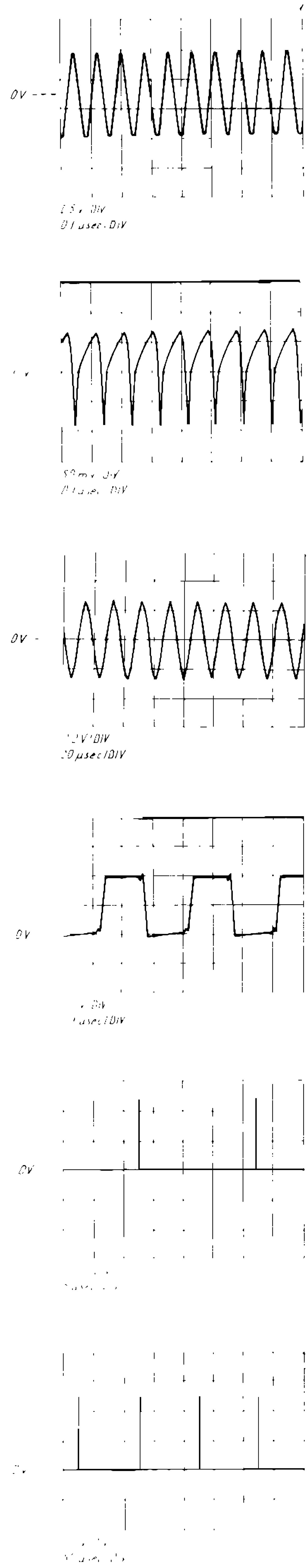
○: Only AM

) : Only SSB

] : Only FM

A : 88 MHz

B : 100 Mhz



Test conditions.

Oscilloscope input: Passive probe 10 Mohm/11pF

DC Voltmeter input: 10 Mohm

⊙: Diode probe measurements

○: Only AM

( ): Only SSB

[ ]: Only FM

A : 88 MHz

B : 100 Mhz

## 5.4. PROCESSOR UNIT (MODULE 4)

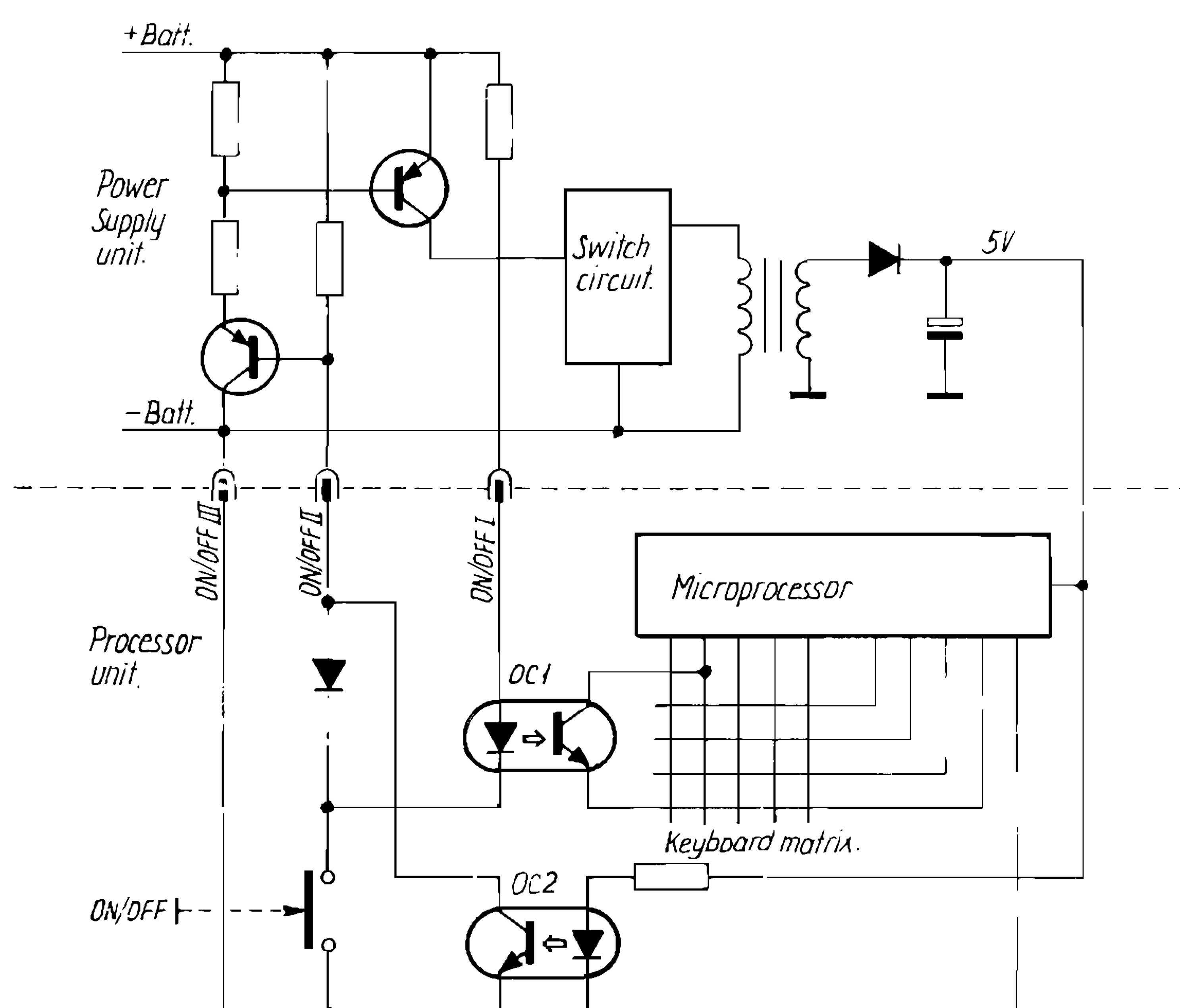
The processor unit is a supervising and controlling unit, which scans the inputs and sets up the receiver operating conditions according to the given commands. The main functions are as follows:

- on/off control of power supply
- keyboard Matrix scanning
- display driving
- frequency setting of the synthesis
- communication with EEPROMS
- scan of external inputs and
- controlling the IF and RF-sections according to the keyboard commands.

### POWER SUPPLY CONTROL

A press on the on/off button turns on the switch circuit (fig. 1) in the power supply, which hereby powers up the microprocessor. By scanning the keyboard, the processor ensures that OC1 is on before it turns on OC2, which hereby holds the supply to the switch circuit. After release of the on/off button another press on it will cause the processor to turn off OC2 and then the supply to the switch circuit will disappear when the on/off button is released. If the processor is reset it checks the condition of the on/off button and if this is not activated the processor will turn off the power supply. This will happen if the 5V supply is lowered below approx. 4.1V or if the backplane drive to the display disappears. The circuit, which handles the mentioned events, is formed by T3, IC14b, D11, and 1/8 IC15.

Fig. 1

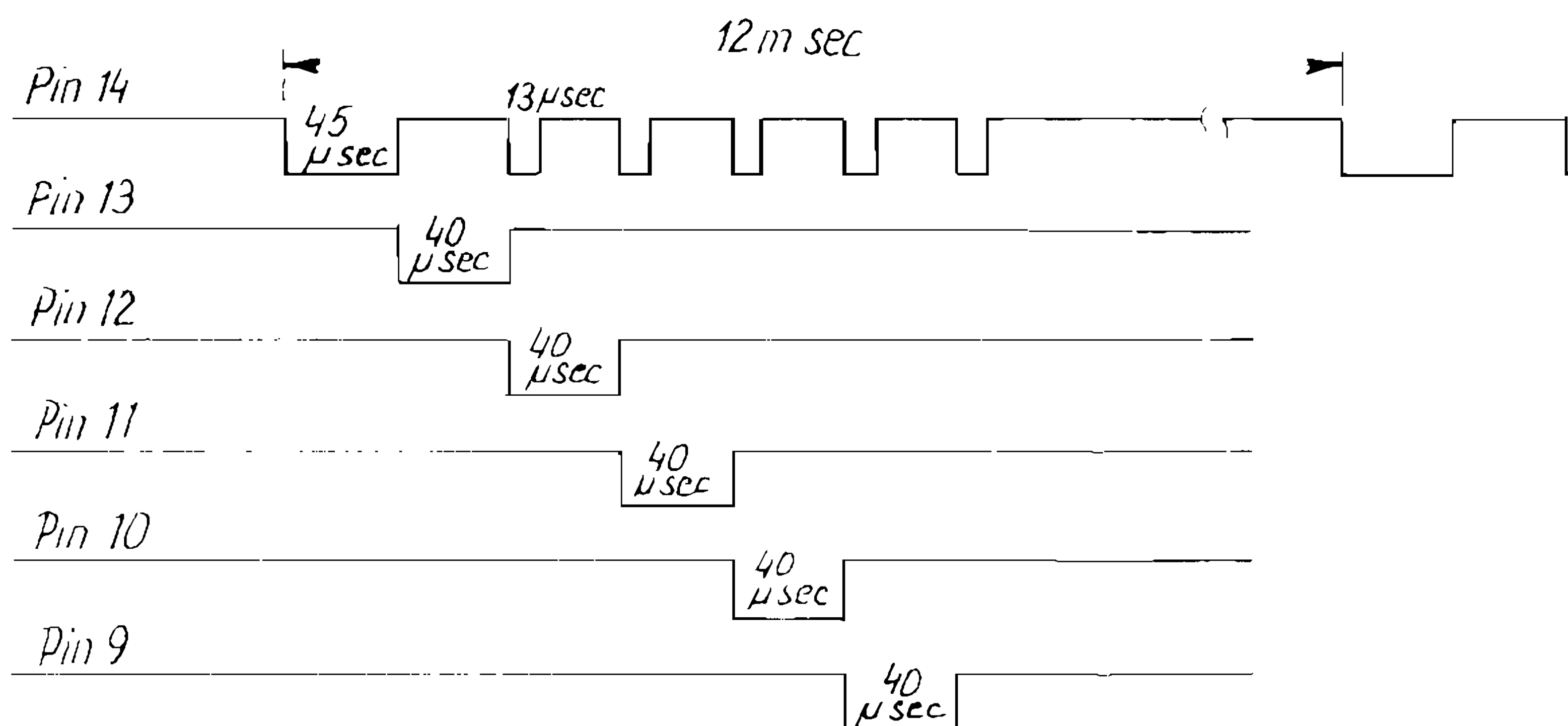
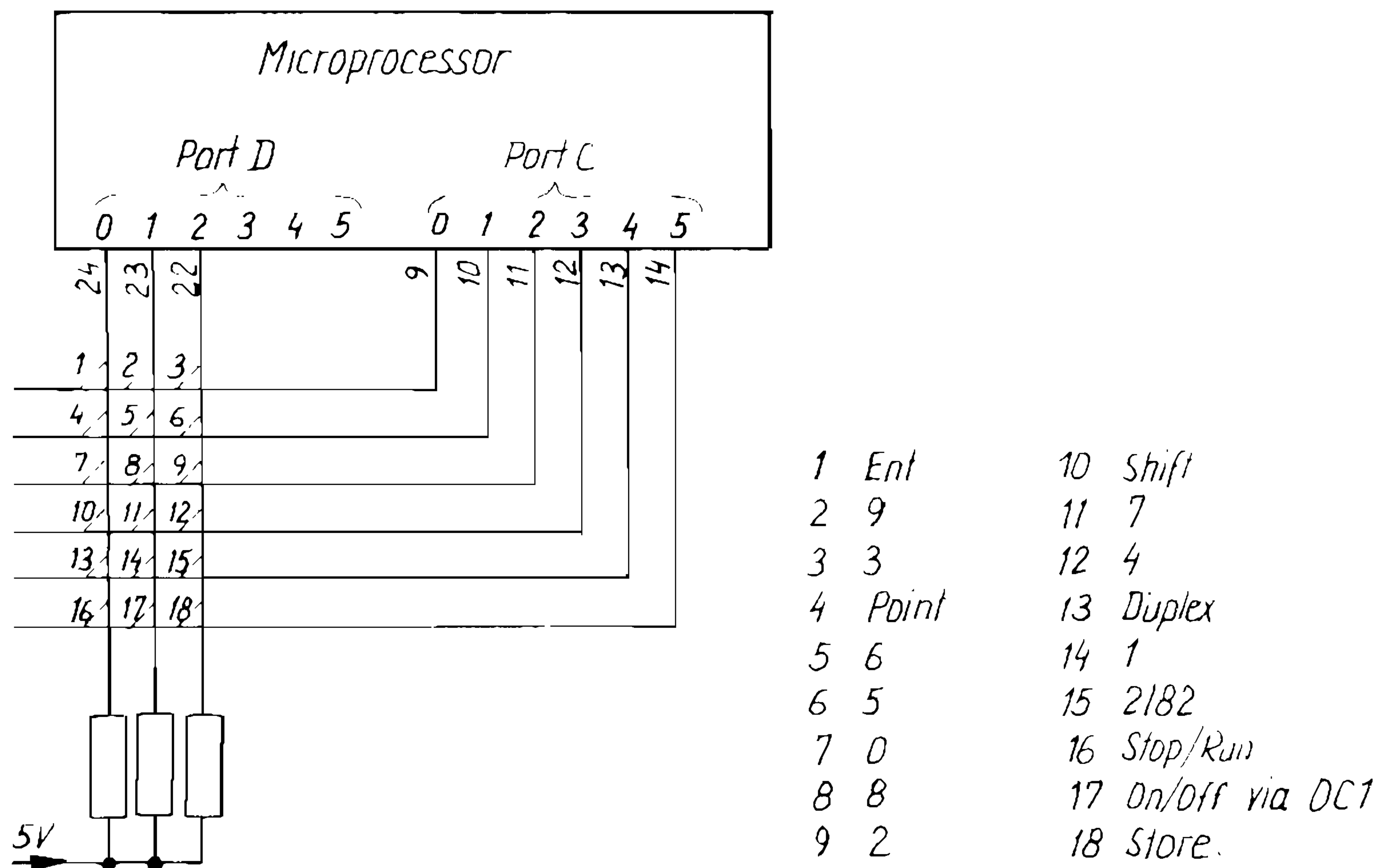


### KEYBOARD SCANNING

The keyboard is a 6x3 Matrix, which is scanned every 12 msec. The scanning takes place as shown in fig. 2. The output pins at port C are turned low one at a time and between every shift the state of the input pins at port D is measured. If they are all high the keyboard is not activated. If one of the input pins is low, then the processor leaves the scanning sequence and performs the command indicated by the activated button.

## 5.4. PROCESSOR UNIT (MODULE 4) cont.:

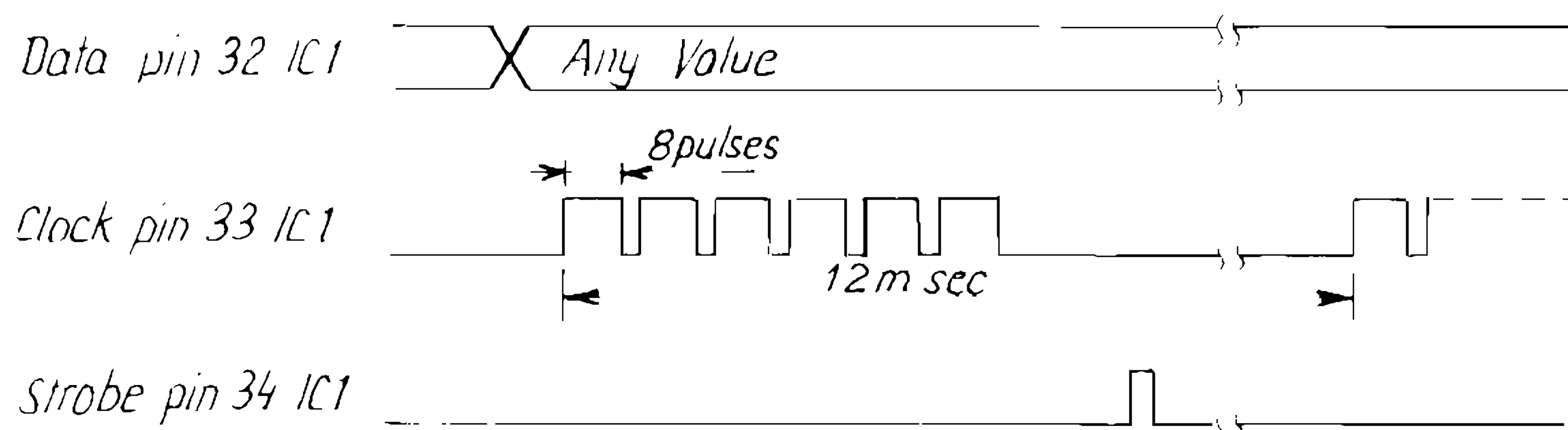
Fig. 2



## DISPLAY DRIVING

The display is an LCD type which demands an alternating voltage across the segments. This is done by inverting the display driver data (IC8 - IC13) every 12 msec. Simultaneously the backplane is inverted via IC2F and IC2C. The display drivers are loaded serially by the microprocessor with data, clock, and strobe pulses from pin 32, 33, and 34. The timing is shown in fig. 3.

Fig. 3



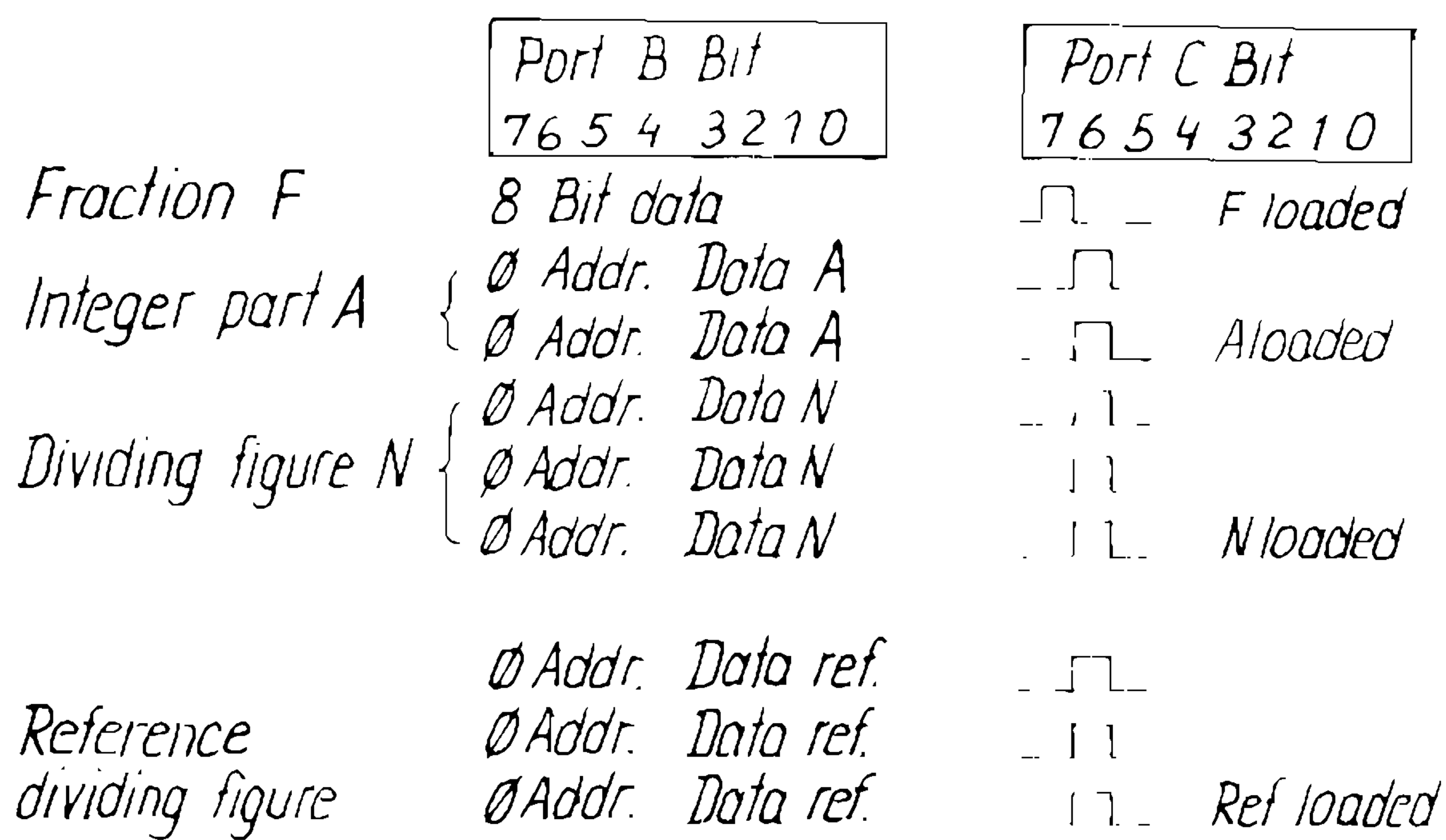
## FREQUENCY SETTING OF THE SYNTHESIS

After a frequency is entered, the microprocessor calculates three figures which are necessary for the frequency setting of the synthesis. These figures (dividing figure N, integer part A, fraction F) are in parallel mode loaded into the synthesis via the processor port B and two strobe lines. Additionally the synthesis is loaded with a reference dividing figure every time the other figures are loaded in. The fraction is loaded as an eight bit word. The other figures are splitted up in a four bit data word together with a three bit address. The loading order is shown in fig. 4.



Fig. 4

**DATA TO SYNTHESIS**



VCO Selection via IC 7

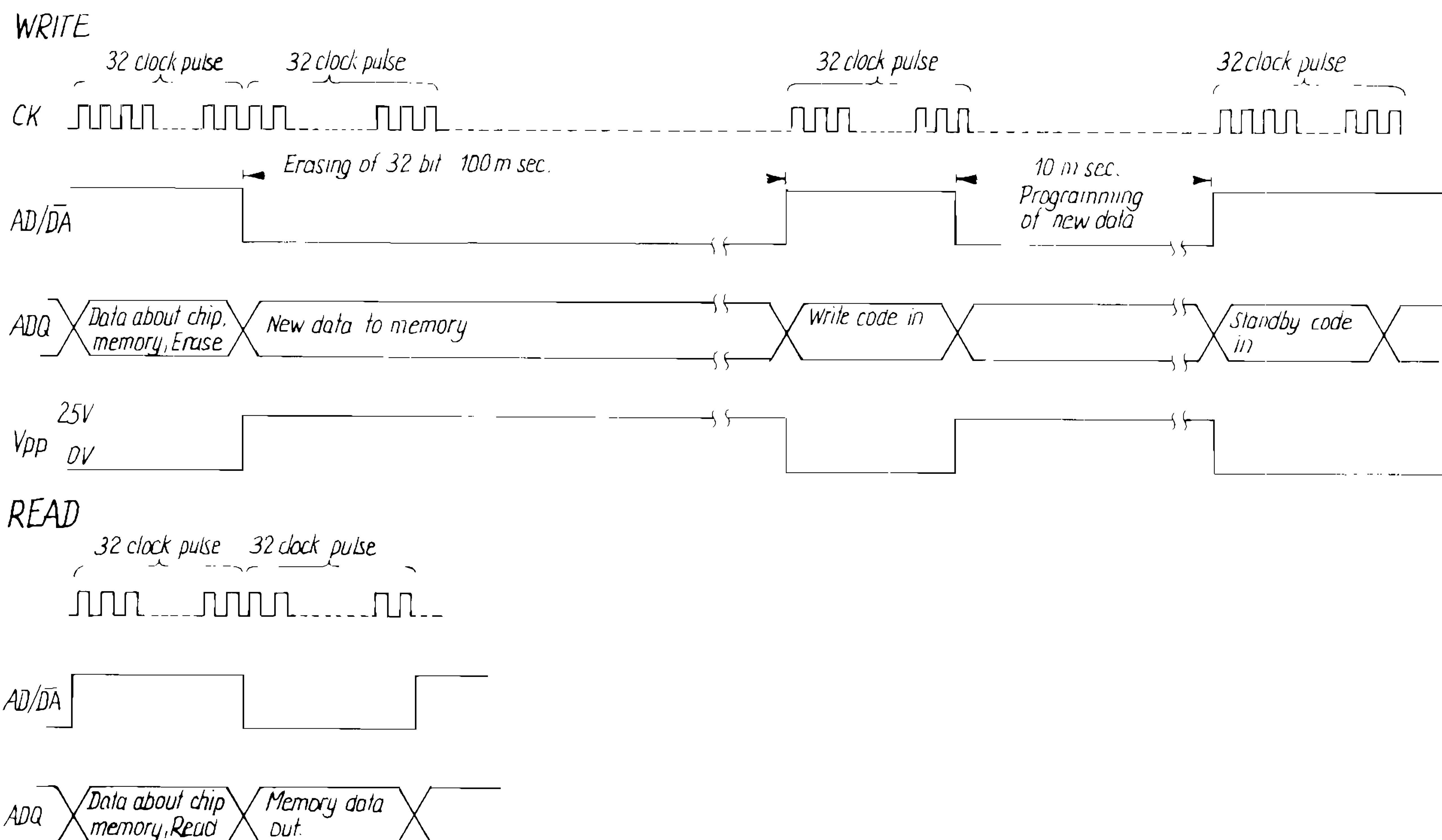
IC7 pin 12 VCO II	IC7 pin 13 VCO I	
0	0	0 - 1604.9 kHz
0	1	1605.0 - 3048.9 kHz, 87.2 - 98.87 MHz
1	0	3049.0 - 4499.9 kHz, 98.88 - 107.99 MHz

**EEPROM COMMUNICATION**

The memory is formed by two EEPROMS, which are accessed on three lines named ADQ, CK, and AD/DA. The data exchange runs serial on the ADQ line controlled by the CK line. The AD/DA line controls the data direction in the EEPROMS. Further it is used when erasing and programming the EEPROMS. The three mentioned control lines are paralleled on the three EEPROMS which are accessed separately by an address input in the first data word every time access is wanted. The individual address is set up with the inputs C1, C2, C3, C4 on the chips. Additional the first data word contains an operating code which indicates what to be done in the addressed EEPROM (erase, write, read).

If an EEPROM is addressed with opcode erase or write pin 1 will turn low and cause pin 4 on 24.5V, which is necessary for erasing or writing in an EEPROM.

The EEPROMS are built as 32x 32 bit memories which causes all data exchange formed as 32 bit words. The actual timing of the data transfer is shown in fig. 5.



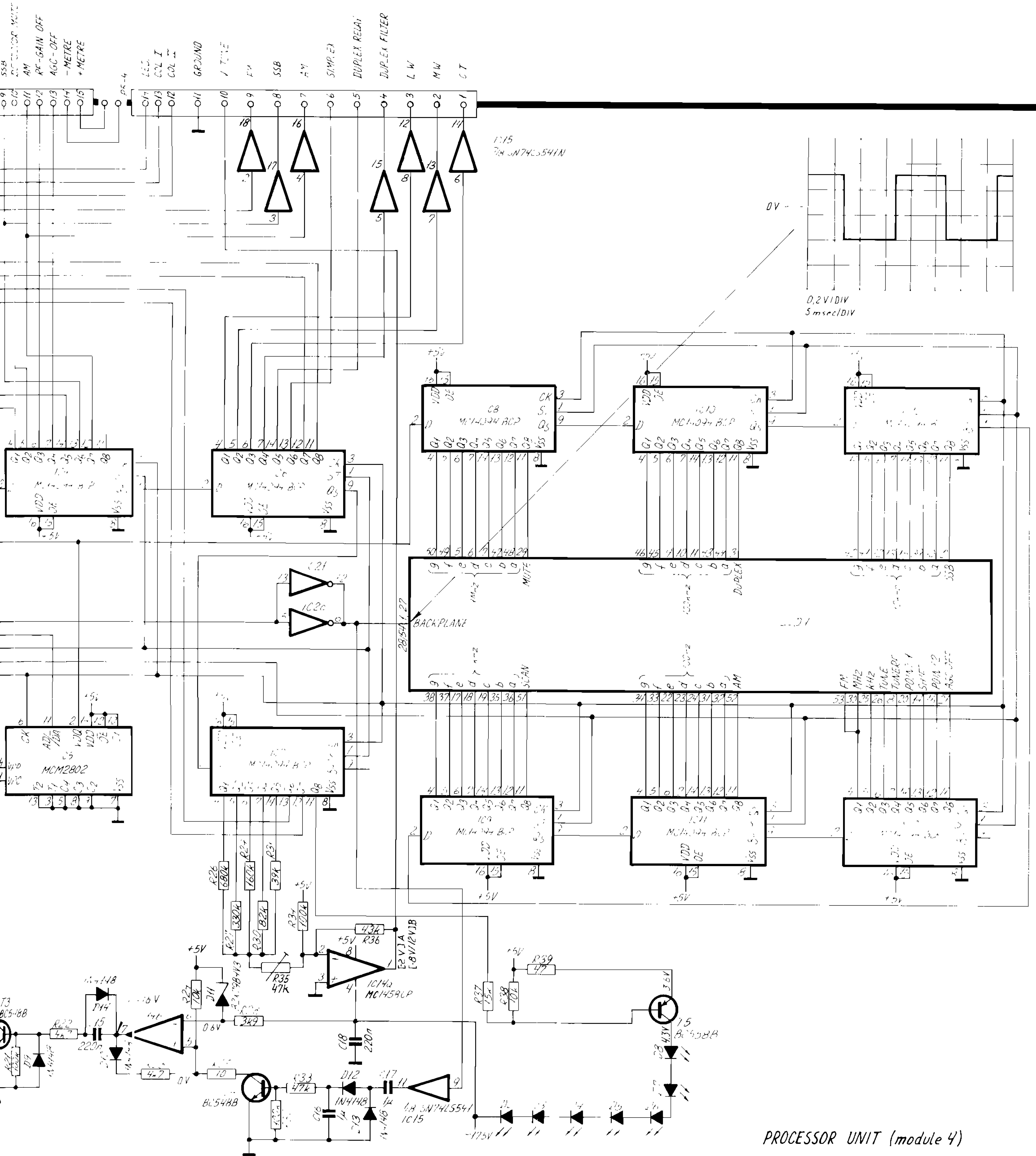
#### 5.4. PROCESSOR UNIT (MODULE 4) cont.:

##### IF AND RF SECTIONS CONTROL, EXTERNAL INPUT.

Besides the already mentioned things the processor unit selects or controls the following circuits; front end filter, IF controls (mode, AGC on/off, mute), front end relays and tune voltage for FM front end filter. These circuits are on/off controlled by means of three latches IC4, IC6, and IC7. The latches are loaded serially from the processor using data, clock and strobe lines. They are loaded once every time the ENT button is activated. The tune voltage to the FM tuner is created in a current summation network. A five bit code held by IC7 creates via a resistor network a current in R36. This current causes the output of IC14a to assume a voltage indicated by the five bit code.

External inputs are noise generator, key and pulses from the flywheel optocouplers.

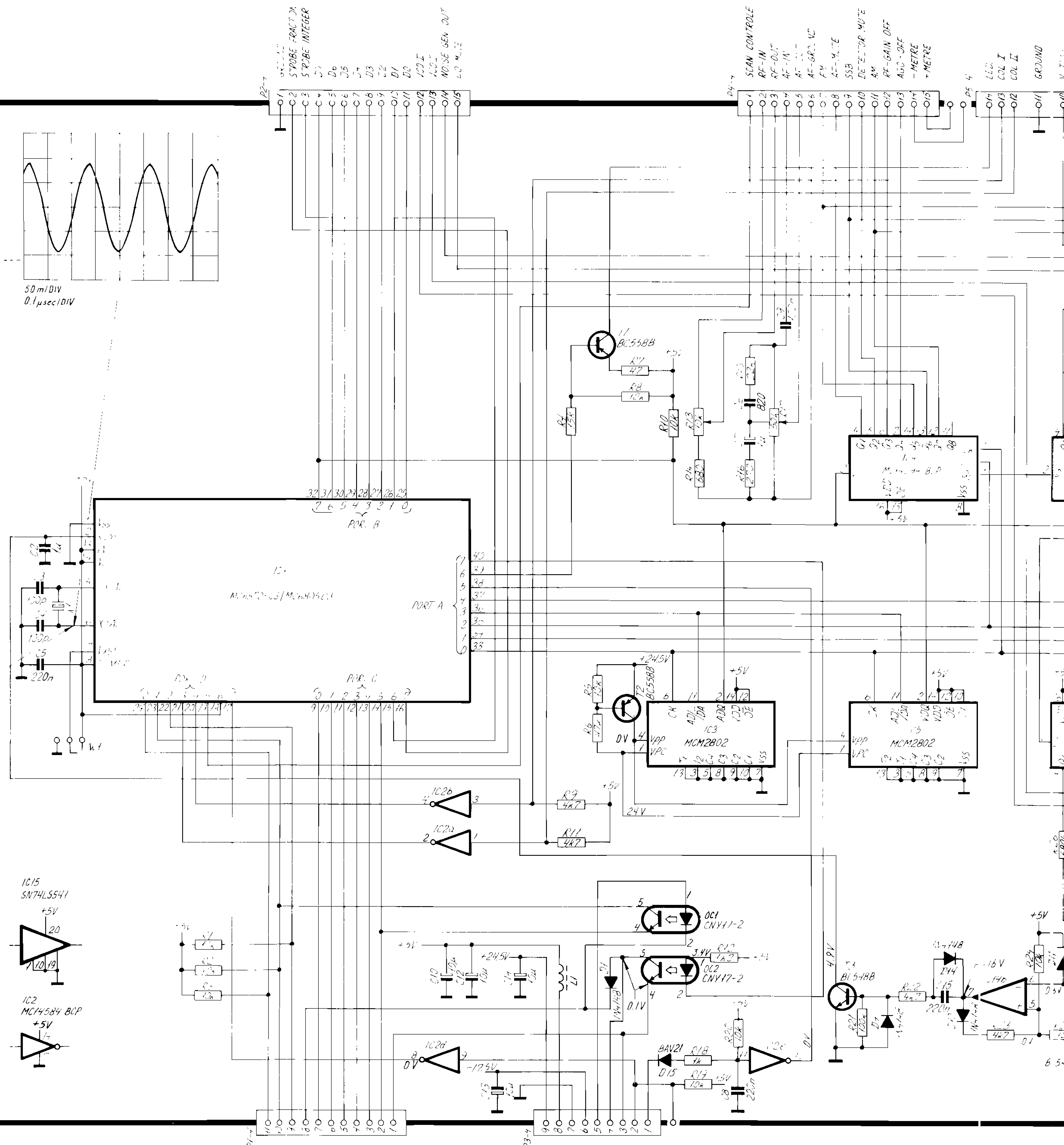
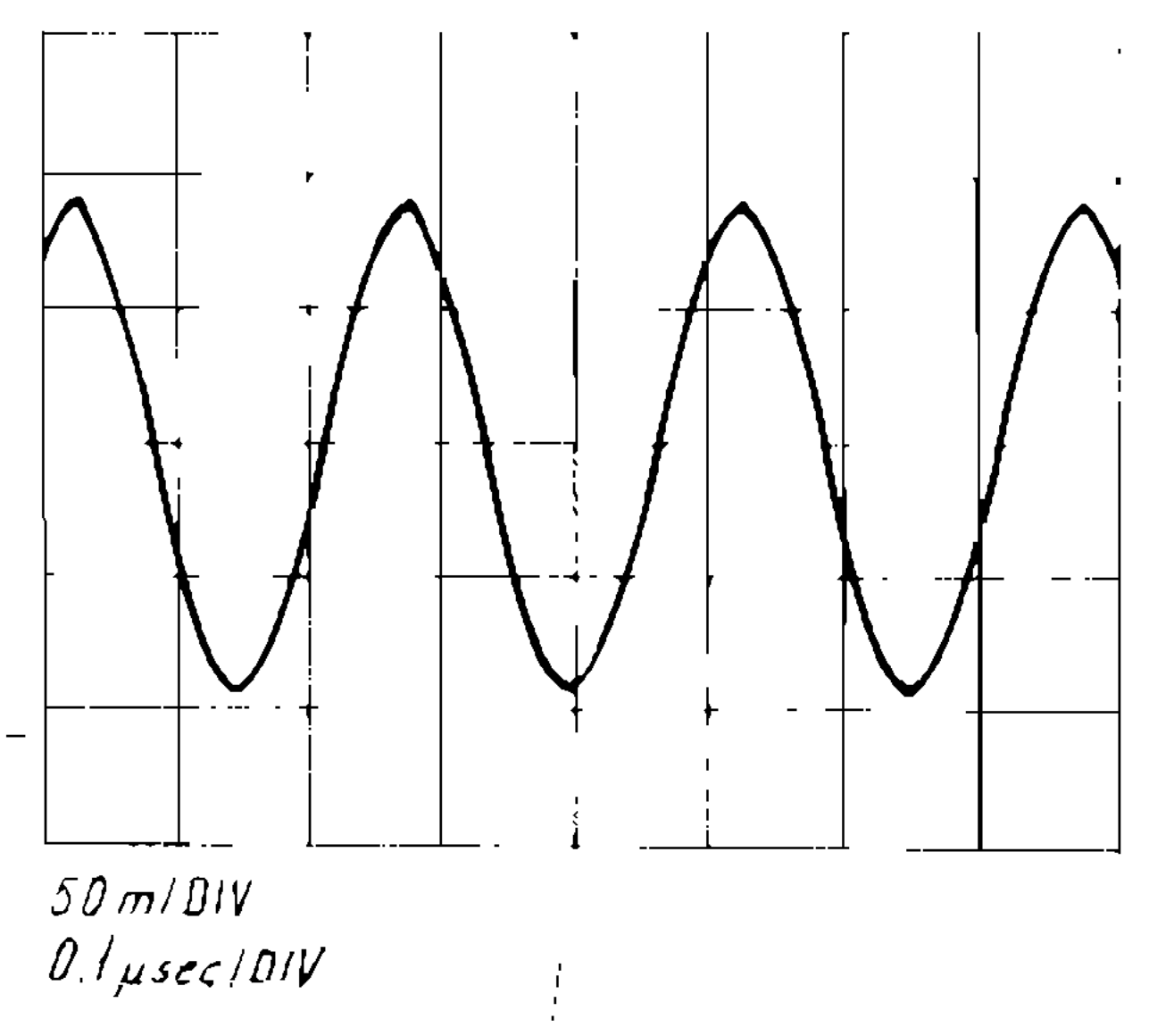
Noise generator input is active when the tune knob is pressed. The key input turns the processor into a protected mode (depending on duplex or simplex mode selected) when it is activated. The inputs from noise generator and key are shaped in the Schmitt triggers IC2d and IC2e. Finally this unit supervises the slotted optocouplers on the front end module. When TUNE or CLARIF is selected, T1 is current source for the optocoupler diodes. To determine the rotation direction it is necessary to have two pulse sources with a mutual phase difference of  $90^{\circ}$ . The two pulse trains created by rotating the wheel are shaped in Schmitt triggers IC2a and IC2b.



PROCESSOR UNIT (module 4)

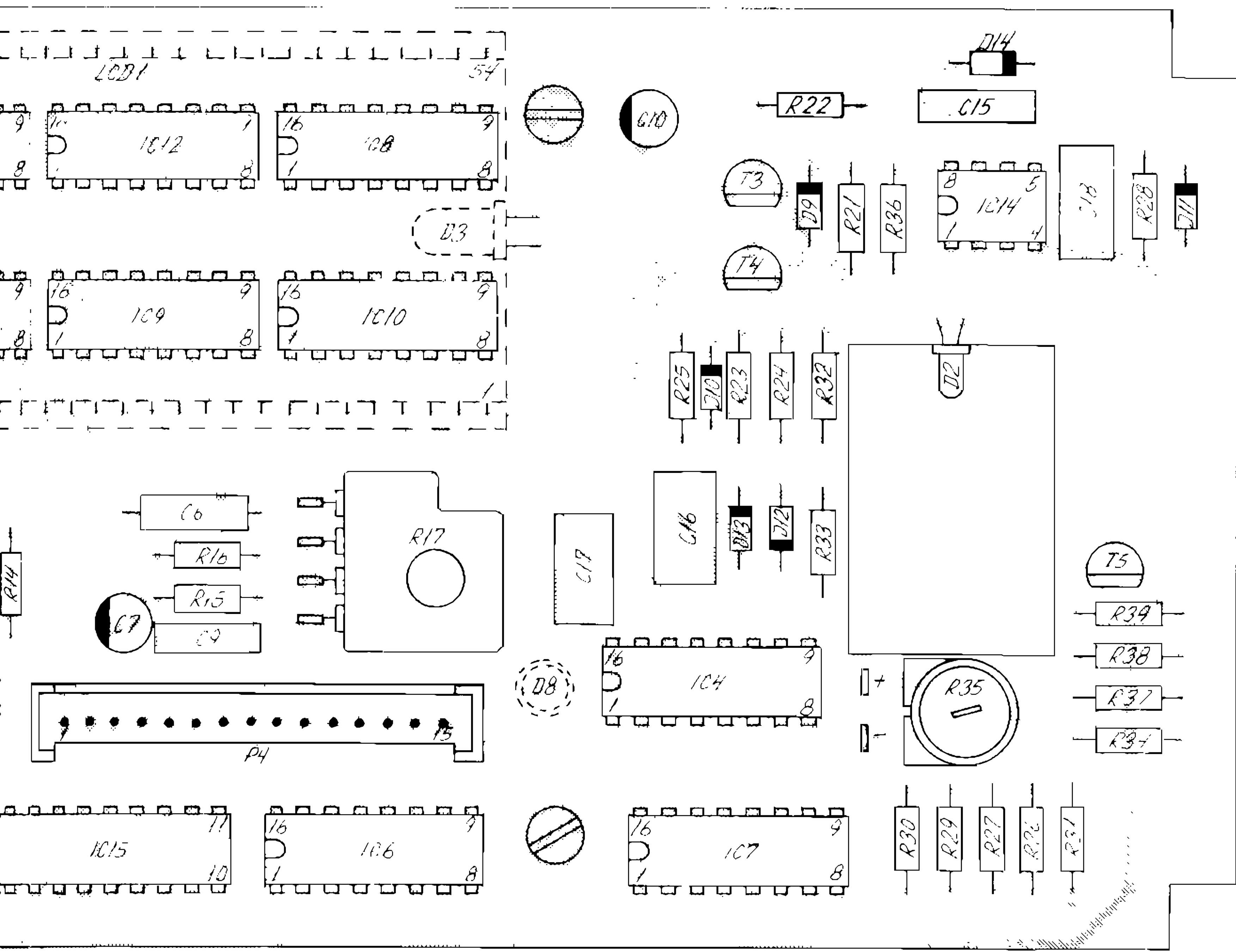
5-0-24146

PROCESSOR UNIT (MODULE 4)



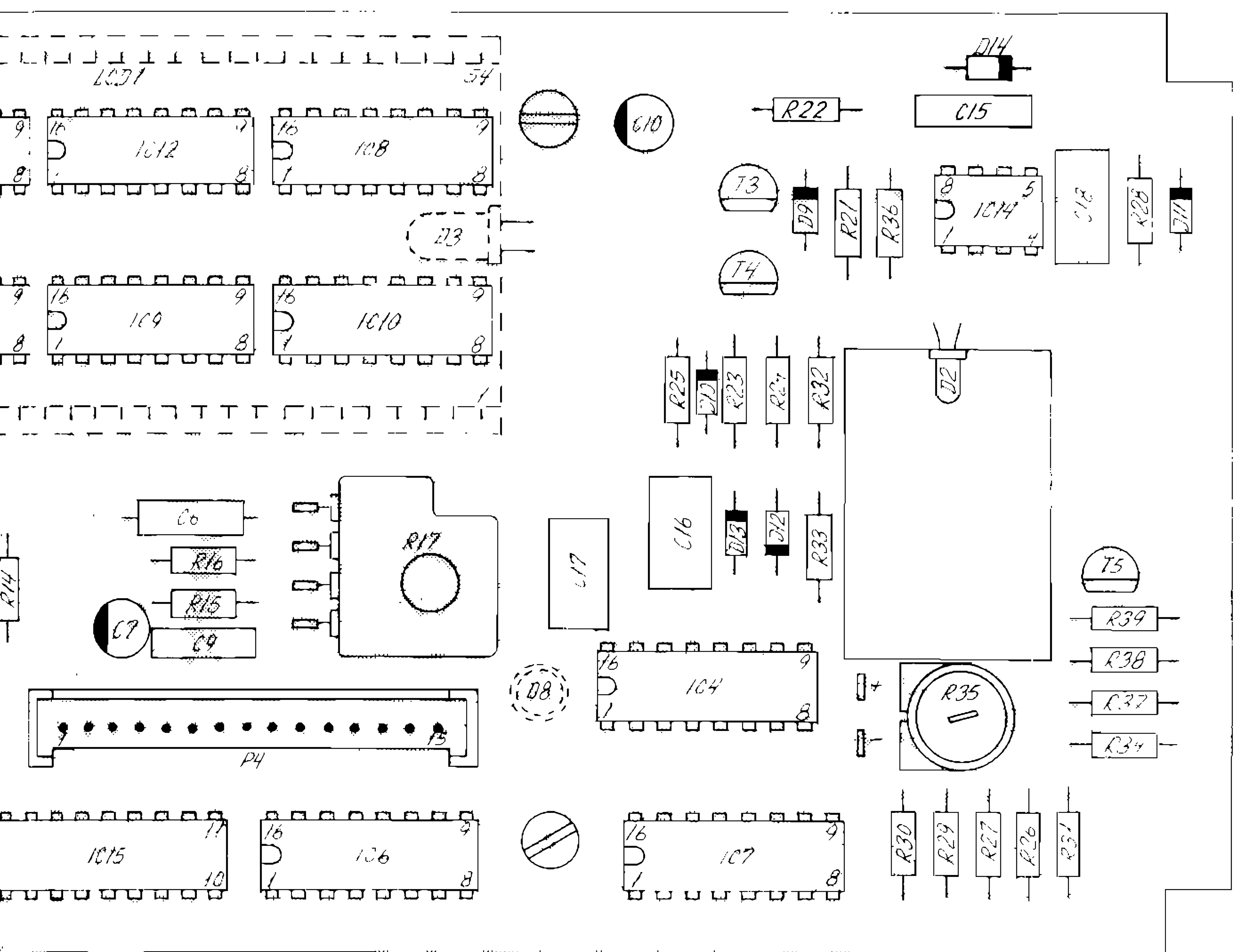
Operating conditions:  
 Oscilloscope input: passive probe 10 Mohm/11pF  
 Voltmeter input: 10 Mohm  
 ): Diode probe measurements  
 ): Only AM  
 ): Only SSB  
 ): Only FM  
 : 88 MHz  
 : 100 MHz

- +24.5V
- +5V
- GROUND
- 17.5V
- ON/OFF I
- ON/OFF II
- ON/OFF III
- NOISE GEN IN
- KEY



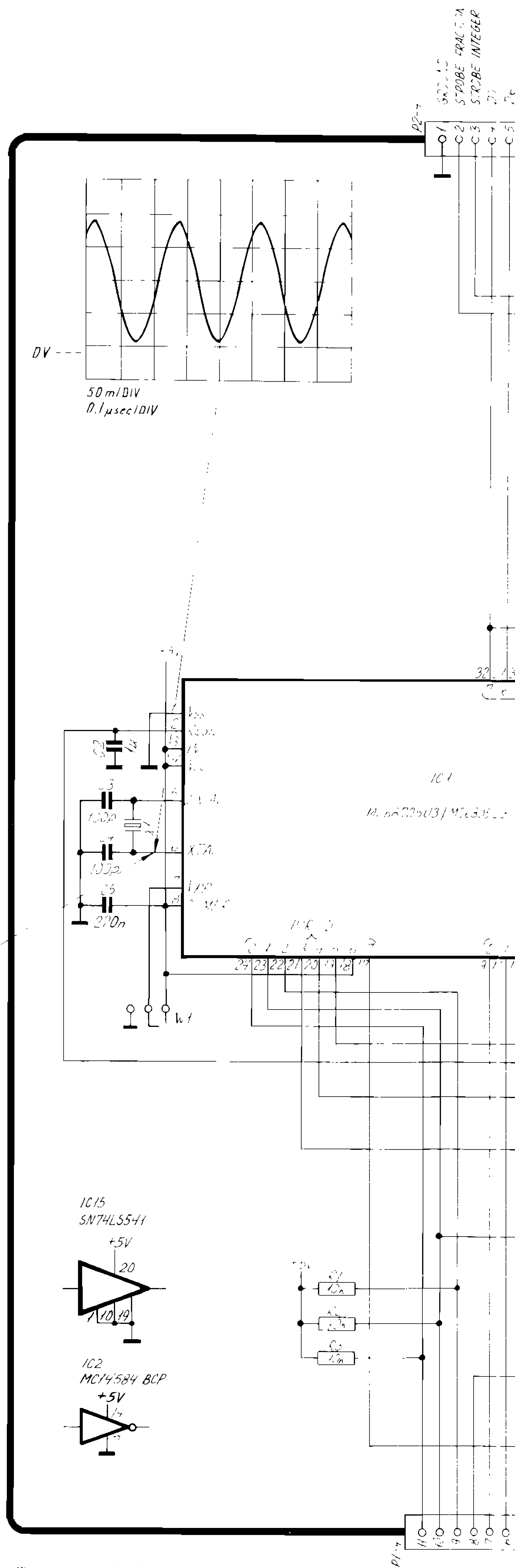
(A)

de tracks.



(A)

de tracks.



Test conditions.

Oscilloscope input: passive probe 10 Mohm/11pF

DC Voltmeter input: 10 Mohm

⊙: Diode probe measurements

○: Only AM

( ): Only SSB

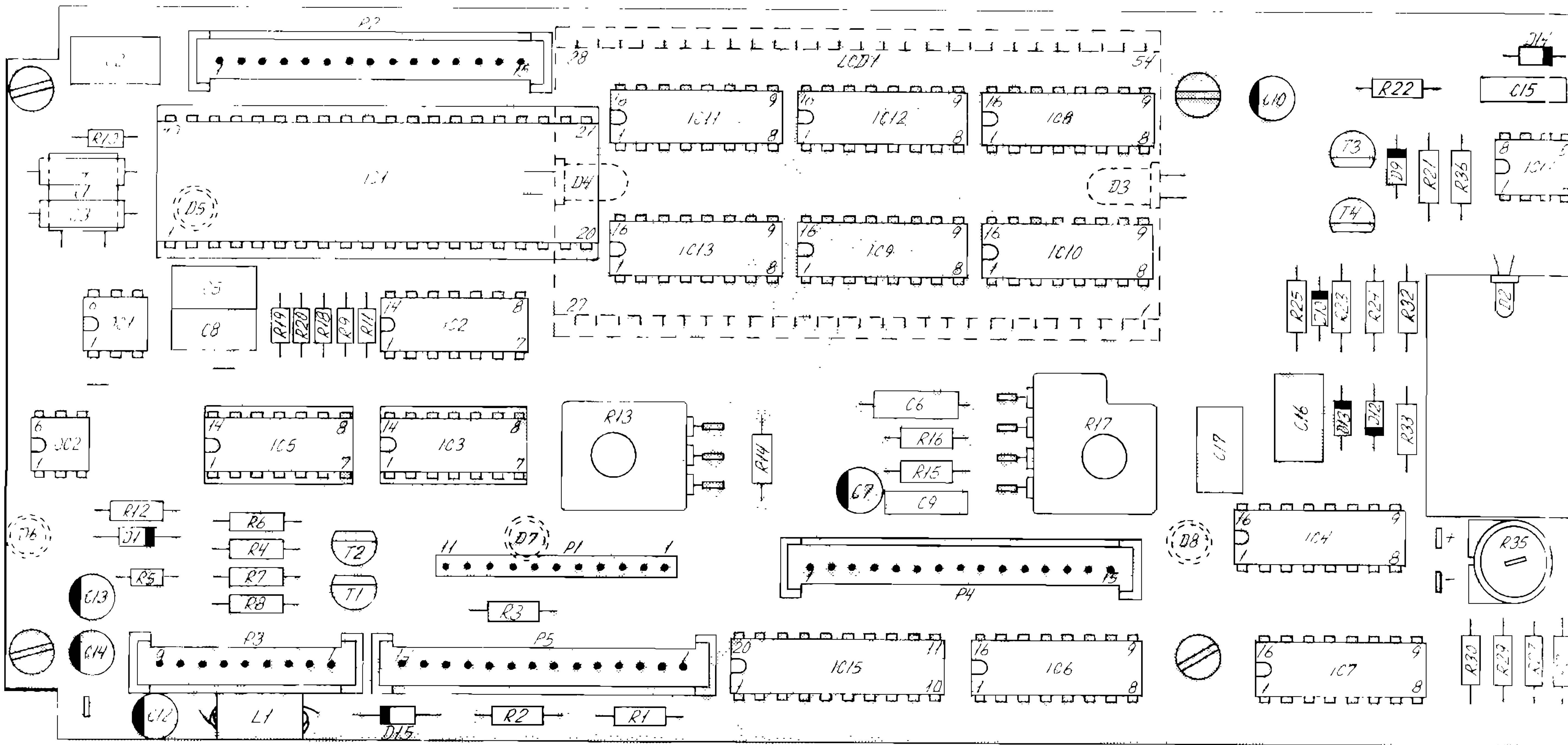
[ ]: Only FM

A : 88 MHz

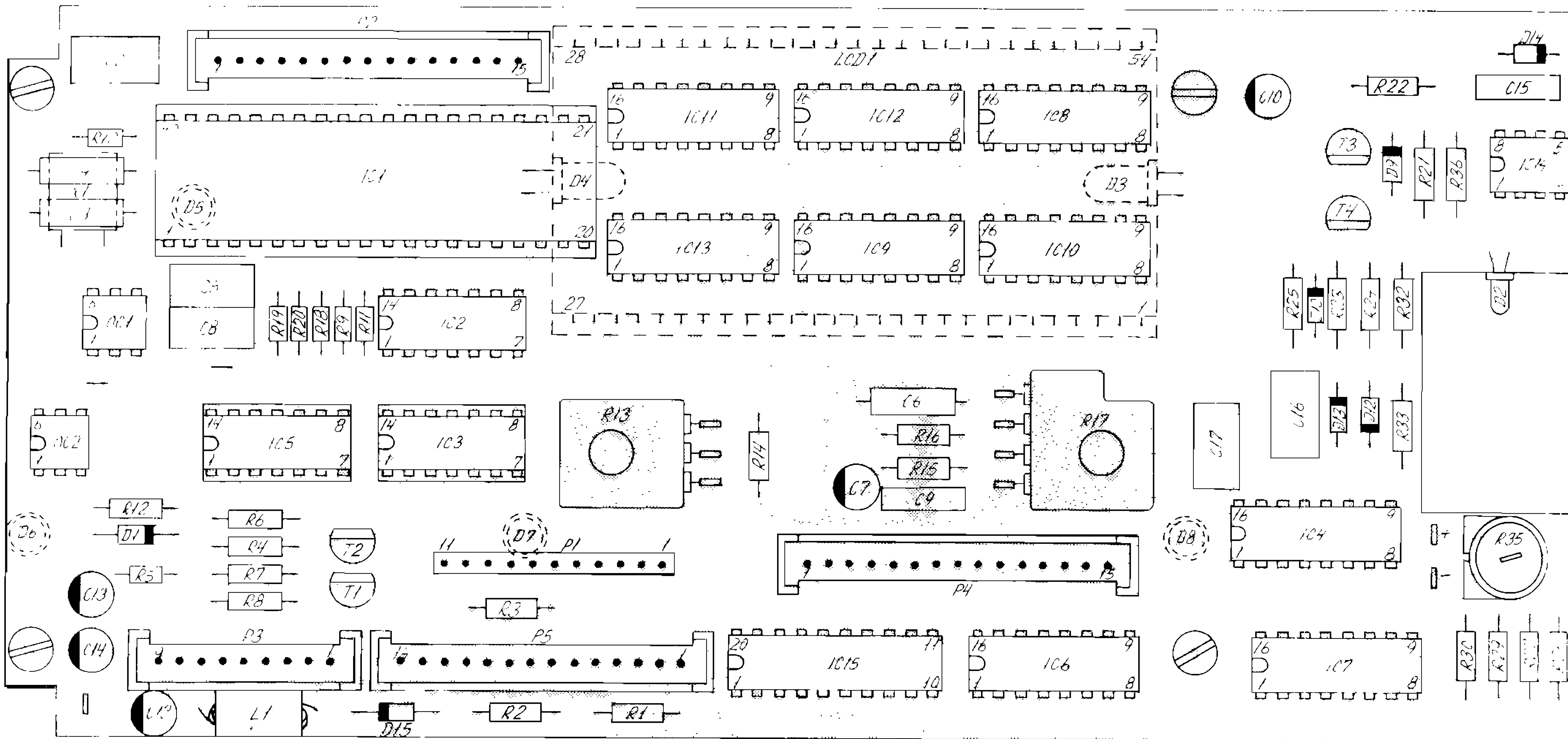
B : 100 Mhz



R2022A 4-6-24146A  
4-0-24146D



View from component side with upper side tracks.



View from component side with lower side tracks.

## 5.5. CONVERTER UNIT (MODULE 5) AND AF AMP. AND FILTER UNIT (MODULE 7)

### CONVERTER MODULE

The regulation works after the Pulse Width Modulation principle. The switch transistor T6 is controlled by IC1, which produces a square wave signal. The "ON-time" (duty-cycle) mainly depends upon the input voltage. The windings of the transformer TR1 are connected in such a way that the output diodes are reverse-biased when the transistor T6 is conducting. Because of this, a current is established in the primary windings which increases linearly in relation to time, and energy is stored in the primary inductance. When T6 is on the load current is supplied from the output capacitors. The switch-off of the transistor T6 produces polarity inversion of the voltage across the secondary windings. The output diodes conduct and the energy stored in the transformer TR1 is fed to the output capacitors and through the filters to the load. For stabilizing the output voltages a feed-back regulation signal created in module 7 is led to IC1 pin 1 and controls the duty-cycle. The switch transistor T6 is a power mos-fet and for protecting it against electrostatic discharge and transient overvoltage a zener diode D1 is placed across the transistor T6.

The resistors R8 and R18 and the capacitors C6 and C11 form two RC-snubbers which reduce the overvoltage transients and unwanted oscillations on primary and secondary windings.

Transistor T3 is producing a regulated voltage for the drivers T4 and T5 and for the relay in module 7.

The frequency of the Pulse Width Modulator IC1 is determined by R2 and C3. The duty-cycle is limited by the resistors R4 and R7 to 50%. In order to limit the inrush current during switching on the converter a capacitor C5 is charged through resistor R7 and gives a soft start of 50-260 ms depending on the input voltage.

When pushing the ON/OFF button on front panel the microcomputer turns on the transistors T1, T2 and IC1, and then the converter starts up. Push again the ON/OFF button and the microcomputer turns off T1, T2 and IC1 and the converter then stops.

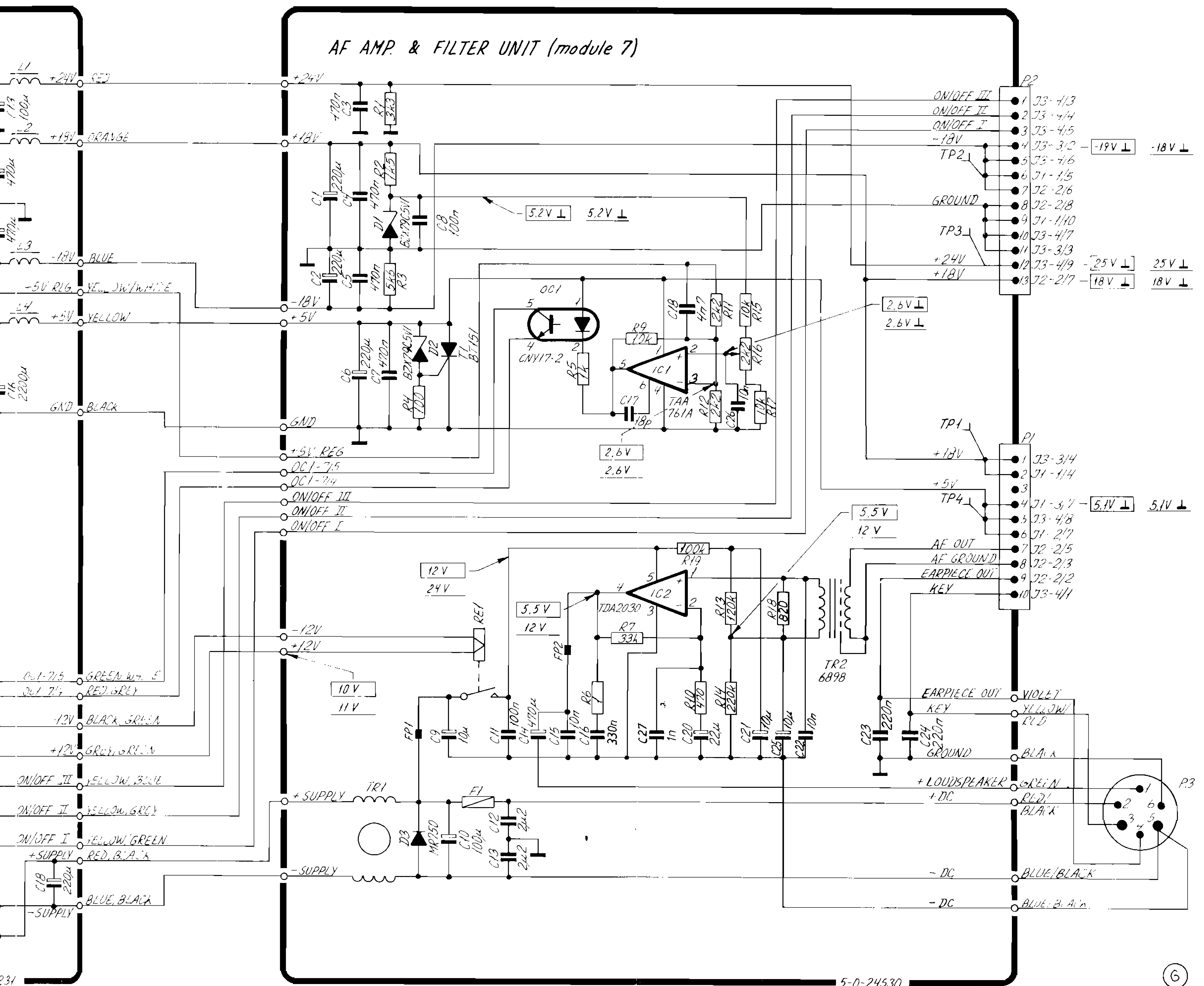
### AF AMP. & FILTER UNIT

The AF signal from the detector is led through transformer TR2 and to the integrated power amplifier IC2. AF-gain is determined by the resistors R7 and R10. The amplified AF-signal is led through capacitor C14 to the loudspeaker. The other wire to the loudspeaker must be connected to -DC input voltage and should be handled carefully because of the DC mains. The amplifier is turned on and off by means of the relay RE1, which is controlled from the converter unit.

The converter output voltage is controlled by the error amplifier IC1. Reference voltage is taken from diode D1 and output voltage is adjusted by means of resistor R16.

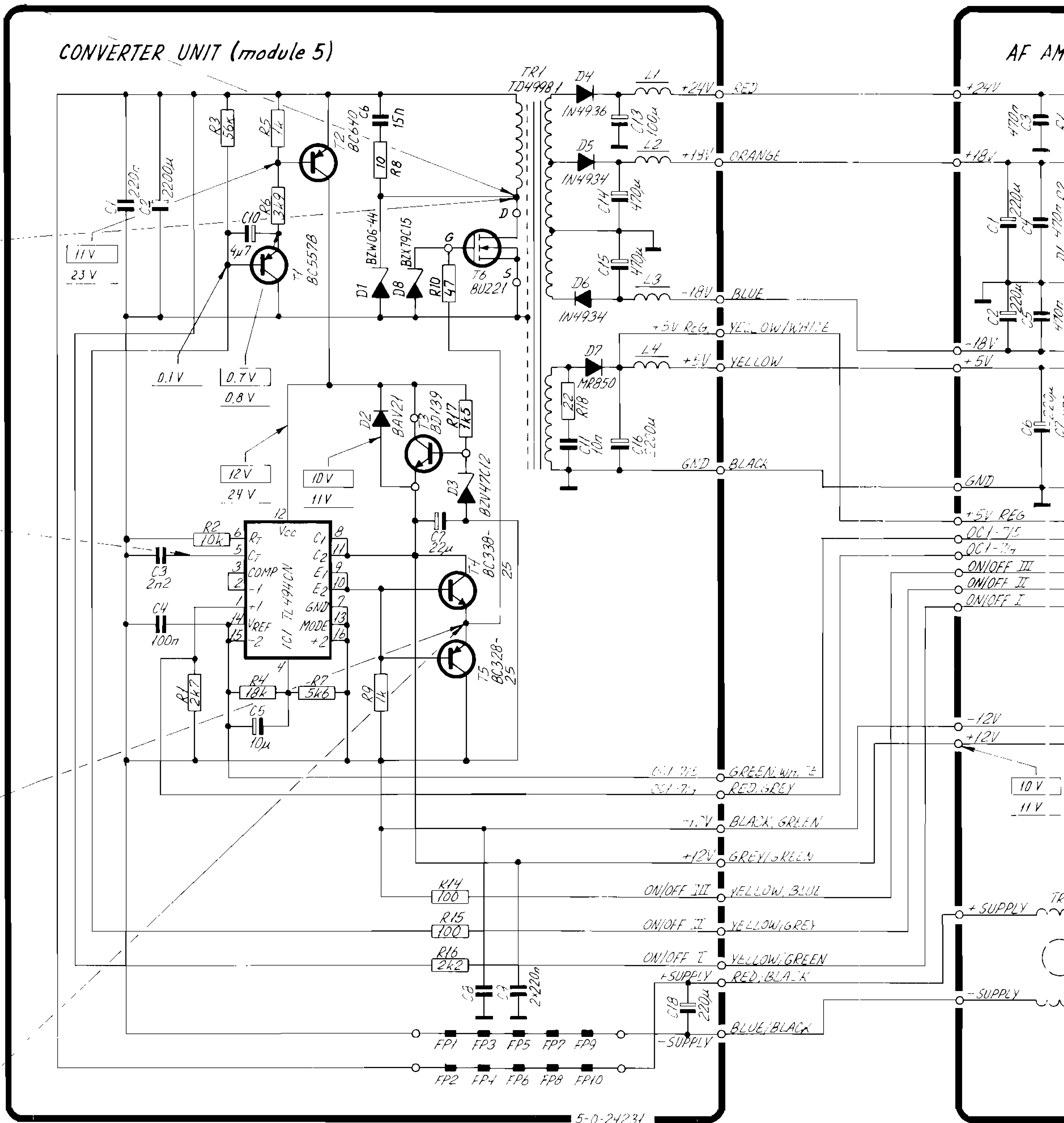
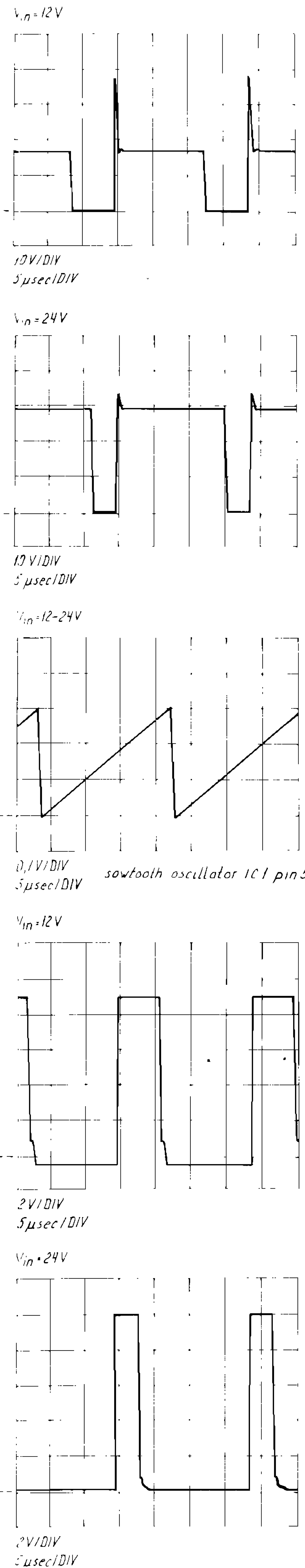
If regulation should fail, output voltage increases and causes damage to sensitive circuits, a "crowbar" is connected across 5V output. If 5V output comes over approx. 5.7V, thyristor T1 turns on and pulls down the voltage. This is detected by the "watch dog" in the computer unit which then turns off the converter.

By means of capacitors, ferrit beads and trafo TR1, switching noise is suppressed so that the power supply fulfils the CISPR noise regulations.



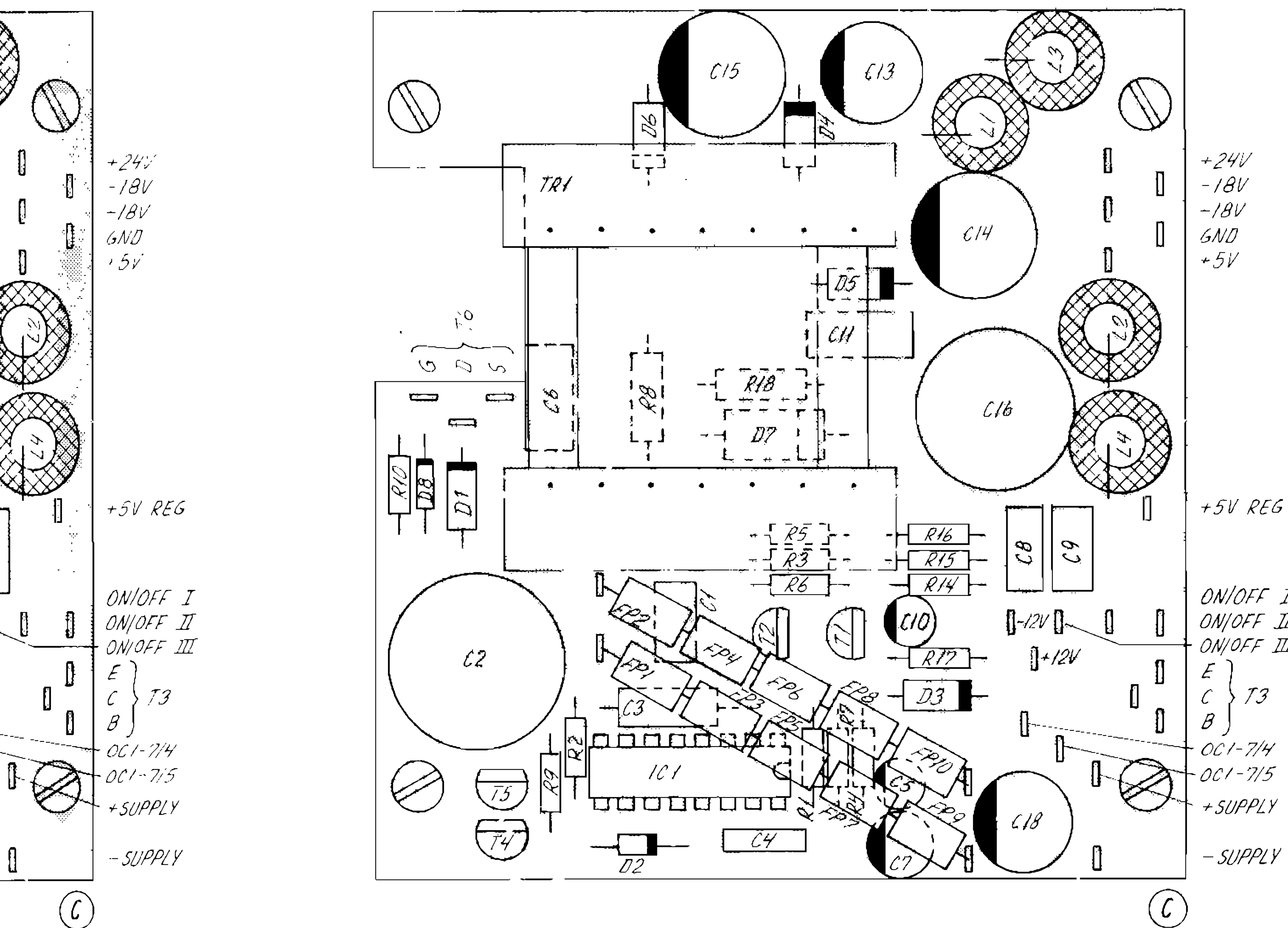
POWER SUPPLY  
 CONVERTER UNIT (MODULE 5) AND  
 AF POWER AMP. & FILTER UNIT (MODULE 7)





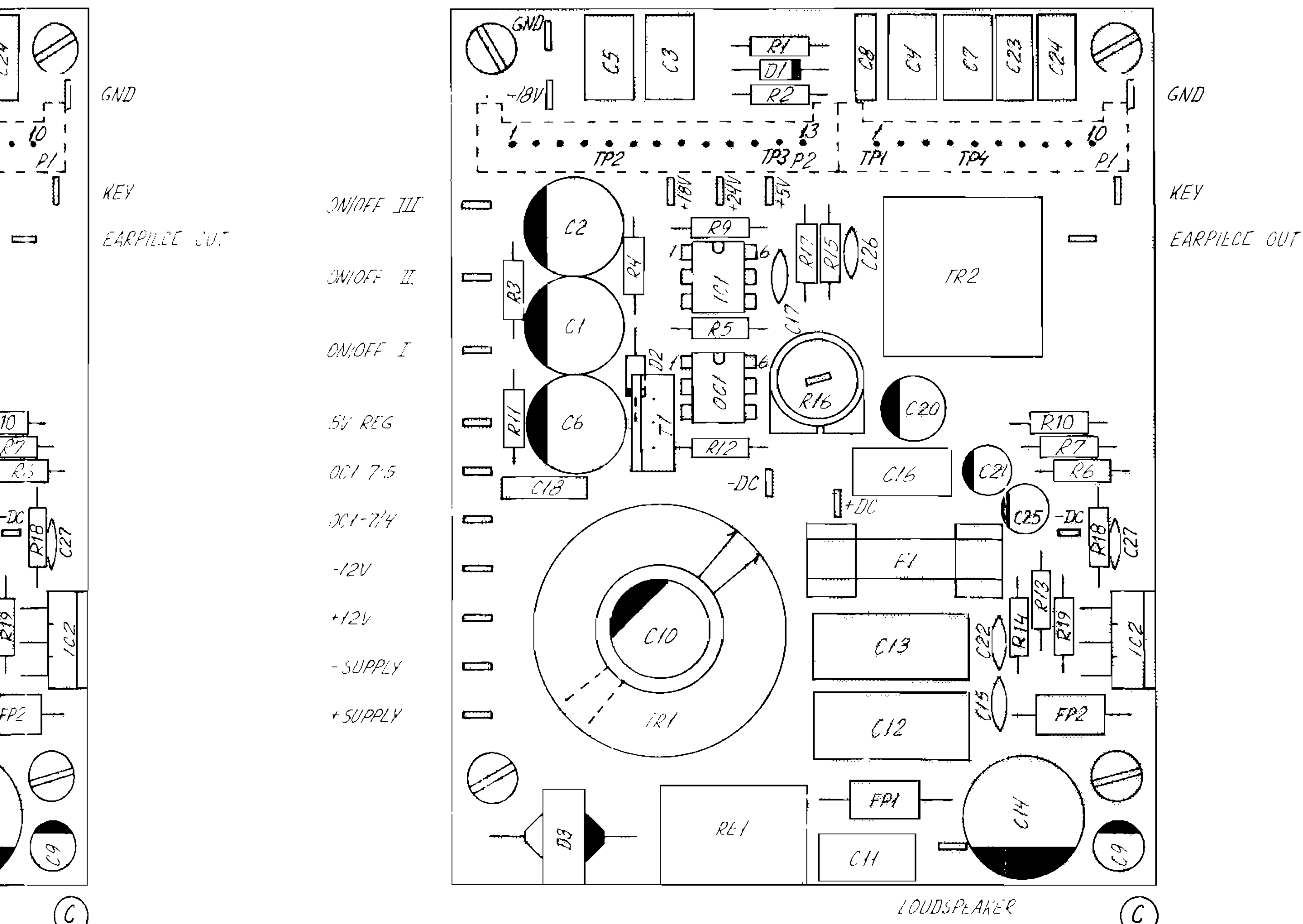
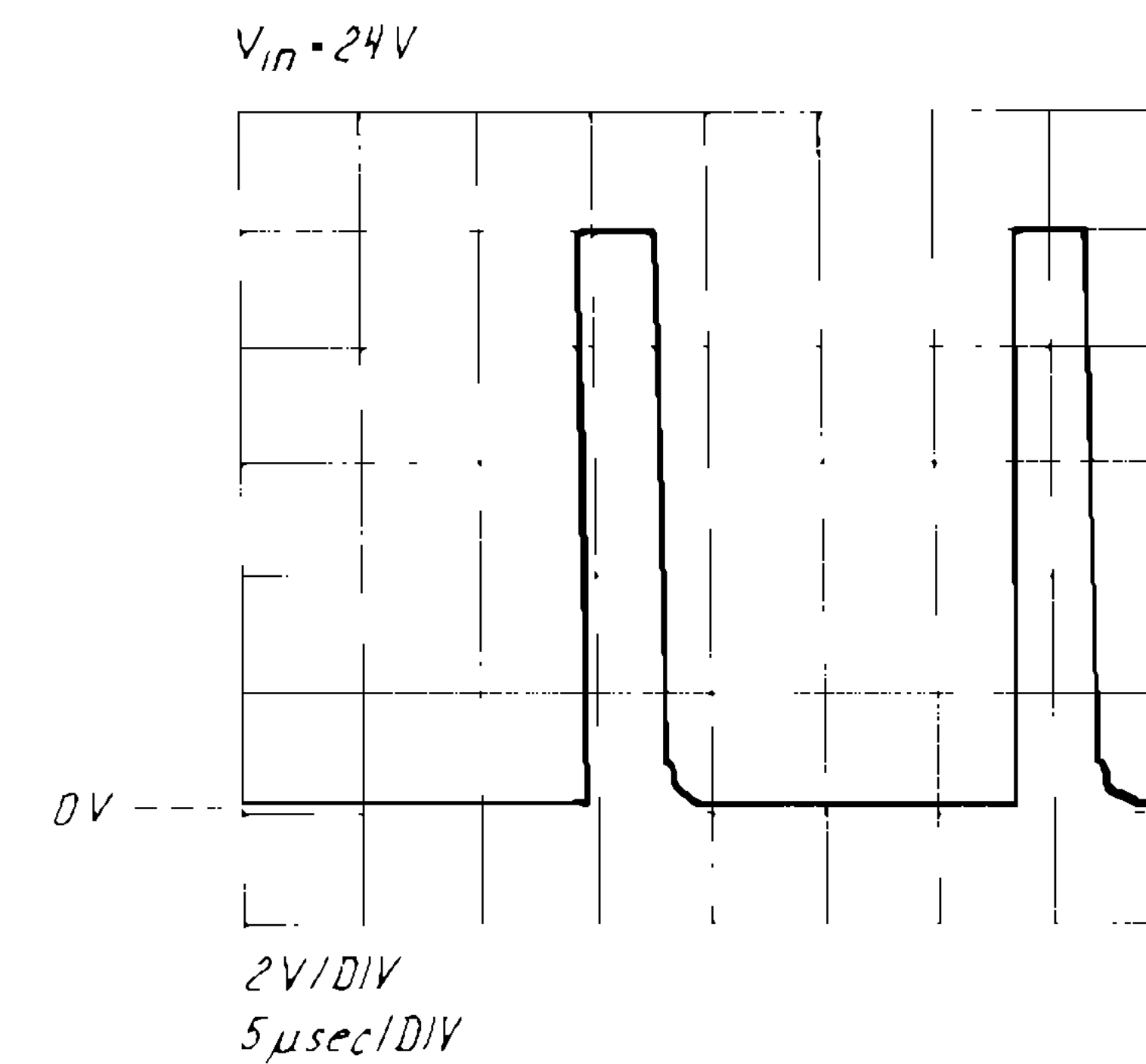
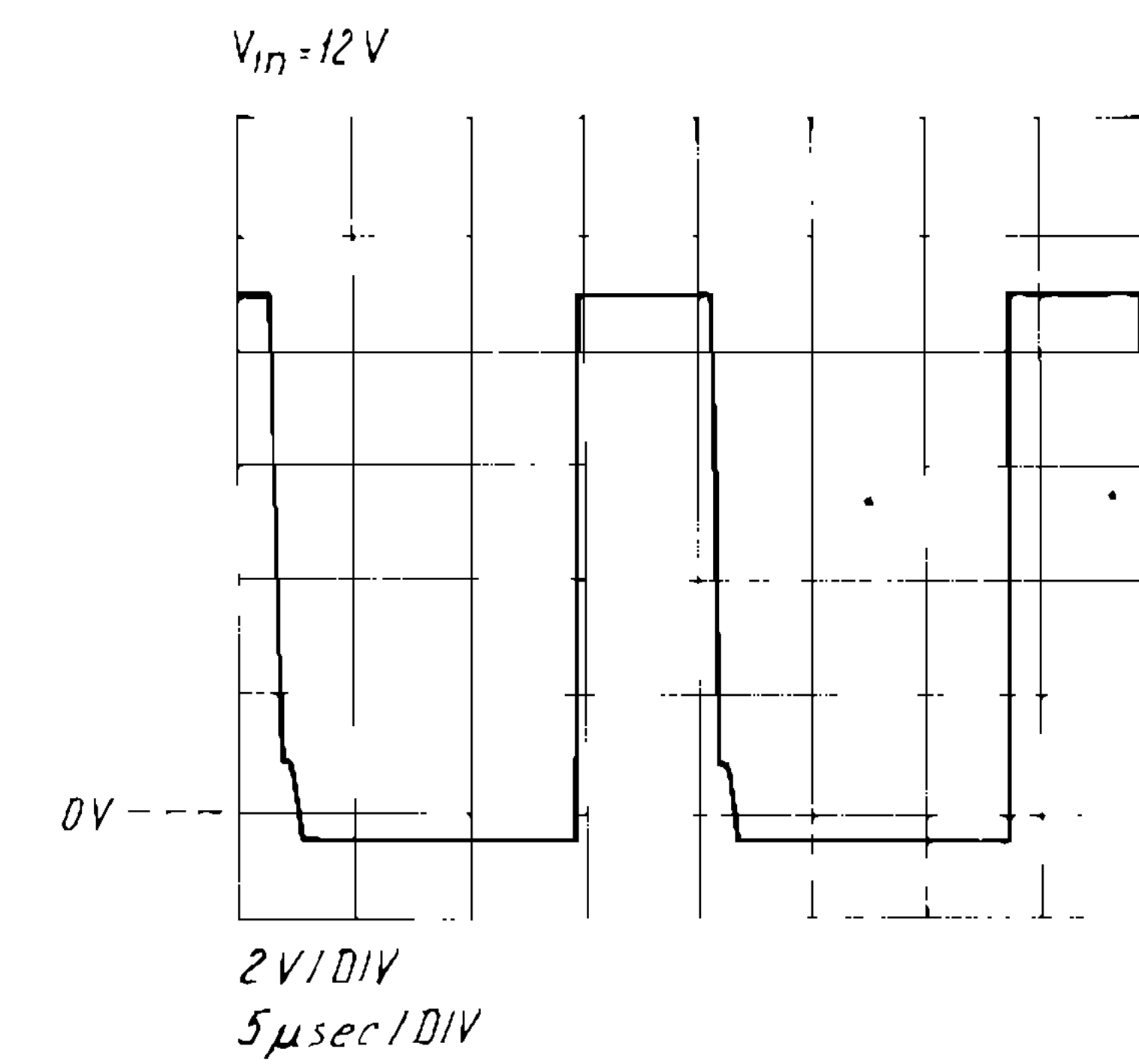
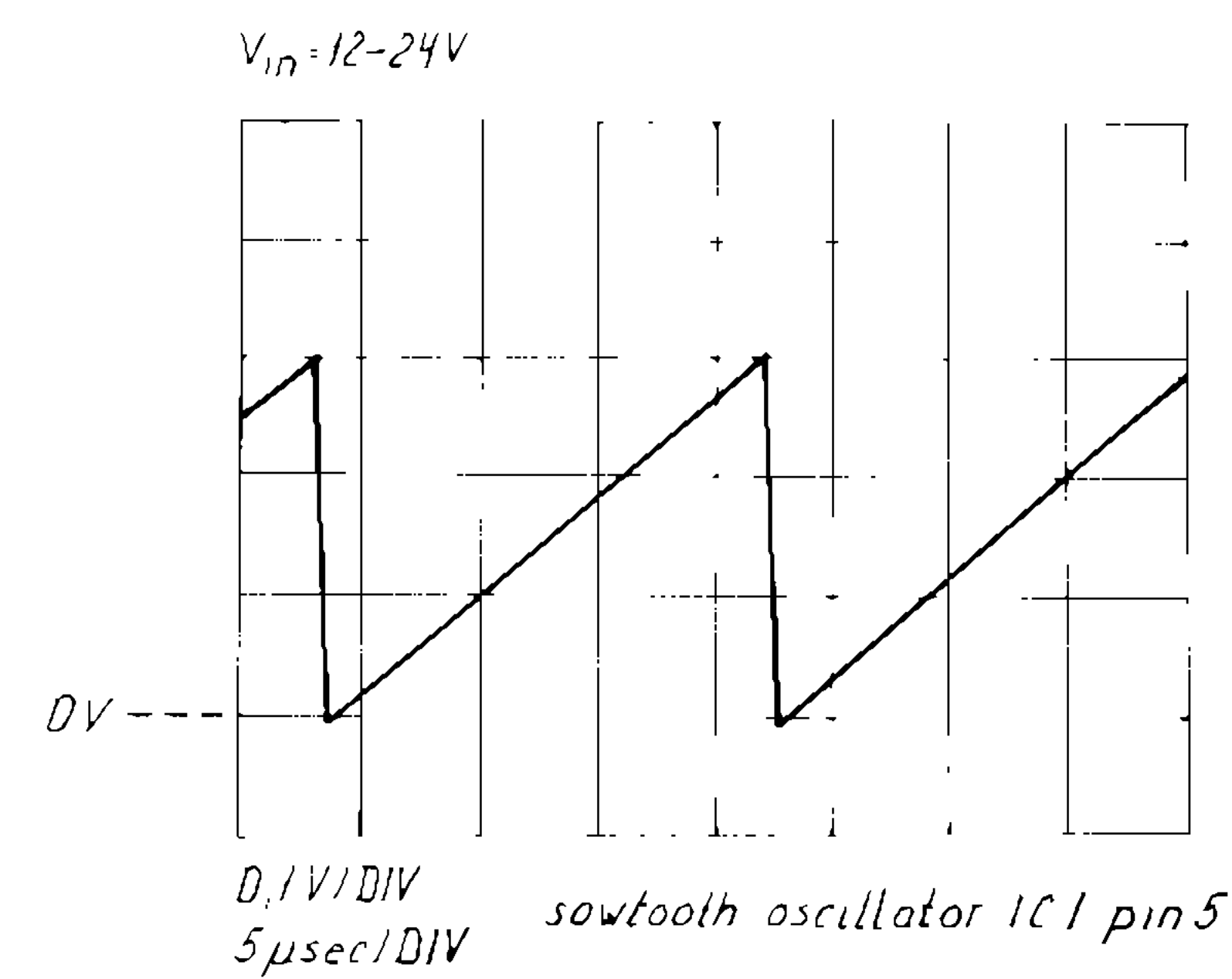
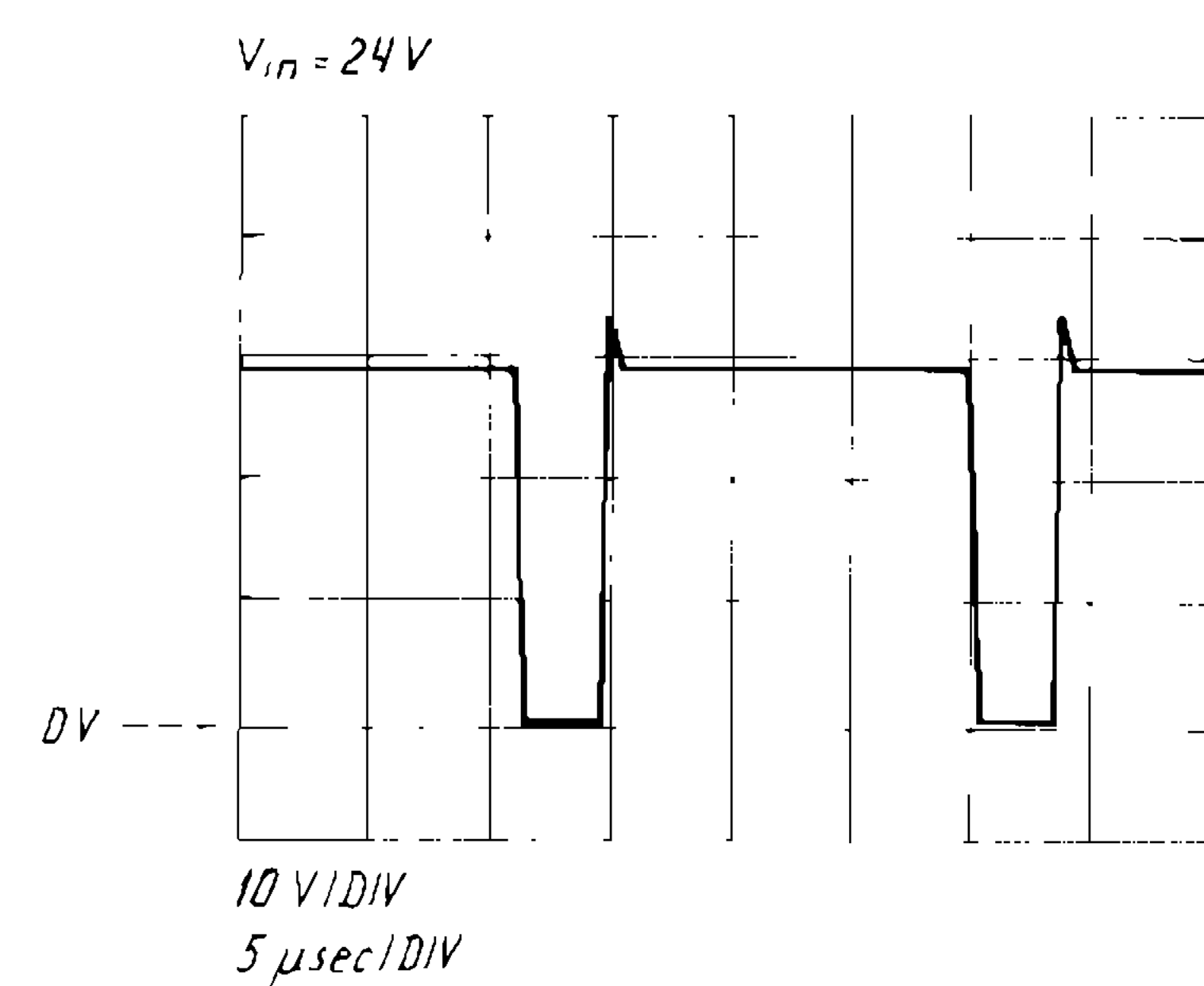
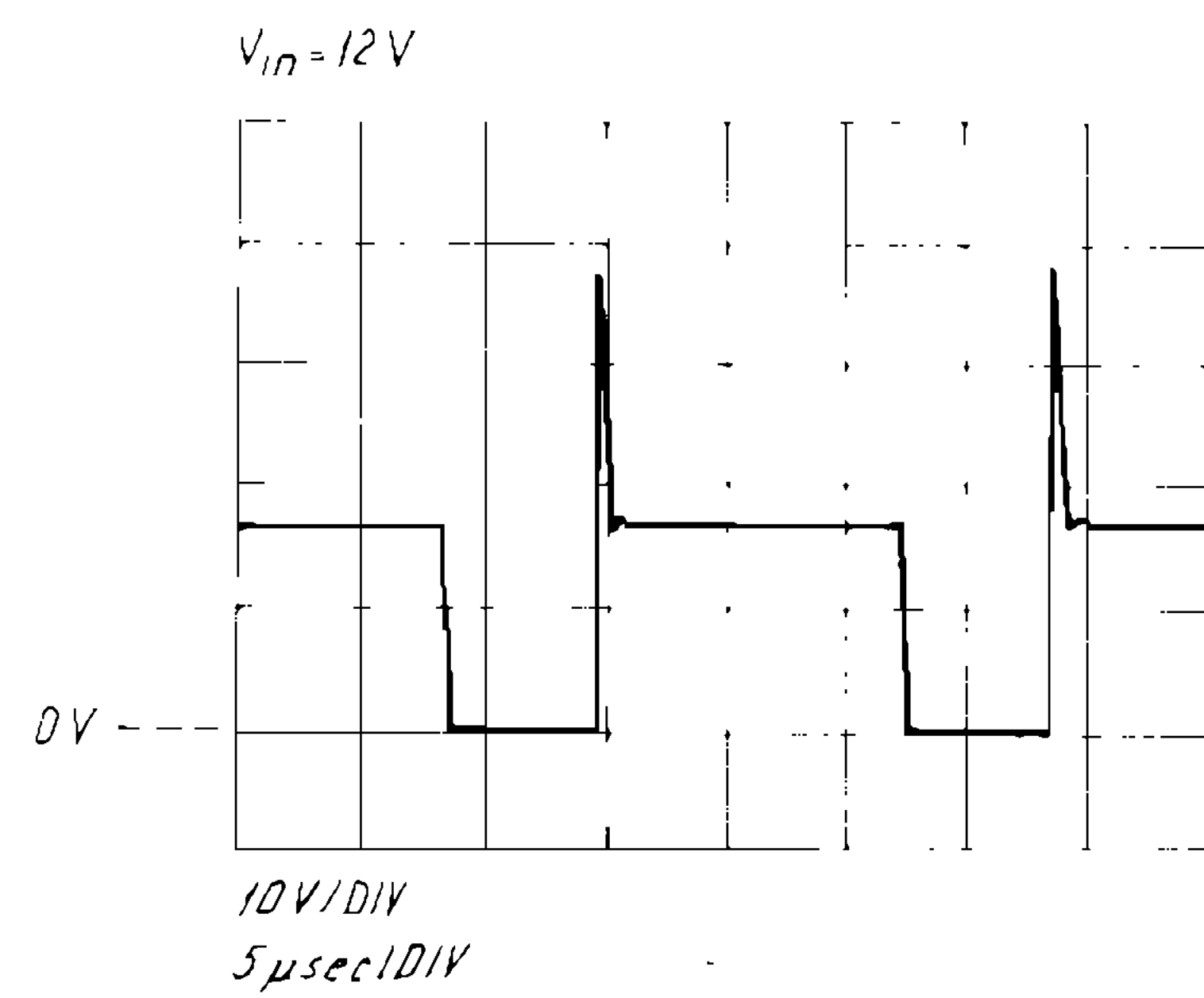
- ⌋ V<sub>1</sub> volt open measured at 12V DC supply
- ⌋ V<sub>2</sub> volt open measured at 24V DC supply
- ⌋ the voltages are measured relative to -DC (+5 = 7 pins)
- ⌋ volt open measured relative to signal ground

5-0-24231



View from component side with lower side tracks.

### CONVERTER UNIT (MODULE 5)

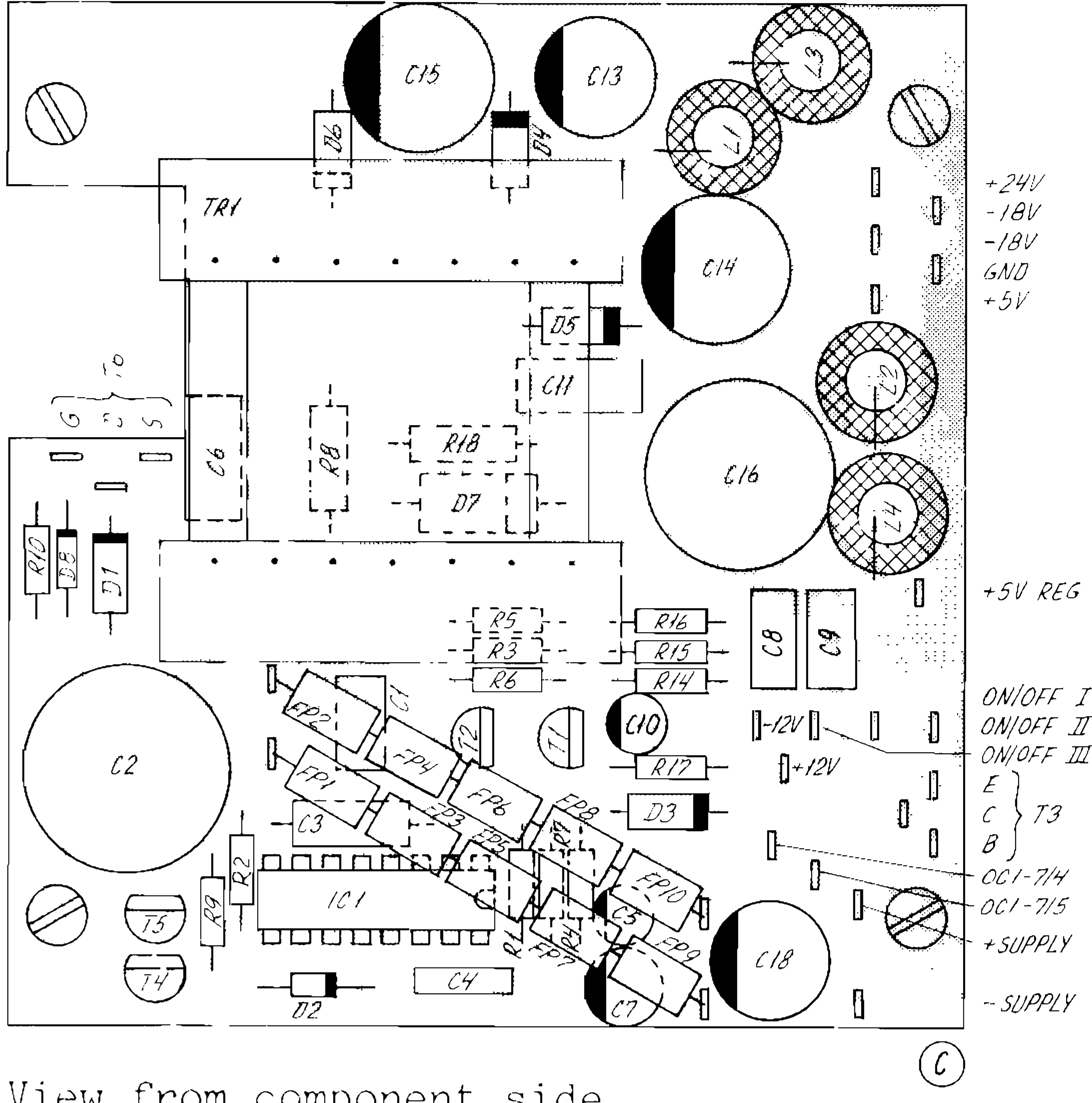


View from component side with lower side tracks.

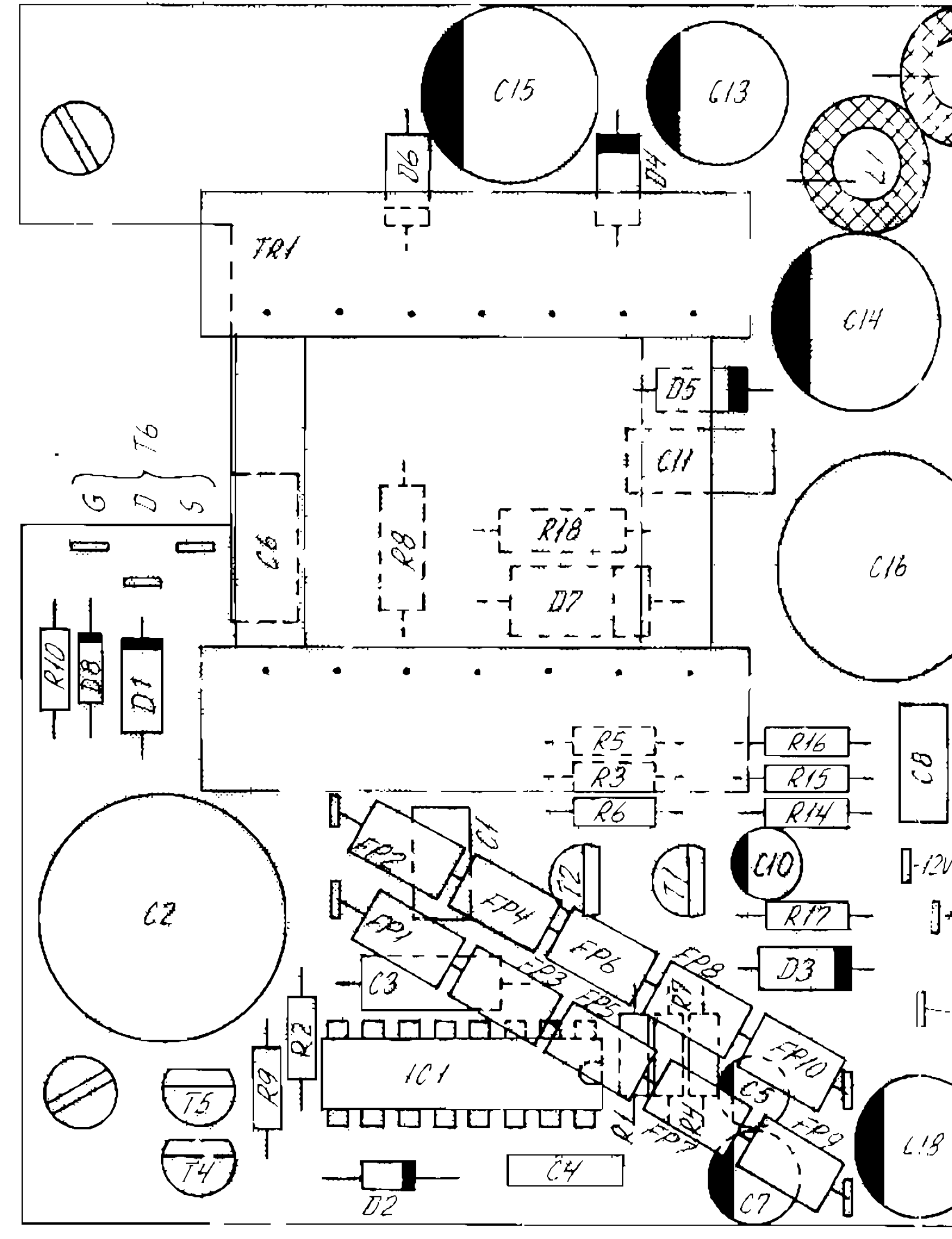
### AF POWER AMP. & FILTER UNIT (MODULE 7)



R2022A  
 4-6-24231C  
 4-6-24530C  
 4-0-24530 G

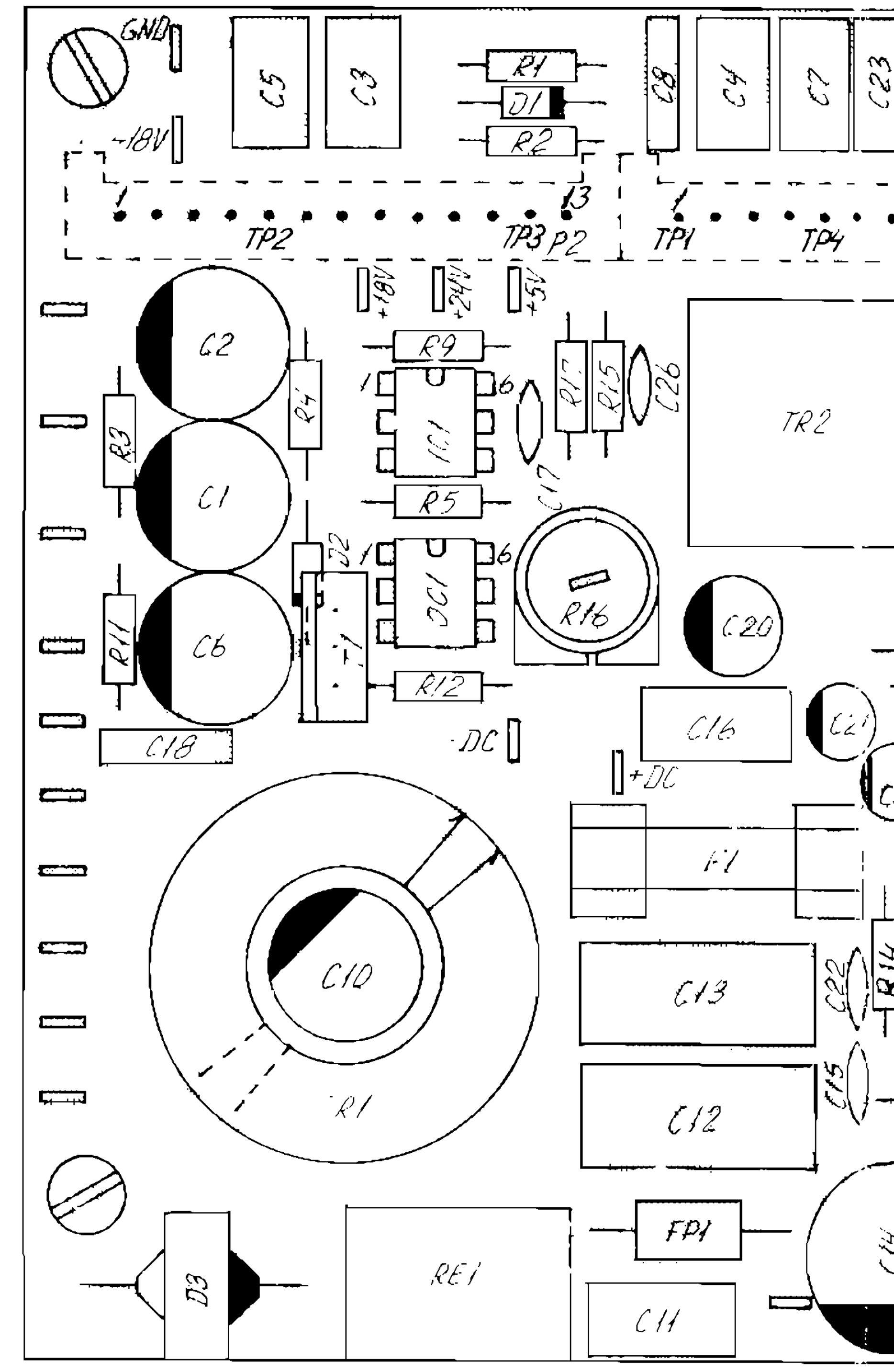
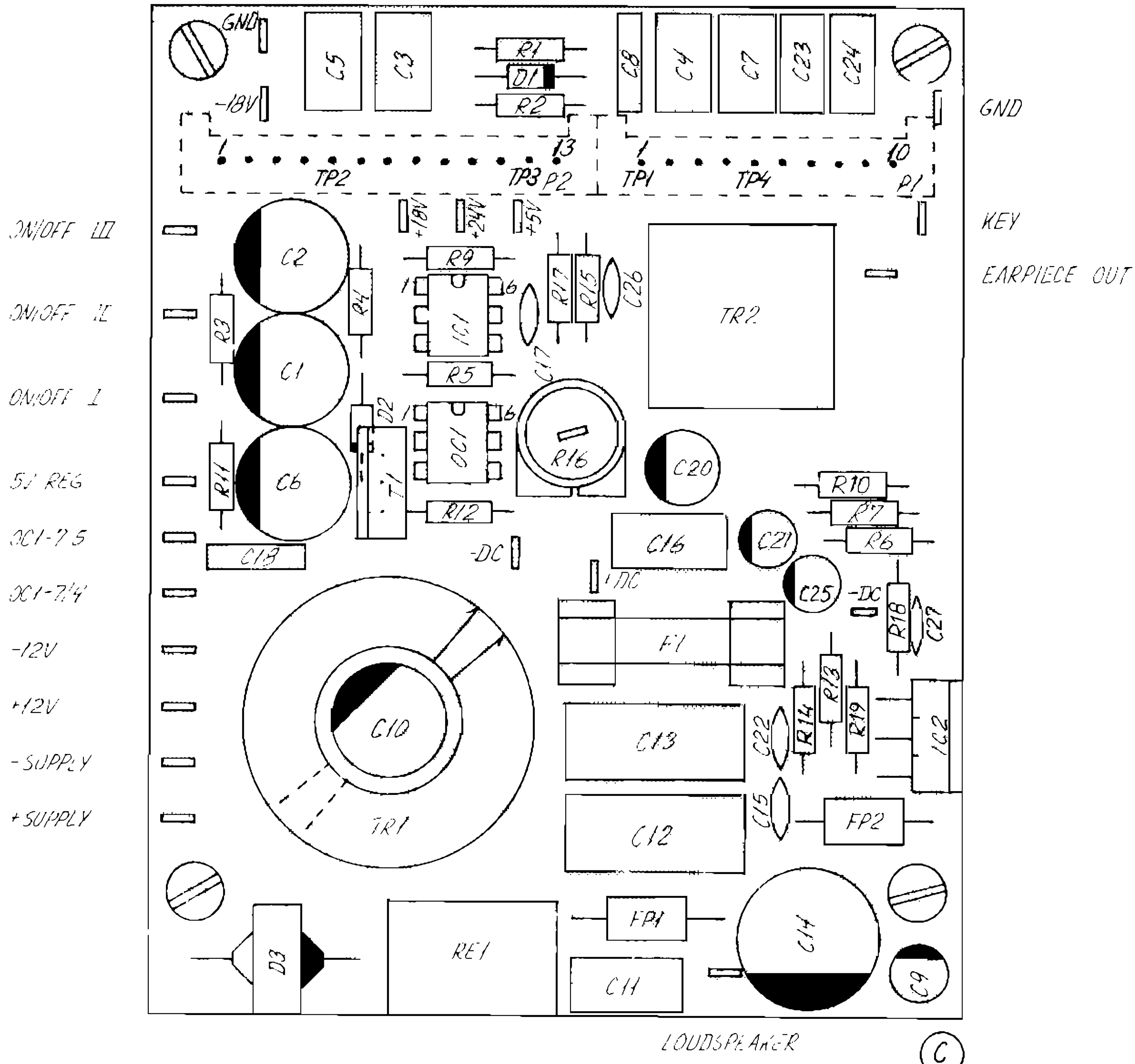


View from component side with upper side tracks.



View from component side with lower side tracks.

CONVERTER UNIT (MODULE)



View from component side with lower side tracks.

AF POWER AMP. & FILTER UNIT (MODULE)

MICROPROCESSOR (4)

MICROPROCESSOR (4)

FREQ. SYNTH. (3)

J2-4

1	J1-3/1	BLACK	GROUND
2	J1-3/6	RED/RED	STROBE FRACTION
3	J1-2/7	RED/WHITE	STROBE INTEGER
4	J1-3/9	VIOLET	D7
5	J1-3/8	BLUE	D6
6	J1-3/10	GREEN	D5
7	J1-3/11	ORANGE/GREY	D4
8	J1-3/4	ORANGE	D3
9	J1-3/5	RED	D2
10	J1-3/13	BROWN	D1
11	J1-3/12	BROWN/BLUE	D0
12	J3-3/6	ORANGE/RED	VCO II
13	J3-3/7	RED/YELLOW	VCO I
14	J1-3/3	GREEN/RED	NG OUT
15	J2-3/3	RED/BLUE	MUTE LO

J4-4

1	J1-2/5	BROWN/BLACK	SCAN CONTROL
2	J1-2/6	BROWN/RED	RF-IN
3	J1-2/4	BROWN/ORANGE	RF-OUT
4	J1-2/14	BLUE/YELLOW	AF-IN
5	J2-2/4	BLUE/GREY	AF-OUT
6	J1-2/1	BLACK	AF-GROUND
7	J1-2/13	BROWN/YELLOW	FM
8	J1-2/8	BROWN/GREEN	AF-MUTE
9	J1-2/12	BROWN/BLUE	SSB
10	J2-2/1	BLUE/WHITE	DETEKTOR MUTE
11	J1-2/11	BROWN/GREY	AM
12	J1-2/10	BROWN/WHITE	RF-GAIN OFF
13	J1-2/9	GREEN/BLUE	AGC-OFF
14	J1-2/3	GREEN/GREY	METRE -
15	J1-2/2	GREEN/WHITE	METRE +

J1-3

1	J2-4/1	BLACK	GROUND
2	J2-1/5	GREEN/YELLOW	NOISE GEN OUT
3	J2-4/14	GREEN/RED	NOISE GEN MUTE
4	J2-4/8	ORANGE	D3
5	J2-4/9	RED	D2
6	J2-4/2	GREY/RED	STROBE FRACTION
7	J1-7/4	YELLOW	+5V
8	J2-4/5	BLUE	D6
9	J2-4/4	VIOLET	D7
10	J2-4/6	GREEN	D5
11	J2-4/7	ORANGE/GREY	D4
12	J2-4/11	BROWN/BLUE	D0
13	J2-4/10	BROWN	D1
14	J2-4/3	RED/WHITE	STROBE INTEGER

J3-4

1	J1-7/10	YELLOW/RED	KEY
2	J1-6	YELLOW/GREEN	NOISE GEN. IN
3	J2-7/1	YELLOW/BLUE	ON/OFF III
4	J2-7/2	YELLOW/GREY	ON/OFF II
5	J2-7/3	YELLOW/WHITE	ON/OFF I
6	J2-7/5	BLUE	-18V
7	J2-7/10	BLACK	GROUND
8	J1-7/5	YELLOW	+5V
9	J2-7/12	RED	+24V

J5-4

1	J1-1/7	BLACK/BROWN	CT
2	J2-1/6	BLACK/RED	MW
3	J1-1/8	GREY	LW
4	J1-1/9	BLACK/YELLOW	DUPLEX FILTER
5	J2-1/7	BLACK/GREEN	AERIAL SWITCH RELAY
6	J2-1/8	BLACK/BLUE	SIMPLEX
7	J2-1/3	BLACK/WHITE	AM
8	J2-1/2	BLACK/GREY	SSB
9	J2-1/4	ORANGE/GREEN	FM
10	J2-1/10	ORANGE/BLUE	V TUNE
11	J2-1/9	BLACK	GROUND
12	J1-1/2	WHITE/VIOLET	COL II
13	J1-1/3	WHITE/ORANGE	COL I
14	J1-1/1	WHITE/GREY	LED

J3-3

1	J2-7/4	BLUE	-18V
2	J2-7/11	BLACK	GROUND
3	J1-7/1	ORANGE	+18V
4	J2-3/1	ORANGE	+18V
5	J2-4/12	ORANGE/RED	VCO II
6	J2-4/13	RED/YELLOW	VCO I
7			

J2-3

1	J3-3/5	ORANGE	+18V
2			
3	J2-4/15	RED/BLUE	LD MUTE

INTERCONNECTION CABLE DIAGRAM  
FOR R2022 (F)

IF (2)

FRONT END (1)

MICROPROCESSOR (4)

MICROPRO

J4-2

1	J4-4/6	BLACK	GROUND AF
2	J4-4/15	GREEN/WHITE	METRE +
3	J4-4/14	GREEN/GREY	METRE
4	J4-4/3	BROWN/ORANGE	RF-IN
5	J4-4/1	BROWN/BLACK	SCAN CONTROL
6	J4-4/2	BROWN/RED	RF OUT
7	J1-7/6	YELLOW	5V
8	J4-4/8	BROWN/GREEN	AF-MUTE
9	J4-4/13	GREEN/BLUE	AGC-OFF
10	J4-4/12	BROWN/WHITE	RF-GAIN OFF
11	J4-4/11	BROWN/GREY	AM
12	J4-4/9	BROWN/BLUE	SSB
13	J4-4/7	BROWN/YELLOW	FM
14	J4-4/4	BLUE/YELLOW	AF-OUT

J1-1

1	J5-4/14	WHITE/GREY	LED
2	J5-4/12	WHITE/VIOLET	COL II
3	J5-4/13	ORANGE/WHITE	COL I
4	J1-7/2	ORANGE	+18V
5	J2-7/6	BLUE	-18V
6	J2-1/1	BLACK/GREY	SSB
7	J5-4/1	BLACK/BROWN	CT
8	J5-4/3	GREY	LW
9	J5-4/4	BLACK/YELLOW	DUPLEX FILTER
10	J2-7/9	BLACK	GROUND

J2-4

1	J1-3/1	BLACK	GROUND
2	J1-3/6	GREY/RED	STROBE FRACTION
3	J1-3/7	RED/WHITE	STROBE INTEGER
4	J1-3/9	VIOLET	D7
5	J1-3/8	BLUE	D6
6	J1-3/10	GREEN	D5
7	J1-3/11	ORANGE/GREY	D4
8	J1-3/4	ORANGE	D3
9	J1-3/5	RED	D2
10	J1-3/13	BROWN	D1
11	J1-3/12	BROWN/BLUE	D0
12	J3-3/6	ORANGE/RED	VCO II
13	J3-3/7	RED/YELLOW	VCO I
14	J1-3/3	GREEN/RED	NG OUT
15	J2-3/3	RED/BLUE	MUTE LO

J4-4

1	J1-2/5	BROWN	BROWN
2	J1-2/6	BROWN	BROWN
3	J1-2/7	BROWN	BROWN
4	J1-2/14	BLUE	BLUE
5	J2-2/4	BLUE	BLUE
6	J1-2/1	BLACK	BLACK
7	J1-2/13	BROWN	BROWN
8	J1-2/3	BROWN	BROWN
9	J1-2/12	BROWN	BROWN
10	J2-2/1	BLUE	BLUE
11	J1-2/11	BROWN	BROWN
12	J1-2/10	BROWN	BROWN
13	J1-2/9	GREEN	GREEN
14	J1-2/3	GREEN	GREEN
15	J1-2/2	GREEN	GREEN

J4-2

1	J4-4/10	BLUE/WHITE	DETECTOR MUTE
2	J1-7/9	VIOLET	EARPIECE OUT
3	J1-7/8	BLACK	AF-GROUND
4	J4-4/5	BLUE/GREY	AF-IN
5	J1-7/7	BROWN	AF-OUT
6	J2-7/7	BLUE	-18V
7	J2-7/13	ORANGE	+18V
8	J2-7/8	BLACK	GROUND PS

J2-1

1	J1-1/6	BLACK/GREY	SSB
2	J5-4/8	BLACK/GREY	SSB
3	J5-4/7	BLACK/WHITE	AM
4	J5-4/9	ORANGE/GREEN	FM
5	J1-3/2	GREEN/YELLOW	NOISE GEN. IN
6	J5-4/2	BLACK/RED	MW
7	J5-4/5	BLACK/GREEN	AERIAL SWITCH RELAY
8	J5-4/6	BLACK/BLUE	SIMPLEX RELAY
9	J5-4/11	BLACK	GROUND
10	J5-4/10	ORANGE/BLUE	V TUNE

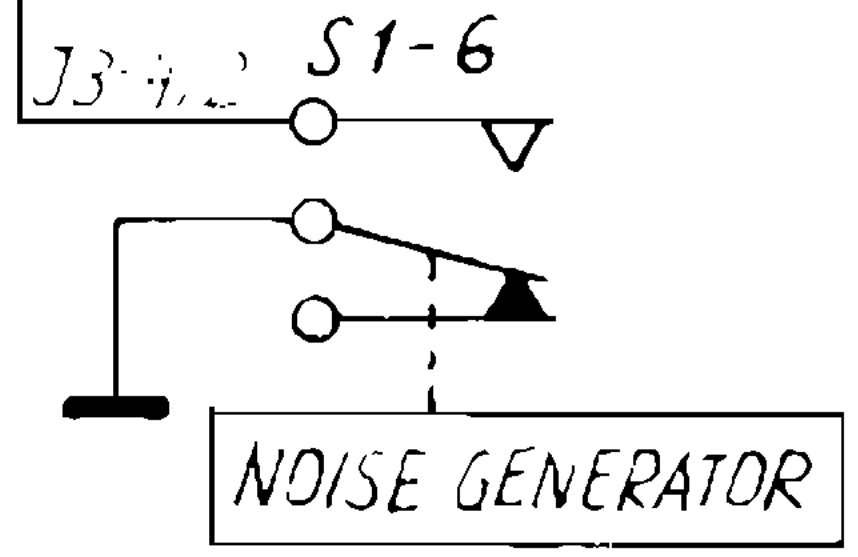
J3-4

1	J1-7/10	YELLOW/RED	KEY
2	S1-6	YELLOW/GREEN	NOISE GEN. IN
3	J2-7/1	YELLOW/BLUE	ON/OFF III
4	J2-7/2	YELLOW/GREY	ON/OFF II
5	J2-7/3	YELLOW/WHITE	ON/OFF I
6	J2-7/5	BLUE	-18V
7	J2-7/10	BLACK	GROUND
8	J1-7/5	YELLOW	+5V
9	J2-7/12	RED	+24V

J5-4

1	J1-1/7	BLACK	BLACK
2	J2-1/6	BLACK	BLACK
3	J1-1/8	GREY	GREY
4	J1-1/9	BLACK	BLACK
5	J2-1/7	BLACK	BLACK
6	J2-1/8	BLACK	BLACK
7	J2-1/3	BLACK	BLACK
8	J2-1/2	BLACK	BLACK
9	J2-1/4	ORANGE	ORANGE
10	J2-1/10	ORANGE	ORANGE
11	J2-1/2	BLACK	BLACK
12	J1-1/2	WHITE	WHITE
13	J1-1/3	WHITE	WHITE
14	J1-1/1	WHITE	WHITE

POWER SUPPLY (7)



POWER CABLE 7x1mm<sup>2</sup> Connection Box H2091, ...



**POWER SUPPLY (7)**

**IF (2)**

**FRONT END (1)**

J1-7

1	J3-3/4	ORANGE	+18V
2	J1-1/4	ORANGE	+18V
3			
4	J1-3/7	YELLOW	+5V
5	J3-4/8	YELLOW	+5V
6	J1-2/7	YELLOW	+5V
7	J2-2/5	BROWN	AF OUT
8	J2-2/3	BLACK	AF GROUND
9	J2-2/2	VIOLET	EARPIECE OUT
10	J3-4/1	YELLOW/RED	KEY

J1-2

1	J4-4/6	BLACK	GROUND AF
2	J4-4/15	GREEN/WHITE	METRE +
3	J4-4/14	GREEN/GREY	METRE -
4	J4-4/3	BROWN/ORANGE	RF - IN
5	J4-4/1	BROWN/BLACK	SCAN CONTROL
6	J4-4/2	BROWN/RED	RF - OUT
7	J1-7/6	YELLOW	5V
8	J4-4/8	BROWN/GREEN	AF - MUTE
9	J4-4/13	GREEN/BLUE	AGC - OFF
10	J4-4/12	BROWN/WHITE	RF - GAIN OFF
11	J4-4/11	BROWN/GREY	AM
12	J4-4/9	BROWN/BLUE	SSB
13	J4-4/7	BROWN/YELLOW	FM
14	J4-4/4	BLUE/YELLOW	AF - OUT

J1-1

1	J5-4/14	WHITE/GREY	LED
2	J5-4/12	WHITE/VIOLET	COL. I
3	J5-4/13	ORANGE/WHITE	COL. I
4	J1-7/2	ORANGE	+18V
5	J2-7/6	BLUE	-18V
6	J2-1/1	BLACK/GREY	SSB
7	J5-4/1	BLACK/BROWN	CT
8	J5-4/3	GREY	LW
9	J5-4/4	BLACK/YELLOW	DUPLEX FILTER
10	J2-7/9	BLACK	GROUND

J2-7

1	J3-4/3	YELLOW/BLUE	ON/OFF III
2	J3-4/4	YELLOW/GREY	ON/OFF II
3	J3-4/5	YELLOW/WHITE	ON/OFF I
4	J3-3/2	BLUE	-18V
5	J3-4/6	BLUE	-18V
6	J1-1/5	BLUE	-18V
7	J2-2/6	BLUE	-18V
8	J2-2/8	BLACK	GROUND
9	J1-1/10	BLACK	GROUND
10	J3-4/7	BLACK	GROUND
11	J3-3/3	BLACK	GROUND
12	J3-4/9	RED	+24V
13	J2-2/7	ORANGE	+18V

J2-2

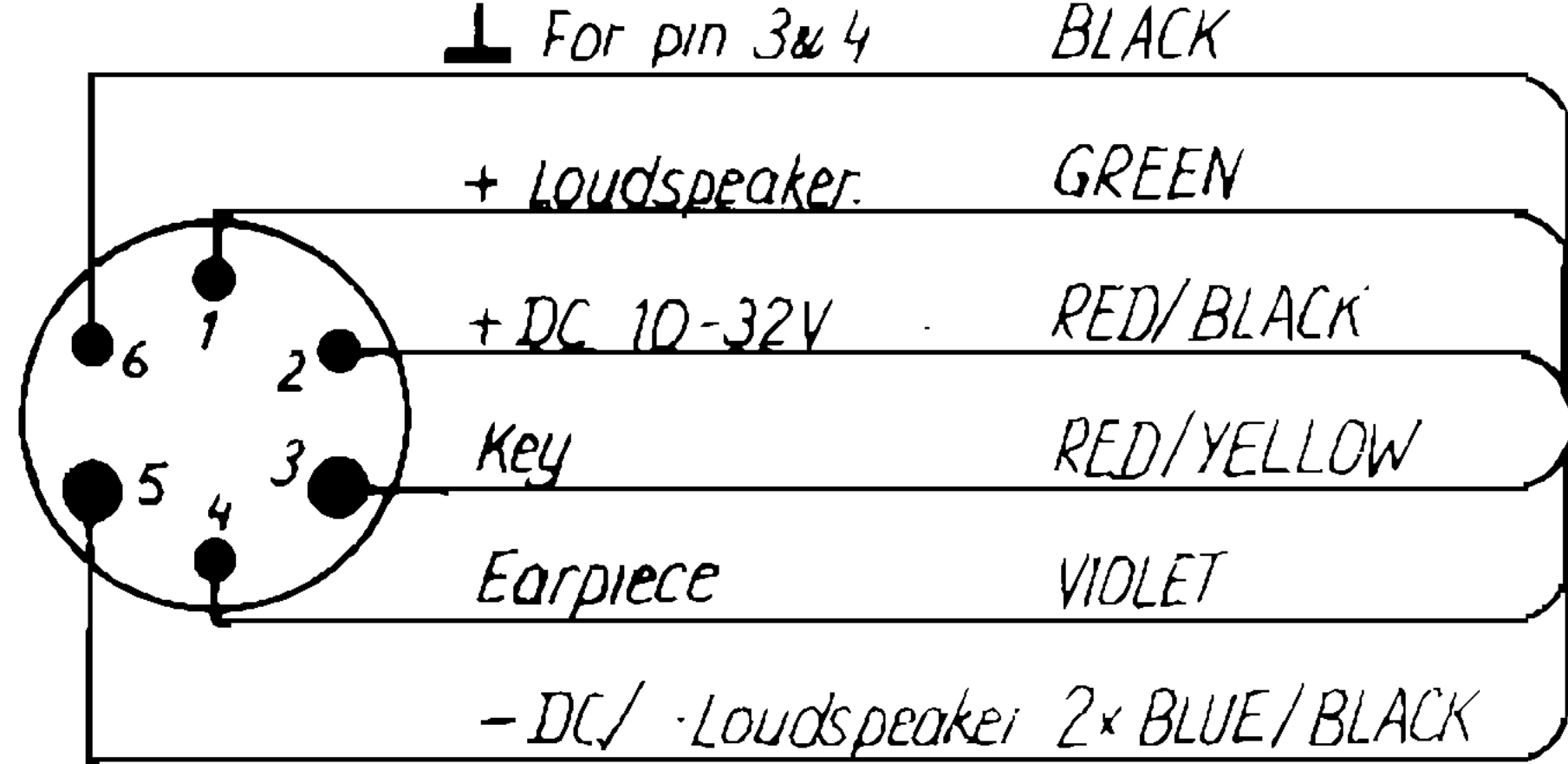
1	J4-4/10	BLUE/WHITE	DETECTOR MUTE
2	J1-7/9	VIOLET	EARPIECE OUT
3	J1-7/8	BLACK	AF - GROUND
4	J4-4/5	BLUE/GREY	AF - IN
5	J1-7/7	BROWN	AF - OUT
6	J2-7/7	BLUE	-18V
7	J2-7/13	ORANGE	+18V
8	J2-7/8	BLACK	GROUND PS

J2-1

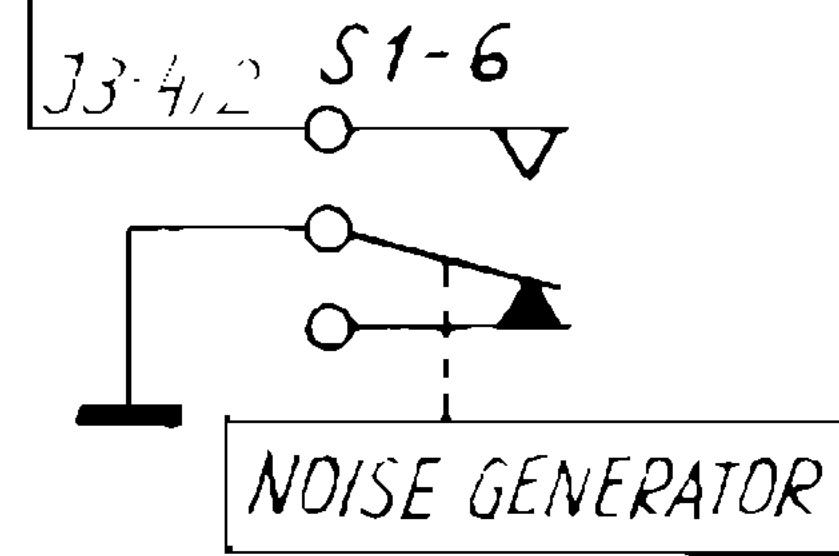
1	J1-1/6	BLACK/GREY	SSB
2	J5-4/8	BLACK/GREY	SSB
3	J5-4/7	BLACK/WHITE	AM
4	J5-4/9	ORANGE/GREEN	FM
5	J1-3/2	GREEN/YELLOW	NOISE GEN. IN
6	J5-4/2	BLACK/RED	MW
7	J5-4/5	BLACK/GREEN	AERIAL SWITCH RE. IN
8	J5-4/6	BLACK/BLUE	SIMPLEX RELAY
9	J5-4/11	BLACK	GROUND
10	J5-4/10	ORANGE/BLUE	V TUNE

**CHASSIS (6)**

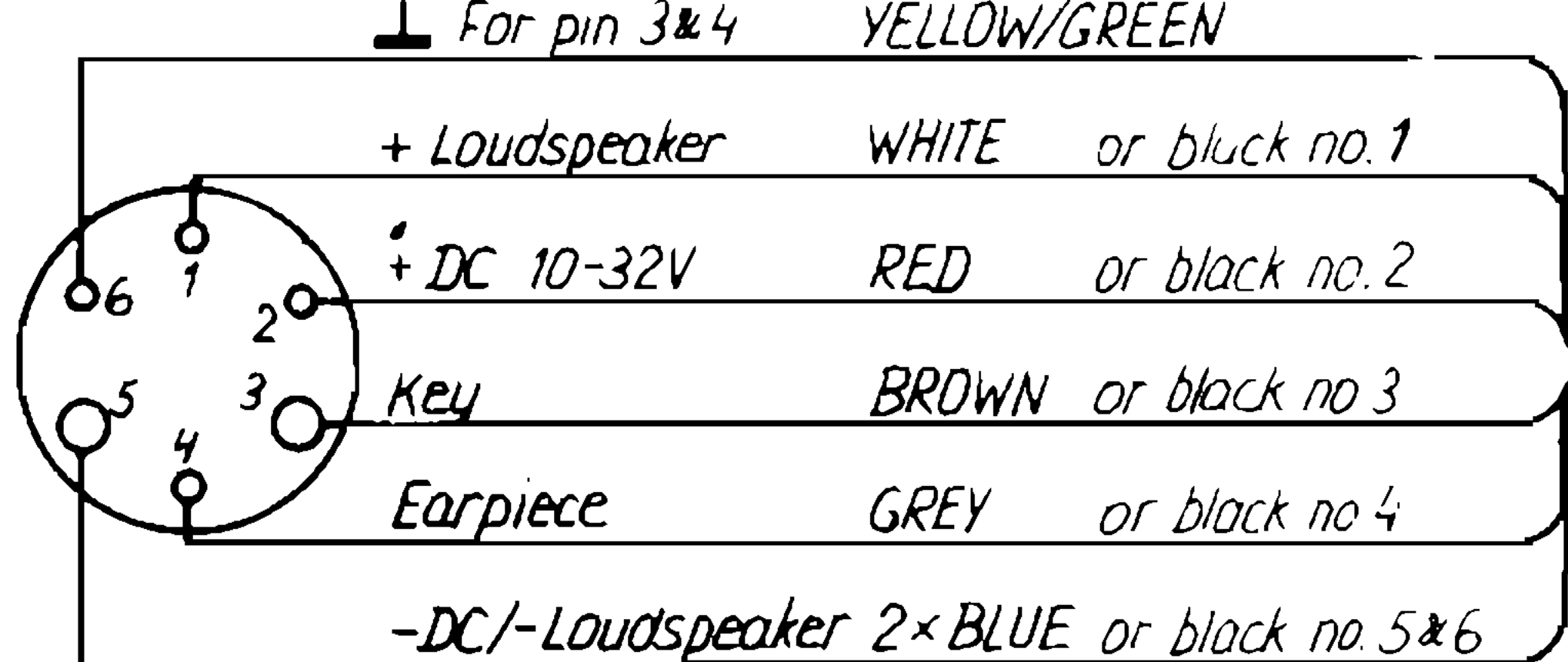
P4-6



POWER SUPPLY (7)



J4-6



POWER CABLE 7x1mm<sup>2</sup>  
To Connection Box H2091, 2

R2022 4-0-24397F

CONTENTS

6. PARTS LIST



POSITION	DESCRIPTION	MANUFACTOR	TYPE	S.P. NUMBER	
	MAIN CHASSIS R2022	MODULE 6	ESPERA	CT RECEIVER	802022
VARIOUS	FRONT PLATE R2022	GREEN NYLON COATING	ESPERA	1-0-239816 / 141.554	200261
VARIOUS	KEYBOARD FOIL R2022		ESPERA	1-0-24179D *	200262
VARIOUS	KNOB	Ø35mm	ESPERA	2-0-24376A *	200265
VARIOUS	1/4 BOX KABINET FOR R2022	GREEN NYLON COATING	ESPERA	KABINET R2022 INCL. GROUNDING SCREWS	200533
VARIOUS	BLACK SEALING FOR 1/4 BOX	(THIN)	A.SANDER	TG.0-3-23955	48.570
VARIOUS	BLACK SEALING FOR 1/4 BOX	(WIDE)	A.SANDER	TG.0-3-24522A	48.571
VARIOUS	POWERCABLE R2022	LENGHT 1 METER	ESPERA	500539 POWERCABLE R2022	500539
VARIOUS	COVER FOR KNOB Ø35mm	Ø40-6025/200265	ELMA	040-6025	83.154
VARIOUS	KNOB	10mm	SIFAM	S100.004 BLACK	84.146
VARIOUS	COVER FOR KNOB Ø10mm		SIFAM	C100 BLACK	84.250
VARIOUS	SCREW M3x30mm LHXR A2		HFC	HFC 1876 DIN 966	86.827
VARIOUS	FELT PAD	BLACK Ø9xØ3.5x1mm	OPPENHEJM	PA SORT	89.600
VARIOUS	FELT PAD	BLACK Ø25xØ5.6x1.5mm	OPPENHEJM A/S	TG.1-3-24388A	89.611
-1	FRONT END	R2022 MODULE 1	ESPERA	5-0-24153G	600177
-2	IFamp DET.AGC & AFamp	R2022 MODULE 2	ESPERA	5-0-24096G R2022	600178
-3	FREQUENCY SYNTHESIZER	R2022 MODULE 3	ESPERA	5-0-24057L	600179
-4	PROCESSOR UNIT	R2022 MODULE 4	ESPERA	5-0-24146G R2022	600181
-5	CONVERTER UNIT	R2022 MODULE 5	ESPERA	5-0-24231K	600182
-7	AF amp. & FILTER UNIT	R2022 MODULE 7	ESPERA	5-0-24530H	600381
FP1-6	FERRITE BEAD	Ø3.7xØ1.2x3.5mm GRADE 4B1	PHILIPS	4322 020 34420	35.181
FP2-6	FERRITE BEAD	Ø3.7xØ1.2x3.5mm GRADE 4B1	PHILIPS	4322 020 34420	35.181
FP3-6	FERRITE BEAD	Ø3.7xØ1.2x3.5mm GRADE 4B1	PHILIPS	4322 020 34420	35.181
GL1-6	NEON LAMP	90V 5kA/5A	SIEMENS	B1-C90/20-Q69-X151	45.074
GL2-6	NEON LAMP	90V 5kA/5A	SIEMENS	B1-C90/20-Q69-X151	45.074
J1-4	MEMBRANESWITCH 4+7	11 POLE CONNECTOR	MEKOPRINT *	LEVERES EFTER GODK.PRØVE PRØVE OPBEV.HOS B.K.	44.501
J1-6	COAX SOCKET (FEMALE)	L603/B	BELLING LEE	L603/B	78.445
J2-6	COAX SOCKET (FEMALE)	L603/B	BELLING LEE	L603/B	78.445
J3-6	COAX SOCKET (FEMALE)	L603/B	BELLING LEE	L603/B	78.445
ME1-6	INSTRUMENT	R2022	NKW	KL-243E-19B/9-3-24178B	23.105
P1-6	COAX PLUG (MALE)	RS 299-999	R.S.	RS 299-999 110-177 SORT KAPPE	78.370
P2-6	COAX PLUG (MALE)	RS 299-999	R.S.	RS 299-999 110-177 SORT KAPPE	78.370
P3-6	COAX PLUG (MALE)	RS 299-999	R.S.	RS 299-999 110-177 SORT KAPPE	78.370
P4-6	SUPPLY JACK (FEMALE)	MEK 60 BZ	HIRSCHMANN	973025-100 6 pole Female for Cable	78.309

POSITION	DESCRIPTION	MANUFACTOR	TYPE	S.P. NUMBER	
S1-6	MICROSWITCH	E62-10H PDT	CHERRY	E62-10H PDT	44.025

POSITION	DESCRIPTION	MANUFACTOR	TYPE	S.P. NUMBER	
	CONNECTION BOX H2091	FOR T2031	ESPERA	5-0-24664E	600544
C1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C2	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C3	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C4	CAPACITOR MKT	2.2uF 5% 63V	ERO	MKT1822	11.141
C5	CAPACITOR MKT	1uDF 10% 100VDC	PHILIPS	2222 344 25105	11.079
C6	CAPACITOR MKT	1uDF 10% 100VDC	PHILIPS	2222 344 25105	11.079
D1	DIODE GENERAL PURPOSE	BAV21 200V/0.25A	TFK	BAV21	25.340
L1	CHOKE	700 OHM / 15 MHZ	SIEMENS*	B82114-R-A3	20.052
L2	CHOKE	700 OHM / 15 MHZ	SIEMENS*	B82114-R-A3	20.052
P2	PLUG (MALE)	5 POLE	AMP	0-826375-5	78.105
R1	RESISTOR MF	82k OHM 5% 0.4W	PHILIPS	2322 181 53823	01.247
R2	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R3	RESISTOR MF	47k OHM 5% 0.4W	PHILIPS	2322 181 53473	01.241
R4	RESISTOR MF	150 OHM 5% 0.4W	PHILIPS	2322 181 53151	01.179
R5	RESISTOR MF	22 OHM 5% 0.4W	PHILIPS	2322 181 53229	01.158
RE1	RELAY	12VDC 1SH. 2A.	MILTRONIC AB	OUC-S-112D	21.300
T1	TRANSISTOR AF	BC548 NPN T0-92	PHILIPS	BC548 (-A/-B/-C)	28.070
T2	TRANSISTOR AF	BC548 NPN T0-92	PHILIPS	BC548 (-A/-B/-C)	28.070

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	CONNECTION BOX H2093	FOR T12X	ESPERA	5-0-24963	600784
C1	CAPACITOR MKT	1uF 10% 63V	ERO*	MKT1818	11.138
C2	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C3	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C4	CAPACITOR MKT	1uF 10% 63V	ERO*	MKT1818	11.138
C5	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C6	CAPACITOR ELECTROLYTIC	22uF 20% 35VDC	ELNA	RJ2-35-V-220-M-T12	14.516
C7	CAPACITOR MKT	0.22uF 10% 63V	ERO*	MKT1818	11.090
C8	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C9	CAPACITOR ELECTROLYTIC	22uF 20% 35VDC	ELNA	RJ2-35-V-220-M-T12	14.516
C10	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C11	CAPACITOR MKT	0.22uF 10% 63V	ERO*	MKT1818	11.090
C12	CAPACITOR CERAMIC	1nF 10% 400V	FERROPERM	9/0129-9	16.098
C13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C14	CAPACITOR MKT	680nF 20% 63V	ERO	MKT1818	11.092
C15	CAPACITOR MKT	22nF 10% 100VDC	PHILIPS	2222 370 88223	11.175
C16	CAPACITOR MKT	0.22uF 10% 63V	ERO*	MKT1818	11.090
C17	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C18	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C19	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C20	CAPACITOR MKT	22nF 10% 100VDC	PHILIPS	2222 370 88223	11.175
C21	CAPACITOR MKT	0.22uF 10% 63V	ERO*	MKT1818	11.090
D1	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D3	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
FP1	FERRITE BEAD	HZ 4.2/2.1/7 G K1201	KASCHKE	HZ 4.2/2.1/7 G K1201 405 442 075 021	35.011
IC1	INTEGRATED CIRCUIT	74LS123N	TEXAS	74LS123N	33.872
IC2	AF POWER AMPLIFIER	TDA 2030 HORIZONTAL	TFK	TDA 2030 H	31.484
IC3	VOLTAGE REGULATOR	FIXED 5V/1A	MOTOROLA	MC7805CT	31.250
J2	PLUG (FEMALE)	MEB 60HDK	HIRSCHMANN	973353-100DK 6 pole Female for Chassis	78.316
OC1	OPTO COUPLER	CNY17-2	TOSHIBA	CNY 17-2	32.530
P1	PLUG	6 POLES	HIRSCHMANN	973 021-100 6 pole Male for Chassis	78.311

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R1	RESISTOR MF	22k OHM 5% 0.4W	PHILIPS	2322 181 53223	01.233
R2	RESISTOR MF	22k OHM 5% 0.4W	PHILIPS	2322 181 53223	01.233
R3	RESISTOR MF	470k OHM 5% 0.4W	PHILIPS	2322 181 53474	01.266
R4	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R5	RESISTOR MF	47k OHM 5% 0.4W	PHILIPS	2322 181 53473	01.241
R6	RESISTOR MF	1 OHM 5% 0.4W	PHILIPS	2322 181 53108	01.125
R7	RESISTOR MF	47k OHM 5% 0.4W	PHILIPS	2322 181 53473	01.241
R8	RESISTOR MF	470k OHM 5% 0.4W	PHILIPS	2322 181 53474	01.266
R9	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R10	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222	01.208
R11	RESISTOR MF	270 OHM 5% 0.4W	PHILIPS	2322 181 53271	01.185
R12	RESISTOR MF	120k OHM 5% 0.4W	PHILIPS	2322 181 53124	01.252
R13	RESISTOR MF	120k OHM 5% 0.4W	PHILIPS	2322 181 53124	01.252
R14	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
R15	POTENTIOMETER TRIMMING	1 KOHM 20% 0.3W	NOBLE	TM8-KV2-1S	07.784
R16	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222	01.208
R17	RESISTOR MF	270 OHM 5% 0.4W	PHILIPS	2322 181 53271	01.185
R18	RESISTOR MF	560 OHM 5% 0.4W	PHILIPS	2322 181 53561	01.193
R19	RESISTOR MF	470k OHM 5% 0.4W	PHILIPS	2322 181 53474	01.266
L1	CHOKE	TL079	ESPERA	TL079	400079
ST1			*PTR	AK300/6b m.MESS.SKRUER	81.016
ST2	SUPPLY TERMINAL BLOCK	3 POLE	PHONIX	MKDS 3/3-5-1711039	81.031
T1	TRANSISTOR AF	BC548B NPN TO-92	PHILIPS	BC548B	28.076
T2	TRANSISTOR AF	BC548B NPN TO-92	PHILIPS	BC548B	28.076
TR1	TRANSFORMER	6598	SCANELECTRIC	TD6598	22.501

POSITION	DESCRIPTION	MANUFACTOR	TYPE	S.P.NUMBER	
	FRONT END	R2022 MODULE 1	ESPERA	5-0-24153G	600177
C1-1	CAPACITOR CERAMIC	10pF 10% 400V	FERROPERM	9/0112,9	15.566
C2-1	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C3-1	CAPACITOR TRIMMING	9-300pF	DAU	016.8601.300	17.252
C5-1	CAPACITOR POLYSTYRENE	261pF 1% 630V	*PHILIPS	2222 431 82611	10.412
C6-1	CAPACITOR POLYSTYRENE	3.9nF 1% 63V	*PHILIPS	2222 428 83902	10.215
C7-1	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C9-1	CAPACITOR MKT	22nF 5% 250VDC	PHILIPS	2222 371 49223	11.174
C10-1	CAPACITOR POLYSTYRENE	1.5nF 1% 160V	*PHILIPS	2222 429 81502	10.280
C11-1	CAPACITOR POLYSTYRENE	470pF 1% 630VDC	PHILIPS	2222 431 84701	10.429
C12-1	CAPACITOR POLYSTYRENE	1.3nF 1% 160V	*PHILIPS	2222 429 81302	10.279
C13-1	CAPACITOR MKT	150nF 5% 50VDC	ERO	MKT 1826-415/06 4-G	11.181
C14-1	CAPACITOR MKT	0.22uF 10% 63V	ERO*	MKT1818	11.090
C15-1	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C16-1	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C17-1	CAPACITOR POLYSTYRENE	1.3nF 1% 160V	*PHILIPS	2222 429 81302	10.279
C18-1	CAPACITOR POLYSTYRENE	430pF 1% 630VDC	PHILIPS	2222 431 84301	10.428
C19-1	CAPACITOR POLYSTYRENE	91pF 1% 630V	*PHILIPS	2222 431 89109	10.399
C20-1	CAPACITOR MKT	0.22uF 10% 63V	ERO*	MKT1818	11.090
C21-1	CAPACITOR CERAMIC	7p5F +/-0.25pF NPO 50VDC	NKE	DT 330 758S CH 7R5 C 50V FLAT PACK	15.557
C22-1	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C23-1	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C24-1	CAPACITOR POLYSTYRENE	1.3nF 1% 160V	*PHILIPS	2222 429 81302	10.279
C25-1	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C26-1	CAPACITOR POLYSTYRENE	510pF 1% 630V	*PHILIPS	2222 431 85101	10.431
C27-1	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C28-1	CAPACITOR POLYSTYRENE	470pF 1% 630VDC	PHILIPS	2222 431 84701	10.429
C29-1	CAPACITOR POLYSTERENE	120pF 1% 630V	*PHILIPS	2222 431 81201	10.403
C30-1	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C31-1	CAPACITOR POLYSTYRENE	130pF 1% 630VDC	PHILIPS	2222 431 81301	10.404
C32-1	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C33-1	CAPACITOR POLYSTYRENE	91pF 1% 630V	*PHILIPS	2222 431 89109	10.399
C34-1	CAPACITOR MKT	0.22uF 10% 63V	ERO*	MKT1818	11.090
C35-1	CAPACITOR CERAMIC	3p3F +/-0.25pF NPO 500VDC	NKE	DT 350 758L CJ 3R3 C 500V FLAT PACK	15.521
C36-1	CAPACITOR CERAMIC	10pF 5% N150 400V	FERROPERM	9/0116,9	16.113
C37-1	CAPACITOR CERAMIC	56pF 5% NPO	*KCK	HE60SJCH560J	15.111
C38-1	CAPACITOR CERAMIC	470pF 10% 500VDC	NKE	DT35-0465 758L 471BK 500V FLAT PACK	16.095
C39-1	CAPACITOR CERAMIC	56pF 5% NPO	*KCK	HE60SJCH560J	15.111
C40-1	CAPACITOR CERAMIC	470pF 10% 500VDC	NKE	DT35-0465 758L 471BK 500V	16.095

POSITION	DESCRIPTION	MANUFACTOR	TYPE	S.P.NUMBER	
C41-1	CAPACITOR CERAMIC	470pF 10% 500VDC	NKE	DT35-0465 758L 471BK 500V FLAT PACK	16.095
C42-1	CAPACITOR MKT	10nF 20% 100VDC	PHILIPS	2222 370 87103	11.168
C43-1	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C44-1	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C45-1	CAPACITOR CERAMIC	30pF 5% 500V	KCK	HM60SJCH300J	15.064
C46-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C48-1	CAPACITOR CERAMIC	470pF 10% 500VDC	NKE	DT35-0465 758L 471BK 500V FLAT PACK	16.095
C49-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C50-1	CAPACITOR POLYSTYRENE	360pF 1% 630VDC	PHILIPS	2222 431 83601	10.418
C51-1	CAPACITOR MKT	10nF 20% 100VDC	PHILIPS	2222 370 87103	11.168
C52-1	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C53-1	CAPACITOR POLYSTYRENE	180pF 1% 630VDC	PHILIPS	2222 431 81801	10.407
C55-1	CAPACITOR TRIMMING	5-45pF PTFE	DAU	107.5901.045	17.130
C56-1	CAPACITOR MKT	22nF 5% 250VDC	PHILIPS	2222 371 49223	11.174
C57-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C58-1	CAPACITOR MKT	22nF 5% 250VDC	PHILIPS	2222 371 49223	11.174
C59-1	CAPACITOR MKT	22nF 5% 250VDC	PHILIPS	2222 371 49223	11.174
C61-1	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C62-1	CAPACITOR MKT	22nF 5% 250VDC	PHILIPS	2222 371 49223	11.174
C63-1	CAPACITOR CERAMIC	10pF 5% N150 400V	FERROPERM	9/0116,9	16.113
C64-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C65-1	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C66-1	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C67-1	CAPACITOR MKT	10nF 20% 100VDC	PHILIPS	2222 370 87103	11.168
C68-1	CAPACITOR MKT	10nF 20% 100VDC	PHILIPS	2222 370 87103	11.168
C69-1	CAPACITOR MKT	10nF 20% 100VDC	PHILIPS	2222 370 87103	11.168
C70-1	CAPACITOR MKT	10nF 20% 100VDC	PHILIPS	2222 370 87103	11.168
C71	CAPACITOR MKT	150nF 5% 50VDC	ERO	MKT 1826-415/06 4-G	11.181
D1-1	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D2-1	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D3-1	DIODE GENERAL PURPOSE	BAV21 200V/0.25A	TFK	BAV21	25.340
D4-1	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D5-1	DIODE SWITCH	BA243	TFK	BA243	25.386
D6-1	DIODE SWITCH	BA243	TFK	BA243	25.386
D7-1	DIODE SWITCH	BA243	TFK	BA243	25.386
D8-1	DIODE SWITCH	BA243	TFK	BA243	25.386
D9-1	DIODE SWITCH	BA243	TFK	BA243	25.386

R2022 - 07/90



POSITION	DESCRIPTION	MANUFACTOR	TYPE	S.P. NUMBER	
D10-1	DIODE SWITCH	BA243	TFK	BA243	25.386
D11-1	DIODE SWITCH	BA243	TFK	BA243	25.386
D12-1	DIODE SWITCH	BA243	TFK	BA243	25.386
D13-1	DIODE	BB139 QUINT	ITT	BB139 QUINTET	26.140
D14-1	DIODE ZENER	8V2 5% 0.4W	PHILIPS	BZX79C8V2	26.542
D15-1	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D16-1	DIODE	BB139 QUINT	ITT	BB139 QUINTET	26.140
D17-1	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D18-1	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D19-1	DIODE SWITCH	BA243	TFK	BA243	25.386
D20-1	DIODE SWITCH	BA243	TFK	BA243	25.386
D21-1	DIODE SWITCH	BA243	TFK	BA243	25.386
D22-1	DIODE SWITCH	BA243	TFK	BA243	25.386
D23-1	DIODE SWITCH	BA243	TFK	BA243	25.386
D24-1	DIODE SWITCH	BA243	TFK	BA243	25.386
D25-1	DIODE ZENER	4.7V 5% 0.4W	PHILIPS	BZX79C4V7	26.524
D26-1	DIODE ZENER	4.7V 5% 0.4W	PHILIPS	BZX79C4V7	26.524
D27-1	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D28-1	DIODE SWITCH	BA243	TFK	BA243	25.386
D29-1	DIODE SWITCH	BA243	TFK	BA243	25.386
D30-1	DIODE SWITCH	BA243	TFK	BA243	25.386
FL1-1	CERAMIC FILTER	Fc=10.7MHz +/-30kHz	TDK	FFE-1070-NA	41.511
FL2-1	CRYSTAL FILTER	10.7008MHz	NDK	SP SPEC. C1034	40.028
FL3-1	CRYSTAL FILTER	10.7008MHz	NDK	SP SPEC. C1028	40.027
FP1-1	FERRITE BEAD	Ø3.7xØ1.2x3.5mm GRADE 4B1	PHILIPS	4322 020 34420	35.181
FP2-1	FERRITE BEAD	Ø3.7xØ1.2x3.5mm GRADE 4B1	PHILIPS	4322 020 34420	35.181
FP3-1	FERRITE BEAD	Ø3.7xØ1.2x3.5mm GRADE 4B1	PHILIPS	4322 020 34420	35.181
FP4-1	FERRITE BEAD	Ø3.7xØ1.2x3.5mm GRADE 4B1	PHILIPS	4322 020 34420	35.181
FP5-1	FERRITE BEAD	Ø3.7xØ1.2x3.5mm GRADE 4B1	PHILIPS	4322 020 34420	35.181
FP6-1	FERRITE BEAD	Ø3.7xØ1.2x3.5mm GRADE 4B1	PHILIPS	4322 020 34420	35.181
FP7-1	FERRITE BEAD	Ø3.7xØ1.2x3.5mm GRADE 4B1	PHILIPS	4322 020 34420	35.181
FP8-1	FERRITE BEAD	Ø3.7xØ1.2x3.5mm GRADE 4B1	PHILIPS	4322 020 34420	35.181
FP9-1	FERRITE BEAD	Ø3.7xØ1.2x3.5mm GRADE 4B1	PHILIPS	4322 020 34420	35.181
FP10-1	FERRITE BEAD	Ø3xØ0.7x4mm GRADE 4S2	PHILIPS	4330 030 32360	35.187
FP11-1	FERRITE BEAD	Ø3xØ0.7x4mm GRADE 4S2	PHILIPS	4330 030 32360	35.187
FP12-1	FERRITE BEAD	Ø3xØ0.7x4mm GRADE 4S2	PHILIPS	4330 030 32360	35.187
IC1-1	INTEGRATED CIRCUIT	QUADRUPLE LINE DRIVER	TEXAS	SN75188N	34.304
IC2-1	INTEGRATED CIRCUIT	QUADRUPLE LINE DRIVER	TEXAS	SN75188N	34.304
L1-1	COIL	TL261	S.P.RADIO	6-0-21662B	400261
L2-1	COIL	TL409	ESPERA	6-0-24241	400409
L3-1	COIL	TL261	S.P.RADIO	6-0-21662B	400261
L4-1	CHOKE FIXED	390uH 5% SD75	NEOSID	00 6122 19	20.188
L5-1	CHOKE FIXED	10mH 5%	NEOSID	AMMO PACK 00 6122 36	20.215

POSITION	DESCRIPTION	MANUFACTOR	TYPE	S.P. NUMBER	
L6-1	CHOKE FIXED	100uH 5%	NEOSID	AMMO PACK 00 6122 12	20.169
L7-1	CHOKE FIXED	39uH 5%	NEOSID	AMMO PACK 00 6122 07	20.193
L8-1	CHOKE FIXED	270uH 5%	NEOSID	AMMO PACK 00 6122 17	20.187
L9-1	CHOKE FIXED	82uH 5%	NEOSID	AMMO PACK 00 6122 11	20.168
L10-1	CHOKE FIXED	27uH 5%	NEOSID	AMMO PACK 00 6122 05	20.191
L11-1	CHOKE FIXED	470uH 5%	NEOSID	AMMO PACK 00 6122 20	20.186
L12-1	CHOKE FIXED	100uH 5%	NEOSID	AMMO PACK 00 6122 12	20.169
L13-1	CHOKE FIXED	39uH 5%	NEOSID	AMMO PACK 00 6122 07	20.193
L14-1	CHOKE FIXED	27uH 5%	NEOSID	AMMO PACK 00 6122 05	20.191
L15-1	CHOKE FIXED	27uH 5%	NEOSID	AMMO PACK 00 6122 05	20.191
OC1-1	OPTOCOUPLER	OPB-825	OPTRON-INC.	OPB-825	32.520
OC2-1	OPTOCOUPLER	OPB-825	OPTRON-INC.	OPB-825	32.520
P1-1	PLUG (MALE)	10 POLE	AMP	1-826375-0	78.110
P2-1	PLUG (MALE)	10 POLE	AMP	1-826375-0	78.110
R1-1	RESISTOR MF	100k OHM 5% 0.4W	PHILIPS	2322 181 53104	01.250
R2-1	RESISTOR MF	100k OHM 5% 0.4W	PHILIPS	2322 181 53104	01.250
R3-1	RESISTOR PMF	15 OHM 5% 3W	PHILIPS	2322 192 31509	04.654
R4-1	RESISTOR MF	120 OHM 5% 0.4W	PHILIPS	2322 181 53121	01.177
R5-1	RESISTOR MF	6k8 OHM 5% 0.4W	PHILIPS	2322 181 53682	01.220
R6-1	RESISTOR PMF	15 OHM 5% 3W	PHILIPS	2322 192 31509	04.654
R7-1	RESISTOR MF	180 OHM 5% 0.4W	PHILIPS	2322 181 53181	01.181
R8-1	RESISTOR MF	6k8 OHM 5% 0.4W	PHILIPS	2322 181 53682	01.220
R9-1	RESISTOR MF	56k OHM 5% 0.4W	PHILIPS	2322 181 53563	01.243
R10-1	RESISTOR MF	6k8 OHM 5% 0.4W	PHILIPS	2322 181 53682	01.220
R11-1	RESISTOR MF	68k OHM 5% 0.4W	PHILIPS	2322 181 53683	01.245
R12-1	RESISTOR MF	3k9 OHM 5% 0.4W	PHILIPS	2322 181 53392	01.214
R13-1	RESISTOR MF	3k9 OHM 5% 0.4W	PHILIPS	2322 181 53392	01.214
R14-1	RESISTOR MF	3k9 OHM 5% 0.4W	PHILIPS	2322 181 53392	01.214
R15-1	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R16-1	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R17-1	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R18-1	RESISTOR MF	2k7 OHM 5% 0.4W	PHILIPS	2322 181 53272	01.210
R19-1	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P. NUMBER
R20-1	RESISTOR MF	33k OHM 5% 0.4W	PHILIPS	2322 181 53333	01.237
R21-1	RESISTOR MF	12k OHM 5% 0.4W	PHILIPS	2322 181 53123	01.227
R22-1	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R23-1	RESISTOR MF	680 OHM 5% 0.4W	PHILIPS	2322 181 53681	01.195
R25-1	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R26-1	RESISTOR MF	5k6 OHM 5% 0.4W	PHILIPS	2322 181 53562	01.218
R27-1	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
R28-1	RESISTOR MF	470 OHM 5% 0.4W	PHILIPS	2322 181 53471	01.191
R29-1	RESISTOR MF	470k OHM 5% 0.4W	PHILIPS	2322 181 53474	01.266
R30-1	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
R31-1	RESISTOR MF	33k OHM 5% 0.4W	PHILIPS	2322 181 53333	01.237
R32-1	RESISTOR MF	56k OHM 5% 0.4W	PHILIPS	2322 181 53563	01.243
R33-1	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R35-1	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
R36-1	RESISTOR MF	470 OHM 5% 0.4W	PHILIPS	2322 181 53471	01.191
R37-1	RESISTOR MF	1k5 OHM 5% 0.4W	PHILIPS	2322 181 53152	01.204
R38-1	RESISTOR MF	100k OHM 5% 0.4W	PHILIPS	2322 181 53104	01.250
R41-1	RESISTOR MF	3k3 OHM 5% 0.4W	PHILIPS	2322 181 53332	01.212
R42-1	RESISTOR MF	3k3 OHM 5% 0.4W	PHILIPS	2322 181 53332	01.212
R44-1	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R45-1	RESISTOR MF	330 OHM 5% 0.4W	PHILIPS	2322 181 53331	01.187
R46-1	RESISTOR MF	1k5 OHM 5% 0.4W	PHILIPS	2322 181 53152	01.204
R47-1	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R48-1	RESISTOR MF	68k OHM 5% 0.4W	PHILIPS	2322 181 53683	01.245
R49-1	RESISTOR MF	1k5 OHM 5% 0.4W	PHILIPS	2322 181 53152	01.204
R50-1	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R51-1	RESISTOR MF	56k OHM 5% 0.4W	PHILIPS	2322 181 53563	01.243
R52-1	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R53-1	RESISTOR MF	620 OHM 5% 0.4W	PHILIPS	2322 181 53621	01.194
R54-1	RESISTOR MF	180 OHM 5% 0.4W	PHILIPS	2322 181 53181	01.181
R55-1	RESISTOR MF	100k OHM 5% 0.4W	PHILIPS	2322 181 53104	01.250
R56-1	RESISTOR MF	750 OHM 5% 0.4W	PHILIPS	2322 181 53751	01.196
R58-1	RESISTOR MF	220 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-220R	01.683
R59-1	RESISTOR MF	56 OHM 5% 0.4W	PHILIPS	2322 181 53569	01.168
R 60-1	RESISTOR MF	3k9 OHM 5% 0.4W	PHILIPS	2322 181 53392	01.214
RE1-1	RELAY	12VDC 2A 2SHIFT	ERNI	REL35-A1-2W1.0P-12VDC	21.193
RE2-1	RELAY	LZ12H-12V	TAKAMISAWA	LZ12H-12V	21.136
T1-1	TRANSISTOR AF	BC548 NPN T0-92	PHILIPS	BC548 (-A/-B/-C)	28.070
T2-1	TRANSISTOR AF	BC548 NPN T0-92	PHILIPS	BC548 (-A/-B/-C)	28.070
T3-1	TRANSISTOR AF	BC548 NPN T0-92	PHILIPS	BC548 (-A/-B/-C)	28.070
T4-1	TRANSISTOR	BF479	AEG*	BF479	28.198
T5-1	TRANSISTOR AF	BC558 PNP T0-92	PHILIPS	BC558 (-A/-B/-C)	28.095
T6-1	TRANSISTOR SELECTED	TIS 88 A2 IN PAIR	ESPERA	C1066A	700315
T7-1	TRANSISTOR SELECTED	TIS 88 A2 IN PAIR	ESPERA	C1066A	700315

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P. NUMBER
T8-1	TRANSISTOR AF	BC548 NPN T0-92	PHILIPS	BC548 (-A/-B/-C)	28.070
T9-1	TRANSISTOR SELECTED	TIS 88 A2 IN PAIR	ESPERA	C1066A	700315
T10-1	TRANSISTOR SELECTED	TIS 88 A2 IN PAIR	ESPERA	C1066A	700315
TR1-1	TRANSFORMER	0.2uH ADJUSTABLE	MITSUMI*	R12-E517-X	38.421
TR2-1	COIL	TL408	ESPERA	6-0-24244	400408
TR3-1	COIL	TL454	ESPERA	6-0-24980	400454
TR4-1	COIL	TL407	ESPERA	6-0-24246A	400407
TR5-1	TRANSFORMER	0.61uH ADJUSTABLE	MITSUMI*	R12-E518-A	38.422
TR6-1	TRANSFORMER	0.2uH ADJUSTABLE	MITSUMI*	R12-E517-X	38.421

R2022 - 07/90



POSITION	DESCRIPTION	MANUFACTOR	TYPE	S.P.NUMBER	
	IFamp DET.AGC & AFamp	R2022 MODULE 2	ESPERA	5-0-240966 R2022	600178
C1-2	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C2-2	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C3-2	CAPACITOR CERAMIC	470pF 10% 500VDC	NKE	DT35-0465 758L 471BK 500V FLAT PACK	16.095
C4-2	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C5-2	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C6-2	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C7-2	CAPACITOR CERAMIC	470pF 10% 500VDC	NKE	DT35-0465 758L 471BK 500V FLAT PACK	16.095
C8-2	CAPACITOR CERAMIC	470pF 10% 500VDC	NKE	DT35-0465 758L 471BK 500V FLAT PACK	16.095
C9-2	CAPACITOR CERAMIC	470pF 10% 500VDC	NKE	DT35-0465 758L 471BK 500V FLAT PACK	16.095
C10-2	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C11-2	CAPACITOR MKT	10nF 20% 100VDC	PHILIPS	2222 370 87103	11.168
C12-2	CAPACITOR MKT	10nF 20% 100VDC	PHILIPS	2222 370 87103	11.168
C13-2	CAPACITOR CERAMIC	470pF 10% 500VDC	NKE	DT35-0465 758L 471BK 500V FLAT PACK	16.095
C14-2	CAPACITOR MKT	10nF 20% 100VDC	PHILIPS	2222 370 87103	11.168
C15-2	CAPACITOR MKT	10nF 20% 100VDC	PHILIPS	2222 370 87103	11.168
C16-2	CAPACITOR MKT	220nF 20% 63VDC	SIEMENS	B32529-A224-M-289	11.183
C17-2	CAPACITOR CERAMIC	470pF 10% 500VDC	NKE	DT35-0465 758L 471BK 500V FLAT PACK	16.095
C18-2	CAPACITOR ELECTROLYTIC	47uF 20% 25VDC	ELNA	RJ2-25-V-470-M-T12	14.524
C19-2	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C20-2	CAPACITOR MKT	150nF 5% 50VDC	ERO	MKT 1826-415/06 4-G	11.181
C21-2	CAPACITOR MKT	22nF 5% 100VDC	PHILIPS	2222 370 89223	11.169
C22-2	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C23-2	CAPACITOR MKT	220nF 20% 63VDC	SIEMENS	B32529-A224-M-289	11.183
C24-2	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C25-2	CAPACITOR CERAMIC	470pF 10% 500VDC	NKE	DT35-0465 758L 471BK 500V FLAT PACK	16.095
C26-2	CAPACITOR CERAMIC	470pF 10% 500VDC	NKE	DT35-0465 758L 471BK 500V FLAT PACK	16.095

POSITION	DESCRIPTION	MANUFACTOR	TYPE	S.P.NUMBER	
C27-2	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C28-2	CAPACITOR CERAMIC	470pF 10% 500VDC	NKE	DT35-0465 758L 471BK 500V FLAT PACK	16.095
C29-2	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C30-2	CAPACITOR MKT	10nF 20% 100VDC	PHILIPS	2222 370 87103	11.168
C32-2	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C33-2	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C34-2	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C35-2	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C36-2	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C37-2	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C38-2	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C39-2	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C40-2	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C41-2	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C42-2	CAPACITOR MKT	1uF 10% 63V	ERO*	MKT1818	11.138
C43-2	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C44-2	CAPACITOR CERAMIC	150pF 20% 400V	FERROPERM	9/0129-9	16.081
C45-2	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C46-2	CAPACITOR MKT	3.3nF 10% 630V	ERO	MKT1818	11.144
C47-2	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C48-2	CAPACITOR POLYSTYRENE	820pF 1% 250VDC	PHILIPS	2222 430 88201	10.348
C49-2	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C50-2	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C51-2	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EB 00 FB 310 E B5	14.558
C52-2	CAPACITOR MKT	330nF 10% 63VDC	PHILIPS	2222 371 18334	11.122
C53-2	CAPACITOR POLYSTYRENE	240pF 1% 630VDC	PHILIPS	2222 431 82401	10.410
C54-2	CAPACITOR POLYSTYRENE	82pF 1% 630V	*PHILIPS	2222 431 88209	10.398
C55-2	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C56-2	CAPACITOR POLYSTYRENE	1nF 1% 160VDC	PHILIPS	2222 429 81102	10.351
C57-2	CAPACITOR MKT	0.22uF 10% 63V	ERO*	MKT1818	11.090

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
C58-2	CAPACITOR MKT	10nF 5% 250VDC	PHILIPS	2222 371 49103	11.167
C59-2	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C61-2	CAPACITOR POLYSTYRENE	2nF 1% 160V	*PHILIPS	2222 429 82002	10.283
C62-2	CAPACITOR POLYSTYRENE	180pF 1% 630VDC	PHILIPS	2222 431 81801	10.407
C63-2	CAPACITOR MKT	330nF 10% 63VDC	PHILIPS	2222 371 18334	11.122
C64-2	CAPACITOR MKT	10nF 5% 250VDC	PHILIPS	2222 371 49103	11.167
C65-2	CAPACITOR MKT	10nF 5% 250VDC	PHILIPS	2222 371 49103	11.167
C66-2	CAPACITOR MKT	10nF 5% 250VDC	PHILIPS	2222 371 49103	11.167
C67-2	CAPACITOR MKT	33nF 5% 250V	ERO	MKT1818	11.172
C68-2	CAPACITOR MKT	33nF 5% 250V	ERO	MKT1818	11.172
C69-2	CAPACITOR MKT	33nF 5% 250V	ERO	MKT1818	11.172
C70-2	CAPACITOR CERAMIC	1.8nF -20/+80% 400V	FERROPERM	9/0141-9	15.735
C71-2	CAPACITOR MKT	220nF 20% 63VDC	SIEMENS	B32529-A224-M-289	11.183
D1-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D2-2	DIODE PIN	BA4795	AEG	BA4795	25.395
D3-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D4-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D5-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D6-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D7-2	DIODE ZENER	12V 5% 0.4W BZX79C12	PHILIPS*	BZX79C12	26.554
D8-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D9-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D10-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D11-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D12-2	DIODE ZENER	4.7V 5% 0.4W	PHILIPS	BZX79C4V7	26.524
D13-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D14-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D15-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D16-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D17-2	DIODE SWITCH	BA243	TFK	BA243	25.386
D18-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D19-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D20-2	DIODE SWITCH	BA243	TFK	BA243	25.386
D21-2	DIODE SWITCH	BA243	TFK	BA243	25.386
D22-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D23-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D24-2	DIODE SWITCH	BA243	TFK	BA243	25.386
FL1-2	CERAMIC FILTER	Fc=10.7MHz +/-30kHz	TDK	FFE-1070-NA	41.511
FP1-2	FERRITE BEAD	Ø3.7xØ1.2x3.5mm GRADE 4B1	PHILIPS	4322 020 34420	35.181
FP2-2	FERRITE BEAD	Ø3.7xØ1.2x3.5mm GRADE 4B1	PHILIPS	4322 020 34420	35.181
FP3-2	FERRITE BEAD	Ø3.7xØ1.2x3.5mm GRADE 4B1	PHILIPS	4322 020 34420	35.181
IC1-2	QUAD OP.AMP.	324	TEXAS	LM324N	31.065
IC2-2	INTEGRATED CIRCUIT	SL1612	PLESSEY	SL1612 C DP	31.532
IC3-2	INTEGRATED CIRCUIT	SL1612	PLESSEY	SL1612 C DP	31.532

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
IC4-2	INTEGRATED CIRCUIT	MC1413P	TEXAS*	U1N2003A	31.077
IC5-2	FM IF SYSTEM	3189	RCA	CA3189E	31.752
IC6-2	QUAD OP.AMP.	324	TEXAS	LM324N	31.065
IC7-2	INTEGRATED CIRCUIT	MC14016BCP	MOTOROLA*	MC14016BCP	33.084
IC9-2	VOLTAGE REGULATOR	12V 5% 0.1A	MOTOROLA	MC78L12ACP	31.139
L1-2	CHOKE	22uH 5%	NEOSID	006122 04	20.156
L2-2	CHOKE FIXED	33uH 5%	NEOSID	00 6122 06	20.162
L3-2	CHOKE FIXED	22uH 10%	FASTRON	MICCS-220K-02	20.363
L4-2	COIL	2.7uH ADJUSTABLE	MITSUMI	IFT 41M7-D R12-2881-A	38.420
L5-2	COIL	TLO67	S.P.RADIO	6-0-20854A	400067
				400067=20.053	
P1-2	PLUG (MALE)	14 POLE	AMP	1-826375-4	78.114
P2-2	PLUG (MALE)	8 POLE	AMP	0-826375-8	78.108
R1-2	RESISTOR MF	2k7 OHM 5% 0.4W	PHILIPS	2322 181 53272	01.210
R2-2	RESISTOR MF	15k OHM 5% 0.4W	PHILIPS	2322 181 53153	01.229
R3-2	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
R4-2	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R5-2	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R6-2	RESISTOR MF	39k OHM 5% 0.4W	PHILIPS	2322 181 53393	01.239
R7-2	RESISTOR MF	27k OHM 5% 0.4W	PHILIPS	2322 181 53273	01.235
R8-2	RESISTOR MF	15k OHM 5% 0.4W	PHILIPS	2322 181 53153	01.229
R9-2	RESISTOR MF	5k6 OHM 5% 0.4W	PHILIPS	2322 181 53562	01.218
R10-2	RESISTOR MF	510 OHM 5% 0.4W	PHILIPS	2322 181 53511	01.192
R11-2	RESISTOR MF	3k3 OHM 5% 0.4W	PHILIPS	2322 181 53332	01.212
R12-2	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
R13-2	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R14-2	RESISTOR MF	3k9 OHM 5% 0.4W	PHILIPS	2322 181 53392	01.214
R15-2	RESISTOR MF	3k3 OHM 5% 0.4W	PHILIPS	2322 181 53332	01.212
R16-2	RESISTOR MF	27k OHM 5% 0.4W	PHILIPS	2322 181 53273	01.235
R17-2	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R18-2	RESISTOR MF	470k OHM 5% 0.4W	PHILIPS	2322 181 53474	01.266
R19-2	RESISTOR MF	47k OHM 5% 0.4W	PHILIPS	2322 181 53473	01.241
R20-2	RESISTOR MF	120k OHM 5% 0.4W	PHILIPS	2322 181 53124	01.252
R21-2	RESISTOR MF	2M7 OHM 5% 0.4W	PHILIPS	2322 181 53275	01.285
R22-2	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
R23-2	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
R24-2	RESISTOR MF	470 OHM 5% 0.4W	PHILIPS	2322 181 53471	01.191
R25-2	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R26-2	RESISTOR MF	100k OHM 5% 0.4W	PHILIPS	2322 181 53104	01.250
R27-2	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
R28-2	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R29-2	RESISTOR MF	100k OHM 5% 0.4W	PHILIPS	2322 181 53104	01.250
R30-2	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175

R2022 - 07/90



POSITION	DESCRIPTION	MANUFACTOR	TYPE	S.P. NUMBER
R31-2	RESISTOR MF	47k OHM 5% 0.4W	PHILIPS	2322 181 53473 01.241
R32-2	RESISTOR MF	470 OHM 5% 0.4W	PHILIPS	2322 181 53471 01.191
R33-2	RESISTOR MF	5k6 OHM 5% 0.4W	PHILIPS	2322 181 53562 01.218
R34-2	RESISTOR MF	47 OHM 5% 0.4W	PHILIPS	2322 181 53479 01.166
R35-2	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101 01.175
R36-2	RESISTOR MF	15k OHM 5% 0.4W	PHILIPS	2322 181 53153 01.229
R37-2	RESISTOR MF	5k6 OHM 5% 0.4W	PHILIPS	2322 181 53562 01.218
R38-2	RESISTOR MF	100k OHM 5% 0.4W	PHILIPS	2322 181 53104 01.250
R39-2	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472 01.216
R40-2	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102 01.200
R41-2	RESISTOR MF	330 OHM 5% 0.4W	PHILIPS	2322 181 53331 01.187
R42-2	RESISTOR MF	27 OHM 5% 0.4W	PHILIPS	2322 181 53279 01.160
R43-2	RESISTOR MF	680 OHM 5% 0.4W	PHILIPS	2322 181 53681 01.195
R44-2	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103 01.225
R45-2	RESISTOR MF	470 OHM 5% 0.4W	PHILIPS	2322 181 53471 01.191
R46-2	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103 01.225
R47-2	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101 01.175
R48-2	RESISTOR MF	330 OHM 5% 0.4W	PHILIPS	2322 181 53331 01.187
R49-2	RESISTOR MF	12k OHM 5% 0.4W	PHILIPS	2322 181 53123 01.227
R50-2	RESISTOR MF	15k OHM 5% 0.4W	PHILIPS	2322 181 53153 01.229
R51-2	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102 01.200
R52-2	RESISTOR MF	680 OHM 5% 0.4W	PHILIPS	2322 181 53681 01.195
R53-2	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101 01.175
R54-2	RESISTOR MF	1k8 OHM 5% 0.4W	PHILIPS	2322 181 53182 01.206
R55-2	RESISTOR MF	47 OHM 5% 0.4W	PHILIPS	2322 181 53479 01.166
R56-2	RESISTOR MF	47 OHM 5% 0.4W	PHILIPS	2322 181 53479 01.166
R57-2	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222 01.208
R58-2	RESISTOR MF	8k2 OHM 5% 0.4W	PHILIPS	2322 181 53822 01.222
R59-2	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103 01.225
R60-2	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103 01.225
R61-2	RESISTOR MF	2k7 OHM 5% 0.4W	PHILIPS	2322 181 53272 01.210
R62-2	RESISTOR MF	47k OHM 5% 0.4W	PHILIPS	2322 181 53473 01.241
R63-2	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222 01.208
R64-2	RESISTOR MF	2k7 OHM 5% 0.4W	PHILIPS	2322 181 53272 01.210
R65-2	RESISTOR MF	2k7 OHM 5% 0.4W	PHILIPS	2322 181 53272 01.210
R66-2	RESISTOR MF	2k7 OHM 5% 0.4W	PHILIPS	2322 181 53272 01.210
R67-2	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472 01.216
R68-2	RESISTOR MF	2k7 OHM 5% 0.4W	PHILIPS	2322 181 53272 01.210
R69-2	RESISTOR MF	2k7 OHM 5% 0.4W	PHILIPS	2322 181 53272 01.210
R70-2	RESISTOR MF	47k OHM 5% 0.4W	PHILIPS	2322 181 53473 01.241
R71-2	RESISTOR MF	47k OHM 5% 0.4W	PHILIPS	2322 181 53473 01.241
R72-2	RESISTOR MF	47k OHM 5% 0.4W	PHILIPS	2322 181 53473 01.241
R73-2	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103 01.225
R74-2	RESISTOR MF	150 OHM 5% 0.4W	PHILIPS	2322 181 53151 01.179

POSITION	DESCRIPTION	MANUFACTOR	TYPE	S.P. NUMBER
R75-2	RESISTOR MF	100k OHM 5% 0.4W	PHILIPS	2322 181 53104 01.250
R76-2	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103 01.225
R77-2	RESISTOR MF	470k OHM 5% 0.4W	PHILIPS	2322 181 53474 01.266
R78-2	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103 01.225
R79-2	RESISTOR MF	91k OHM 5% 0.4W	PHILIPS	2322 181 53913 01.248
R80-2	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103 01.225
R81-2	RESISTOR MF	470k OHM 5% 0.4W	PHILIPS	2322 181 53474 01.266
R82-2	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103 01.225
R83-2	RESISTOR MF	51k OHM 5% 0.4W	PHILIPS	2322 181 53513 01.242
R84-2	RESISTOR MF	91k OHM 5% 0.4W	PHILIPS	2322 181 53913 01.248
R85-2	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101 01.175
R86-2	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102 01.200
R87-2	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103 01.225
R88-2	RESISTOR MF	91k OHM 5% 0.4W	PHILIPS	2322 181 53913 01.248
R89-2	RESISTOR MF	560 OHM 5% 0.4W	PHILIPS	2322 181 53561 01.193
R91-2	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472 01.216
R92-2	RESISTOR MF	47k OHM 5% 0.4W	PHILIPS	2322 181 53473 01.241
R93-2	RESISTOR MF	15k OHM 5% 0.4W	PHILIPS	2322 181 53153 01.229
R96-2	RESISTOR MF	91k OHM 5% 0.4W	PHILIPS	2322 181 53913 01.248
R97-2	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101 01.175
R99-2	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102 01.200
R100-2	RESISTOR MF	91k OHM 5% 0.4W	PHILIPS	2322 181 53913 01.248
R101-2	RESISTOR MF	15k OHM 5% 0.4W	PHILIPS	2322 181 53153 01.229
R102-2	RESISTOR MF	560k OHM 5% 0.4W	PHILIPS	2322 181 53564 01.268
R103-2	RESISTOR MF	20k OHM 5% 0.4W	PHILIPS	2322 181 53203 01.232
R104-2	RESISTOR MF	470k OHM 5% 0.4W	PHILIPS	2322 181 53474 01.266
R105-2	RESISTOR MF	15k OHM 5% 0.4W	PHILIPS	2322 181 53153 01.229
R106-2	RESISTOR MF	47k OHM 5% 0.4W	PHILIPS	2322 181 53473 01.241
R107-2	RESISTOR MF	1M2 OHM 5% 0.4W	PHILIPS	2322 181 53125 01.277
R109-2	RESISTOR MF	39k OHM 5% 0.4W	PHILIPS	2322 181 53393 01.239
R110-2	RESISTOR MF	430k OHM 5% 0.4W	PHILIPS	2322 181 53434 01.265
R111-2	RESISTOR MF	15k OHM 5% 0.4W	PHILIPS	2322 181 53153 01.229
R112-2	RESISTOR MF	3k3 OHM 5% 0.4W	PHILIPS	2322 181 53332 01.212
R113-2	RESISTOR MF	560 OHM 5% 0.4W	PHILIPS	2322 181 53561 01.193
R114-2	RESISTOR MF	2k7 OHM 5% 0.4W	PHILIPS	2322 181 53272 01.210
R115-2	RESISTOR MF	7k5 OHM 5% 0.4W	PHILIPS	2322 181 53752 01.221
R116-2	RESISTOR MF	5k1 OHM 5% 0.4W	PHILIPS	2322 181 53512 01.217
T1-2	TRANSISTOR AF	BC548 NPN TO-92	PHILIPS	BC548 (-A/-B/-C) 28.070
T2-2	TRANSISTOR	BC548C	MOTOROLA*	BC548C 28.079
T3-2	TRANSISTOR	BF199	PHILIPS	BF199 28.179
T4-2	TRANSISTOR AF	BC558 PNP TO-92	PHILIPS	BC558 (-A/-B/-C) 28.095
T5-2	TRANSISTOR	BF199	PHILIPS	BF199 28.179
T6-2	TRANSISTOR	BF199	PHILIPS	BF199 28.179
T7-2	TRANSISTOR AF	BC548 NPN TO-92	PHILIPS	BC548 (-A/-B/-C) 28.070

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P. NUMBER
T8-2	TRANSISTOR AF	BC548 NPN T0-92	PHILIPS	BC548 (-A/-B/-C)	28.070
T9-2	TRANSISTOR AF	BC548 NPN T0-92	PHILIPS	BC548 (-A/-B/-C)	28.070
T10-2	TRANSISTOR AF	BC548 NPN T0-92	PHILIPS	BC548 (-A/-B/-C)	28.070
T12-2	TRANSISTOR AF	BC548 NPN T0-92	PHILIPS	BC548 (-A/-B/-C)	28.070
T13-2	TRANSISTOR	BC548C	MOTOROLA*	BC548C	28.079
T14-2	TRANSISTOR	BC548C	MOTOROLA*	BC548C	28.079
TR1-2	COIL	TL410	ESPERA	6-0-24226B	400410
TR2-2	COIL	TL410	ESPERA	6-0-24226B	400410

R2022 - 07/90

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P. NUMBER
	FREQUENCY SYNTHESIZER	R2022 MODULE 3	ESPERA	5-0-24057L	600179
C1-3	CAPACITOR MKT	470nF 10% 100V	SIEMENS	B32510-D1474-K000	11.231
C2-3	CAPACITOR POLYSTERENE	680pF 1% 250V	*PHILIPS	2222 430 86801	10.346
C3-3	CAPACITOR POLYSTYRENE	62pF 1% 630V	*PHILIPS	2222 431 86209	10.395
C4-3	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C5-3	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C6-3	CAPACITOR TRIMMING	2-18pF PTFE	DAU	107.2901.018	17.100
C8-3	CAPACITOR POLYSTYRENE	470pF 1% 630VDC	PHILIPS	2222 431 84701	10.429
C9-3	CAPACITOR CERAMIC	39pF 5% NPO 50VDC	NKE	DT 350 758L CH 390 J 50V FLAT PACK	15.085
C10-3	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C11-3	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C12-3	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C13-3	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C14-3	CAPACITOR POLYSTYRENE	240pF 1% 630VDC	PHILIPS	2222 431 82401	10.410
C15-3	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C16-3	CAPACITOR POLYSTYRENE	91pF 1% 630V	*PHILIPS	2222 431 89109	10.399
C17-3	CAPACITOR CERAMIC	470pF 10% 500VDC	NKE	DT35-0465 758L 471BK 500V FLAT PACK	16.095
C18-3	CAPACITOR CERAMIC	470pF 10% 500VDC	NKE	DT35-0465 758L 471BK 500V FLAT PACK	16.095
C19-3	CAPACITOR POLYSTYRENE	1.2nF 1% 160V	*PHILIPS	2222 429 81202	10.278
C20-3	CAPACITOR CERAMIC	22pF 5% NPO 500VDC	KCK	RT-HM60 SK CH 220 J AMMO PACK	15.080
C21-3	CAPACITOR CERAMIC	7p5F +/-0.25pF NPO 50VDC	NKE	DT 330 758S CH 7R5 C 50V FLAT PACK	15.557
C22-3	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C23-3	CAPACITOR CERAMIC	470pF 10% 500VDC	NKE	DT35-0465 758L 471BK 500V FLAT PACK	16.095
C24-3	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C25-3	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C26-3	CAPACITOR MKT	10nF 10% 400V	SIEMENS	B32510-D6103-K000	11.381
C27-3	CAPACITOR MKT	10nF 10% 400V	SIEMENS	B32510-D6103-K000	11.381
C28-3	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C29-3	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C30-3	CAPACITOR TANTALUM	10uF 25V 20%	ERO	ETP-3F	14.130
C32-3	CAPACITOR POLYSTYRENE	100pF 1% 630VDC	PHILIPS	2222 431 81001	10.400
C33-3	CAPACITOR CERAMIC	120pF 10% 400V	FERROPERM	97012629	15.755
C34-3	CAPACITOR MKT	470nF 10% 100V	SIEMENS	B32510-D1474-K000	11.231
C35-3	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C36-3	CAPACITOR POLYSTERENE	120pF 1% 630V	*PHILIPS	2222 431 81201	10.403
C37-3	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P. NUMBER
C38-3	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C39-3	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C40-3	CAPACITOR MKT	470nF 10% 100V	SIEMENS	B32510-D1474-K000	11.231
C41-3	CAPACITOR MKT	470nF 10% 100V	SIEMENS	B32510-D1474-K000	11.231
C42-3	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C43-3	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C44-3	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C45-3	CAPACITOR POLYSTYRENE	1n00F 1% 250VDC	PHILIPS	2222 430 81002	10.350
C46-3	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C47-3	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C48-3	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C49-3	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C50-3	CAPACITOR MKT	10nF 10% 400V	SIEMENS	B32510-D6103-K000	11.381
C51-3	CAPACITOR ELECTROLYTIC	4.7uF 20% 50VDC	ELNA	RJ2-50-V-4R7-M-T12	14.510
C52-3	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E 65	14.610
C53-3	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C54-3	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E 65	14.610
C55-3	CAPACITOR CERAMIC	7p5F +/-0.25pF NPO 50VDC	NKE	DT 330 758S CH 7R5 C 50V FLAT PACK	15.557
C56-3	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C57-3	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E 65	14.610
C58-3	CAPACITOR POLYPROPYLENE	100pF 1% 630V	SIEMENS	B33063-B6101-F7	11.701
C59-3	CAPACITOR POLYSTYRENE	56pF 1% 630V	*PHILIPS	2222 431 85609	10.394
C60-3	CAPACITOR	33pF 1% 630V	SIEMENS	B33063-B6330-F7	11.700
C61-3	CAPACITOR POLYSTYRENE	180pF 1% 630VDC	PHILIPS	2222 431 81801	10.407
C62-3	CAPACITOR POLYSTYRENE	3.3nF 1% 160V	*PHILIPS	2222 429 83302	10.288
C63-3	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C64-3	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C65-3	CAPACITOR MKT	22nF 5% 250VDC	PHILIPS	2222 371 49223	11.174
C66-3	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C67-3	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C69-3	CAPACITOR MKT	1uF 10% 63V	ERO*	MKT1818	11.138
C70-3	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C71-3	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C72-3	CAPACITOR POLYSTYRENE	3nF 1% 160V	*PHILIPS	2222 429 83002	10.287
C73-3	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C74-3	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C75-3	CAPACITOR MKT	1uF 10% 63V	ERO*	MKT1818	11.138
C76-3	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C77-3	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C78-3	CAPACITOR MKT	150nF 10% 100V	SIEMENS	B32510-D1154-K000	11.222
C79-3	CAPACITOR MKT	150nF 10% 100V	SIEMENS	B32510-D1154-K000	11.222
C80-3	CAPACITOR MKT	150nF 10% 100V	SIEMENS	B32510-D1154-K000	11.222
C81-3	CAPACITOR MKT	150nF 10% 100V	SIEMENS	B32510-D1154-K000	11.222

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P. NUMBER
C82-3	CAPACITOR MKT	150nF 10% 100V	SIEMENS	B32510-D1154-K000	11.222
C83-3	CAPACITOR MKT	150nF 10% 100V	SIEMENS	B32510-D1154-K000	11.222
C84-3	CAPACITOR MKT	150nF 10% 100V	SIEMENS	B32510-D1154-K000	11.222
C85-3	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C86-3	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E 65	14.610
C87-3	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C88-3	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C89-3	CAPACITOR MKT	68nF 5% 100V	ERO	MKT1818-368/014	11.177
C90-3	CAPACITOR MKT	10nF 5% 250VDC	PHILIPS	2222 371 49103	11.167
C91-3	CAPACITOR MKT	15nF 5% 250V	ERO	MKT1818	11.170
C92-3	CAPACITOR POLYSTYRENE	180pF 1% 630VDC	PHILIPS	2222 431 81801	10.407
C95-3	CAPACITOR MKT	10nF 20% 100VDC	PHILIPS	2222 370 87103	11.168
C96-3	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C97-3	CAPACITOR MKT	150nF 10% 100V	SIEMENS	B32510-D1154-K000	11.222
C98-3	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32510-D1224-K000	11.225
C99-3	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32510-D1224-K000	11.225
C100-3	CAPACITOR CERAMIC	470pF 10% 500VDC	NKE	DT35-0465 758L 471BK 500V FLAT PACK	16.095
C101-3	CAPACITOR CERAMIC	470pF 10% 500VDC	NKE	DT35-0465 758L 471BK 500V FLAT PACK	16.095
C102-3	CAPACITOR MKT	22nF 5% 100VDC	PHILIPS	2222 370 89223	11.169
D1-3	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D2-3	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D3-3	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D4-3	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D5-3	DIODE ZENER	2V4 5% 0.4W	PHILIPS	BZX79C2V4	26.505
D6-3	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D7-3	DIODE ZENER	5.6V 2% 0.4W	PHILIPS	BZX79B5V6	26.500
D8-3	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D9-3	DIODE	BB139	ITT	BB139	26.130
D10-3	DIODE	BB139	ITT	BB139	26.130
D11-3	DIODE	BB139	ITT	BB139	26.130
D12-3	DIODE	BB139	ITT	BB139	26.130
D13-3	DIODE	BB139	ITT	BB139	26.130
D14-3	DIODE	BB139	ITT	BB139	26.130
D15-3	DIODE	BB139	ITT	BB139	26.130
D16-3	DIODE	BB139	ITT	BB139	26.130
D17-3	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D18-3	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D19-3	DIODE SWITCH	MPN3700	MOTOROLA	MPN3700	26.115
D20-3	DIODE SWITCH	MPN3700	MOTOROLA	MPN3700	26.115
D21-3	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D22-3	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
FP1-3	FERRITE BEAD	HZ 4.2/2.1/7 6 K1201	KASCHKE	HZ 4.2/2.1/7 6 K1201	35.011

R2022 - 07/90



POSITION	DESCRIPTION		MANUFACTURER	TYPE	S.P. NUMBER
FP2-3	FERRITE BEAD	HZ 4.2/2.1/7 G K1201	KASCHKE	405 442 075 021 HZ 4.2/2.1/7 G K1201	35.011
FP3-3	FERRITE BEAD	Ø3.7xØ1.2x3.5mm GRADE 4B1	PHILIPS	4322 020 34420	35.181
FP4-3	FERRITE BEAD	Ø3.7xØ1.2x3.5mm GRADE 4B1	PHILIPS	4322 020 34420	35.181
IC1-3	INTEGRATED CIRCUIT	SN74LS113AN	TEXAS*	SN74LS113AN	33.841
IC2-3	INTEGRATED CIRCUIT	7406N	TEXAS	7406N	33.521
IC3-3	INTEGRATED CIRCUIT	MC3393P	MOTOROLA	MC3393P	31.237
IC4-3	INTEGRATED CIRCUIT	DAC08H	MOTOROLA*	DAC08HP	31.000
IC5-3	INTEGRATED CIRCUIT	74LS377N	TEXAS	74LS377N	34.267
IC6-3	INTEGRATED CIRCUIT	74LS221N	TEXAS*	SN74LS221N	34.180
IC7-3	INTEGRATED CIRCUIT	74LS109N	TEXAS*	SN74LS109AN	33.831
IC8-3	INTEGRATED CIRCUIT	74LS08N	TEXAS*	SN74LS08N	33.527
IC9-3	INTEGRATED CIRCUIT	74LS283N	TEXAS*	74LS283N	34.245
IC10-3	INTEGRATED CIRCUIT	74LS283N	TEXAS*	74LS283N	34.245
IC11-3	INTEGRATED CIRCUIT	74LS221N	TEXAS*	SN74LS221N	34.180
IC12-3	INTEGRATED CIRCUIT	SN74LS290N	TEXAS*	SN74LS290N	34.251
IC13-3	INTEGRATED CIRCUIT	SYNCHR.UP/DOWN BIN.COUNT.	TEXAS	SN74LS669N	34.310
IC14-3	INTEGRATED CIRCUIT	SYNCHR.UP/DOWN BIN.COUNT.	TEXAS	SN74LS669N	34.310
IC15-3	INTEGRATED CIRCUIT	74LS377N	TEXAS	74LS377N	34.267
IC16-3	INTEGRATED CIRCUIT	4BIT SER.INP.PLL SYNTHES	MOTOROLA	MC145146P1	33.490
IC17-3	INTEGRATED CIRCUIT	74F74	FAIRCHILD	IC DIG.TTL 74F74	33.724
IC18-3	VOLTAGE REGULATOR	12V 5% 0.1A	MOTOROLA	MC78L12ACP	31.139
IC19-3	TRANSISTOR ARRAY	3046	NATIONAL	LM3046N	31.025
IC20-3	OPERATIONAL AMPLIFIER	JFET INPUT LF356	NATIONAL	LF356N	31.076
IC21-3	VOLTAGE REGULATOR	ADJUSTABLE I <sub>o</sub> =100mA	TEXAS	TL317CLP	31.145
IC22-3	VOLTAGE REGULATOR	LM337LZ	*NATIONAL	LM337LZ	31.147
IC23-3	OPERATIONAL AMPLIFIER	JFET INPUT LF356	NATIONAL	LF356N	31.076
IC24-3	VOLTAGE REGULATOR	15V 5% 0.1A	MOTOROLA	MC78L15ACP	31.140
IC25-3	VOLTAGE REGULATOR	5V 5% 0.1A	MOTOROLA*	MC78L05ACP	31.135
L1-3	CHOKE FIXED	330nH 10%	FASTRON	MICC-R33K-02	20.107
L2-3	CHOKE FIXED	2u7H 10%	FASTRON	MICC-2R7K-02	20.132
L3-3	CHOKE FIXED	220nH 10%	FASTRON	MICC-R22K-02	20.105
L4-3	CHOKE FIXED	33uH 5%	NEOSID	00 6122 06	20.162
L6-3	CHOKE FIXED	1uH 5%	NEOSID	AMMO PACK 00 6123 23	20.116
L7-3	CHOKE FIXED	2u2H 10%	FRONTIER	1303-17K TAPED	20.128
L8-3	CHOKE FIXED	2u2H 10%	FRONTIER	1303-17K TAPED	20.128
L9-3	COIL	0.2uH ADJUSTABLE	MITSUMI	R12.3266K	38.412
L10-3	COIL	0.425uH ADJUSTABLE	MITSUMI	R12.3255K	38.415
L11-3	COIL	0.125uH ADJUSTABLE	MITSUMI	R12.3267K	38.410

POSITION	DESCRIPTION		MANUFACTURER	TYPE	S.P. NUMBER
L12-3	CHOKE FIXED	10uH 5%	NEOSID	00 6122 00 AMMO PACK	20.118
L13-3	CHOKE FIXED	1uH 5%	NEOSID	00 6123 23 AMMO PACK	20.116
L14-3	CHOKE FIXED	1uH 5%	NEOSID	00 6123 23 AMMO PACK	20.116
L15-3	CHOKE FIXED	1uH 5%	NEOSID	00 6123 23 AMMO PACK	20.116
L16-3	CHOKE FIXED	39uH 5%	NEOSID	00 6122 07 AMMO PACK	20.193
L17-3	CHOKE FIXED	39uH 5%	NEOSID	00 6122 07 AMMO PACK	20.193
L18-3	CHOKE FIXED	39uH 5%	NEOSID	00 6122 07 AMMO PACK	20.193
P1-3	PLUG (MALE)	14 POLE	AMP	1-826375-4	78.114
P2-3	PLUG (MALE)	3 POLE	AMP	0-826375-3	78.103
P3-3	PLUG (MALE)	7 POLE	AMP	0-826375-7	78.107
R1-3	RESISTOR MF	3k6 OHM 5% 0.4W	PHILIPS	2322 181 53362	01.213
R2-3	RESISTOR MF	5R6 OHM 5% 0.4W	PHILIPS	2322 181 53568	01.143
R3-3	RESISTOR MF	91 OHM 5% 0.4W	PHILIPS	2322 181 53919	01.174
R4-3	RESISTOR MF	27k OHM 5% 0.4W	PHILIPS	2322 181 53273	01.235
R5-3	RESISTOR MF	33k OHM 5% 0.4W	PHILIPS	2322 181 53333	01.237
R6-3	RESISTOR MF	750 OHM 5% 0.4W	PHILIPS	2322 181 53751	01.196
R7-3	RESISTOR MF	750 OHM 5% 0.4W	PHILIPS	2322 181 53751	01.196
R8-3	RESISTOR MF	120 OHM 5% 0.4W	PHILIPS	2322 181 53121	01.177
R9-3	RESISTOR MF	270 OHM 5% 0.4W	PHILIPS	2322 181 53271	01.185
R10-3	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R11-3	RESISTOR MF	5k6 OHM 5% 0.4W	PHILIPS	2322 181 53562	01.218
R12-3	RESISTOR MF	22 OHM 5% 0.4W	PHILIPS	2322 181 53229	01.158
R13-3	RESISTOR MF	300 OHM 5% 0.4W	PHILIPS	2322 181 53301	01.186
R14-3	RESISTOR MF	6k8 OHM 5% 0.4W	PHILIPS	2322 181 53682	01.220
R15-3	RESISTOR MF	2k7 OHM 5% 0.4W	PHILIPS	2322 181 53272	01.210
R16-3	RESISTOR MF	1k2 OHM 5% 0.4W	PHILIPS	2322 181 53122	01.202
R17-3	RESISTOR MF	560 OHM 5% 0.4W	PHILIPS	2322 181 53561	01.193
R18-3	RESISTOR MF	5k6 OHM 5% 0.4W	PHILIPS	2322 181 53562	01.218
R19-3	RESISTOR MF	8k2 OHM 5% 0.4W	PHILIPS	2322 181 53822	01.222
R20-3	RESISTOR MF	2k7 OHM 5% 0.4W	PHILIPS	2322 181 53272	01.210
R21-3	RESISTOR MF	10k0 OHM 1% 0.6W	* PHILIPS	2322 156 11003	03.427
R22-3	RESISTOR MF	470 OHM 5% 0.4W	PHILIPS	2322 181 53471	01.191
R23-3	RESISTOR MF	360 OHM 5% 0.4W	PHILIPS	2322 181 53361	01.188
R24-3	RESISTOR MF	3k3 OHM 5% 0.4W	PHILIPS	2322 181 53332	01.212
R25-3	RESISTOR MF	680 OHM 5% 0.4W	PHILIPS	2322 181 53681	01.195
R26-3	RESISTOR MF	910 OHM 5% 0.4W	PHILIPS	2322 181 53911	01.199
R27-3	RESISTOR	12 KOHM 1% 0.4W	*PHILIPS	2322 156 11203	03.461

POSITION	DESCRIPTION	MANUFACTOR	TYPE	S.P. NUMBER
R28-3	RESISTOR MF	5k11 OHM 1% 0.6W	* PHILIPS	2322 156 15112 03.414
R29-3	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472 01.216
R30-3	RESISTOR MF	2k7 OHM 5% 0.4W	PHILIPS	2322 181 53272 01.210
R31-3	RESISTOR MF	5k6 OHM 5% 0.4W	PHILIPS	2322 181 53562 01.218
R32-3	RESISTOR MF	2k7 OHM 5% 0.4W	PHILIPS	2322 181 53272 01.210
R33-3	RESISTOR MF	5k11 OHM 1% 0.6W	* PHILIPS	2322 156 15112 03.414
R34-3	RESISTOR	33 KOHM 1% 0.4W	*PHILIPS	2322 156 13303 03.443
R35-3	RESISTOR MF	750 OHM 5% 0.4W	PHILIPS	2322 181 53751 01.196
R36-3	RESISTOR MF	270 OHM 5% 0.4W	PHILIPS	2322 181 53271 01.185
R37-3	RESISTOR MF	470 OHM 5% 0.4W	PHILIPS	2322 181 53471 01.191
R38-3	RESISTOR MF	82 OHM 5% 0.4W	PHILIPS	2322 181 53829 01.172
R39-3	RESISTOR MF	360 OHM 5% 0.4W	PHILIPS	2322 181 53361 01.188
R40-3	RESISTOR MF	560 OHM 5% 0.4W	PHILIPS	2322 181 53561 01.193
R41-3	RESISTOR MF	160 OHM 5% 0.4W	PHILIPS	2322 181 53161 01.180
R42-3	RESISTOR	22 KOHM 1% 0.4W	**PHILIPS	2322 156 12213 03.441
R43-3	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102 01.200
R44-3	POTENTIOMETER TRIMMING	1 KOHM 10% 0.5W	* PHILIPS	2322 482 42102 07.660
R45-3	RESISTOR MF	2k7 OHM 5% 0.4W	PHILIPS	2322 181 53272 01.210
R46-3	RESISTOR MF	6k8 OHM 5% 0.4W	PHILIPS	2322 181 53682 01.220
R47-3	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102 01.200
R48-3	RESISTOR MF	5k6 OHM 5% 0.4W	PHILIPS	2322 181 53562 01.218
R49-3	RESISTOR	2.55 KOHM 1% 0.4W	*PHILIPS	2322 156 12552 03.407
R50-3	RESISTOR MF	390 OHM 5% 0.4W	PHILIPS	2322 181 53391 01.182
R51-3	RESISTOR MF	5k11 OHM 1% 0.6W	* PHILIPS	2322 156 15112 03.414
R52-3	RESISTOR MF	1k2 OHM 5% 0.4W	PHILIPS	2322 181 53122 01.202
R53-3	RESISTOR MF	160 OHM 5% 0.4W	PHILIPS	2322 181 53161 01.180
R54-3	RESISTOR MF	220 OHM 5% 0.4W	PHILIPS	2322 181 53221 01.183
R55-3	RESISTOR MF	68 OHM 5% 0.4W	PHILIPS	2322 181 53689 01.170
R56-3	RESISTOR MF	560 OHM 5% 0.4W	PHILIPS	2322 181 53561 01.193
R57-3	POTENTIOMETER TRIMMING	1 KOHM 10% 0.5W	* PHILIPS	2322 482 42102 07.660
R58-3	RESISTOR MF	8k2 OHM 5% 0.4W	PHILIPS	2322 181 53822 01.222
R59-3	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472 01.216
R60-3	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102 01.200
R61-3	RESISTOR MF	220 OHM 5% 0.4W	PHILIPS	2322 181 53221 01.183
R62-3	RESISTOR MF	5R6 OHM 5% 0.4W	PHILIPS	2322 181 53568 01.143
R63-3	RESISTOR MF	560 OHM 5% 0.4W	PHILIPS	2322 181 53561 01.193
R64-3	RESISTOR	8.66 KOHM 1% 0.4W	*PHILIPS	2322 156 18662 03.425
R65-3	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472 01.216
R66-3	RESISTOR MF	15k OHM 5% 0.4W	PHILIPS	2322 181 53153 01.229
R67-3	RESISTOR MF	220k OHM 5% 0.4W	PHILIPS	2322 181 53224 01.258
R68-3	RESISTOR MF	39k OHM 5% 0.4W	PHILIPS	2322 181 53393 01.239
R69-3	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103 01.225
R70-3	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102 01.200
R71-3	RESISTOR MF	82 OHM 5% 0.4W	PHILIPS	2322 181 53829 01.172

POSITION	DESCRIPTION	MANUFACTOR	TYPE	S.P. NUMBER
R72-3	RESISTOR MF	330k OHM 5% 0.4W	PHILIPS	2322 181 53334 01.262
R73-3	RESISTOR	5.6 OHM 1% 0.4W	*PHILIPS	2322 156 15608 03.350
R74-3	RESISTOR MF	560 OHM 5% 0.4W	PHILIPS	2322 181 53561 01.193
R75-3	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222 01.208
R76-3	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222 01.208
R77-3	RESISTOR MF	18k OHM 5% 0.4W	PHILIPS	2322 181 53183 01.231
R78-3	RESISTOR MF	680 OHM 5% 0.4W	PHILIPS	2322 181 53681 01.195
R79-3	RESISTOR MF	15k OHM 5% 0.4W	PHILIPS	2322 181 53153 01.229
R80-3	RESISTOR MF	180 OHM 5% 0.4W	PHILIPS	2322 181 53181 01.181
R81-3	RESISTOR MF	270 OHM 5% 0.4W	PHILIPS	2322 181 53271 01.185
R82-3	RESISTOR MF	1k3 OHM 5% 0.4W	PHILIPS	2322 181 53132 01.203
R85-3	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222 01.208
R86-3	RESISTOR MF	8k2 OHM 5% 0.4W	PHILIPS	2322 181 53822 01.222
R87-3	RESISTOR MF	16k OHM 5% 0.4W	PHILIPS	2322 181 53163 01.230
R88-3	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102 01.200
R89-3	RESISTOR	18 KOHM 1% 0.4W	*PHILIPS	2322 156 11803 03.440
R90-3	RESISTOR	18 KOHM 1% 0.4W	*PHILIPS	2322 156 11803 03.440
R91-3	RESISTOR MF	1k6 OHM 5% 0.4W	PHILIPS	2322 181 53162 01.205
R92-3	RESISTOR	9.09 KOHM 1% 0.4W	**PHILIPS	2322 156 19092 03.426
R93-3	RESISTOR	9.09 KOHM 1% 0.4W	**PHILIPS	2322 156 19092 03.426
R94-3	RESISTOR MF	43k OHM 5% 0.4W	PHILIPS	2322 181 53433 01.240
R95-3	RESISTOR MF	5k11 OHM 1% 0.6W	* PHILIPS	2322 156 15112 03.414
R96-3	RESISTOR MF	5k11 OHM 1% 0.6W	* PHILIPS	2322 156 15112 03.414
R97-3	RESISTOR MF	680 OHM 5% 0.4W	PHILIPS	2322 181 53681 01.195
R98-3	RESISTOR MF	15k OHM 5% 0.4W	PHILIPS	2322 181 53153 01.229
R99-3	RESISTOR	261 OHM 1% 0.4W	*PHILIPS	2322 156 12611 03.386
R100-3	RESISTOR	2.7 KOHM 1% 0.4W	*PHILIPS	2322 156 12702 03.405
R101-3	RESISTOR	261 OHM 1% 0.4W	*PHILIPS	2322 156 12611 03.386
R102-3	RESISTOR	2.7 KOHM 1% 0.4W	*PHILIPS	2322 156 12702 03.405
R103-3	RESISTOR MF	1k3 OHM 5% 0.4W	PHILIPS	2322 181 53132 01.203
R104-3	RESISTOR MF	16k OHM 5% 0.4W	PHILIPS	2322 181 53163 01.230
R105-3	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103 01.225
R106-3	RESISTOR MF	91k OHM 5% 0.4W	PHILIPS	2322 181 53913 01.248
R107-3	RESISTOR MF	1k6 OHM 5% 0.4W	PHILIPS	2322 181 53162 01.205
R108-3	RESISTOR MF	43k OHM 5% 0.4W	PHILIPS	2322 181 53433 01.240
R109-3	RESISTOR MF	330 OHM 5% 0.4W	PHILIPS	2322 181 53331 01.187
R110-3	RESISTOR MF	56 OHM 5% 0.4W	PHILIPS	2322 181 53569 01.168
R114-3	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101 01.175
R115-3	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101 01.175
T1-3	TRANSISTOR RF	BFW17A PNP TO-39	PHILIPS	BFW17A 29.151
T2-3	TRANSISTOR RF	BF199	PHILIPS	BF199 28.178
T3-3	TRANSISTOR RF	BFW92A	TEK	BFW92A 29.160
T4-3	TRANSISTOR RF	BF199	MOTOROLA	BF199 28.177
T5-3	TRANSISTOR RF SWITCH	2N2369A	MOTOROLA	2N2369A 28.315



POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P. NUMBER
T6-3	TRANSISTOR	BF 506	SIEMENS	BF506	28.202
T7-3	TRANSISTOR RF	BF199	PHILIPS	BF199	28.178
T8-3	TRANSISTOR RF	BF199	PHILIPS	BF199	28.178
T9-3	TRANSISTOR	BF 506	SIEMENS	BF506	28.202
T10-3	TRANSISTOR RF SWITCH	MPS3640	MOTOROLA	MPS-3640	28.405
T11-3	TRANSISTOR RF	BFW92A	TFK	BFW92A	29.160
T12-3	TRANSISTOR JFET	TIS88A3 T0-92	MOTOROLA	TM 00 044-3	29.737
T13-3	TRANSISTOR RF SWITCH	2N2369A	MOTOROLA	2N2369A	28.315
T14-3	TRANSISTOR N-CHAN. JFET	TIS88A1	MOTOROLA	TM 00 044 -1	29.735
T15-3	TRANSISTOR N-CHAN. JFET	TIS88A1	MOTOROLA	TM 00 044 -1	29.735
T16-3	TRANSISTOR MOSFET	N-CHANNEL ENHANCEMENT	SILICONIX	SD210DE	29.719
T17-3	TRANSISTOR MOSFET	N-CHANNEL ENHANCEMENT	SILICONIX	SD210DE	29.719
T18-3	TRANSISTOR	BF 506	SIEMENS	BF506	28.202
T19-3	TRANSISTOR	BC559B	PHILIPS*	BC559B	28.105
T20-3	TRANSISTOR AF	BC548 NPN T0-92	PHILIPS	BC548 (-A/-B/-C)	28.070
T21-3	TRANSISTOR	BC559B	PHILIPS*	BC559B	28.105
T22-3	TRANSISTOR AF	BC548 NPN T0-92	PHILIPS	BC548 (-A/-B/-C)	28.070
X1-3	CRYSTAL	10.7008MHz	DANTRONIC	C1029	39.845
L5-3	COIL	TL411	ESPERA	6-D-24230B	400411

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P. NUMBER
	PROCESSOR UNIT	R2022 MODULE 4	ESPERA	5-0-241466 R2022	600181
C2-4	CAPACITOR MKT	1uF 10% 63V	ERO*	MKT1818	11.138
C3-4	CAPACITOR POLYSTYRENE	100pF 1% 630VDC	PHILIPS	2222 431 81001	10.400
C4-4	CAPACITOR POLYSTYRENE	100pF 1% 630VDC	PHILIPS	2222 431 81001	10.400
C5-4	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32510-D1224-K000	11.225
C6-4	CAPACITOR POLYSTYRENE	820pF 1% 250VDC	PHILIPS	2222 430 88201	10.348
C7-4	CAPACITOR ELECTROLYTIC	1uF 20% 50VDC	ELNA	RJ2-50-V-010-M-T12	14.506
C8-4	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32510-D1224-K000	11.225
C9-4	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C10-4	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C12-4	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C13-4	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C14-4	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C15-4	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32511-D1224-K000	11.227
C16-4	CAPACITOR MKT	1uF 10% 63V	ERO*	MKT1818	11.138
C17-4	CAPACITOR MKT	1uF 10% 63V	ERO*	MKT1818	11.138
C18-4	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32510-D1224-K000	11.225
D1-4	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D2-4	DIODE LIGHT EMITTING	YELLOW 3mm	GI	MV5374C-25.4MM BEN	25.540
D3-4	DIODE LIGHT EMITTING	YELLOW 5mm	SANKEN	SEL1910D	25.630
D4-4	DIODE LIGHT EMITTING	YELLOW 5mm	SANKEN	SEL1910D	25.630
D5-4	DIODE LIGHT EMITTING	ORANGE 5mm	SANKEN	SEL 1913K	25.631
D6-4	DIODE LIGHT EMITTING	ORANGE 5mm	SANKEN	SEL 1913K	25.631
D7-4	DIODE LIGHT EMITTING	ORANGE 5mm	SANKEN	SEL 1913K	25.631
D8-4	DIODE LIGHT EMITTING	ORANGE 5mm	SANKEN	SEL 1913K	25.631
D9-4	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D10-4	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D11-4	DIODE ZENER	4.3V 2% 0.4W BZX79B4V3	PHILIPS*	BZX79B4V3	26.495
D12-4	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D13-4	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D14-4	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D15-4	DIODE GENERAL PURPOSE	BAV21 200V/0.25A	TFK	BAV21	25.340
IC1-4	MIKROPROCESSOR	R2022 COMPUTER UNIT	ESPERA	C1043C (9CAF)	700192
IC2-4	INTEGRATED CIRCUIT	MC14584BCP	MOTOROLA	MC14584BCP	31.210
IC3-4	INTEGRATED CIRCUIT	MCM2802P	MOTOROLA	MCM2802P	33.495
IC4-4	INTEGRATED CIRCUIT	MC14094BCP	NAT.*	CD4094BCN	33.305
IC5-4	INTEGRATED CIRCUIT	MCM2802P	MOTOROLA	MCM2802P	33.495
IC6-4	INTEGRATED CIRCUIT	MC14094BCP	NAT.*	CD4094BCN	33.305
IC7-4	INTEGRATED CIRCUIT	MC14094BCP	NAT.*	CD4094BCN	33.305
IC8-4	INTEGRATED CIRCUIT	MC14094BCP	NAT.*	CD4094BCN	33.305
IC9-4	INTEGRATED CIRCUIT	MC14094BCP	NAT.*	CD4094BCN	33.305

R2022 - 07/90

POSITION	DESCRIPTION	MANUFACTOR	TYPE	S.P.NUMBER
IC10-4	INTEGRATED CIRCUIT	MC14094BCP	NAT.*	CD4094BCN 33.305
IC11-4	INTEGRATED CIRCUIT	MC14094BCP	NAT.*	CD4094BCN 33.305
IC12-4	INTEGRATED CIRCUIT	MC14094BCP	NAT.*	CD4094BCN 33.305
IC13-4	INTEGRATED CIRCUIT	MC14094BCP	NAT.*	CD4094BCN 33.305
IC14-4	INTEGRATED CIRCUIT	DUAL OPERATIONAL AMP.	TEXAS	MC1458P 31.215
IC15-4	INTEGRATED CIRCUIT	SN74LS541N	TEXAS*	74LS541 34.285
L1-4	CHOKE	700 OHM / 15 MHZ	SIEMENS*	B82114-R-A3 20.052
LCD1-4	LIQUID CRYSTAL DISPLAY	COSTUM DESIGNED R2022	HAMLIN	SP TG.0-3-23963 25.707
				HAMLIN TG.3423-365-423
OC1-4	OPTO COUPLER	CNY17-3	MOTOROLA	CNY17-3 32.533
OC2-4	OPTO COUPLER	CNY17-3	MOTOROLA	CNY17-3 32.533
P1-4	PLUG	1/10" SIL SQ.PINS 11POLES	AMP	1-826937-1 78.344
P2-4	PLUG (MALE)	15 POLE	AMP	1-826375-5 78.115
P3-4	PLUG (MALE)	9 POLE	AMP	0-826375-9 78.109
P4-4	PLUG (MALE)	15 POLE	AMP	1-826375-5 78.115
P5-4	PLUG (MALE)	14 POLE	AMP	1-826375-4 78.114
R1-4	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103 01.225
R2-4	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103 01.225
R3-4	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103 01.225
R4-4	RESISTOR MF	15k OHM 5% 0.4W	PHILIPS	2322 181 53153 01.229
R5-4	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103 02.496
R6-4	RESISTOR MF	47k OHM 5% 0.4W	PHILIPS	2322 181 53473 01.241
R7-4	RESISTOR MF	47 OHM 5% 0.4W	PHILIPS	2322 181 53479 01.166
R8-4	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103 01.225
R9-4	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472 02.488
R10-4	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103 02.496
R11-4	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472 02.488
R12-4	RESISTOR MF	1k2 OHM 5% 0.4W	PHILIPS	2322 181 53122 01.202
R13-4	POTENTIOMETER	10 KOHM 50mW LIN	NOBLE	E732-1116A 08.260
R14-4	RESISTOR MF	680 OHM 5% 0.4W	PHILIPS	2322 181 53681 01.195
R15-4	RESISTOR MF	22k OHM 5% 0.4W	PHILIPS	2322 181 53223 01.233
R16-4	RESISTOR MF	270 OHM 5% 0.4W	PHILIPS	2322 181 53271 01.185
R17-4	POTENTIOMETER	50kOHM 50mW LOG	NOBLE	E732-1117B 08.262
R18-4	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 180 73102 02.472
R19-4	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103 02.496
R20-4	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103 02.496
R21-4	RESISTOR MF	100k OHM 5% 0.4W	PHILIPS	2322 181 53104 01.250
R22-4	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472 01.216
R23-4	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472 01.216
R24-4	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103 01.225
R25-4	RESISTOR MF	10 OHM 5% 0.4W	PHILIPS	2322 181 53109 01.150
R26-4	RESISTOR MF	680k OHM 5% 0.4W	PHILIPS	2322 181 53684 01.270
R27-4	RESISTOR MF	330k OHM 5% 0.4W	PHILIPS	2322 181 53334 01.262
R28-4	RESISTOR MF	3k9 OHM 5% 0.4W	PHILIPS	2322 181 53392 01.214

POSITION	DESCRIPTION	MANUFACTOR	TYPE	S.P.NUMBER
R29-4	RESISTOR MF	160k OHM 5% 0.4W	PHILIPS	2322 181 53164 01.255
R30-4	RESISTOR MF	82k OHM 5% 0.4W	PHILIPS	2322 181 53823 01.247
R31-4	RESISTOR MF	39k OHM 5% 0.4W	PHILIPS	2322 181 53393 01.239
R32-4	RESISTOR MF	100k OHM 5% 0.4W	PHILIPS	2322 181 53104 01.250
R33-4	RESISTOR MF	47k OHM 5% 0.4W	PHILIPS	2322 181 53473 01.241
R34-4	RESISTOR MF	100k OHM 5% 0.4W	PHILIPS	2322 181 53104 01.250
R35-4	PRESET CERMET	47kOHM 20% 0.5w	AD	HC10 200 150 47k 20% 07.717
R36-4	RESISTOR MF	43k OHM 5% 0.4W	PHILIPS	2322 181 53433 01.240
R37-4	RESISTOR MF	15k OHM 5% 0.4W	PHILIPS	2322 181 53153 01.229
R38-4	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103 01.225
R39-4	RESISTOR MF	47 OHM 5% 0.4W	PHILIPS	2322 181 53479 01.166
T1-4	TRANSISTOR AF	BC558B	PHILIPS	BC558B 28.100
T2-4	TRANSISTOR AF	BC558B	PHILIPS	BC558B 28.100
T3-4	TRANSISTOR AF	BC548B NPN TO-92	PHILIPS	BC548B 28.076
T4-4	TRANSISTOR AF	BC548B NPN TO-92	PHILIPS	BC548B 28.076
T5-4	TRANSISTOR AF	BC558B	PHILIPS	BC558B 28.100
X1-4	RESONATOR CERAMIC	4MHz	TDK	FCR-4 41.510

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	CONVERTER UNIT	R2022 MODULE 5	ESPERA	5-0-24231K	600182
C1-5	CAPACITOR MKT	0.22uF 10% 63V	ERO*	MKT1818	11.090
C2-5	CAPACITOR ELECTROLYTIC	2200uF 20% 40VDC	PHILIPS	2222 021 47222	14.719
C3-5	CAPACITOR POLYSTYRENE	2.2nF 1% 160V	*PHILIPS	2222 429 82202	10.284
C4-5	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C5-5	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C6-5	CAPACITOR MKT	15nF 10% 400VDC	PHILIPS	2222 344 55153	11.732
C7-5	CAPACITOR ELECTROLYTIC	22uF 20% 35VDC	ELNA	RJ2-35-V-220-M-T12	14.516
C8-5	CAPACITOR MKT	0.22uF 10% 63V	ERO*	MKT1818	11.090
C9-5	CAPACITOR MKT	0.22uF 10% 63V	ERO*	MKT1818	11.090
C10-5	CAPACITOR ELECTROLYTIC	4.7uF 20% 50VDC	ELNA	RJ2-50-V-4R7-M-T12	14.510
C11-5	CAPACITOR MKT	10nF 10% 400V	PHILIPS	2222 344 55103	11.731
C13-5	CAPACITOR ELECTROLYTIC	100uF -10/+50% 40V	ERO	EKM 00 DD 310 G	14.561
C14-5	CAPACITOR ELECTROLYTIC	470uF -10/+50% 40VDC	PHILIPS*	2222 035 57471	14.650
C15-5	CAPACITOR ELECTROLYTIC	470uF -10/+50% 40VDC	PHILIPS*	2222 035 57471	14.650
C16-5	CAPACITOR ELECTROLYTIC	2200uF -10/+50% 16V	ERO**	EG03KE422D	14.714
C18-5	CAPACITOR ELECTROLYTIC	220uF -10/+50% 40VDC	ERO	EKM 05 DE 322 G 05	14.648
D1-5	DIODE PROTECTION	51V 2W 600W Peak	THOMSON	BZV 06-P44	26.995
D2-5	DIODE GENERAL PURPOSE	BAV21 200V/0.25A	TFK	BAV21	25.340
D3-5	DIODE ZENER	12V	THOMSON-CSF	BZV47C12	26.750
D4-5	DIODE	1N4936	MOTOROLA	1N4936	25.157
D5-5	DIODE	1N4934	MOTOROLA	1N4934	25.155
D6-5	DIODE	1N4934	MOTOROLA	1N4934	25.155
D7-5	DIODE FAST RECOVERY	400V/3A Trr=200ns	THOMSON	PFR854	27.155
D8-5	DIODE ZENER	15V 5% 0.4W	PHILIPS	BZX79C15	26.561
FP1-5	FERRITE BEAD	HZ 4.2/2.1/7 G K1201	KASCHKE	HZ 4.2/2.1/7 G K1201 405 442 075 021	35.011
FP2-5	FERRITE BEAD	HZ 4.2/2.1/7 G K1201	KASCHKE	HZ 4.2/2.1/7 G K1201 405 442 075 021	35.011
FP3-5	FERRITE BEAD	HZ 4.2/2.1/7 G K1201	KASCHKE	HZ 4.2/2.1/7 G K1201 405 442 075 021	35.011
FP4-5	FERRITE BEAD	HZ 4.2/2.1/7 G K1201	KASCHKE	HZ 4.2/2.1/7 G K1201 405 442 075 021	35.011
FP5-5	FERRITE BEAD	HZ 4.2/2.1/7 G K1201	KASCHKE	HZ 4.2/2.1/7 G K1201 405 442 075 021	35.011
FP6-5	FERRITE BEAD	HZ 4.2/2.1/7 G K1201	KASCHKE	HZ 4.2/2.1/7 G K1201 405 442 075 021	35.011
FP7-5	FERRITE BEAD	HZ 4.2/2.1/7 G K1201	KASCHKE	HZ 4.2/2.1/7 G K1201 405 442 075 021	35.011
FP8-5	FERRITE BEAD	HZ 4.2/2.1/7 G K1201	KASCHKE	HZ 4.2/2.1/7 G K1201 405 442 075 021	35.011
FP9-5	FERRITE BEAD	HZ 4.2/2.1/7 G K1201	KASCHKE	HZ 4.2/2.1/7 G K1201	35.011

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
FP10-5	FERRITE BEAD	HZ 4.2/2.1/7 G K1201	KASCHKE	405 442 075 021 HZ 4.2/2.1/7 G K1201 405 442 075 021	35.011
IC1-5	PWM REGULATOR	TL494CN	TEXAS	TL494CN	31.487
L1-5	CHOKE	TL079	ESPERA	TL079	400079
L2-5	CHOKE	TL079	ESPERA	TL079	400079
L3-5	CHOKE	TL079	ESPERA	TL079	400079
L4-5	CHOKE	TL079	ESPERA	TL079	400079
R1-5	RESISTOR MF	2k7 OHM 5% 0.4W	PHILIPS	2322 181 53272	01.210
R2-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R3-5	RESISTOR MF	56k OHM 5% 0.4W	PHILIPS	2322 181 53563	01.243
R4-5	RESISTOR MF	18k OHM 5% 0.4W	PHILIPS	2322 181 53183	01.231
R5-5	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R6-5	RESISTOR MF	3k9 OHM 5% 0.4W	PHILIPS	2322 181 53392	01.214
R7-5	RESISTOR MF	5k6 OHM 5% 0.4W	PHILIPS	2322 181 53562	01.218
R8-5	RESISTOR MF	10 OHM 5% 0.5W	PHILIPS	2322 156 11009	01.351
R9-5	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R10-5	RESISTOR MF	47 OHM 5% 0.4W	PHILIPS	2322 181 53479	01.166
R14-5	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
R15-5	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
R16-5	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222	01.208
R17-5	RESISTOR MF	1k5 OHM 5% 0.4W	PHILIPS	2322 181 53152	01.204
R18-5	RESISTOR	22 OHM 5% 0.5W	PHILIPS	2322 156 12209	03.159
T1-5	TRANSISTOR AF	BC557B NPN TO-92	PHILIPS	BC557B	28.091
T2-5	TRANSISTOR	BC640	PHILIPS	BC640	28.124
T3-5	TRANSISTOR AF	POWER NPN BD139 SOT-39	PHILIPS	BD139	29.060
T4-5	TRANSISTOR AF	BC338-25 NPN TO-92	PHILIPS	BC338-25	28.058
T5-5	TRANSISTOR AF	BC328-25 PNP TO-92	PHILIPS	BC328-25	28.052
T6-5	TRANSISTOR	BUZ21	SILICONIX*	IFR540	29.400
TR1-5			ESPERA	TRAF0 4998.1 R2022	700997

R2022 - 07/90



POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	AF amp. & FILTER UNIT	R2022 MODULE 7	ESPERA	5-0-24530H	600381
C1-7	CAPACITOR ELECTROLYTIC	220uF -20/+50% 25VDC	ELNA	RJ2-25-V-221-T-F	14.647
C2-7	CAPACITOR ELECTROLYTIC	220uF -20/+50% 25VDC	ELNA	RJ2-25-V-221-T-F	14.647
C3-7	CAPACITOR MKT	470nF 10% 63V	ERO*	MKT 1818-447/065	11.185
C4-7	CAPACITOR MKT	470nF 10% 63V	ERO*	MKT 1818-447/065	11.185
C5-7	CAPACITOR MKT	470nF 10% 63V	ERO*	MKT 1818-447/065	11.185
C6-7	CAPACITOR ELECTROLYTIC	220uF -20/+50% 25VDC	ELNA	RJ2-25-V-221-T-F	14.647
C7-7	CAPACITOR MKT	470nF 10% 63V	ERO*	MKT 1818-447/065	11.185
C8-7	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C9-7	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C10-7	CAPACITOR ELECTROLYTIC	100uF -10/+50% 40V	ERO	EKM 00 DD 310 G	14.561
C11-7	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C12-7	CAPACITOR MKT	2.2uF 10% 100V	SIEMENS	B32512-E1225-K000	11.406
C13-7	CAPACITOR MKT	2.2uF 10% 100V	SIEMENS	B32512-E1225-K000	11.406
C14-7	CAPACITOR ELECTROLYTIC	470uF -10/+50% 40VDC	PHILIPS*	2222 035 57471	14.650
C15-7	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C16-7	CAPACITOR MKT	330nF 10% 63VDC	PHILIPS	2222 371 18334	11.122
C17-7	CAPACITOR CERAMIC	18 pF 10% NPO 400V	FERROPERM	9/0112,9	15.593
C18-7	CAPACITOR CERAMIC	4n7F 20% CL2 50VDC	NKE	DT 380 758S D 472 M 50V FLAT PACK	15.165
C20-7	CAPACITOR ELECTROLYTIC	22uF 20% 35VDC	ELNA	RJ2-35-V-220-M-T12	14.512
C21-7	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C22-7	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C23-7	CAPACITOR MKT	0.22uF 10% 63V	ERO*	MKT1818	11.090
C24-7	CAPACITOR MKT	0.22uF 10% 63V	ERO*	MKT1818	11.090
C25-7	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C26-7	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C27-7	CAPACITOR CERAMIC	1nF 10% 50VDC CL2	NKE	DT 340 758L B 102 K 50V FLAT PACK	16.160
D1-7	DIODE ZENER	5.1V 5% 0.4W	PHILIPS	BZX79C5V1	26.527
D2-7	DIODE ZENER	5.1V 5% 0.4W	PHILIPS	BZX79C5V1	26.527
D3-7	DIODE	MR750	MOTOROLA	MR750	25.219
F1-7	FUSE	3.15A M Ø5x20mm	WICKMANN	919201	45.552
FP1-7	FERRITE BEAD	HZ 4.2/2.1/7 G K1201	KASCHKE	HZ 4.2/2.1/7 G K1201 405 442 075 021	35.011
FP2-7	FERRITE BEAD	HZ 4.2/2.1/7 G K1201	KASCHKE	HZ 4.2/2.1/7 G K1201 405 442 075 021	35.011
IC1-7	INTEGRATED CIRCUIT	OP-AMP OPEN COLLECTOR OUT	SIEMENS	Q67000-A524 (TAA765A)	31.300
IC2-7	AF POWER AMPLIFIER	TDA 2030 VERT.	THOMSON	TDA 2030 V	31.483

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
OC1-7	OPTO COUPLER	CNY17-2	TOSHIBA	CNY 17-2	32.530
P1-7	PLUG (MALE)	10 POLE	AMP	1-826375-0	78.110
P2-7	PLUG (MALE)	13 POLE	AMP	1-826375-3	78.113
P3-7	PLUG	6 POLES	HIRSCHMANN	973 021-100 6 pole Male for Chassis	78.311
R1-7	RESISTOR MF	3k3 OHM 5% 0.4W	PHILIPS	2322 181 53332	01.212
R2-7	RESISTOR MF	1k5 OHM 5% 0.4W	PHILIPS	2322 181 53152	01.204
R3-7	RESISTOR MF	5k6 OHM 5% 0.4W	PHILIPS	2322 181 53562	01.218
R4-7	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
R5-7	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R6-7	RESISTOR MF	1 OHM 5% 0.4W	PHILIPS	2322 181 53108	01.125
R7-7	RESISTOR MF	33k OHM 5% 0.4W	PHILIPS	2322 181 53333	01.237
R9-7	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R10-7	RESISTOR MF	470 OHM 5% 0.4W	PHILIPS	2322 181 53471	01.191
R11-7	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222	01.208
R12-7	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222	01.208
R13-7	RESISTOR MF	120k OHM 5% 0.4W	PHILIPS	2322 181 53124	01.252
R14-7	RESISTOR MF	220k OHM 5% 0.4W	PHILIPS	2322 181 53224	01.258
R15-7	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R16-7	POTENTIOMETER TRIMMING	2.2KOHM 20% 0.5W	NOBLE	TM8-KH1-1S	07.785
R17-7	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R18-7	RESISTOR MF	820 OHM 5% 0.4W	PHILIPS	2322 181 53821	01.197
R19-7	RESISTOR MF	100k OHM 5% 0.4W	PHILIPS	2322 181 53104	01.250
RE1-7	RELAY	12VDC 1SH. 1A.	ALOIS ZETTLER	AZ 5-12DE	21.290
T1-7	THYRISTOR	BT151-500R	PHILIPS	BT151-500R	29.912
TR2-7	TRANSFORMER	6898	SCANELECTRIC	EE16/6898-1:4 TG.1-0-24648/1-0-24649	22.504
TR1-7	CHOKE	TL412	TRANS-ELECTRO	6-0-24232B	400412