Daimler-Benz Aerospace
Hagenuk Marinekommunikation

Description

Receiver RX 1001 M / RX 5001

Abbreviation index

AC	Alternating Current
AGC	Automatic Gain Control
BCD	Binary Coded Decimal
BFO	Beat Frequency Oscillator
BITE	Built In Test Equipment
CCITT	Commité Consultatif International Télégraphique et Téléphonique
CPU	Central Processing Unit
CW	Continuous Wave
DC	Direct Current
DSB	Double Side Band
EMC	Electromagnetic Compatibility
EMF	Electromotiv Force
EPROM	Erasable Programmable ROM
FM	Frequency Modulation
HF	High Frequency
IC	Integrated Circuit
IF	Intermediate Frequency
ISB	Independant Side Band
LED	Light Emitting Diode
LF	Low Frequency
LSB	Lower Side Band
max.	maximum
MGC	Manual Gain Control
min.	minimum
PIO	Parallel Input/Output port
PLL	Phase Locked Loop
RAM	Random Access Memory
ROM	Read Only Memory
RX	Receiver

SINAD	Signal to Noise ratio And Distortion
SSB	Single Side Band
SW	Width Across Flats
TCXO	Temperature Compensated crystal (X-tal) Oscillator
TTL	Transistor - Transistor Logic
typ.	typical
USB	Upper Side Band
VCO	Voltage Controlled Oscillator
VDE	(Verband Deutscher Elektrotechniker) Association of German Electrotechnical Engineers
VLF	Very Low Frequency

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1 GENERAL DESCRIPTION

1.1 Technical Data

1.1.1 Receiver RX 1001 M / RX 5001

Frequency range	10 kHz to 30 MHz
Frequency resolution	10 Hz increments Keyboard or single knob flywheel tuning at 500 Hz or 5 kHz per revolution
Frequency tuning	10 Hz, 100 Hz selectable
Frequency synthesizer	Triple PLL lowest reference frequency 10kHz
Frequency change-over time	Within frequency decades: > 20 msec between frequency decades: ≥ 100 msec options: on request
Frequency stability	
frequency standard internal	$5 \cdot 10^{-7}$ per day
TCXO - 10 MHz	$1 \cdot 10^{-6}$ per year
additional input external standard 1 MHZ or 10 MHz (BFO II)	Input level: 0 dBm ± 3 dB/50 ohms
BFO	±5 kHz in 10 Hz steps, synthesized
Channel memory	99 channels capable of being loaded with receiver parameters: frequency, mode of operation incl. bandwidth, RF-gain control, preselector and antenna-attenuator.
SCAN functions	1. SCAN BY TIME 2. SCAN CHANNEL + CHANNEL * 3. CHANEL SCAN * 4. FREQUENCY SWEEP increments 10 Hz to 10 kHz lower and upper frequencies are to be programmed in up to 20 blocks
SCAN-STOP	Stop time programmable 0.1 - 0.9 sec dwell time 1 - 9 sec and infinite AGC threshold 5 - 95 dBµV

* RX 5001 only

Modes of operation	DSB (A2A, H2A, A3E, H3E) USB (J3E, R3E, H3E) LSB (J3E, R3E, H3E) CW (AIA) * ISB (B3E) (Option) TELEX/FAX (F1B, F1C, F3C) (requires optional TTY/FAX converter)
Antenna impedance	50 ohms SWR < 2 : 1 and Ant. Att. = 0 dB
Antenna input voltage	a.) 30 VEMF for 10 kHz to 1.5 MHz 10 minutes b.) 100 VEMF for 1.5 MHz to 30 MHz 10 minutes c.) 50 VEMF for 30 MHz to 400 MHz 10 minutes
Input attenuator	0 dB, 20 dB selectable; manual or automatic
Spurious emission at antenna input	$\leq 1 \cdot 10^{-9}$ W
Spurious radiations at antenna input	≤ -97 dBm
Image- and IF rejection	> 100 dB
Intermediate frequencies	1st IF 63.078 MHz 2nd IF 4.9985 MHz
IF-Output 1 IF-Output 2	30 kHz; 600 ohms; 0 dBm 4.9985 MHz; 50 ohms - 10 dBm
AGC-characteristics	Output is maintained within 6 dB for a change in input of 120 dB for input levels between 0.5 µV and 500 mV. Within frequency subrange 10 kHz to 80 kHz AGC characteristics apply to 90 dB

* RX 5001 only

AGC-time constants (SSB 30dB step):	Attack	Hold	Decay
long:	≤ 10 ms	1.5 - 3.5 s	0.55 (± 25%)
short.	≤ 10 ms	——	0.25 (± 25%)

Sensitivity	A3E	B = 6 kHz, m = 0.5
without	20.....40 kHz	≤ 7 µV EMF
HF preselection	40.....200 kHz	≤ 4 µV EMF
10 dB SINAD	0.2....30 kHz	≤ 3 µV EMF
with CCITT-Filter	A1A	B=300 Hz
	10.....40 kHz	≤ 1 µV EMF
	40.....200 kHz	≤ 0.5 µV EMF
	0.2....30 MHz	≤ 0.5 µV EMF
	J3E	B=0.3...2.7 kHz
	10...40 kHz	≤ 3 µV EMF
	0.04...1.6	≤ 1 µV EMF
	1.6...30 MHz	≤ 1 µV EMF

IF-Bandwidth and Selection

Filter Bandwidth (kHz)		min. Bandwidth (kHz)		max. Bandwidth (kHz)	
Standard	Special (Option)	Standard 6 dB	Special 6 dB	Standard 60 dB	Special 60 dB
0.1	0.15	0.1	0.15	0.75	0.80
0.15	0.3	0.15	0.3	0.80	0.90
0.3	0.4	0.3	0.4	0.90	1.00
0.6	0.6	0.6	0.6	1.70	1.70
1.5	1.5	1.5	1.5	4.00	3.00
2.4 *	2.7	2.4	2.7	3.80	4.20
3.0 **	3.0	3.0	3.0	4.60	4.60
6.0	6.0	6.0	6.0	15.60	15.60

* Special design for SSB- USB 0.3 to 2.7 LSB -0.3 to -2.7
Optional filters require replacement of any standard filter.

** Group delay ≤ 800 µsec at f_o ± 1.2 kHz (for SSB audio 600 to 800 Hz)

Intercept point	26 dBm (1 - 30 MHz)
Crossmodulation	For a wanted signal 60 dBμV_{EMF} the interference produced by an unwanted signal 20 kHz off-tune and 90 dBμV_{EMF} will be more than 30 dB below standard output.
Intermodulation	**Out of band:** 3rd order -60 dB or better, for two equal signals each of 100 dBμV_{EMF} at f_o +50 kHz and f_o +100 kHz (f_o > 200 kHz).
	In band: Unwanted signals -45 dB for two equal signals each of 100 dBμ V_{EMF} at f_o +800 Hz and f_o +1200 Hz (f_o > 200 kHz)
Blocking	For a wanted signal 60 dBμV_{EMF} an unwanted carrier 20 kHz off-tune must exceed 110 dBμV_{EMF} to effect the output by 3 dB 3 or SINAD < 14 dB.
Level indication	
RF-LED-band	0 to 110 dBμV, 10 dB steps
AF-LED-band	-15 to +6 dBm
Audio outputs	
Built-in loudspeaker	1.5 W
Extern. loudspeaker	3 W into 4 ohms
Earphones:	10 mW into 600 ohms
Line:	0 dBm ± 10 dB adjustable at the rearside of the receiver; 600 ohms balanced.
Audio distortion for 1000 Hz at standard output power:	< 5 % for SSB < 5 % for DSB at 80 % modulation
AF 1 output	-7 dBm 600 Ohms line output for remote control
AF 2 output	-7 dBm 600 Ohms line output for remote control
IF-output	30 kHz, 600 Ohms, typically 0 dBm
BCD frequency output	TTL-level
AGC output	2 - 3.2 V
Antenna diversity	2- 3.2 V

Power supplies	
AC-operation	110 - 120 V ± 10 % 45 to 400 Hz 220 - 240 V ± 10 % 45 to 400 Hz power consumption: 65 VA ± 20%
DC-operation	21 to 32 V, power consumption: 50 W ± 25% floating
Environmental conditions	
Temperature	
Operating	-15 to +55 °C
Storage	-40 to +85 °C
Humidity	95 % up to 40 °C
Vibration	
without shockmounts	0 to 12.5 Hz 3.2 mm amplitude 12.5 to 25 Hz 0.7 mm amplitude 25 to 50 Hz 0.4 mm amplitude
	Additional: 0 - 50 Hz 0.3 mm peak to peak 50 - 500 Hz 2 g acceleration
Shock	30 g., 11 msec. all sides
MIL spec.	Above tests according to respective section of VG 95332
Weight	Approx. 15 kg (Standard without options)
Dimensions	19" standard
Height	132.5 mm (3 RU)
Depth	450 mm (with handles)
Width	483 mm

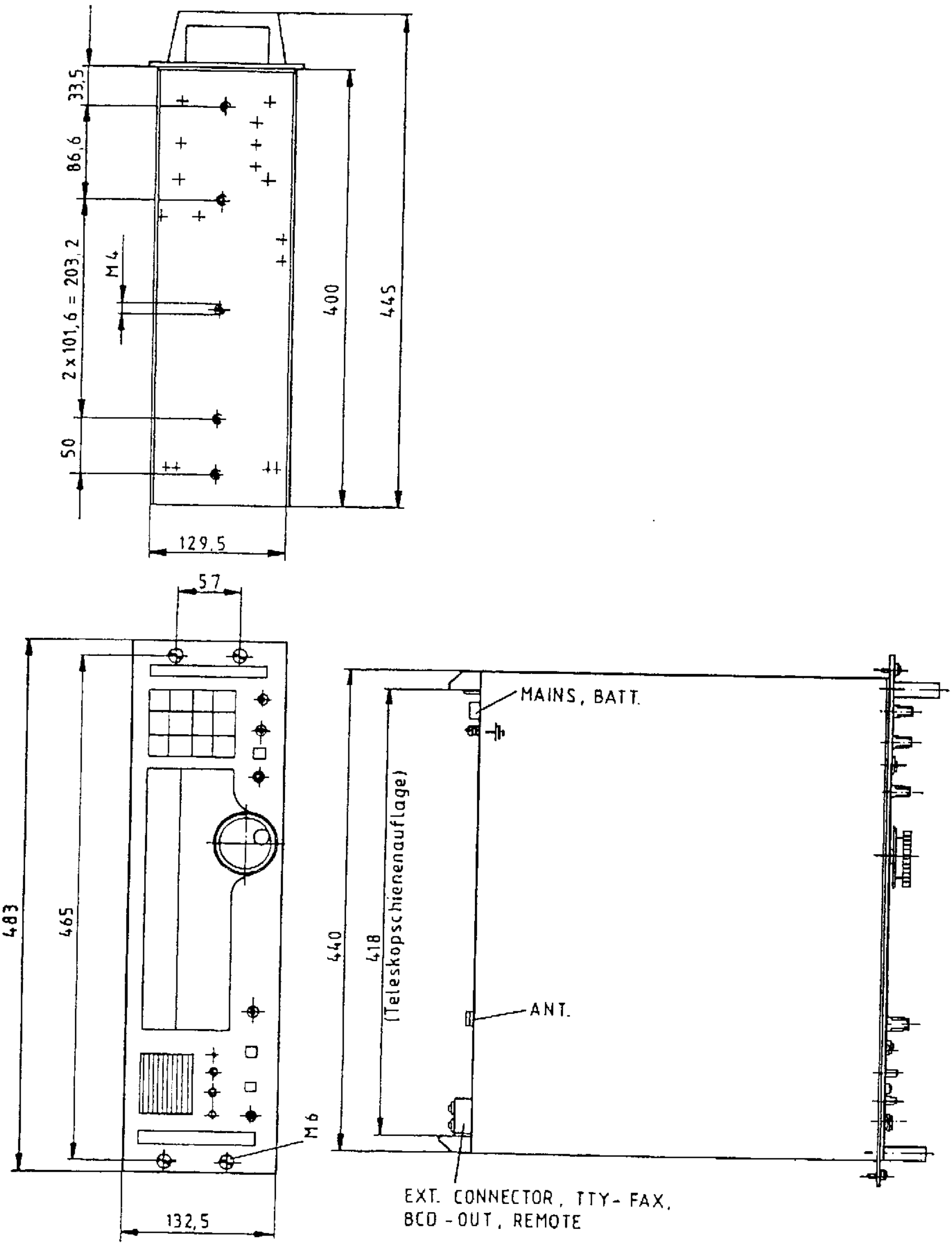


Fig. 1-1
Dimensional drawing RX 1001 M

1.2 Receiver Concept

The radio receiver RX 1001 M / RX 5001 has been developed for telegraphy, SSB-telephony and, with the additional-demodulator unit TC 1001, for teletype and facsimile reception. For the control of a narrow band active antenna, a BCD-Frequency output is provided.

Apart from local control it can be operated in remote control (Plug-in PCB Serial Interface). By using this PCB, the receiver may be remote-controlled either by a computer (for example a PC) with a RS-232-C interface or via a remote control unit (HAGENUK RX 1001 RC).

By means of an optional PRESELECTOR an RF-input selection improvement can be achieved which could be of advantage in close proximity to powerful transmitters.

Apart from the AF-outputs 30 kHz, 625 kHz, 10 kHz and a 5 MHz IF-output are provided. The mode "antenna diversity" makes it necessary to feed-back level information about the HF-signals being filtered in the receiver to the diversity switching facility in the TC 1001. For this, the RX 1001 M is equipped with a quick-action demodulator with a suitable output.

The RX 1001 M is equipped with extensive auto test arrangements (BITE). Tests being performed continuously during operation and the individual test can be distingushed by pressing the TEST key. When these individual tests are being done, a 1 MHz Test-signal is given to the receiver-input. The level of this signal is then checked in individual modules. A failure indication takes place, when values are exceeding the fixed limits.

The block diagrams shows the receiver concept of the RX 1001 M and RX 5001.

The antenna signal is either connected via the protector module or, if optionally fitted, via the preselector module to the 1. Mixer. The preselector consists of three circuit passive tracking bandpass filters.

In the 1. Mixer, the received RF signal is being mixed with the local oscillator frequency of 63.088...93.078 MHz to the first IF of 63.078 MHz. The mixer is a 17 dBm high level diode ring mixer.

In the 2. Mixer Module the 1. IF is converted down to the 2. IF of 5 MHz by mixing the insertion frequency of 58.078 MHz from the VCO A with the 1. IF. The 6 kHz DSB Filter and the 3 kHz SSB Filter is located in the 2. Mixer module as well. At strong antenna input signals the gain of the 1.Mixer-module can be reduced up to 40 dB and the gain of the 2. Mixer Module can be reduced up to 80 dB, both depending on the voltage U AGC/MGC.

For further selection, 6 filters are provided in the filter cassette. Downmixing of the 2. IF to the 30 kHz IF output is done in the filter cassette as well.

The demodulator cassette contains an IF amplifier, the SSB/CW demodulator (product detector), the AM demodulator and an AGC and diversity rectifier. The time response of the AGC-generator can be changed by the receiver frontpanel (AGC short/long).
Upper and lower sideband are selected by changing the BFO insertion frequency. For CW demodulation, the BFO frequency is variable ± 5 kHz by front panel control.

The frequency synthesis of the receiver is done in the BFO-, VCO A- and VCO B-cassette.

The BFO Cassette generates the BFO frequency and PLL reference frequencies for VCO A (10 kHz) and VCO B (25 kHz) and also a test frequency spectrum starting at 1 MHz. This signal is used for BITE testing and it is a 1 MHz square wave signal of +25 dBm which can be attenuated to -54 dBm.

A 10 MHz TCXO in the BFO cassette is the source for all generated frequencies in the receiver. An external 10 MHz or 1 MHz frequency standard can be connected as well. The internally generated frequency is available on a receptacle on the back of the BFO cassette.

The VCO-A generates the frequency steps 10 Hz, 100 Hz, 1 kHz and 10 kHz, and also the second LO-frequency of 58.078 MHz.

By means of the VCO-B, the steps 100 kHz, 1 MHz and 10 MHz are determined and, together with the mixture of the VCO-A, a local oscillator-signal of 63.088 - 93.078 MHz is generated.

The receiver is equipped with a switch mode power supply. The power supply provides +18 V and +5 V and also +12 V for charging the built-in accumulator. A break-down of the AC power supply makes that the power supply automatically switches over to the battery supply.

The operational unit is indicated in the block diagram by "CONTROL PART". It contains the microprocessor for the control of individual settings such as frequencies, bandwidth etc. being entered via the operational elements. The DISPLAY indicates the set operational modes.
For the indication of frequency, time and channel-no., 7-segment LED displays are provided. Single LEDs are provided to indicate the operational modes, input voltages and also the AF-level.

Frequency entry is done either via key-board or the tuning knob.

In CW (mode A1A), the BFO-frequency may be set via a separate knob. The Receiver RX 1001 M offers a memory capacity of 99 channels and features two basic different scan programs, 1 and 2.
The receiver RX 5001 in contrast offers three basic Scan programs 1,3 and 4. (Refer to the list below).

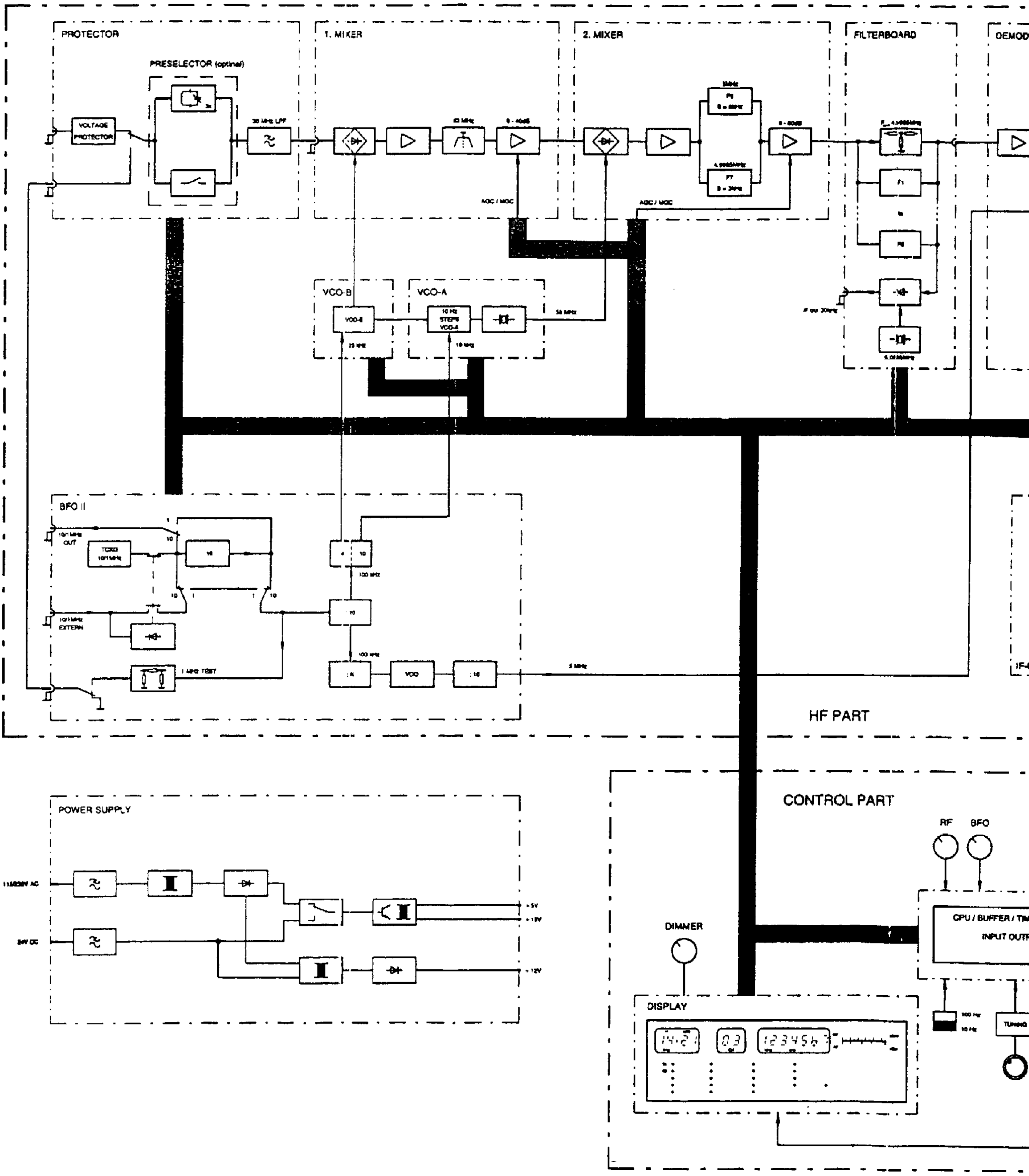
1. SCAN BY TIME
   This program operates on channel scanning with priority to those channels which are designated to preset times. At these given times the programmed channel is activated and stays active during a preset time interval.

2. SCAN CHANNEL + CHANNEL
   Up to 99 channels in any sequence can be linked together and scanned in 2 second intervals.

3. CHANNEL SCAN
   For CHANNEL SCAN set lower channel and upper channel of a group to be scanned, followed by the stop time and dwell time and AGC-threshold. Up to twenty groups of channels can be selected following the same input procedure before the Scan-program is started. Scanning can be stopped from the keyboard or externally by grounding a connector pin.

4. FREQUENCY SWEEP
   For this scan program select lower frequency and upper frequency of band required followed by input for stop time, dwell time frequency increments and AGC-threshold. This programming procedure can be repeated for up to twenty groups of frequency bands to be scanned in sequence until a go-command starts scanning. Scanning can be stopped from the keyboard or externally by grounding a connector pin.

RX 1001 M / RX 5001
Part 1



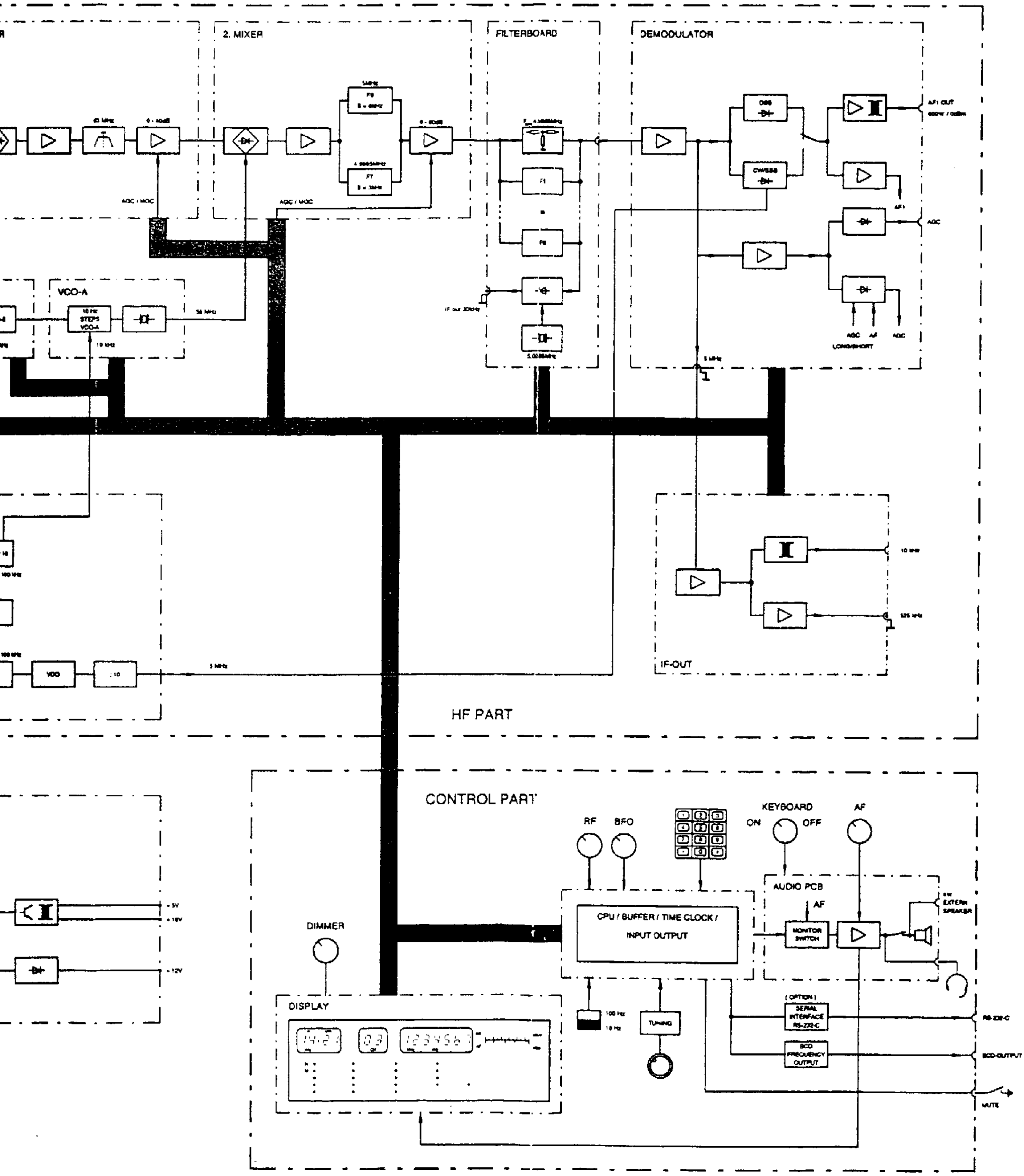
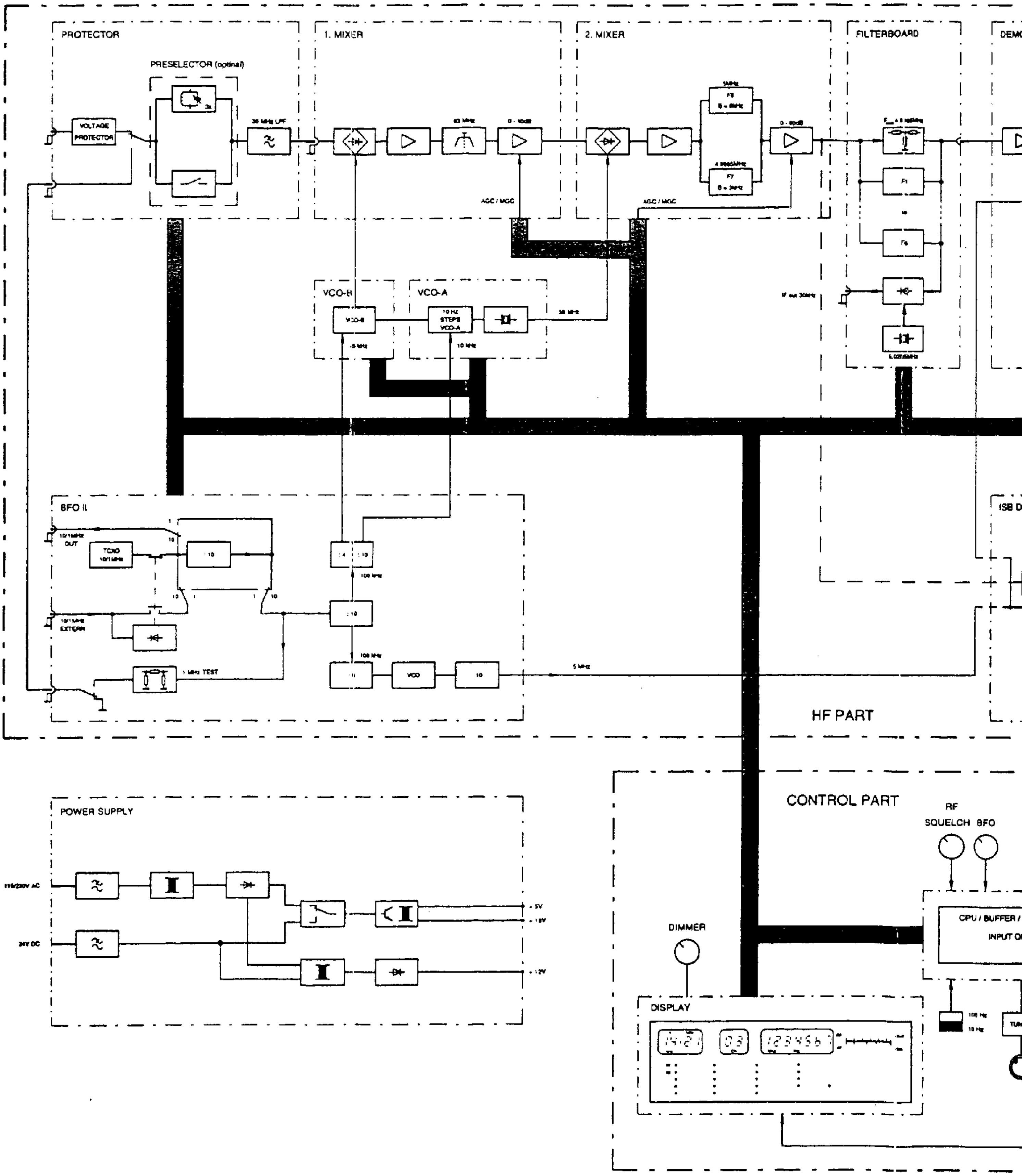


Fig. 1-2
Blockdiagram RX 1001 M

RX 1001 M / RX 5001
Part 1



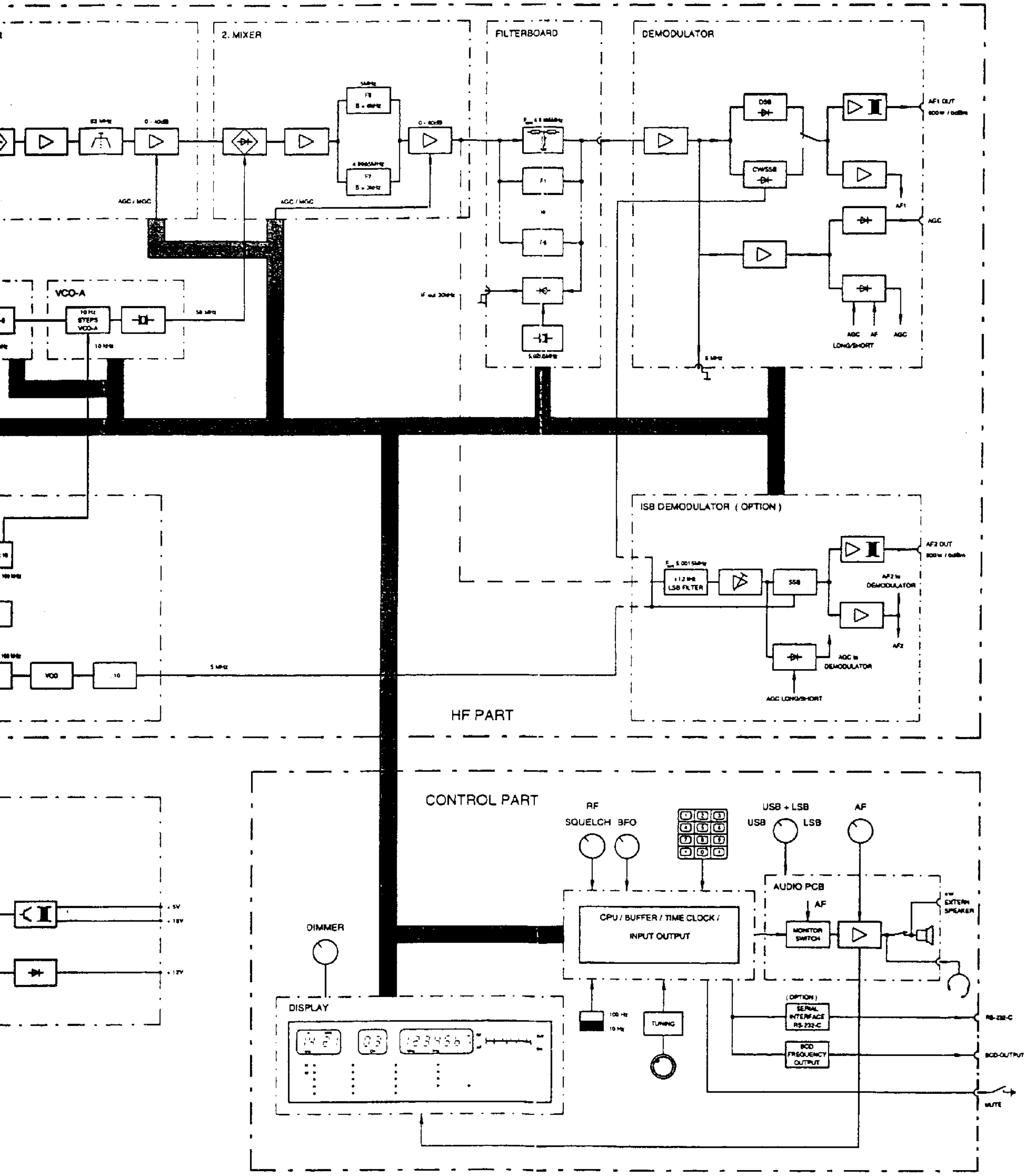


Fig. 1-3
Blockdiagram RX 5001

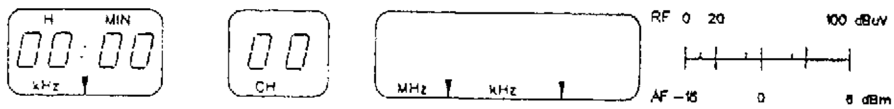
2 OPERATIONS

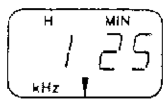
2.1 Operating Instructions RX 1001 M / RX 5001

2.1.1 Controls and Displays

Loudspeaker — The incorporated loudspeaker is positioned behind the cover

Display



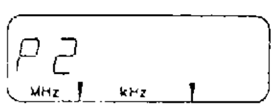


1. Indication of actual time by flashing colon.
2. Indication of channel times colon off-off time, colon on-on time.
3. Indication of BFO-frequency offset in CW mode.

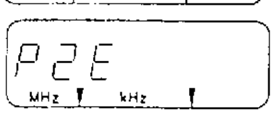
Indication of channel number, while programming or recalling channels.

Indication of the set frequency

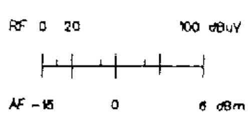
Failure localisation of the built-in test equipment BITE.



Programming indication during the programming process, normal receiver setting respectively.



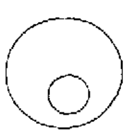
Failure indication after inadmissible entries (ERROR).



Upper line: Indication of RF-input level.
Lower line: Indication of audio output level.

Keyboard	Normal keyboard (telephone keyboard 0-9) with special function * and #. * Frequency entry, error reset and special functions. # Channel selection, filling display with trailing zeros.
DIMMER	The light intensity of the LED display can be varied in order to match the brightness to the environmental light conditions.
RF	If the automatic gain control **AGC** is switched OFF (enter **60** on keyboard), this control can be used to control the RF gain manually. NOTE (RX 5001 only) If AGC is on, the RF gain control is used as a threshold control for a squelch gate. Fully CW means squelch gate open (optional).
10 Hz/100 Hz -STEPS-	Selecting frequency increment during manual tuning with the knob.
BFO	In the mode A1A, the BFO frequency may be shifted by +/- 5 kHz in 10 Hz increments. Offset will be indicated in the time display window.
TUNING KNOB	Is used for frequency setting, resolution of the change depends on position of switch 10 Hz/100 Hz STEPS. The knob is provided with an electronical locking device. If locked during tuning, the frequency display shows for a short time.

(Locked)



LOCK FLYWHEEL - Entry 70
UNLOCK FLYWHEEL - Entry 71

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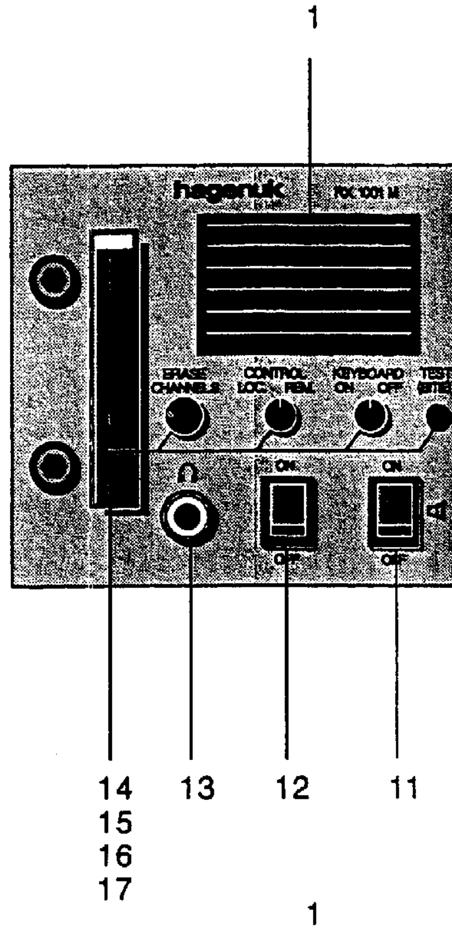
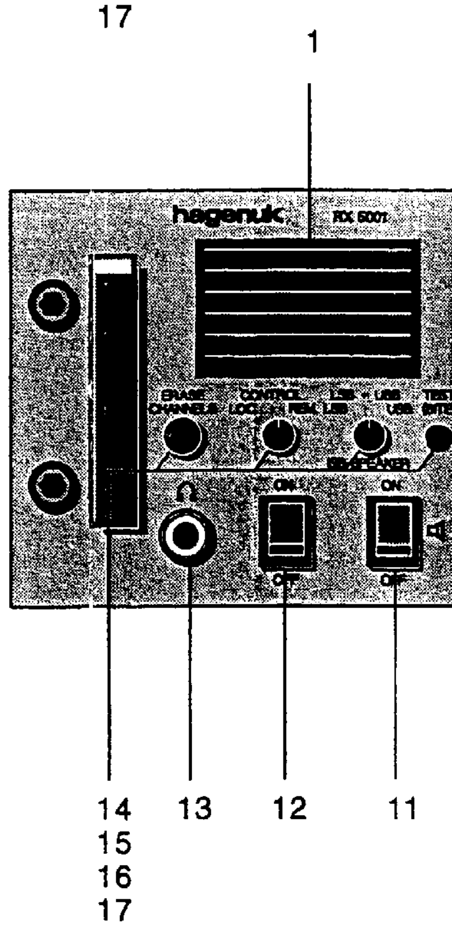
LED indications	Indication of the operational mode, AGC mode, filter band width etc.
AF	This control is used to set the audio volume for the earphone and the loudspeaker.
Loudspeaker ON/OFF	The built-in loudspeaker can be switched-off; it additionally can be switched-off electronically in the duplex mode by means of a signal from the transmitter, if the receiver is muted, and if the squelch gate is closed.
Mains switch ON/OFF	Switches the receiver on; automatic change-over to battery when the power supply breaks down (LED indication BATTERY).
Headphones	Connection for a 600 ohms headphones
TEST -(BITE)-	Activates the auto test.
Keyboard ON/OFF	(RX 1001 M only) In position ON, all operating elements are released. In position OFF, the following positions are looked: - Enteries via keyboard - Frequency adjustment with tuning knob - BFO-adjustment - Auto Test tripping
LSB/USB Speaker Switch	(RX 5001 only)
ISB-SPEAKER	Selects the audio for the speaker in mode ISB.
LSB	LSB is monitored on the speaker.
USB	USB is monitored on the speaker.
LSB+USB	Both sidebands are monitored on the speaker.
CONTROL LOCAL/REMOTE	In position "REM" remote control of the receiver RX 1001 M / RX 5001 is possible.

ERASE CHANNELS	By pressing the key ERASE CHANNELS all stored channels and also the frequency just entered are being cleared and the indication field filled-up with zeros. The mode will be set to DSB and the ACG time constant is set to short. Preselection and antenna attenuation are switched off. If the key is being pressed during the auto test, this test will be stopped and then the receiver is cleared as above. In order to reset the receiver to its basic conditions (emergency frequency 2182 kH2), the key ERASE CHANNELS must be kept pressed during switching-on the receiver (RESET-Function)

1 Loudspeaker
2 Display
3 Keyboard
4 Dimmer
5 RF-Gain Control/Squelch Control
6 Selector 10 Hz / 100 Hz STEPS
7 BFO Control
8 Tuning Knob
9 LED Display
10 AF-Gain Control
11 Loudspeaker Switch
12 Mains Switch
13 Headphones
14 Test - Key
15 ISB Speaker (RX 5001) - or Keyboard ON/OFF (RX 1001 M) Switch
16 Local/Remote Control Switch
17 Erase Channel Switch





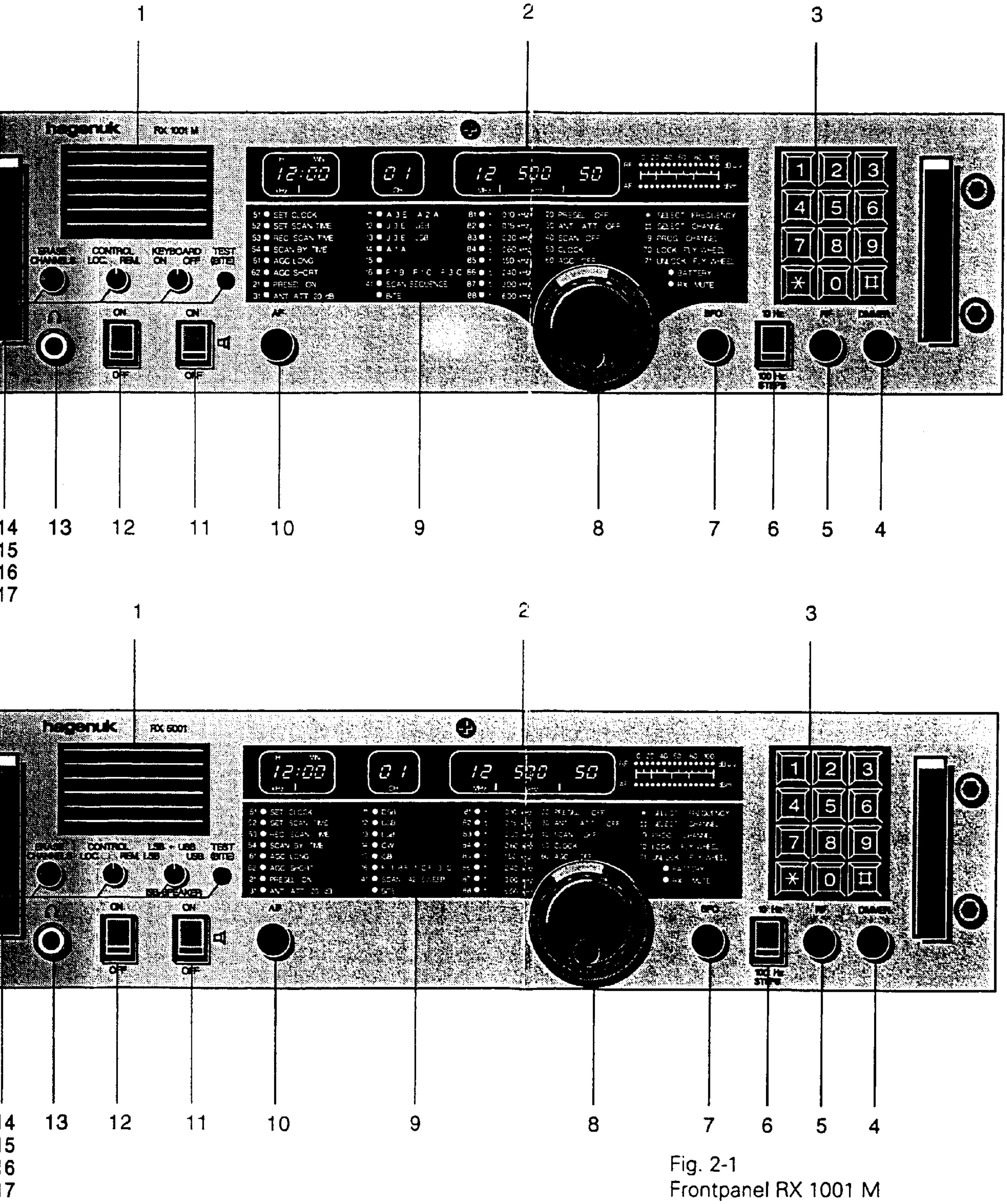


Fig. 2-1
Frontpanel RX 1001 M
Frontpanel RX 5001

2.1.2 Menu Selection of the Display

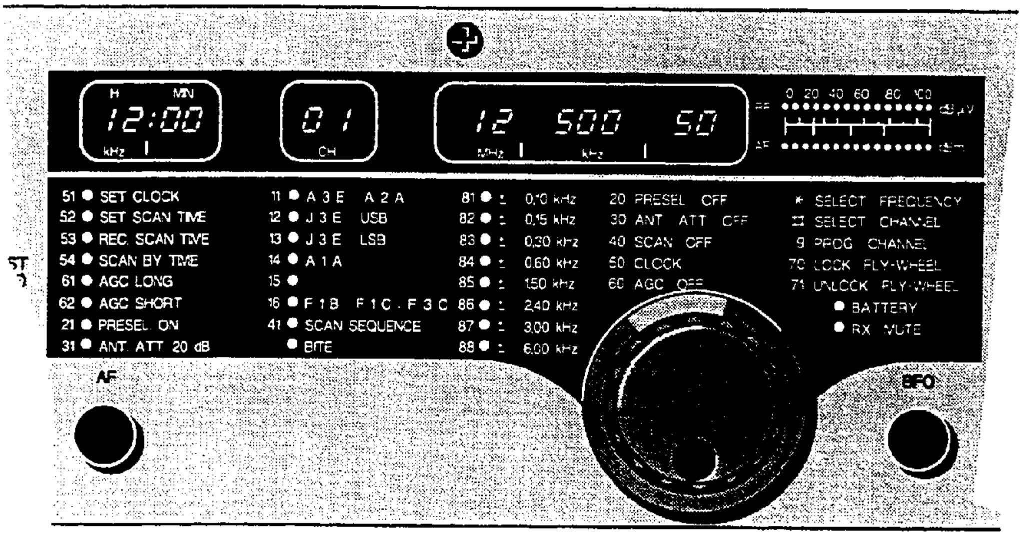


Fig. 2-2 Menu Selection RX 1001 M / RX 5001

The selection of menus is to be shown in the following orders:

Example:

51	0	Set Clock
entry code	LED	brief description of the entry command

With the brief description of the entry command the operator can select what the receiver is supposed to do. Then he enters the entry code via keyboard. When the receiver has recognized this entry as correct and performed it accordingly, the corresponding LED goes ON.
An annulled entry makes the corresponding LED turn "OFF" as for example:

20 PRESEL OFF

After this entry, the LED **21** PRESEL. ON extinguishes. Furthermore, there are also information-LEDs on the menu selection:

BITE, BATTERY and RX-MUTE.

2.1.3 Operation and Programming

As a general principle, continue a started operating process to the end, although you might have recognized in the meantime that you have committed an error.

A faulty entry may be partially corrected immediately and digit-wise with * key. Frequency-inputs can only be corrected as a whole. Start this by operating * twice. The * key has several special functions in some operations, refer to chapters for scanning and sweeping.

ATTENTION

The receiver RX 1001 M/RX 5001 is provided with a fail safe memory:

1. In case of a power supply failure - mains or battery - the actual status and the content of the channels are being stored for 12 days.
2. In case the mains connector on the receiver is being disconnected, all memory contents such as channels, frequencies, etc. will be cleared (as a matter of secrecy regarding operating frequencies and operating channels in case the receiver is being serviced).

2.1.4 Switching-ON the Receiver

The following pre-settings must be checked:

- CONTROL in position LOCAL

Push mains switch to ON, with the DIMMER knob control the intensity of indication LEDs.

When the LED BATTERY lights up, automatic switching-over in the power pack of the receiver to battery supply has taken place because of the non-availability of the mains.
When the LED BITE lights up, the receiver can be operated normally, if a failure in the monitoring system is the only reason .

RX-MUTE is being entered by an external signal, as for example on simplex mode by the transmitter and on auto test.

In case of overvoltage at the antenna input the protective circuit also causes muting of the receiver and makes the LED RX-MUTE illuminate
(only if option PRESELECTOR is installed).

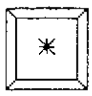
2.2 Programming

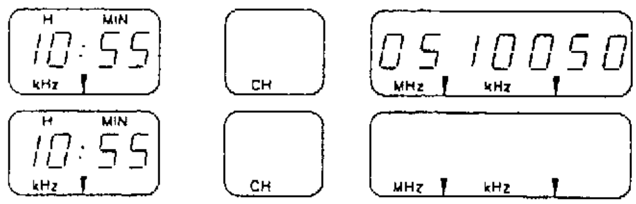
2.2.1 Entering a Frequency

An entry of a new frequency is initiated by pressing the * key. The double function (blanking function) of this key has to be taken into account, i.e.: a previous entry must have been finished until a new frequency is being entered.

Entry — Display

actual indication

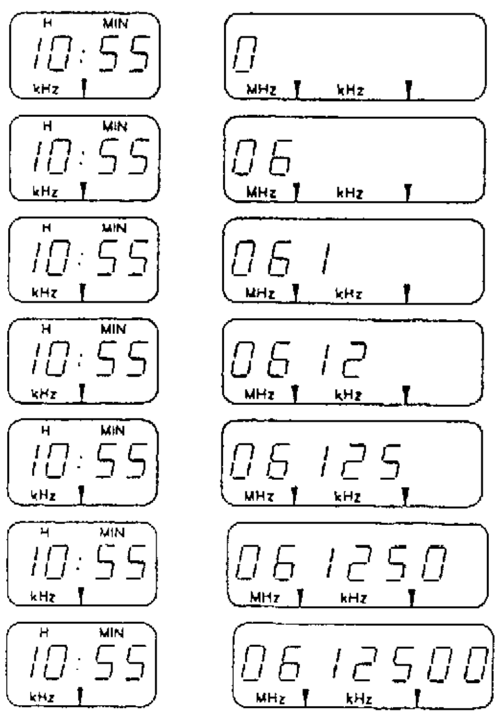




NOTE
The indication on the frequency-display has been blanked, the receiver remains with the momentary frequency and is receiving normally until the new frequency is being entered completely.
New frequency is e.g. 06.125.00 MHz

Entry — Display

0
6
1
2
5
0
0

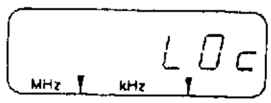


When entering the last digit the receiver switches-over to the new receiving frequency and is ready for further entries. After the digit **5** is being entered, the key # may be also pressed in order to fill-up with zeros.

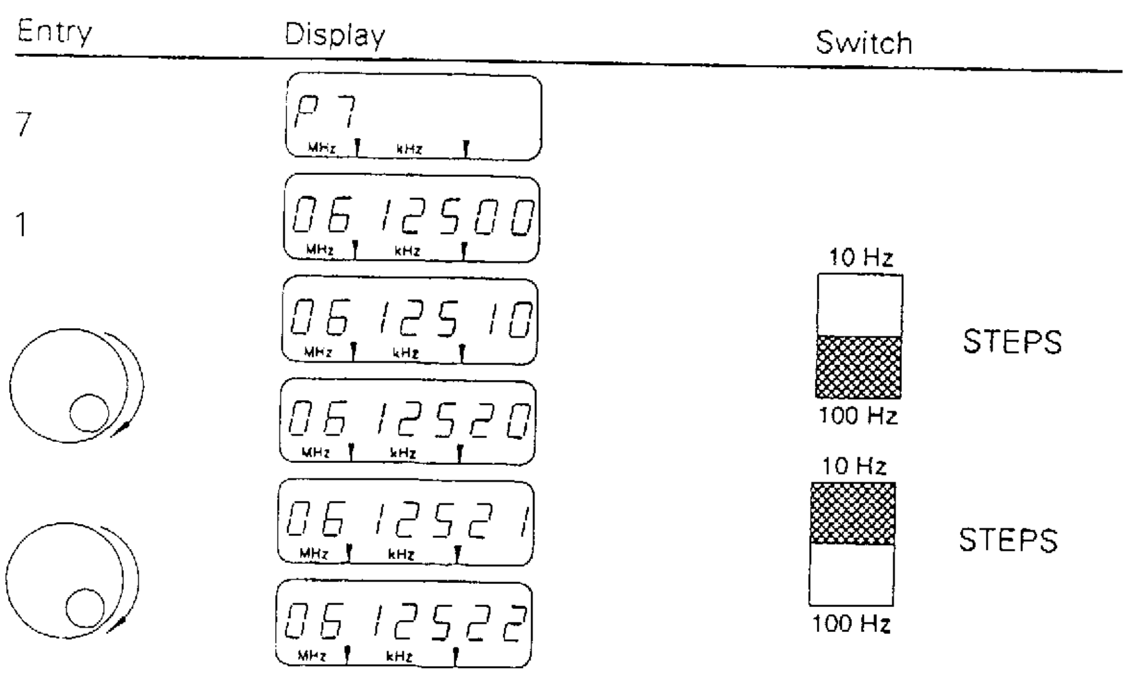
2.2.2 Varying the frequency with the fly wheel knob

NOTE

For this operation, the knob must be switched-on which is done by entering the code 71 UNLOCK FLY-WHEEL.
In case the knob is locked, code 70 LOCK FLY-WHEEL, the display shows briefly



while operating the knob.
Entry codes 7 and 7E may be interrupted by means of the key * in case the entries have been incorrectly entered. The tuning speed may be changed by means of the switch STEPS 10 Hz/100 Hz.



2.2.3 Setting the operating mode

From the menu, the required mode may be selected. A faulty entry, as for example, code 10 will be indicated by the receiver with the following ERROR indication:

P 1E
MHz kHz

By pressing the key *, the entry is being interrupted, whereas the previous mode is maintained.

Example: set operating mode J3E LSB -code 13-

Entry	Display		LED (*)
actual indication	-2 00	06 12522	14 • CW
1	10:55	P 1	14 o CW
3	10:55	06 12522	13 • J3E LSB

* • LED lights
o LED does not light

2.2.4 Operational mode CW and setting the BFO frequency

When the mode CW is switched-on, the BFO frequency offset appears on the CLOCK indication field. In 10 Hz increments, this offset can be adjusted by the BFO control knob.

Example: set operating mode CW code -14-

Entry	Display		LED (*)
actual indication	10:55	06 12522	13 • J3E LSB
1	10:55	P 1	13 o J3E LSB
4	-1 00	06 12522	14 • A1A
BFO 	-1 01	06 12522	14 • A1A
	-1 02	06 12522	14 • A1A

indication with "-" -1 00 means that the BFO-frequency is 1.00 kHz **lower** than the IF frequency.

indication without "-" 1 00 means that the BFO-frequency is 1.00 kHz above the IF frequency. The tuning range of the BFO is -/+ 5 kHz related to the IF frequency.

* • LED lights
o LED does not light

2.2.5 Setting the filter bandwidth

The filter bandwidth is being preset automatically on mode selection. From menu code 81 0.10 kHz to 88 6.00 kHz any other filter may be selected after this.
Entry errors may be corrected again by key *.

Op. mode	Preset filter bandwidth
DSB	6.0 kHz
USB/LSB	2.4 kHz
CW	0.3 kHz
F1B	0.6 kHz at $f_{RX} \leq 3$ MHz
	1.5 kHz at $f_{RX} \geq 3$ MHz

Example: entry code 85 "1.5 kHz"

Entry	Display		LED (*)
actual indication	10:55	06 12522	12 • J3E USB 86 • 2.40 kHz
8	10:55	P8	12 • J3E USB 86 o 2.40 kHz
5	10:55	1250040	12 • J3E USB 85 • 1.50 kHz

2.2.6 Switching - ON/OFF the preselector

Switching ON the preselector code -21-
Switching OFF the preselector code -20-

Entry	Display		LED (*)
actual indication	10:55	1250040	12 • J3E USB 86 • 2.40 kHz 21 • PRESEL. ON

Preselector to be switched off code -20-

2	10:55	P2	12 • J3E USB 86 • 2.40 kHz 21 o PRESEL. ON
0	10:55	1250040	12 • J3E USB 86 • 2.40 kHz 21 o PRESEL. ON

* • LED lights
o LED does not light

2.2.7 Switching - ON/OFF the antenna attenuation

Entry errors may be corrected via key * again.
Example: ANT. ATT. is switched ON code **-31-**
ANT. ATT. is switched OFF code **-30-**

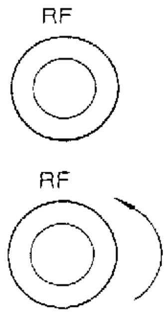
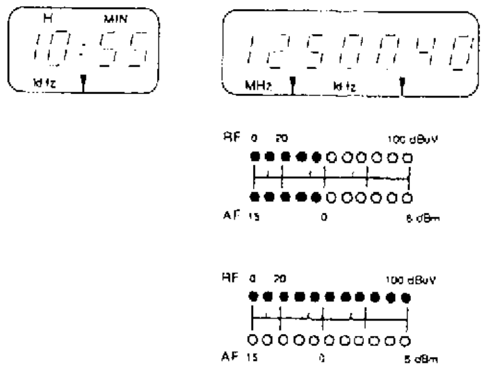
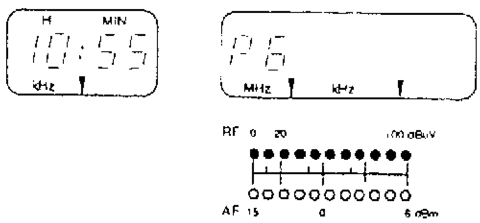
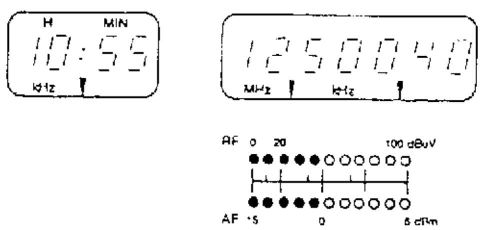
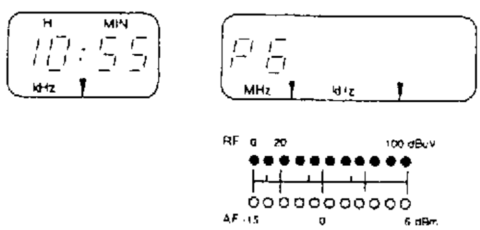
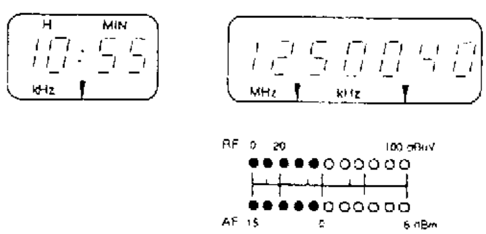
Entry	Display		LED (*)
actual indication	H MIN 10:55 kHz	1250040 MHz kHz	12 • J3E USB 86 • 2.40 kHz 31 • ANT.ATT 20 dB ON
Antenna attenuation to be switched-off code **-30-**			
3	H MIN 10:55 kHz	P 3 MHz kHz	12 • J3E USB 86 • 2.40 kHz 31 o ANT.ATT 20 dB ON
0	H MIN 10:55 kHz	1250040 MHz kHz	12 • J3E USB 86 • 2.40 kHz 31 o ANT.ATT 20 dB ON

* • LED lights
o LED does not light

2.2.8 Change from AGC to RF-manual control and vice versa

Entry errors may be corrected again by key *.
The RF-manual control is set by the entry code **-60-**
In AGC - modes **61** and **62** the manual control potentiometer (RF-control) sets a threshold for an internal Audio gate (requires settings on AUDIO II printed circuit board; squelch option; RX 5001 only)

NOTE
If AGC modes AGC-SHORT or/and AGC-LONG are changed or switched off, the receiver is set to manual gain control MGC after the digit **6** is keyed in. Receiver gain is now determined by setting of RF gain control knob. After entering the second digit the receiver settles in the desired gain control mode.

Entry	Display	LED (*)
actual indication 		12 • J3E USB 86 • 2.40 kHz 61 o AGC LONG 62 o AGC SHORT
Switching over to AGC Long code -61-		
6		12 • J3E USB 86 • 2.40 kHz 61 o AGC LONG 62 o AGC SHORT
1		12 • J3E USB 86 • 2.40 kHz 61 • AGC LONG 62 o AGC SHORT
switching over to AGC SHORT code -62-		
6		12 • J3E USB 86 • 2.40 kHz 61 o AGC LONG 62 o AGC SHORT
2		12 • J3E USB 86 • 2.40 kHz 61 o AGC LONG 62 • AGC SHORT

* • LED lights
o LED does not light

2.2.9 Setting the clock

The function - SET CLOCK - is ordered by the digits **51**. The actual time indication extinguishes and the new time may be entered. After entering the last digit the clock is started with the new set time (full minute).
Via the * -key corrections may also be done. Each pressing of the key erases one entry step. By this, an incorrectly entered digit can be corrected. Pressing the key * -key repeatedly makes that the complete entry process can be annulled; the clock keeps on going with the old setting, without any change.

Example: set the actual time 12:00

Entry	Display		LED (*)
actual indication time = 12:00	10:55	1250040	51 o SET CLOCK
5		P5	51 o SET CLOCK
1		P5	51 • SET CLOCK
1	1	P5	51 • SET CLOCK
2	12	P5	51 • SET CLOCK
0	12 0	P5	51 • SET CLOCK
0	12:00	1250040	51 o SET CLOCK

* • LED lights
o LED does not light

2.2.10 Programming of channels

Storing of the momentarily set receiver data into one channel is preceded via entering digit **9**. After this, a 2-digit channel number must be entered. Permissible channel numbers are **01... 99**. With the key * corrections may also be done here. Each key pressing erases one entry step. By this operation, an incorrectly entered digit can be corrected. By pressing the key * repeatedly the complete entry process can be cancelled.

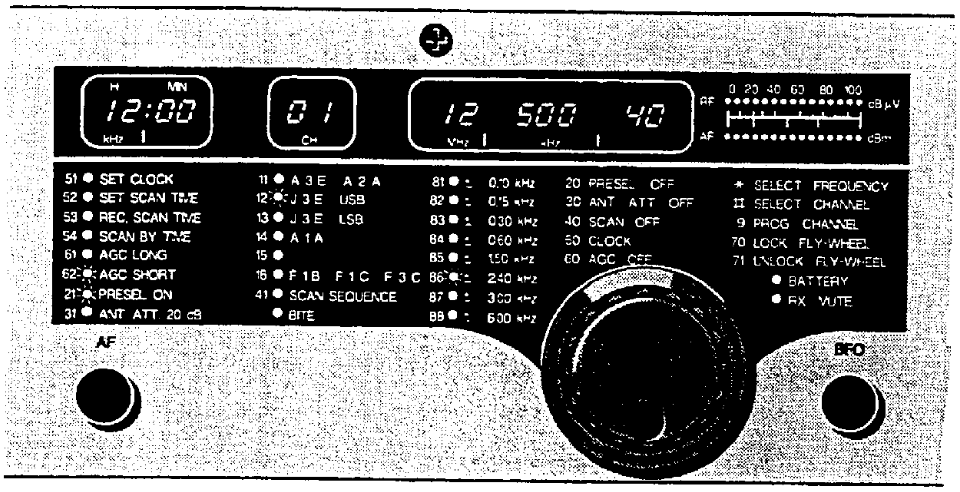


Fig. 2-3 RX 1001 M, Operational Parameters

The current operational parameters shall be stored under channel No. 01.

operational frequency	12.500.40 MHz
mode	J3E USB
pre-selection	PRESEL. ON
IF-bandwidth	2.40 kHz
AGC	AGC SHORT

Entry	Display			LED (*)
	actual indication see drawing Fig. No. 2-3			
9	10:55	CH	P 9	12 • J3E USB 21 • PRESEL. ON 31 o 86 • 2.4 kHz o BITE
0	10:55	0 CH	P 9	62 • AGC SHORT
1	10:55	01 CH	1250040	

* • LED lights
o LED does not light

2.2.11 Recalling stored data

Already programmed channels can be recalled as follows:

1. Programmed recall:

Scan time — The programmed channel will be switched on when the scan time is reached.

Scan CH + CH — The programmed channels will be switched on in a required sequence. The channel will be switched on for a period of 2 seconds. (RX 1001 M only. For RX 5001 refer to chapter 2.3.2)

2. Manual recall — In order to recall receiver data stored on one channel the key # must be pressed. After this, the 2-digit channel number (01...99) has to be entered. When recalling a channel not programmed before, the frequency indication will be filled with zeros and the receiver is muted. The receiver can be released only after entering a new frequency or by recalling a programmed channel. By turning the knob, the frequency is being set to 10 kHz and the receiver is also unmuted.

Indication **P-** : A channel shall be recalled.
Indication **P- E** : Entry error at channel number (example: **00**). With the key * correcting may also be done. By each key press one entry step will be released. In this way, an incorrectly entered digit can be corrected.

2.3 RX 1001 M / RX 5001 SCAN Programs

2.3.1 Program SCAN BY TIME

2.3.1.1 Programming SCAN BY TIME program (daily)

NOTE
This program can only be carried out with channels which are already stored.

The channel is switched on at a certain time (starting time) and switched off at a certain time (finishing time) every 24 hours. (Once a day).

Example: check SCAN TIME, start with code -53-

Entry	Display			LED (*)
	10:55	01	1250040	
5		01	P5	53 o SCAN TIME
3	10:05	01	1250040	53 • SCAN TIME
	10 10	01	1250040	
	00:00	01	1250040	

* • LED lights
o LED does not light

Check, whether a CHANNEL TIME is already programmed on this channel. For example the 10:05 appears as starting time in change with 10 10 as finishing time °. If a change or programming is required this can be achieved by pressing the key *. The time display is now reset to 0.

° If you like to leave the program, just turn the frequency knob.

Example: The channel No. 01 shall be switched on every 24 hours at 11:22 and switched off at 11:47.
Set new SCAN TIME, start with code -52-

Entry	Display			LED (*)
	00:00	01	1250040	53 • SCAN TIME
5		01	P5	
2	:	01	P5	52 • SET SCAN TIME
1	1 :	01	P5	52 •
1	11:	01	P5	52 •
2	11:2	01	P5	52 •
2	11:22	01	P5	52 •
1	1	01	P5	52 •
1	11	01	P5	52 •
4	11 4	01	P5	52 •
7	11 47	01	P5	52 •
	10:55	01	1250040	52 o

* • LED lights
o LED does not light

2.3.1.2 Programming SCAN BY TIME (hourly)

Recall channel to be programmed for example channel 02.

Entry	Display (H MIN)	Display (CH)	Display (MHz kHz)	LED (*)
#	10:50		P -	
0	10:50	0	P -	
2	10:50	02	1250040	
5		02	P 5	
3	24:50	02	1250040	53 •
	24 55	02	1250040	

* • LED lights
o LED does not light

Check whether a channel time is already programmed on this channel. If a change of programming is required, operate * key. The time display will be reset to zero.

Entry	Display (H : MIN)	Display (CH)	Display (MHz / kHz)	LED (*)
*	00:00	02	1250040	53 •
5		02	P5	
2	:	02	P5	52 •
2	2 :	02	P5	52 •
4	24:	02	P5	52 •
0	24:0	02	P5	52 •
0	24:00	02	P5	52 •
0	24 0	02	P5	52 •
2	24 02	02	P5	52 •
	10:51	02	1250040	52 o

* • LED lights
o LED does not light

In above example, after activating SCAN BY TIME, channel **02** will be recalled on the hour and switched off 2 minutes past every hour.

2.3.1.3 Display of all CHANNELS with SCAN times

Interrogation can be terminated by entering any number or by turning the FLY-WHEEL.
Example: display of channel No. 01, 02 etc.

Entry	Display (H MIN / kHz)	Display (CH)	Display (MHz / kHz)	LED/remarks
	12:00		1250000	
#	12:00		P -	
0	12:00	0	P -	
1	12:00	01	1250040	
5		01	P5	
3	11:22	01	1250040	starting-time
	11 47	01	1250040	* finishing-time
#	24:00	02	2150000	
	24 02	02	2150000	

#
etc.

* Finishing-time is indicated without the ' : ' in the display.

With above procedure it is conviniently possible to scroll (upwords only) through the channels and investigate its contents.

2.3.1.4 Activating SCAN BY TIME

Entry	Display		LED/remarks
5		P 5	
4	10:47	2355500	54 •

* • LED lights
o LED does not light

The SCAN BY TIME mode can only be switched off by entering **40**.
If after SCAN BY TIME is activated an entry starts with **5**, a **P 5** E error is displayed. This error can be reset by entering **5** again or entering *. The error is to remind the operator, that SCAN BY TIME is active, and by changing scan times and the clock setting (beginning with **5**) the operator might upset the timing of activated channels. During activated SCAN BY TIME mode, the program is searching through all channels for switch on- and off times. If a channel is activated, the respective channel No. is flashing in the channel display, and the content of this channel is controlling the receiver. No controls except AF volume control is possible. The only command excepted via the keyboard is **40**. Upon switching "off" time, the receiver switches back to its previous status.
If no channel has allocated scan times, error **P 5** E will be displayed after activating SCAN BY TIME mode. This error can be reset by entering *.
For simultaneous activation of SCAN BY TIME and channel scan, scan ch + ch or frequency sweep modes, SCAN BY TIME has to be activated first, and then the respective sweep program.

2.3.2 Programm CHANNEL SCAN (RX5001 and RX1001 M with Audio II PCB)

2.3.2.1 Programming and checking of CHANNEL SCAN-ranges

General:
A CHANNEL can be programmed with a frequency, AGC, IF-bandwidth and other status data. Refer to chapter 2.2.10. 99 different channels are possible.

Following parameters can be stored in 20 CH-SCAN range memories:
(These memories are numbered from **01** to **20**).

-1 starting channel	min. 01 max. 99 (00 followed by # erases the SCAN-range)
-2 end channel	min. starting channel 01, max. 99
-3 STEP-incrementation	STEP-increment is always **1**, nevertheless an interruption of the CH-SCAN programming is possible by entering **40**.
-4 STEP-time	0.1s - 0.9s in 0.1s-steps
-5 Dwell-time	0s - 9s, in 1s-steps (0 = CH-SCAN STOP until # is entered)
-6 Threshold value	05 - 95 dBµV in 5 dBµV-steps

NOTE
When entering the parameters **-1** and **-2** it is not possible to stop programming by code **40**, because all digit combinations are covered with CHANNEL-No.. Interruption is possible at parameter **-3** only.

Entry of all parameter is performed on the frequency-display. As an orientation aid, on programming, each position not used is marked by '-' with the effect that the number of digits to be entered can be recognized easier. (However, the 10 Hz-position cannot be marked due to the hardware configuration). When the programming of CH-SCAN ranges and channel scan-sequences is in progress the previously set receiving frequency is not changed, i.e. one may keep on listening on the 'old' frequency.

Special functions of keys * and # on programmig

* On entering the range number the entries subsequently step back, i.e. the entry of the tens-position of the range number and also the entry of **45** can be reset.

After entering the range number the following functions are given:

* On first position of an entry sets an entry step back. # is followed by the next entry step.
* On entering a multi-digit parameter what erases the 'new' set position and indicates again the prevailing parameter value. # fills zero-digits to the remaining positions, it however does not yet lead to the next entry stop.

After complete entry of a new parameter, this is stored by # (ENTER–key). Simultaneously a transition to the next entry step is established.

Example with the following parameters:

starting channel	07
end channel	15
STEP-time	0.4 sec
Dwell-time	5 sec
Threshold value	50 dBμV

NOTE
The CH-SCAN programming can be done with stored CHANNELS only

The programming starts with the entry **-45-**

Entry	CLOCK	CH	FREQUENCY	Remarks
	12:27		1234567	condition prior to entry
4	12:27		P4	
5	45:		P45	LED 41 •
0	45:0		P45	1st position of range number
1	45:01	-1	--17--	previous starting channel -17-
0	45:01	-1	--0 --	Enter new starting channel
7	45:01	-1	--07--	
#	45:01	-2	--23--	ENTER starting channel In the display previous end channel

• LED lights
o LED does not light

Entry	CLOCK	CH	FREQUENCY	Remarks
1	45:01	- 2	- - 1 - -	Enter new end channel
5	45:01	- 2	- - 15 - -	
#	45:01	- 3	- - - - - -	ENTER end channel, no step incrementation can be entered (only *, # or 4)
#	45:01	- 4	- - - 03 -	ENTER in Display previous step time
0	45:01	- 4	- - - 0 -	New Step-time 0.4 s
4	45:01	- 4	- - - 04 -	
#	45:01	- 5	- - - - 5 -	ENTER new steptime
#	45:01	- 6	- - - 65 -	ENTER, Dwell-time remains unchanged In display previous threshold.
7	45:01	- 6	- - - 7 -	New threshod-value
*	45:01	- 6	- - - 65 -	Correct entry error
5	45:01	- 6	- - - 5 - -	New threshold-value
0	45:01	- 6	- - - 50 -	
#	45:02	- 1	- - 67 - -	ENTER new threshold, *

* Next CH- SCAN range memory starts, which can be programmed in a similar fashion. In display previous start channel of CH-Scan range memory 02

Exit channel scan range memory programming

Entry	CLOCK	CH	FREQUENCY	Remarks
*	45:01	-6	---50-	Check threshold-value memory 01
*	45:01	-5	----5-	Dwell-time memory 01
*	45:01	-4	---04-	Step-time memory 01
*	45:01	-3	-------	
4	45:01	-3	P4	Finish CH-SCAN memory programming
0	12:27		1234567	Previous condition displayed again, LED 41 o.

NOTE
When on the first position of the ENTRY -Step for the starting channel number in memory range 01, the entry of * does not reset to range 20. Instead, a reset to the entry of the range number takes place and, by entering another *, there is an escape from the programming of the CH-SCAN range memories.

Entry	CLOCK	CH	FREQUENCY	Remarks
	45:01	-1	--07--	Starting memory
*	45:		P45	LED 41 •
*	12:30		P4	LED 41 o
*	12:30		1234567	Old state

* • LED lights
  o LED does not light

2.3.2.2 Error reports

Errors are shown on the corresponding position on the display, by the indication 'E' (for ERROR).

Entry	CLOCK	CH	FREQUENCY	Remarks
4	12:27		P4	
5	45:		P45	LED 41 •
0	45:0		P45	1st position of memory number
1	45:01	-1	- - 17 - -	Previous starting channel
3	45:01	-1	- - 3 - -	Enter new starting channel
3	45:01	-1	- - 33 - -	
#	45:01	-2	- - 23 - -	ENTER starting channel

* • LED lights
o LED does not light

If the now displayed end channel of 23 is entered, the memory No. 01 in subsequent programming will be treated as incompletely programmed, because the start channel is higher than the end channel.

Entry	CLOCK	CH	FREQUENCY	Remarks
5	45:01	-2	---5--	
0	45:01	-2	---50-	New end channel
#	45:01	-3	------	ENTER new end channel
#	45:01	-4	---03-	previous step time
0	45:01	-4	---0 -	New Step-time
0	45:01	-4	---0E-	Error: Step-time 0.0 s
4	45:01	-4	---04-	Step-time 0.4 s
#	45:01	-5	----5-	ENTER step time, previous dwell time
#	45:01	-6	---05-	ENTER dwell time, previous threshold
0	45:01	-6	---0 -	New threshold
0	45:01	-6	---0E-	Error threshold 0
5	45:01	-6	---05-	Correct ERROR
#	45:02	-1	---00-	ENTER threshold

2.3.2.3 Erasing the CH-SCAN ranges

Entry	CLOCK	CH	FREQUENCY	Remarks
4	12:35		P 4	
5	45:		P 4 5	
1	45: 1		P 4 5	
5	45: 15	- 1	- - 3 6 - -	
0	45: 15	- 1	- - 0 - -	
0	45: 15	- 1	- - 0 0 - -	Range 15 to be erased
0	45: 16	- 1	- - 8 1 - -	Range 15 to be cleared now.

When looking through the CH-SCAN range memories only the starting channel - - 0 0- - is displayed. After this, the next memory follows immediately.

Entry	CLOCK	CH	FREQUENCY	Remarks
	45: 14	- 5	- - - - 8 -	Dwell-time memory 14
#	45: 14	- 6	- - - 4 5 -	Threshold value memory 14
#	45: 15	- 1	- - 0 0 - -	Memory 15 is erased!
#	45: 16	- 1	- - 8 1 - -	Starting channel memory 16 etc.

2.3.2.4 Entry and start of the CH-SCAN sequence

In order to start a CH-SCAN sequence, 41 is followed by the memories to be scanned and # to be entered for start. All entries, until start of sequence, can be stepped back by *.
After entering the memory number the starting channel of this memory, respectively ´- -00- -´ for an erased memory, or ´-0-0-´ for an incompletely programmed memory is displayed.

A CH-SCAN memory sequence already entered before can be started again by 41, followed by #.
Erased and incompletely programmed CH-SCAN memories are skipped when they are included in the sequence. A sequence consisting of only erased and incompletely programmed memories cannot be started.

The error report **P 41 E** is then given. This report is also given if no sequence is stored previously.

Example: Scanning the programmed memories 02, 03 and 08:

Entry	CLOCK	CH	FREQUENCY	Remarks
4	12:51		P 4	
1	12:51		P 4 1	LED 41/42 •
1	12:51	1	P 4 1	Entry error, should be 0
*	12:51		P 4 1	Error reset
0	12:51	0	P 4 1	
2	12:52	02	- - 40 - -	Starting channel, memory 02
0	12:52	0	P 4 1	next momory
2	12:52	02	- - 40 - -	Error, should be 3
*	12:52	0	P 4 1	Error reset
3	12:52	03	- 0 - 0 -	Memory 03 in-completely prog.
0	12:53	0	P 4 1	next memory
8	12:53	08	- - 73 - -	Starting channel, memory 08
#	12:53	40	1235 700	CH-SCAN starts with memory 02
	12:53	41	006 1200	etc.

NOTE
In contrast to the SWEEP-mode, the channel number is displayed during the CH-SCAN sequence.
The above SCAN program linked together with the **41**- command is not lost after scanning is stopped by command **40**.
Above program can simply be started again by the program sequence **41 #**.

2.3.2.5 Manual interruption and CH-SCAN operation

The CH-SCAN sequence can be interrupted by any key and finished then by **0**, or continued by another entry.
If SCAN BY TIME is active during CH-SCAN mode, the first **40** entered will stop CHANNEL SCAN, and the next **40** entered will reset SCAN BY TIME.
If in above configuration, a channel is switched on by SCAN BY TIME, the first **40** entered will reset SCAN BY TIME, and the next **40** entered will stop channel scanning.

Entry	CLOCK	CH	FREQUENCY	Remarks
	12:53	40	1235700	
	12:53	41	0061200	
X	P4: P	41	0061200	CH-SCAN stop by any key
X	12:55	42	0543900	CH-SCAN continuation by any entry except 0
X	P4: P	42	0543900	Another interruption
0	12:55	42	0543900	CH-SCAN finished LED 41/42 o

* • LED lights
o LED does not light

After finishing the CH-SCAN (Entry X0), the sequence can be continued by entering **49** with the next following channel. However, no other entries of the 4-digit group must be performed in the meantime. Other entries are allowed.

2.3.2.6 External CH-SCAN interruption

If, during the CH-SCAN sequence, the input "Scan-stop extern" gets active (=low) the scanning run is interupted until the input becomes inactive again. This condition is displayed by P on the 'tens' position of the minutes display, whereby P 4 is on the hours-display.

NOTE
The manual CH-SCAN-stop is displayed by P4: P on the time display. Should both interruptions simultaneously take place this will be displayed by P4: PP and CH-SCAN continuation starts only after cancelling of both stop parameters.

2.3.2.7 Internal CH-SCAN interruption by monitoring of AGC-Voltage

Internal level monitoring is done by comparing the AGC - voltage with the preset threshold.
The AGC-voltage value is scanned for the first time 200 ms after setting a new channel (respectively after 100 ms at a step-time of 0.l s), and again after another 200 ms each with the matching long step-time, with the result that 4 scanning values are formed of which - for interpretation - the mean value is taken.
In case the taken mean value exceeds the set threshold-value, the set channel is kept for the programmed Dwell-time period. This state is displayed by ' - ' on the time display. In case the Dwell-time was programmed with 0, a P4 : P is displayed in the same way as on manual interruption and, for CH-SCAN continuation, any key except 0 must be pressed.

2.3.2.8 Checking the programmed CH-SCAN sequence

The CH-SCAN sequence already programmed can be reviewed by entering **46**. Now, the first range memory number appears on the channel display. By entering # the next range memory number is displayed and, by entering * the previous one. By entering # when the last range memory number is displayed, and by entering * when the first range memory number is displayed, the CH-SCAN sequence check is finished. By **40**, the CH-SCAN sequence check can be stopped, and it is reset to the previous frequency and operational mode.

Entry	CLOCK	CH	FREQUENCY	Remarks
	13:07		1234567	
4	13:07		P4	
6	13:07	02	P46	First CH-SCAN range displayed
#	13 07	03	P46	Next range
#	13:07	08	P46	Next range
*	13:08	03	P46	Previous range
#	13:08	08	P46	Next range
#	13:07		1234567	Check finished

2.3.2.9 Indication of CH-SCAN-STOP by AGC-evaluation to outside peripherals

In case an allocated channel is detected during CH-SCAN, and the sequence interrupted due to exceeding the set threshold value, this state could be transmitted to a connected computer by the activation of the DTR connection of the serial interface if the remote control internally is set to the operational mode "Computer control" (S 2/3 on I/O PCB ON). This external computer could now scan the frequency and the RF-level, via the interface.

2.3.2.10 Scan CH + CH

If the above mentioned channel scan procedure should be too difficult and laborious for the customer to perform, a very simple channel scan feature can be introduced, by simply setting switch S 1.1 on the AUDIO II- PCB to OFF. The channel scan mode now in operation is called SCAN CH + CH. After entering **41** the operator has to enter all channels he wants to be scanned in sequence. The entering procedure has to be finished by the # key.

Immediately after entering # the scanning of the channel sequence starts with the first channel and with a fixed SCAN TIME of 2 seconds. Scanning can be interrupted by entering any key and started again by entering any key but **0**. Entering zero will cancel the command **41**. If the same channel sequence has to be scanned again, simply entering **41 #** will start the sequence.

NOTE
During all channel scan modes the preselector (if fitted) will be switched off and AGC - mode will be on "AGC - short", only.
Upon stopping the channel scanning temporarily (during dwell time period), or permanently, the state of preselector and automatic gain control will be set as programmed in the respective channel.
The manual gain control will be switched on during the scanning of a channel, if programmed for that channel.

When the scan CH + CH mode is temporarily halted by keyboard entry, the frequency display shows **P 4 P**. Scan CH + CH can be stopped as well by grounding pin 1 on the external connector and will continue when this connection is disconnected. The display does not give any indication when scanning has been stopped externally, so combination with spare LED (Pin 7 on external connector) during external scan stop is recommended.

2.3.3 Program SWEEP

2.3.3.1 Programming and reviewing of the SWEEP-ranges

General:

During SWEEP the receiver always uses the actual settings of AGC, IF-bandwidth, etc.

Following parameters can be stored individually in 20 SWEEP-range memories: (These memories are numbered from 01 to 20)

-1	Starting frequency	min. l0 kHz, max. 29.999.99 MHz (0000 followed by # erases the SWEEP-range memory)
-2	End frequency	min. starting frequency, max. 29.999.99 MHz
-3	Step width	max. 10 kHz, min. 10 Hz
-4	STEP-time	0.1 sec. to 0.9 sec. in 0.1 sec.-steps
-5	Dwell-time	0 sec. to 9 sec. in 1 sec.-steps Entry 0 =SWEEP-STOP; to continue, enter #
-6	Threshold value	05 to 95 dBµV in 5 dBµV-steps

The indication of all entry parameters appears on the Frequency-Display. As to facilitate the entry, the momentarily not used spaces on programming the values -3 to -6 are filled up with a ´ - ´ sign with the aim of easily recognizing the number of entered digits. Only the 10 Hz-position cannot be marked in this way, due to the hardware configuration. With the programming of SWEEP-range memories and/or SWEEP-sequences in progress, the previously set receiving frequency is not being altered, i. e. one may keep on receiving with the ´old´ frequency.

Special functions of keys * and # on programming

* On entering the range number backspaces the entry step by step

After entering the memory No. the following functions result:

* In first position of an entry step backspaces one step (# goes to the next entry step)

* During the entry of multi-digits parameters clears the just entered positions and shows again the former value parameter. # fills the remaining positions of the parameter with zeros but does not yet lead to the next entry step.

After complete entry of a new parameter this is stored by # (ENTER-key). Simultaneously a transit to the next entry step is performed.

Example:

Frequency range	7.5 MHz to 8.0 MHz
Step width	5 kHz
STEP-TIME	0.4 sec.
Dwell time	5 sec.
Threshold	50 dBµV

Starting the programming with entry 43.

Entry	CLOCK	CH	FREQUENCY	Remarks
	12:27		1234567	Condition before entry
4	12:27		P4	
3	43:		P43	LED 41 •
0	43:0		P43	1st position of range memory number
1	43:01	-1	1135000	Previous starting frequency
0	43:01	-1	0	Entry of new starting frequency
7	43:01	-1	07	
5	43:01	-1	075	
#	43:01	-1	0750000	Starting frequency filled up with zeros
#	43:01	-2	1220000	ENTER starting frequency previous end frequency

* • LED lights
o LED does not light

Entry	CLOCK	CH	FREQUENCY	Remarks
0	43:01	-2	0	Entry of new end frequency
8	43:01	-2	08	
#	43:01	-2	0800000	End frequency filled up with zeroes
#	43:01	-3	- - - 1000	ENTER end frequency display of previous step width
0	43:01	-3	- - - 0	Entry of new step width
5	43:01	-3	- - - 05	
#	43:01	-3	- - - 0500	
#	43:01	-4	- - - 03 -	ENTER step width display of previous step time
0	43:01	-4	- - - 0 -	New STEP-time 0.4 sec.
4	43:01	-4	- - - 04 -	
#	43:01	-5	- - - - 5 -	ENTER step time display of previous dwell-time
#	43:01	-6	- - - 65 -	Dwell-time remains unchanged ENTER dwell-time display of previous threshold
5	43:01	-6	- - - 5 -	New threshold value 50 µV
0	43:01	-6	- - - 50 -	
#	43:02	-1	2135820	ENTER new threshold

In this position the programming of the SWEEP-range is finished and the programming can be closed by entering -**40**-.
In case -**40**- is not entered, the programming of the next SWEEP-range memory starts which can be programmed in a similar fashion.

If a programmed parameter of a SWEEP-range memory is required to be checked again, this can be done when the entry of the last parameter is finished (i.e.: before closing the programming by entry of -40-).

Entry	CLOCK	CH	FREQUENCY	Remarks
*	43:01	-6	---50-	Check threshold value range-memory 01
*	43:01	-5	----5-	Dwell-time range-memory 01
*	43:01	-4	---04-	Step-time range-memory 01
*	43:01	-3	---0500	Step width
*	43:01	-2	0800000	End frequency
*	43:01	-1	0750000	Starting freqeuncy
4	43:01	-1	P4	Finish SWEEP-programming
0	12:27		1234567	Old condition is displayed again LED 41 o

Being in the first position of the entry step for the starting frequency in the range memory 01, the entry of * does not step back to the range 20. Instead, there is a return to the entry of the range number and, on entering a further *, the operator leaves programming of the SWEEP - range memories.

Entry	CLOCK	CH	FREQUENCY	Remarks
	43:01	-1	0750000	Starting frequency
*	43:		P43	LED 41 •
*	12:30		P4	LED 41 o
*	12:30		1234567	Old condition

* • LED lights
  o LED does not light

2.3.3.2 Error display

Error display appears on the corresponding position of the display by an 'E '. In case an error takes place on the entry of the 10 Hz-position, the error is written on the 100 Hz-position, and the data must be also entered again. A display on the 10 Hz-position is not possible, for hardware reasons.

Entry	CLOCK	CH	FREQUENCY	Remarks
3	43:01	-1	E	Frequency too high
2	43:01	-1	2	
#	43:01	-1	2000000	
#	43:01	-2	2300000	
1	43:01	-2	E	End frequency < starting freqeuncy
2	43:01	-2	2	
2	43:01	-2	22	
#	43:01	-2	2200000	
#	43:01	-3	---0400	
0	43:01	-3	---0	
0	43:01	-3	---00	
0	43:01	-3	---000	
0	43:01	-3	---00E	Step width too low
0	43:01	-3	---000	
5	43:01	-3	---0005	
#	43:01	-4	---04-	etc.

2.3.3.3 Clearing of SWEEP-ranges

Entry	CLOCK	CH	FREQUENCY	Remarks
4	12:35		P4	
3	43:		P43	
1	43:1		P43	
5	43:15	-1	1234500	
0	43:15	-1	0	
0	43:15	-1	00	
0	43:15	-1	000	
0	43:15	-1	0000000	Range memory 15 to be cleared Continue with #. With * the previous starting frequency can be recalled
#	43:16	-1	0000000	Range memory 15 is cleared now. Range memory 16 is displayed

NOTE
An entry of less than 4 zeroes followed by # does not lead to clearing of the range but to an error display indicating that the frequency is too low.
When looking up the SWEEP-ranges only the starting frequency 00.000.00 of cleared ranges is displayed which immediately is followed by the next range.

Entry	CLOCK	CH	FREQUENCY	Remarks
	43: 14	- 5	- - - - 8 -	Dwell-time range-memory 14
#	43: 14	- 6	- - - 45 -	Threshold value range memory 14
#	43: 15	- 1	0000000	Range memory 15 cleared
#	43: 16	- 1	1200000	Starting frequency range memory 16 etc.

2.3.3.4 Entry and start of the SWEEP-sequence

For starting a SWEEP-sequence, **42** is followed by a sequence of range memories to be searched and # entered for start. All entries until start of sequence can be stepped and reset by *.
After entry of the range memory number, the starting frequency, resp. 00.000.00 with a cleared range memory or '0-0-0-0' with an incompletely programmed range memory, is displayed. A SWEEP-sequence being already entered previously can be recalled by **42** and started again with #.
Cleared, or incompletely programmed SWEEP-range memories are skipped if they are included in the sequence.
A sequence consisting only of cleared, or incompletely programmed range memories, cannot be started. An error is displayed by **P 42 E**. This indication also appears if no sequence has been stored.

Example: Sweeping through the programmed range memories 02, 03 and 08:

NOTE
In contrast to the CH-SCAN-mode, the channel display remains blank during the SWEEP-sequence.

Entry	CLOCK	CH	FREQUENCY	Remarks
4	12:51		P 4	
2	12:51		P 42	LED 41/42 •
1	12:51	1	P 42	Entry error, should be 0
*	12:51		P 42	Error eliminated
0	12:51	0	P 42	
2	12:52	02	0540000	Starting frequency range memory 02
0	12:52	0	P 42	Next range memory
2	12:52	02	0540000	Error, should be 3
*	12:52	0	P 42	Error eliminated
3	12:52	03	0-0-0-0	Range memory 03 incompletely programmed
0	12:53	0	P 42	Next range memory
8	12:53	08	0440040	Starting frequency range memory 08
#	12:53		0540000	SWEEP starts with range memory 02
	12:53		0540100	

etc.

• LED lights
o LED does not light

2.3.3.5 Manual interruption and stopping the SWEEP-sequence

Similar to CH-SCAN the SWEEP is being interrupted by any key and stopped with 0, or continued with another key entry

Entry	CLOCK	CH	FREQUENCY	Remarks
	12:54		0543700	
	12:54		0543800	
X	12:54	P	0543800	SWEEP-break by any key
X	12:54		0543900	SWEEP-continued by any entry except 0
X	12:55	P	0543900	Repeated interruption
0	12:55		0544000	SWEEP stopped, LED 41/42 o

* • LED lights
o LED does not light

2.3.3.6 External SWEEP-interruption

IF, during the SWEEP-sequence, the input "SCAN -Stop extern" is active (=low) the searching sequence will be interrupted until it changes to inactive. This state is indicated by P in the tens place of the channel display.

NOTE
A manual SWEEP-interruption is indicated by P in the unit place of the channel display. Should both interruptions happen simultaneously this state will be indicated by PP, and the SWEEP run can be continued only after cancelling both break parameters.

2.3.3.7 Internal SWEEP-interruption by AGC-evaluation

Internal level monitoring is done by comparing the AGC-voltage with a preset threshold.

The AGC-voltage value is scanned for the first time after 200 ms after setting of a new frequency (and after 100 ms related to a STEP-time of 0.1 sec.) and again after 200 ms, with a correspondingly longer STEP-time, resulting up to 4 scanning values of which the mean value is formed for evaluation. In case the formed average value is above the chosen threshold value, the set frequency is held during the programmed Dwell-time. This state is being indicated by ´ -´ on the channel display. If the Dwell-time was programmed with 0, a **P** is displayed in the same way as for manual interruption, and any key - except 0 - has to be pressed for SWEEP continuation. The 0-entry stops the SWEEP-sequence.

NOTE
The correct AGC-operational mode must be selected manually!
In the DSB-mode (11) the interruption is done only when the detected level of the received station drops again and the level is then above the threshold. This is to make sure that the received station is tuned near its correct frequency (in actual fact, one sweep step beyond).

Remarks concerning all stated time values

All stated time values have tolerances of about ±20%.

2.3.3.8 Indication of a SWEEP-STOP by AGC-evaluation to outside peripherals

If during SWEEP, a busy channel is found and the sequence interrupted due to exceeding the chosen threshold value, this state could be transmitted to a connected computer by activating the DTR line of the serial interface if the remote control is internally set to the operational mode Computer control (S 2/3 on I/O PCB ON). This external computer could now scan frequency and RF-level via the interface.

2.3.3.9 Checking the programmed SWEEP-sequence of range memories

A SWEEP-sequence being already programmed can be reviewed with the entry **44**. The first range memory number is indicated on the channel display. By pressing # the next range memory number is displayed, and by pressing *, the previous one. If # is entered during the indication of the last number, and * during the indication of the first number, the SWEEP-sequence check is finished.

Entry	CLOCK	CH	Frequency	Remarks
	13:07		1234567	
4	13:07		P4	
4	13:07	02	P44	1st SWEEP-range memory displayed
#	13:07	03	P44	Next range memory
#	13:07	08	P44	Next range memory
*	13:07	03	P44	Previous range memory
#	13:08	08	P44	Next range memory
#	13:08		1234567	Review finished

With **40**, the SWEEP-sequence check can be stopped and the receiver is set to the last frequency and operational mode.

2.3.4 Special Commands used in Conjunction with CHANEL-SCAN and Frequency-SWEEP

CHANNEL-SCAN

45	Range memory programming
41...#	Linking of channel range memories into a scan sequence
46	Reviewing scan sequence
49	Resume scanning after exit out of channel scan (40)

Frequency-SWEEP

43	Range memory programming
42...#	Linking of frequency range memories into a SWEEP-sequence
44	Review of SWEEP-sequence
49	Resume Frequency-SWEEP after exit out of sweeping (40).

2.3.5 Scan CH + CH

Refer to chapter 2.3.2.10 on page 2-35

2.3.6 RESET Function

If the receiver RX 1001 M / RX 5001 is not able to accept further entries via the keyboard any more this indicates that the program is hung up. The receiver has to be reset by the following operation:

1. Switch OFF the receiver.
2. While pressing the key ERASE CHANNELS.
3. Switch ON the receiver again.

The receiver defaults to its basic setting.

- Frequency 02,182,00 MHz
- Mode: 11 "A3E/A2A"
- AGC: 61 "AGC LONG"
- IF-bandwidth 88 6.00 kHz

By R E S E T, all program memories will be cleared.

HAZARDS

Voltages of 60 V and above occur in the equipment. There is a risk of contact with live parts. It is essential to observe the following points:

- The mains power must be disconnected before opening the equipment
- Greatest care must be exercised when working with the equipment in switched-on conditions.
- An attendant should possibly be on hand to disconnect the mains immediately in the event of an accident.

Safety instructions

W A R N I N G The component groups contain M O S components!

MOS COMPONENTS
These are protected against destruction caused by normal charging by means of protective structures at the inputs and outputs. In order to protect the components also from very heavy static charges, we recommend that the following rules be observed:
Persons who work with apparatus containing MOS components should be discharged by contact with an earthed object or by bringing the equipment housing to this potential.
MOS components may only be fixed to the housing; the terminals of the components must not be contacted to this.
When the equipment/apparatus is switched on, conductor tracks and unisolated components must not be touched by hand nor must they be shunted to the housing.
MOS components must always be transported in conductive foam material.
The terminal connections of the MOS components must not bent over.
Before any soldering work the soldering iron tip is to be quickly tapped on the housing or on an earthed object.
Before the wire bridges are touched with the side cutters, the tool held in the hand must be discharged to earth.

3 SERVICE AND MAINTENANCE

3. 1 Trouble-shooting (RX 1001 M / RX 5001)

3.1.1 Built-in test equipment (B I T E)

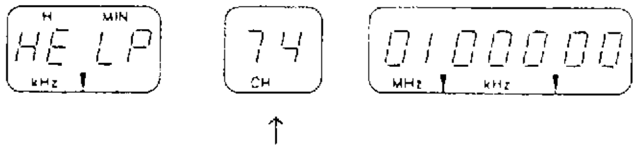
The self-test is separated into two single tests:
During current operation the following tests are continiously being done:

HELP 1	Preselection: Check of setting by comparing the reference voltage with the Servo-Pot voltage.
HELP 2	1. Mixer: Monitoring of Oscillator-level
HELP 3	2. Mixer: Monitoring of the Mixer Oscillator level.
HELP 4	Filterboard: Monitoring of the diode switch and the level for 30 kHz IF-OUT
HELP 5	Demodulator: no continuous monitoring
HELP 6	525/10 kHz IF-OUT (IF-Output): no continuous monitoring (not used in RX 5001)
HELP 7	VCO-B: Check whether PLL is locked
HELP 8	VCO-A: Check whether PLL is locked
HELP 9	BFO: Check whether PLL is locked
HELP 10	Power Supply: Monitoring of voltages +5 V, +12 V and +18 V for permissible tolerance
HELP 11	Buffer-PCB: Monitoring of the reference voltage of the PRESELECTOR middle tuning position (only when Preselector is switched off)
HELP 12	Serial Interface: Monitoring of correct data from the BCD-switch
HELP 13	Audio-PCB: no continuous monitoring
HELP 14	CPU PCB: Monitoring of memory, address bus, data bus, control bus, bus drivers etc., by printing, reading and comparing the test data.
HELP 15	I/O-PCB: no continuous monitoring
HELP 16	CLOCK PCB Monitoring of minute changes

In case a failure is being recognized in one of the monitored functions, this will be indicated by the BITE LED flashing. The failure may be detected by releasing the Auto-Test (see chapter 3.1.2).

3.1.2 Releasing the AUTO TEST

The AUTO TEST can be released by the key TEST and it starts with briefly showing the following display

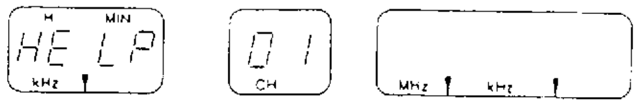


Software version

and then performing the LED-test. After this, the individual functions will be checked by means of the 1 MHz-Test Signal. When the test sequence is in progress the "failure indication-LED" lights, and no entry, except ERASE CHANNELS is possible.

The AUTO TEST cannot start when another entry process (for example: selection of mode, entry of frequency) is not yet finished. Only when this process is finished or being interrupted a test can be released again.
When the test sequence is over, the failures are indicated. This includes the indication of failures recognized before the current operation.
When there are several failures, the individual failure numbers can be made visible by the key *.
By pressing a different key of the keyboard the receiver is being reverted back to the state it was operating in, before releasing the test.
In case no failure has been found the receiver automatically will be brought to the previous state again when the test is over.
Where ever possible, the circuits are being monitored during the current operation. Arising failures will be indicated in this case by flashing of the "failure indication LED" (refer to 3.1.1).
The AUTO TEST can be also released externally in the REMOTE-position of the CONTROL SWITCH when the REMOTE PRINT is used, and the receiver is remote controlled by a Remote Control RX 1001 F or RX 5001 RC, or a computer. Another method to imitate an Auto Test is the Go/No Go Test refer to chapter 3.1.5.

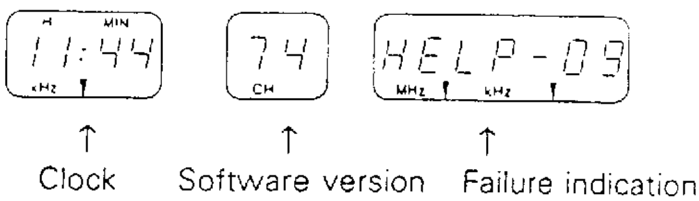
After the LED Test the DISPLAY looks like this:



HELP 01 means Test of the PRESELECTOR acc. to HELP 01 procedure.

The receiver advances automatically to the next test step. Observing the indications HELP 01, HELP 02 etc. one may follow the test run. When the complete test is over and no failure has been detected, the receiver reports this by means of a tone. Simultaneously the LED BITE extinguishes and the receiver gets back to the normal receiver mode.

When the receiver has detected a failure, an indication like this will be given:



i.e.: the receiver has detected a defective BFO. By pressing the key * on the keyboard further malfunctioning groups effected by the present failure may be detected.

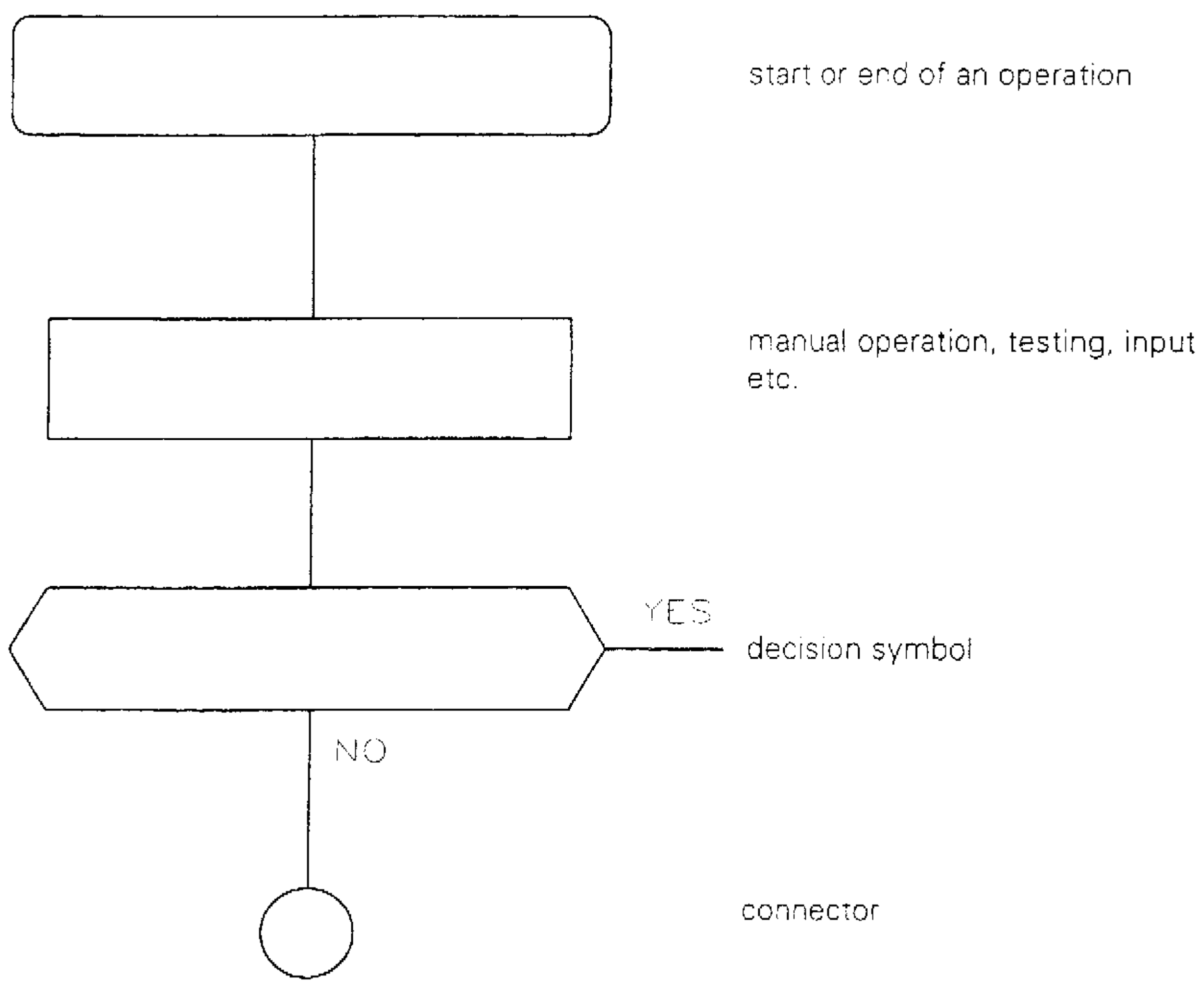
3.1.3 Failure Localisation and Exchange of Modules

After the AUTO TEST via the TEST key the failure indication and localisation is shown on the frequency display as for example: HELP 09.
From the diagram may be seen that the module BFO is defective.
If, in this case the TCXO would not oscillate for example, the VCOs A and B could not synchronize either. Therefore, the microprocessor gives as a first report -HELP 09- and as a further failure indication HELP 07, then, (VCO B) and -HELP 08- (VCO A). Failure indications HELP 07 and HELP 08 are being indicated by pressing the key *. By further pressing of *-key HELP 09 will appear, thus allowing all failure indications to be recalled. In order to reset the receiver to the start condition any other key may be pressed.

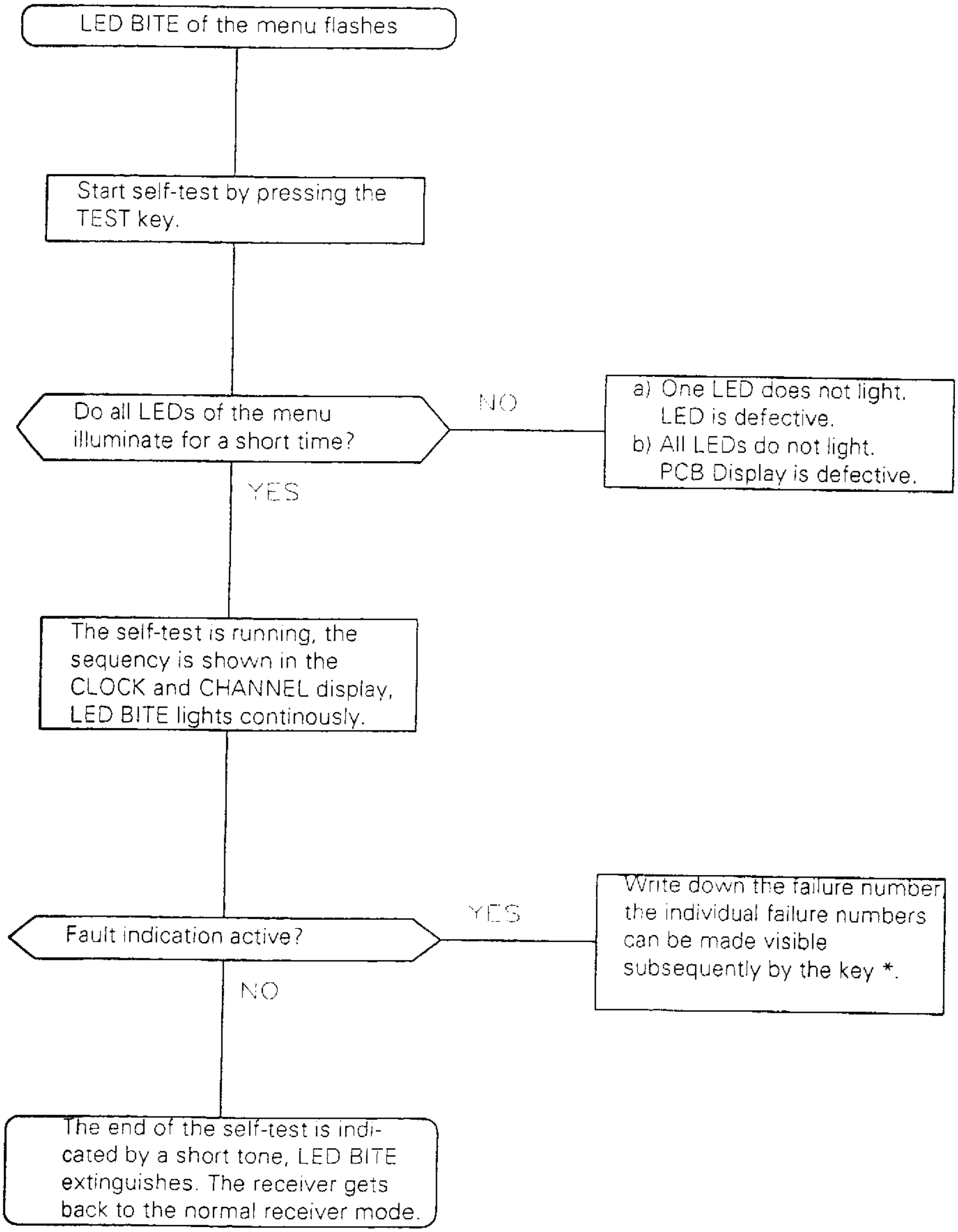
3.1.4 Trouble shooting with the help of the BITE test

If, during the operation in progress, the failure indication LED (BITE) flashes, the specific failure may be detected by pressing the TEST key. A test sequence is then performed, starting with an LED-test of the display. For some time all LEDs light for the operator´s visual check.

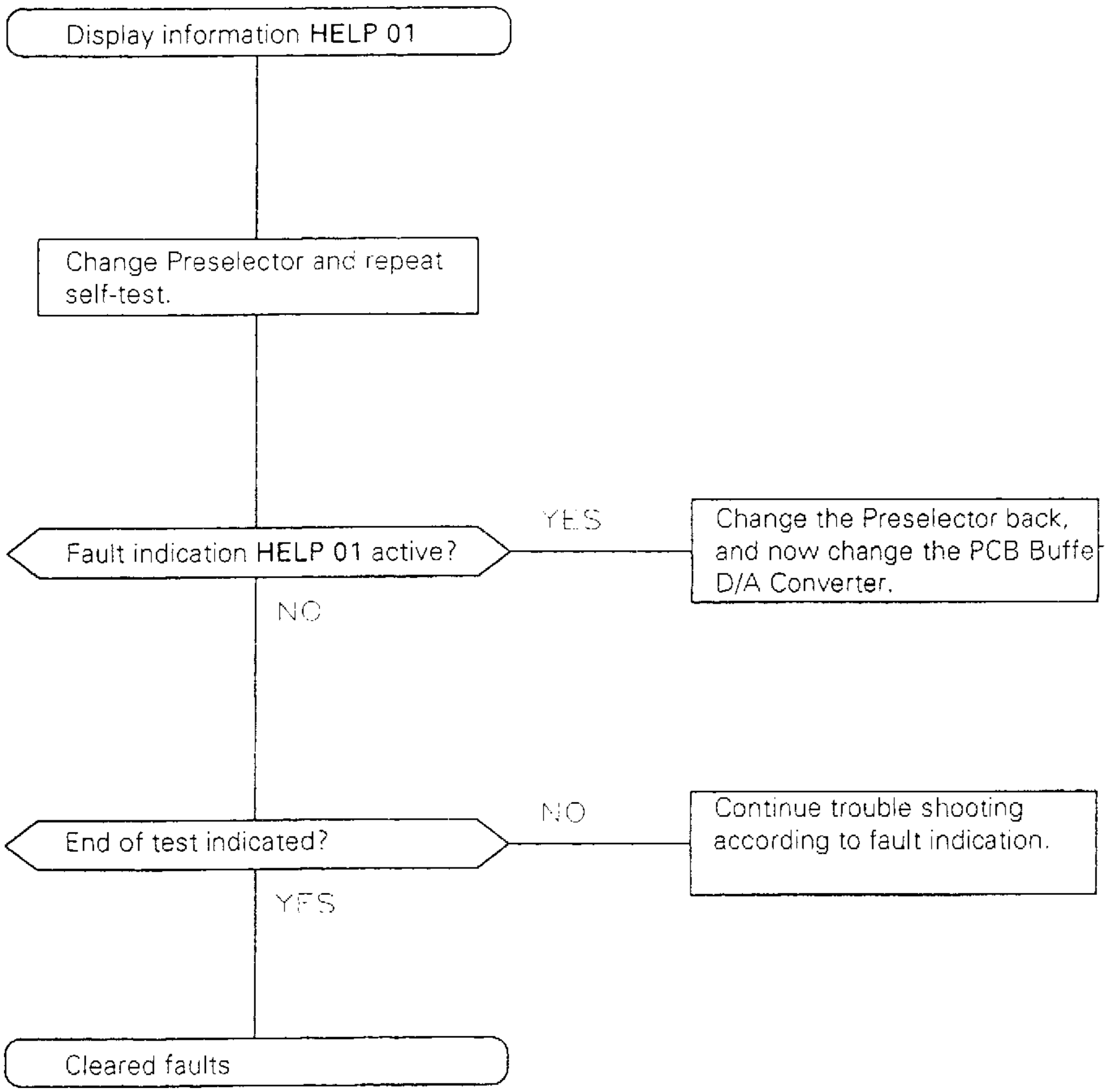
The following symbols are used:



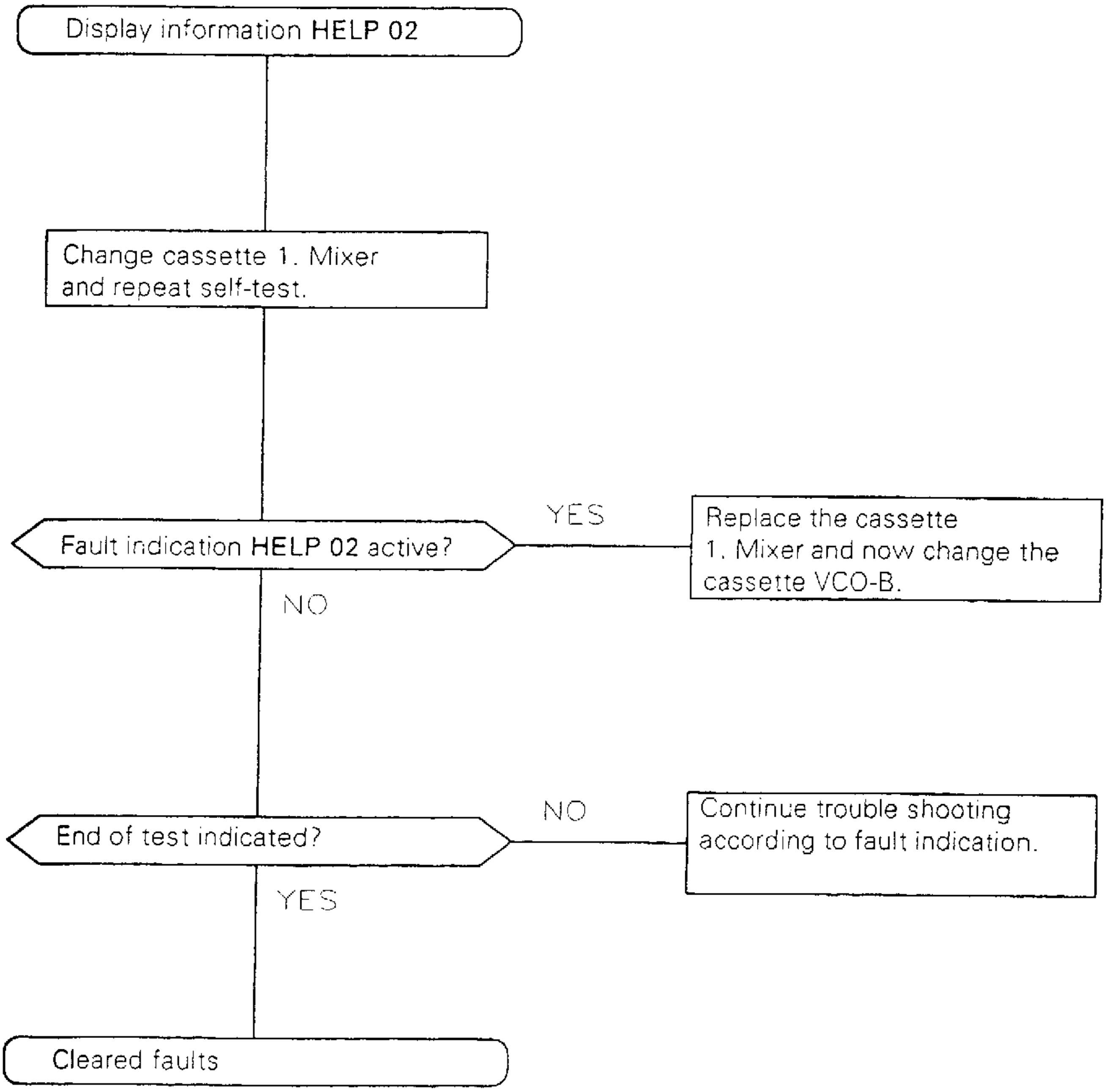
Trouble shooting



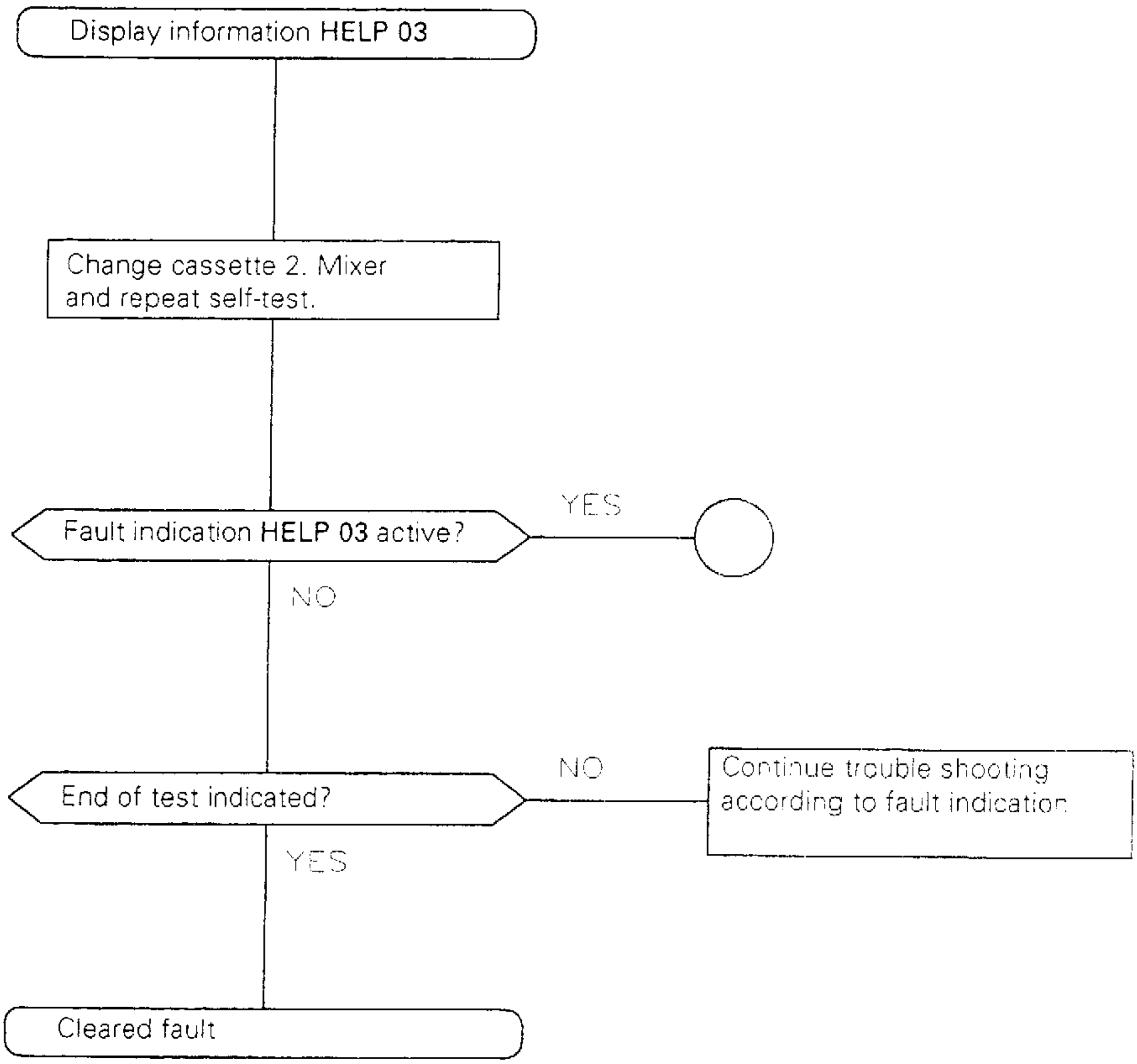
Fault indication HELP 01

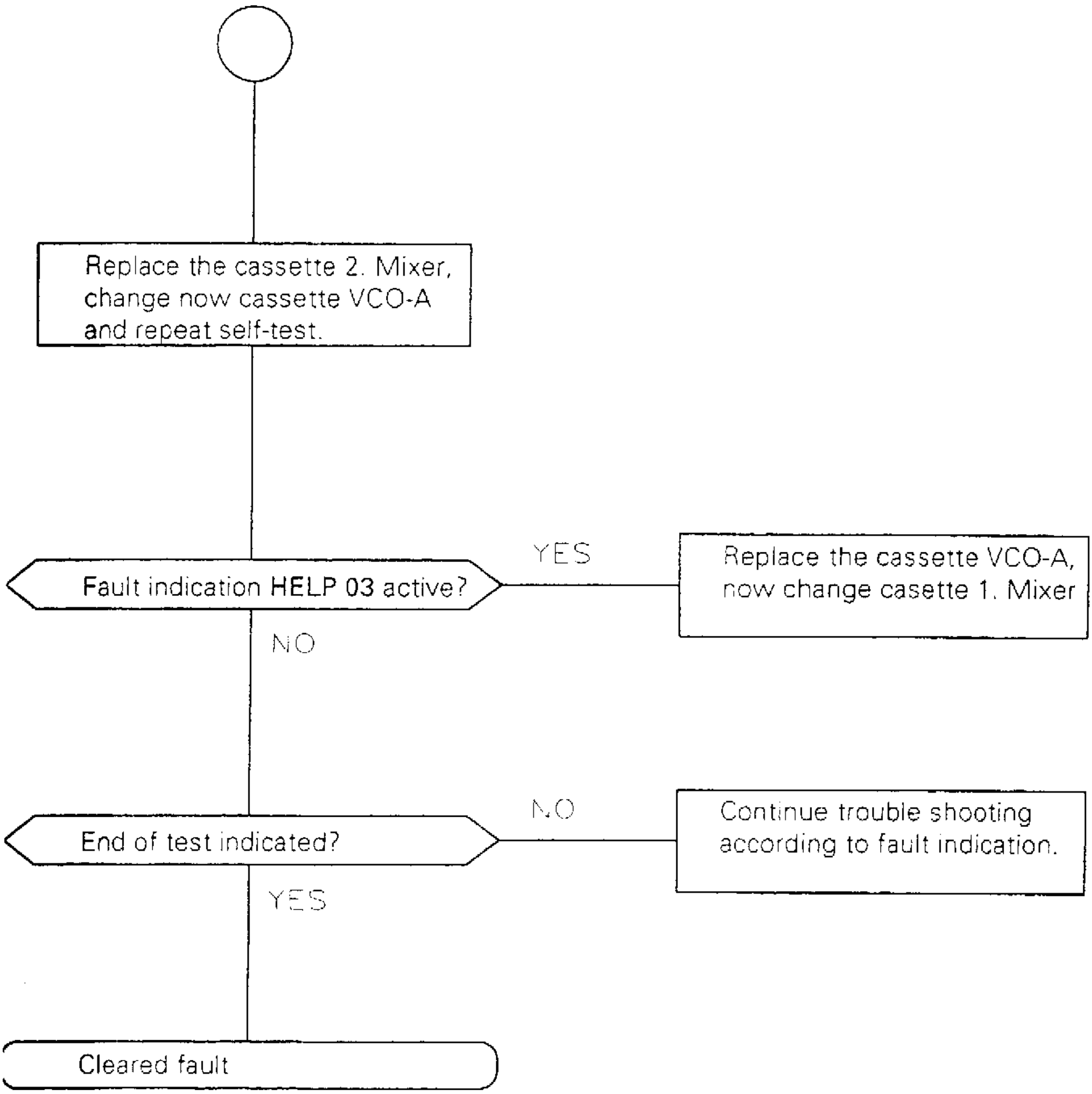


Fault indication HELP 02

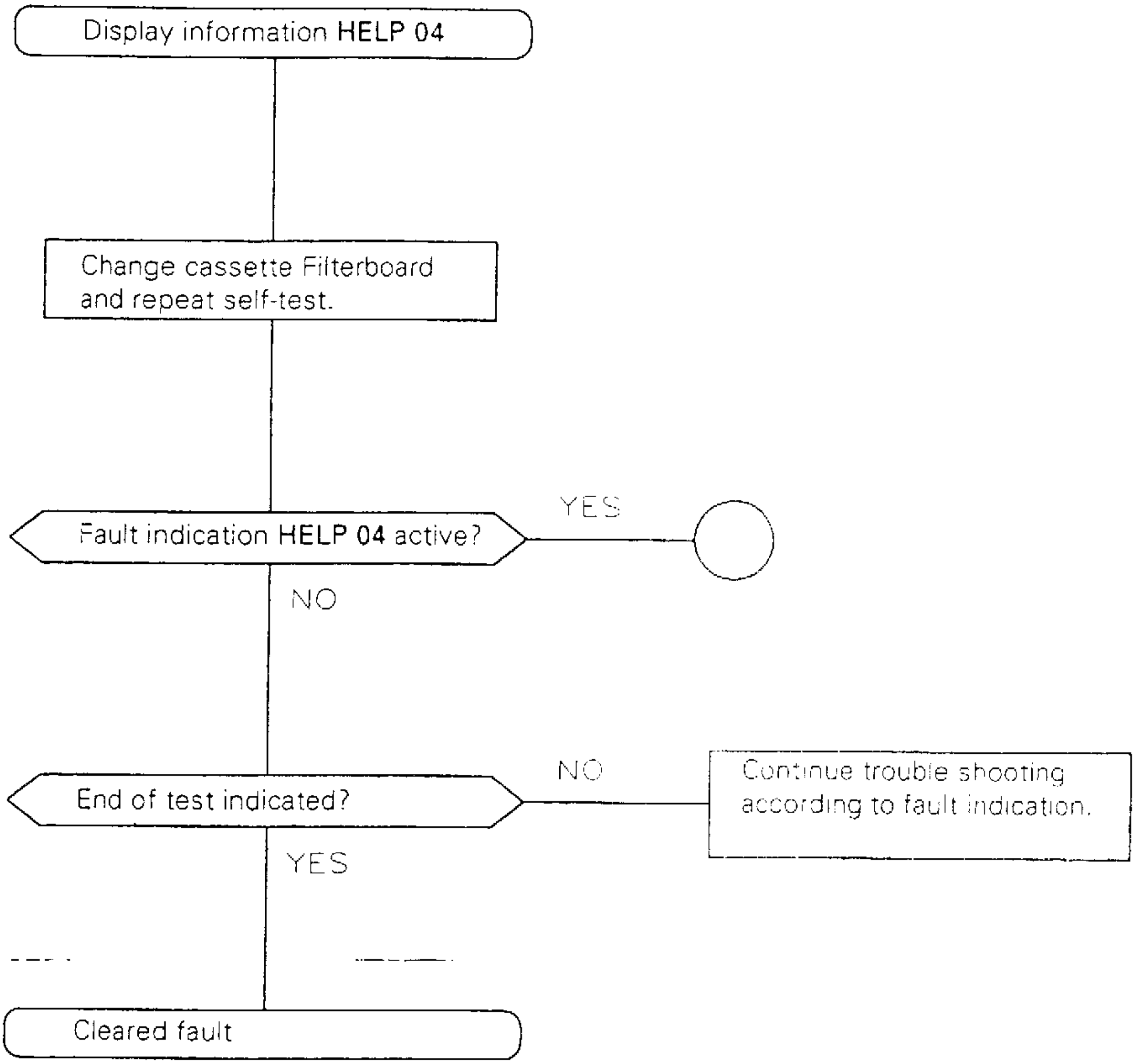


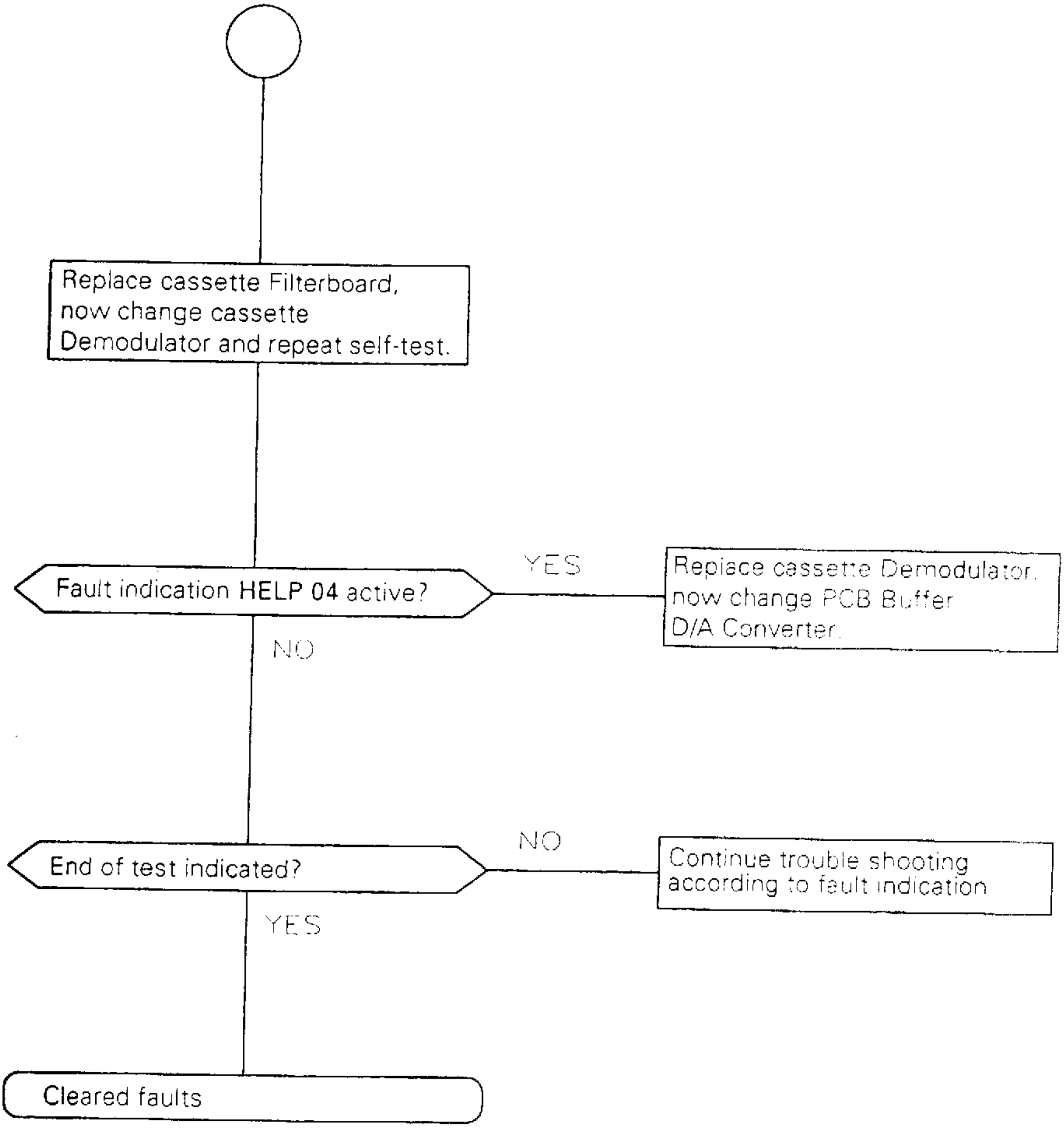
Fault indication **HELP 03**



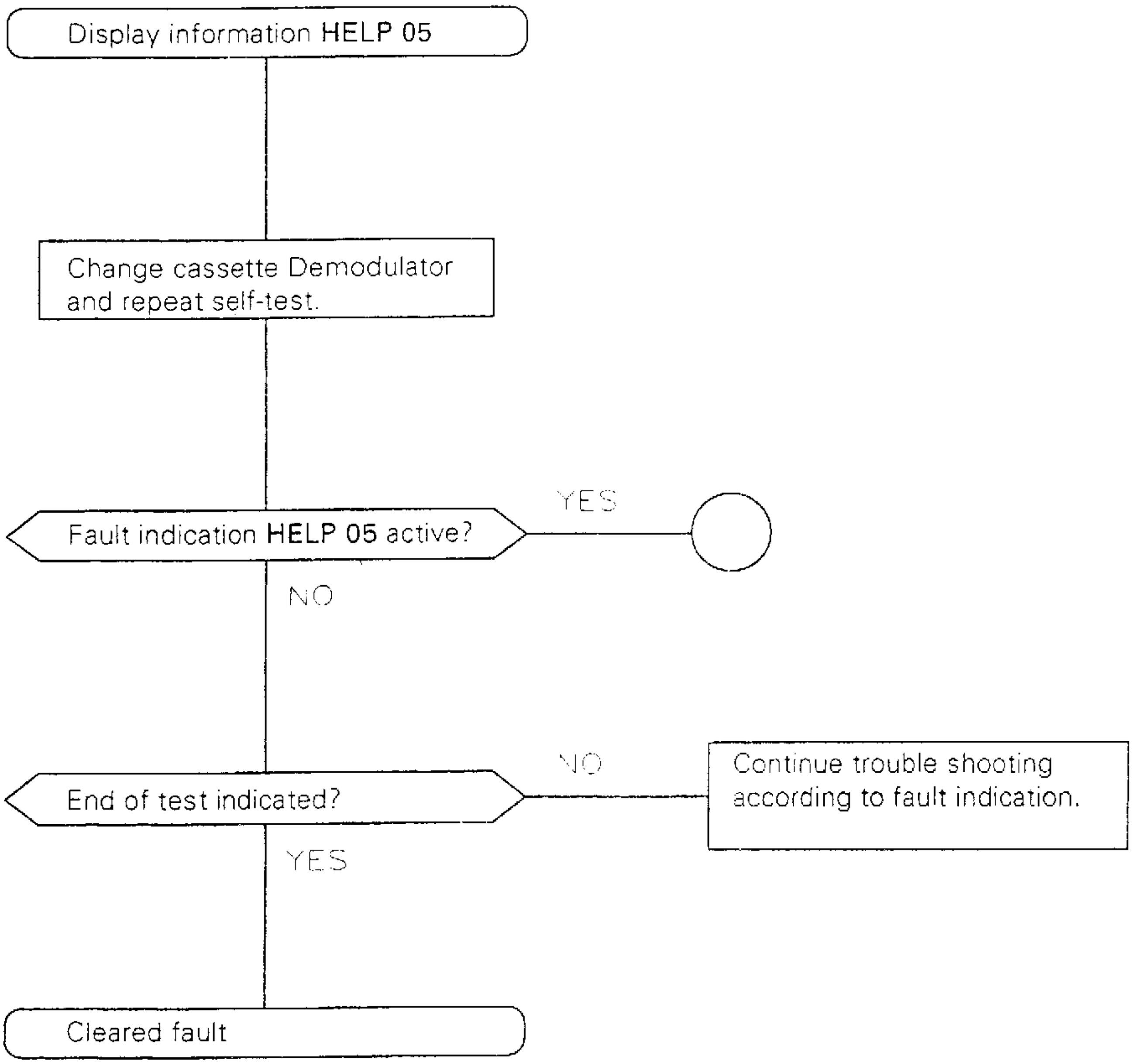

Replace the cassette 2. Mixer, change now cassette VCO-A and repeat self-test.
Fault indication HELP 03 active?
YES
Replace the cassette VCO-A, now change casette 1. Mixer
NO
End of test indicated?
NO
Continue trouble shooting according to fault indication.
YES
Cleared fault

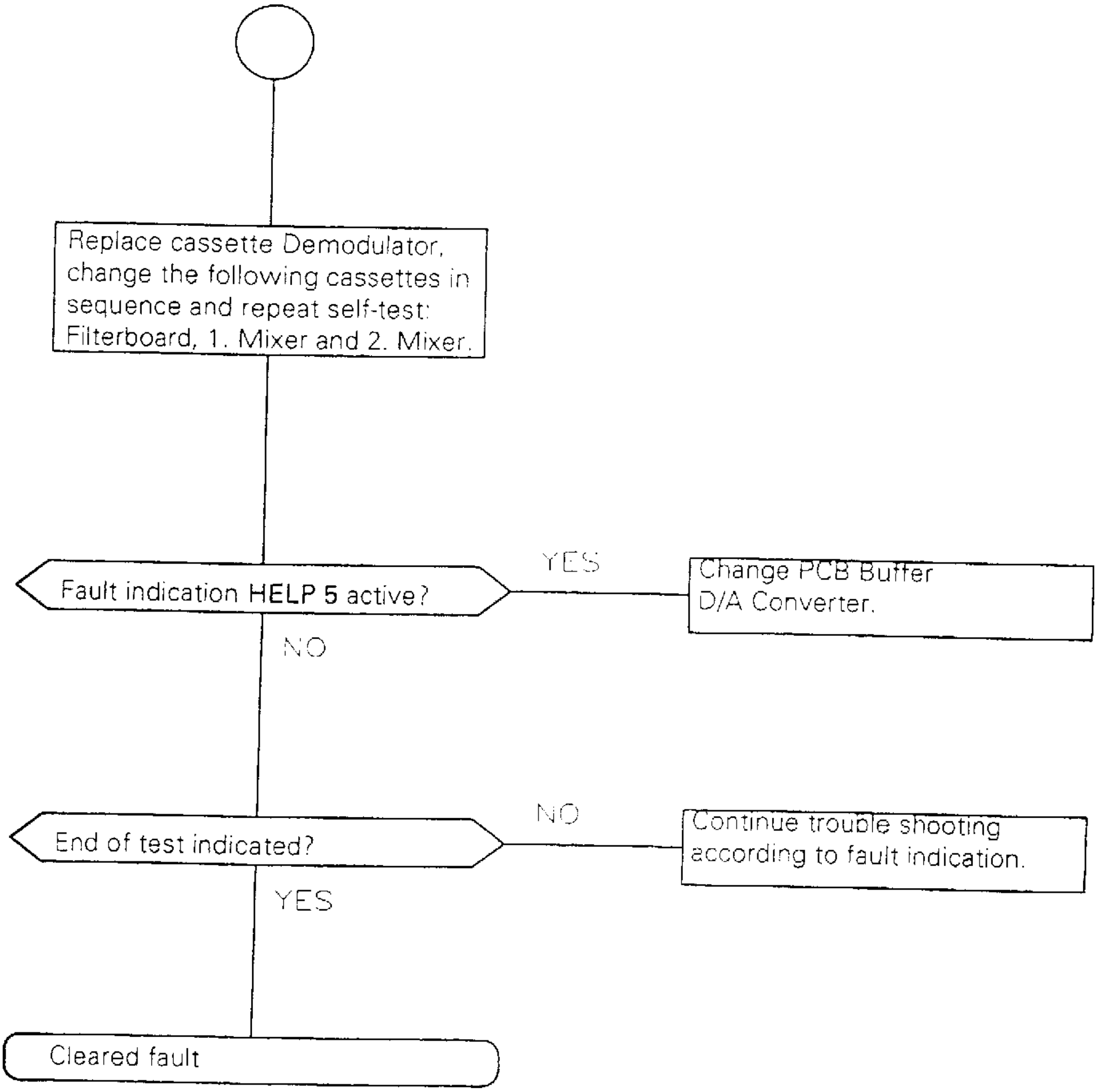
Fault indication HELP 04



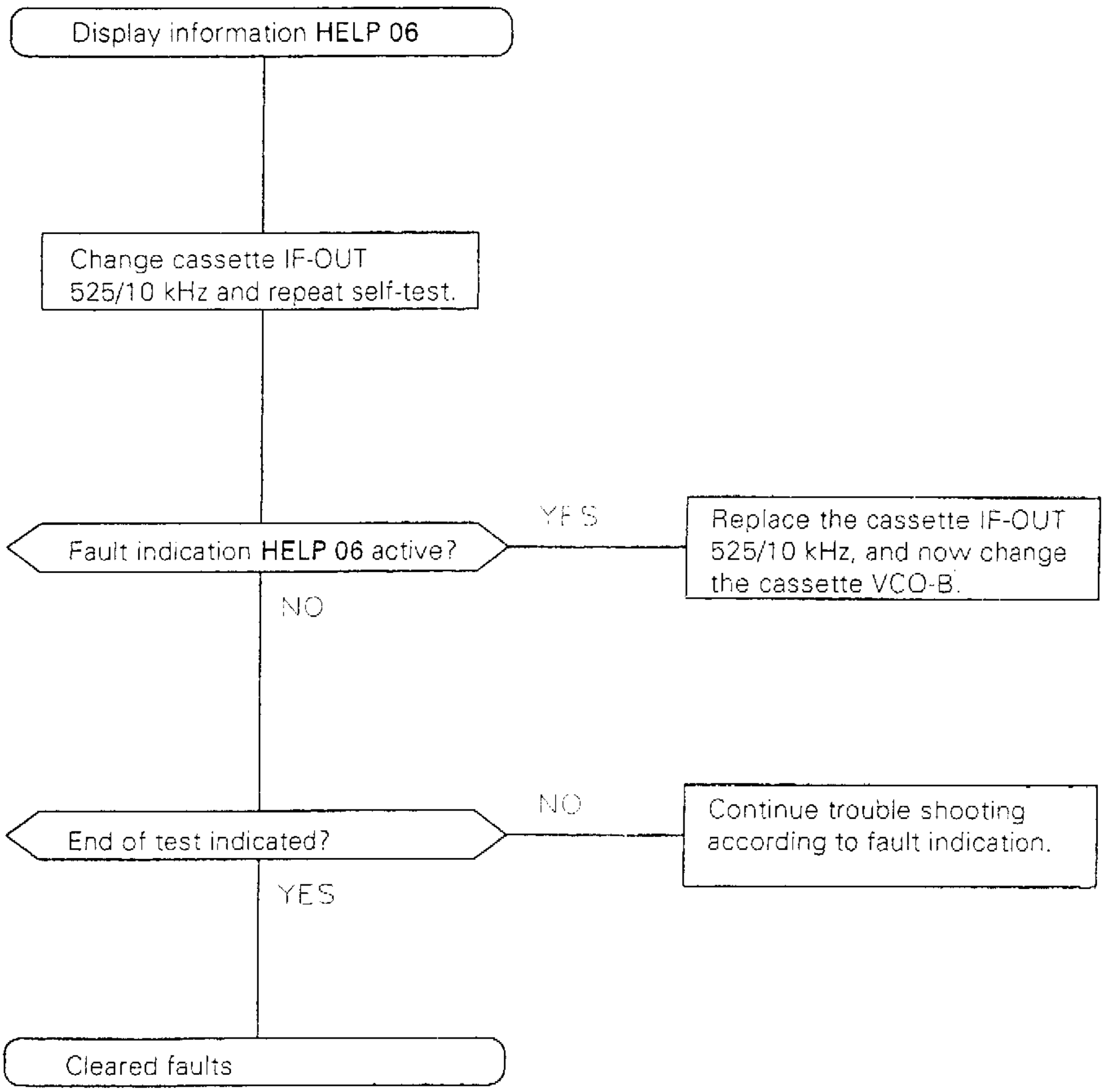

Replace cassette Filterboard, now change cassette Demodulator and repeat self-test.
Fault indication HELP 04 active?
YES
Replace cassette Demodulator, now change PCB Buffer D/A Converter.
NO
End of test indicated?
NO
Continue trouble shooting according to fault indication
YES
Cleared faults

Fault indication HELP 05

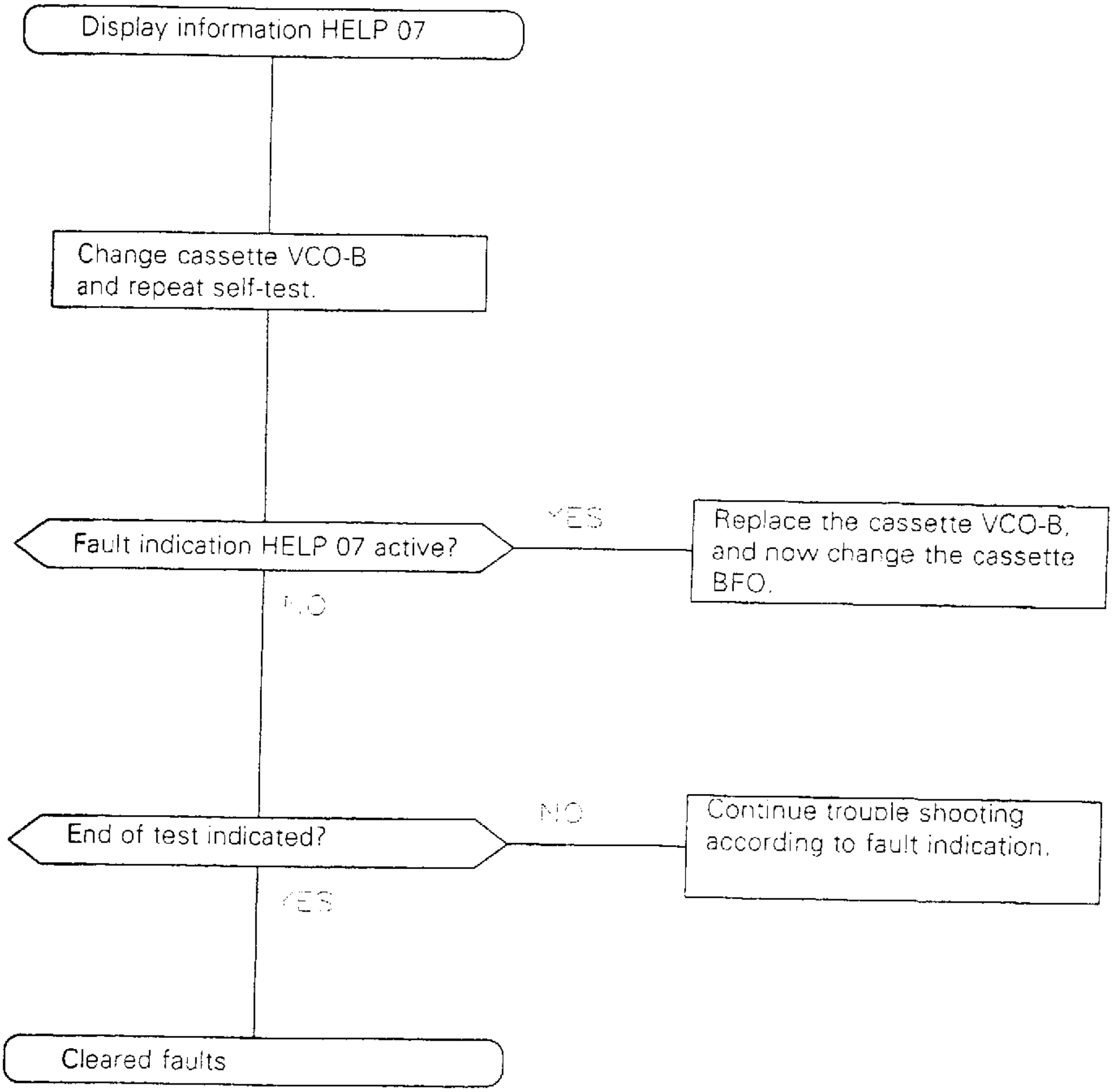



Replace cassette Demodulator, change the following cassettes in sequence and repeat self-test: Filterboard, 1. Mixer and 2. Mixer.
Fault indication **HELP 5** active?
YES
Change PCB Buffer D/A Converter.
NO
End of test indicated?
NO
Continue trouble shooting according to fault indication.
YES
Cleared fault

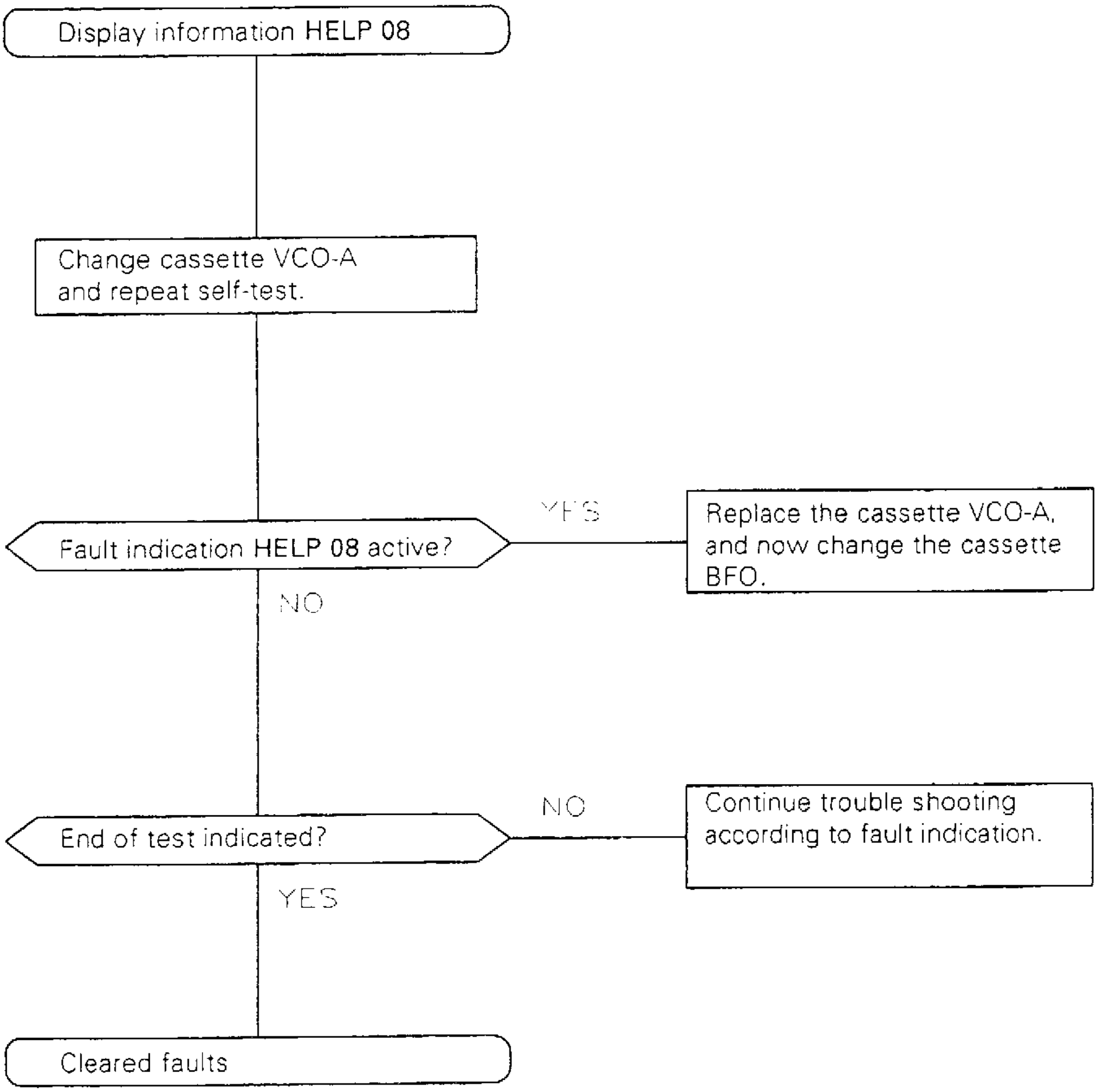
Fault indication HELP 06 (only RX 1001 M)



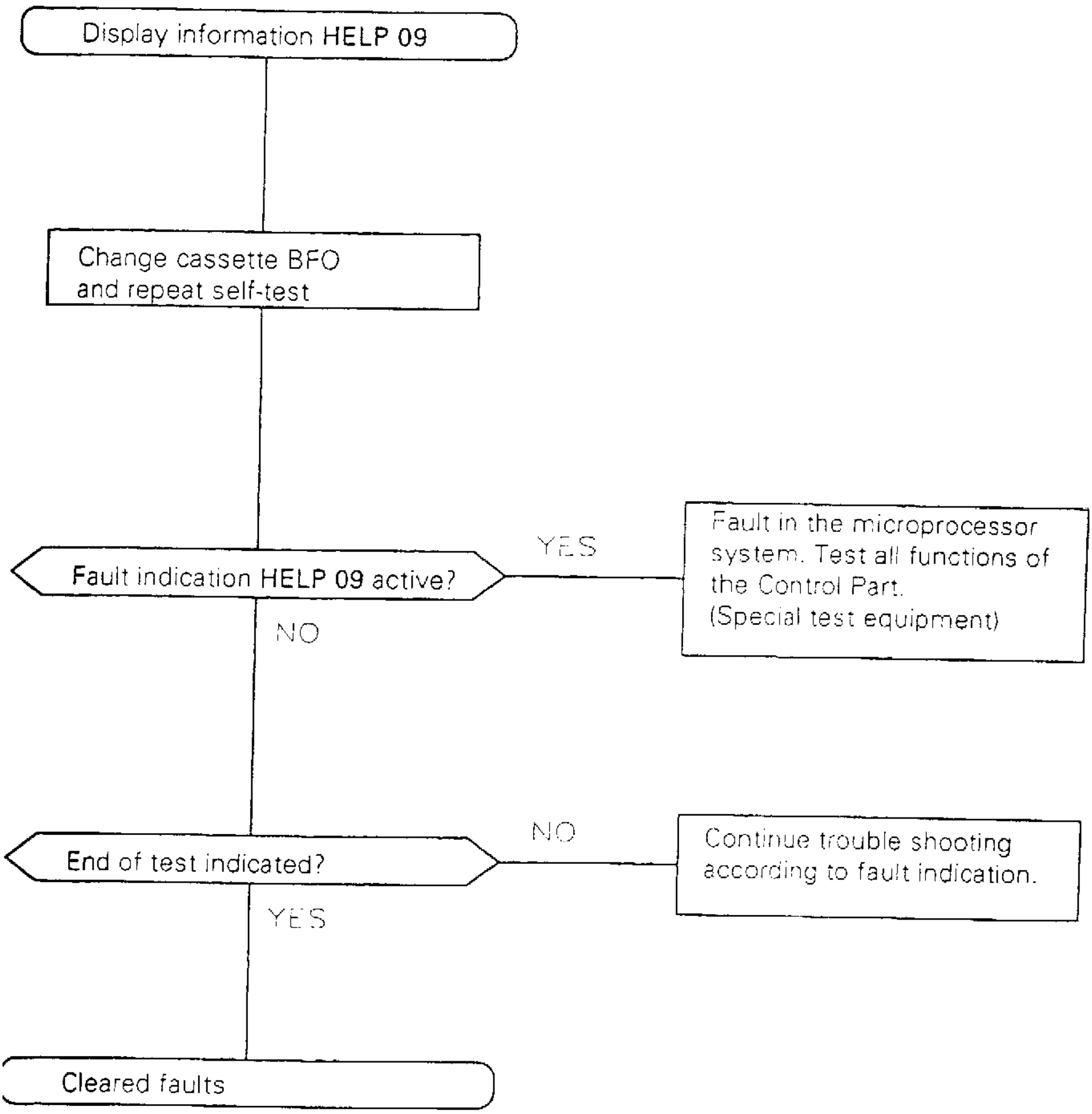
Fault indication HELP 07



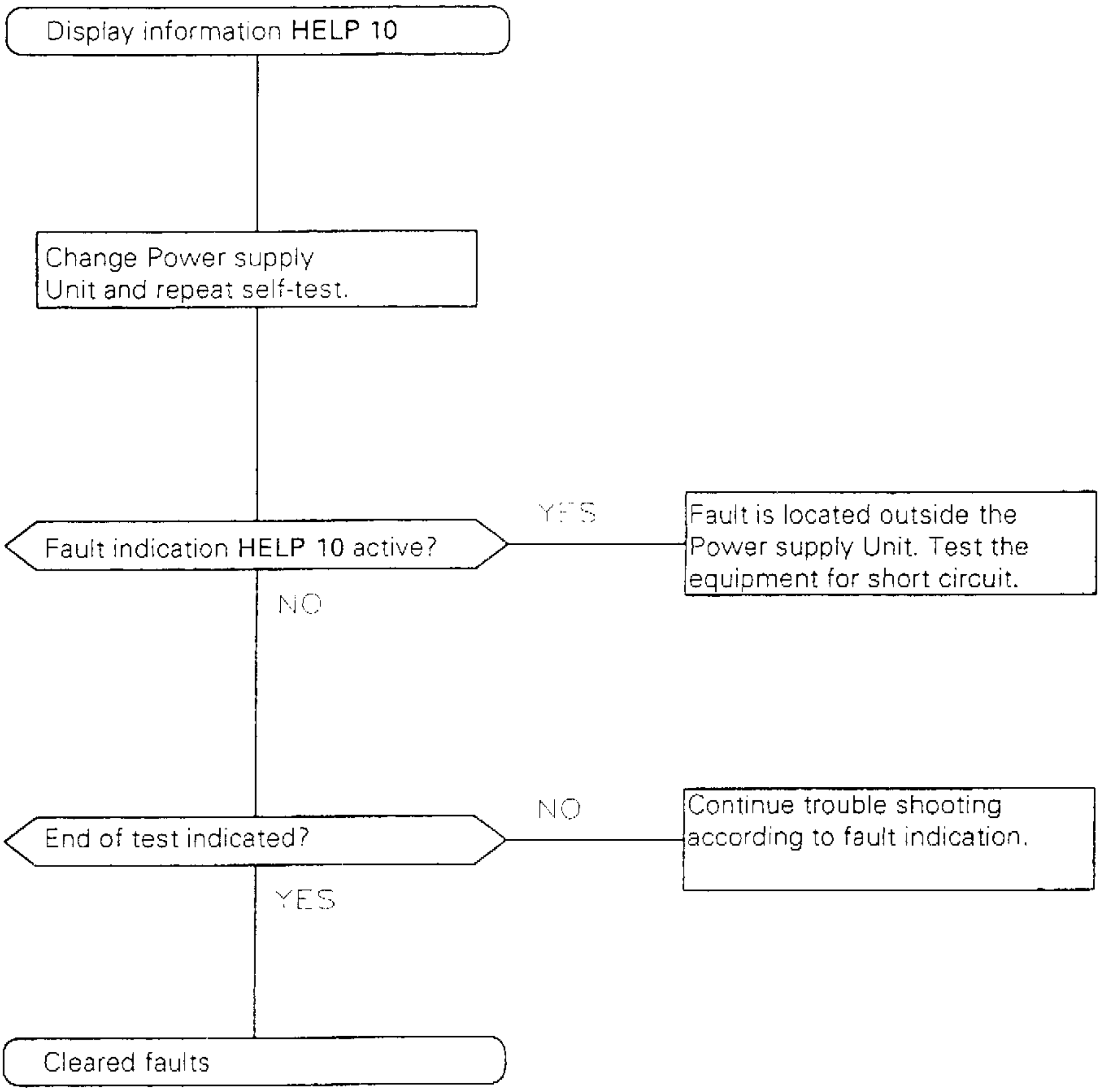
Fault indication HELP 08



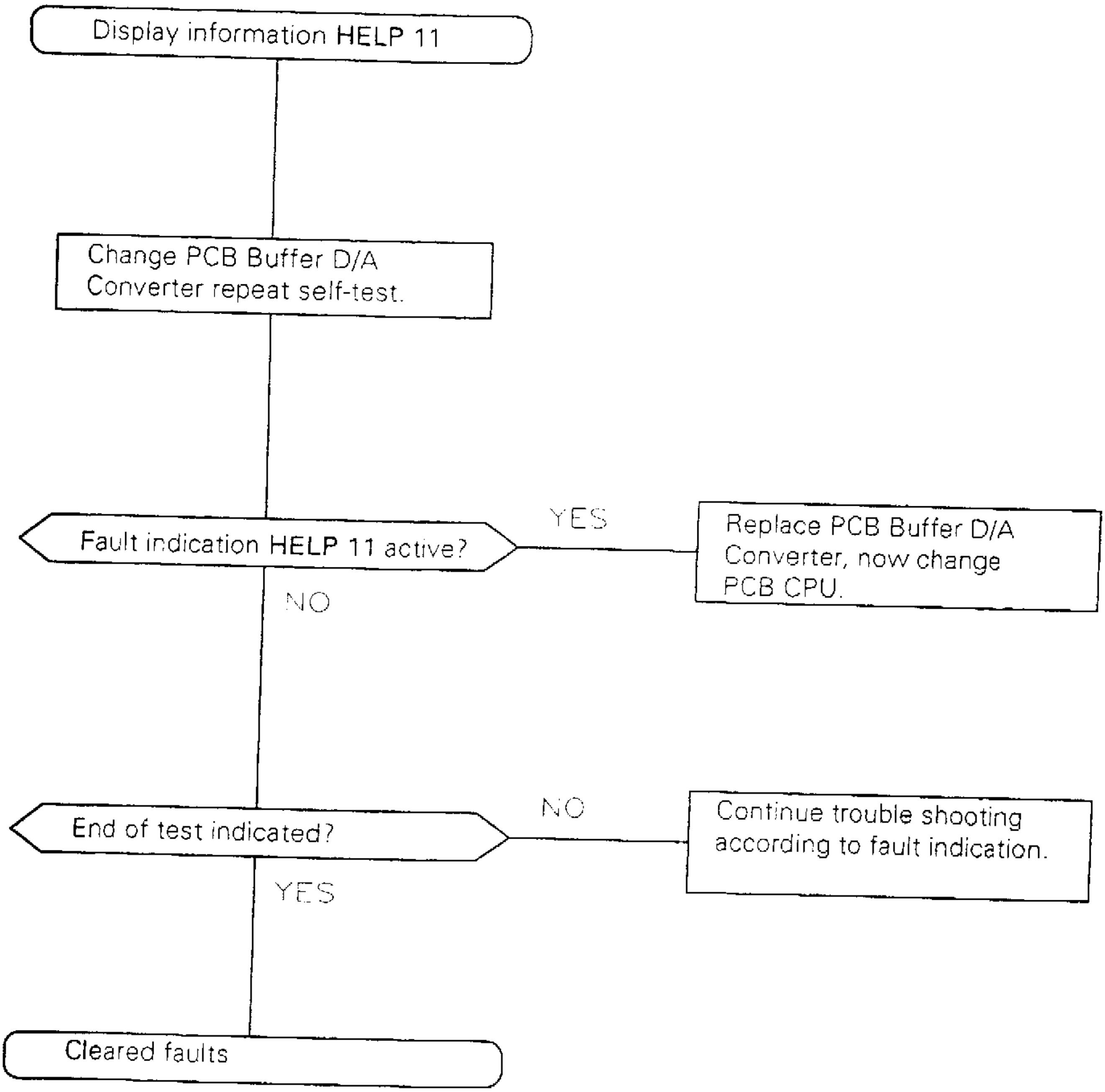
Fault indication HELP 09



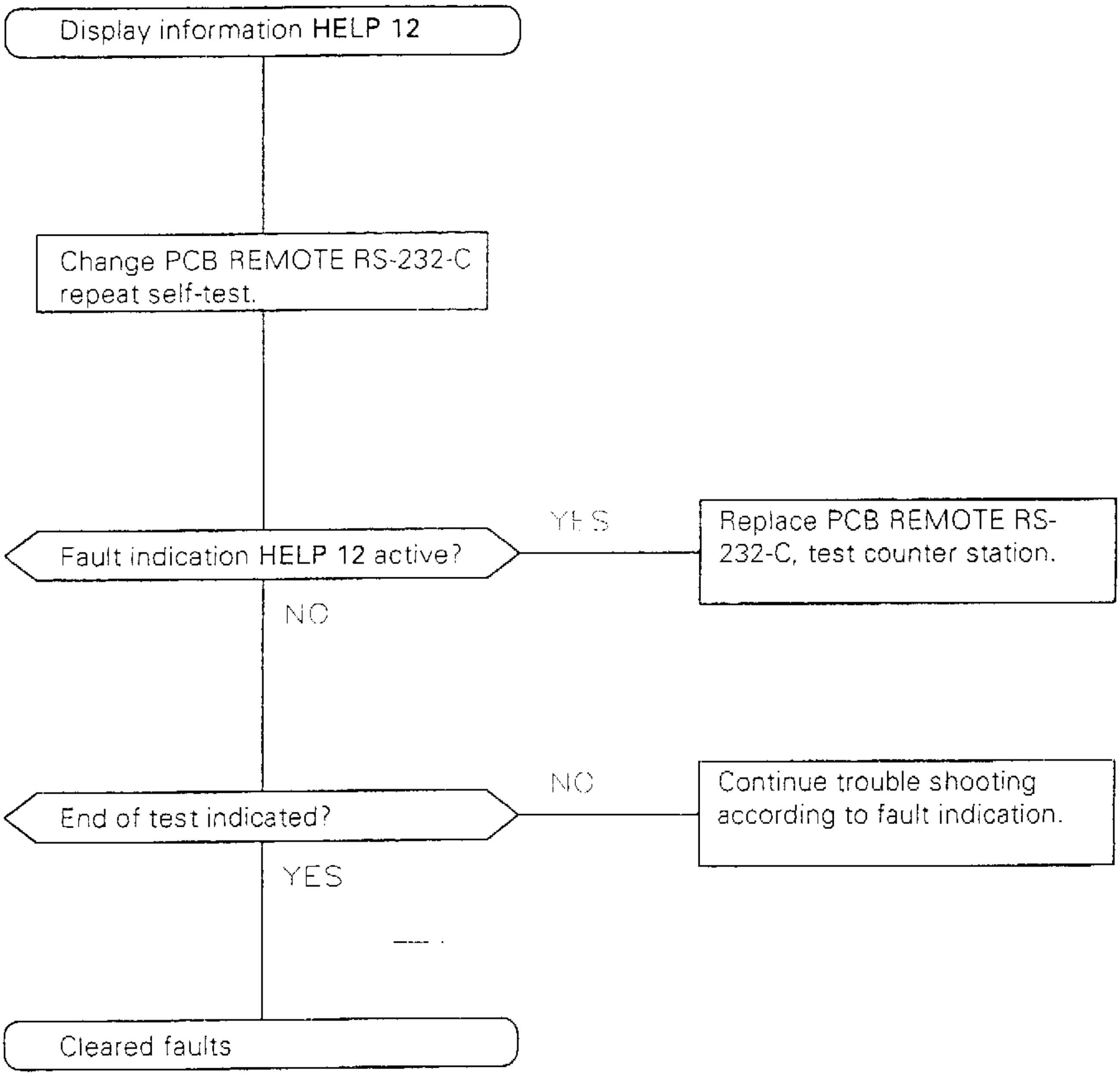
Fault indication HELP 10



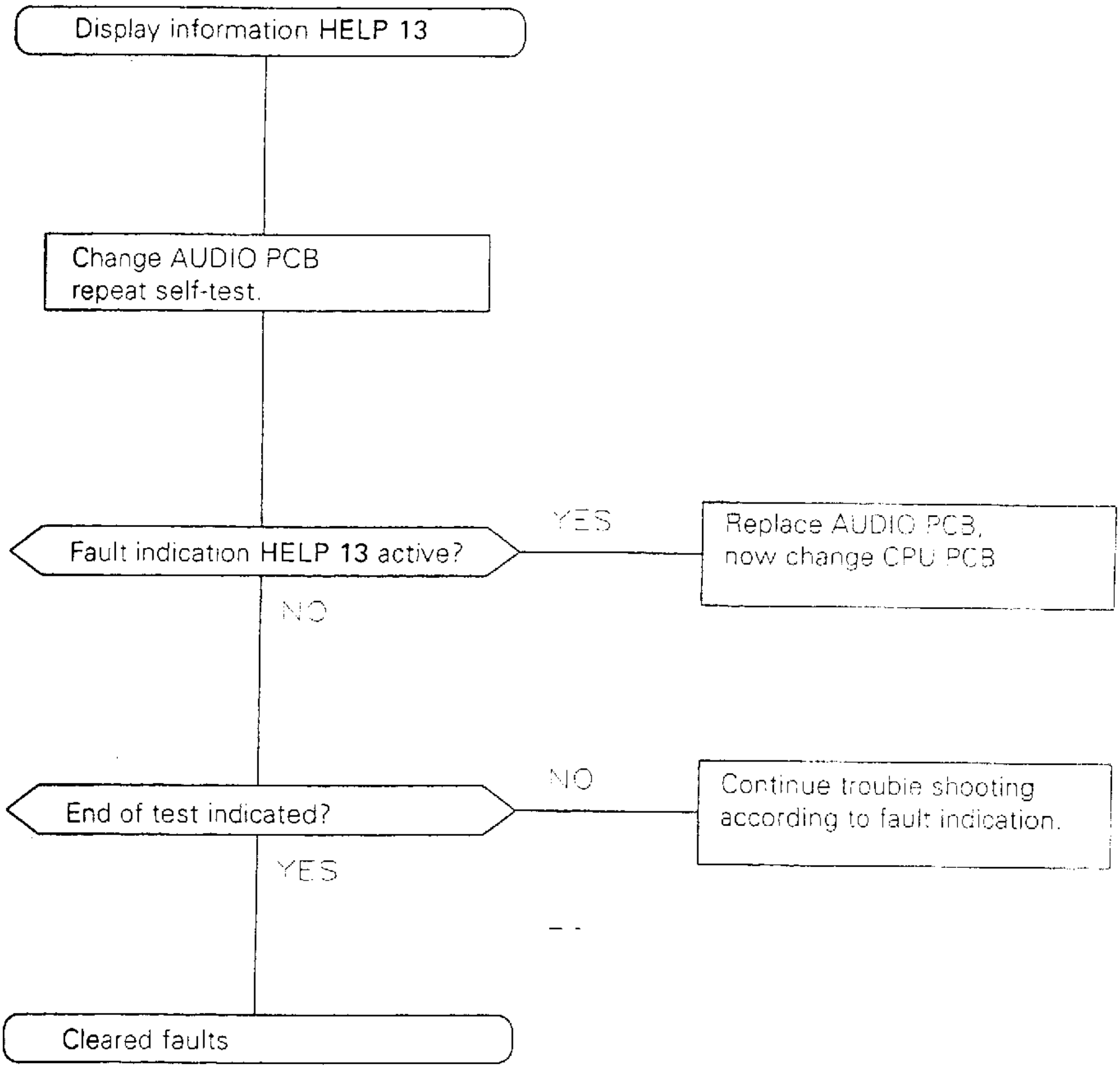
Fault indication HELP 11



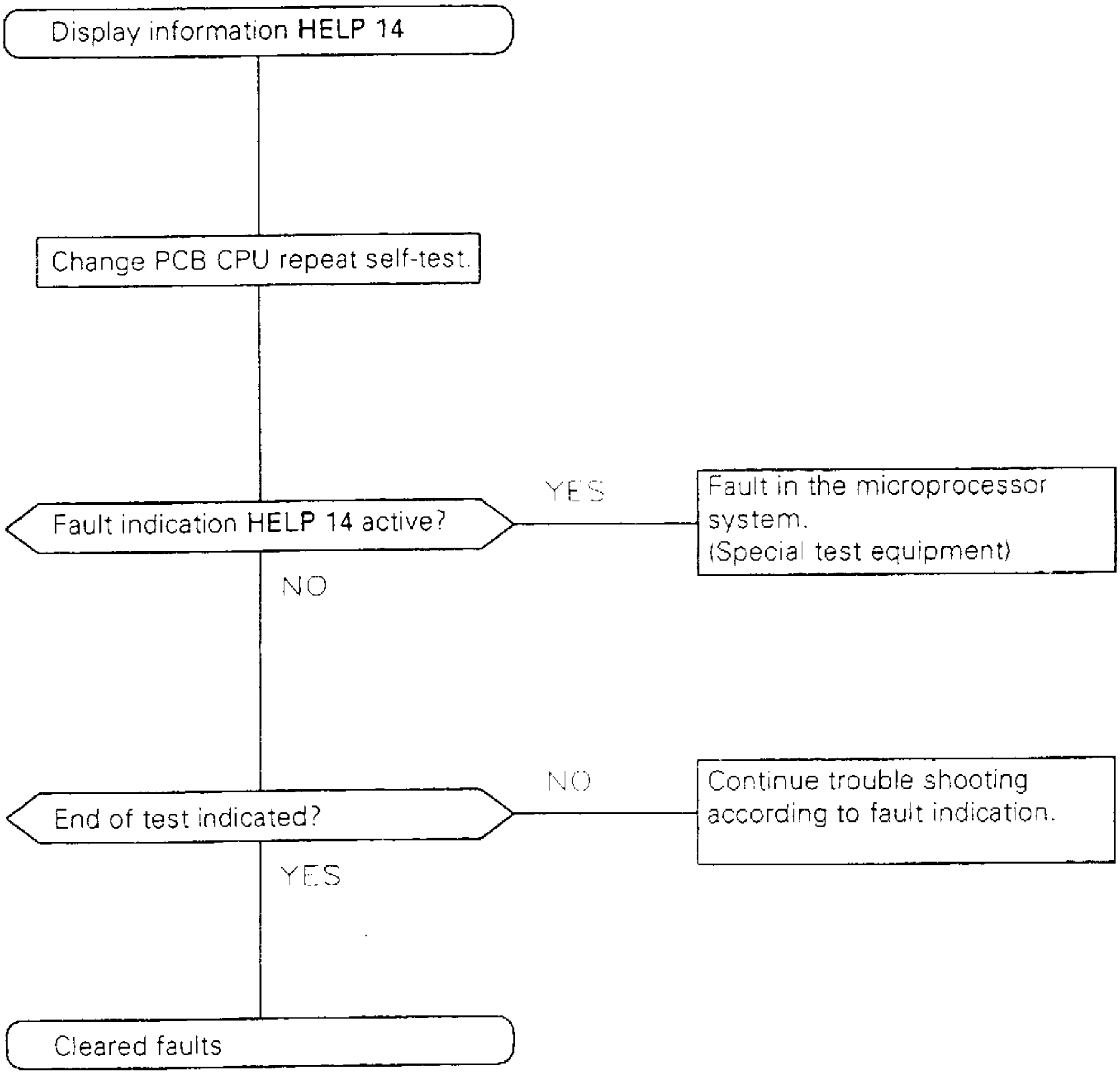
Fault indication HELP 12



Fault indication HELP 13

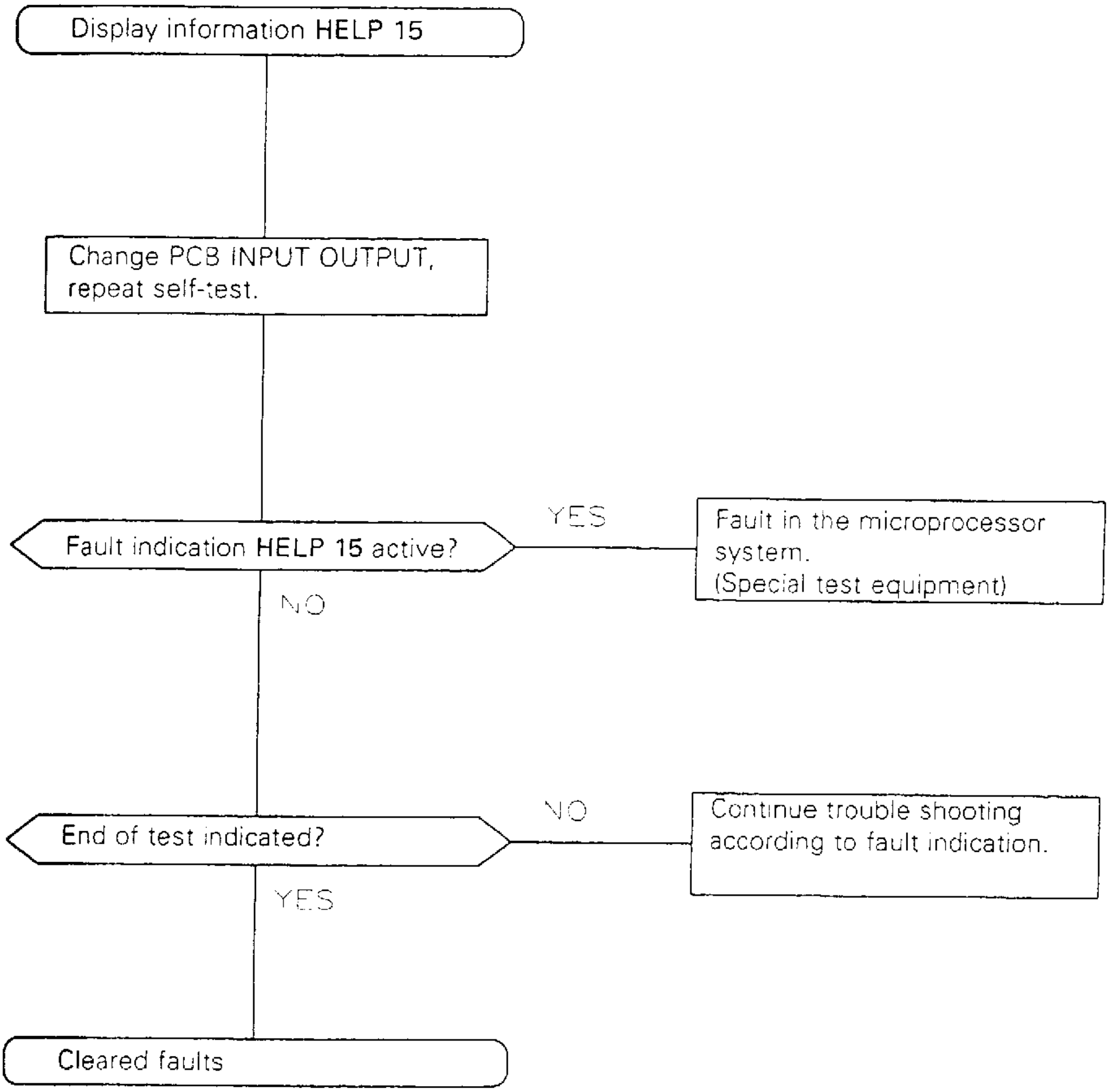


Fault indication HELP 14

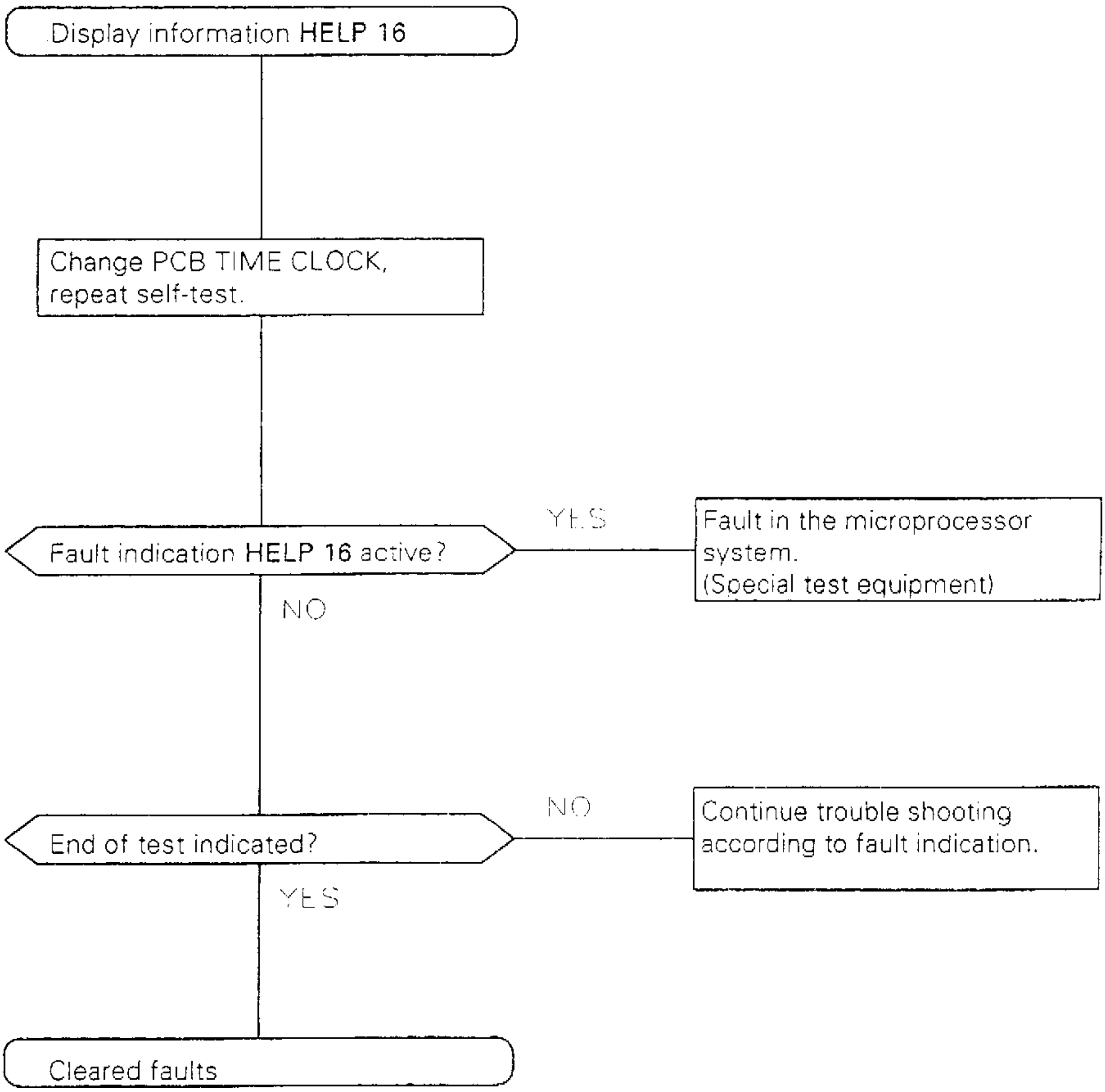


Fault indication HELP 15

The indication HELP 15 can be simulated by the operator (refer to page 3-31).



Fault indication HELP 16



3.1.5 Go/NoGo Test

In case a locally operated receiver is fitted with the option RS 232, a BITE test can be started externally via the remote connector and the result is also being transmitted at this remote connector (Go/NoGo test).

For this Go/NoGo test the following conditions must be set:
- RS 232 option must be fitted
- switch S 2 on RS 232 PCB must be set to position 600 Baud (pull down for DSR)
- switch S 1 on Interconnection PCB must be switched to ON.
- switch S 2.1 on I/O PCB must be switched ON
- switch S 2.2 on I/O PCB must be switched ON

The BITE test is started by sending a high going signal (+12 V) to the DSR input (pin 6) of the remote receptacle.
After the test has finished, the result is being output an the DTR output (pin 20) of the remote receptacle.

pin 20 = +12 V means Go
pin 20 = - 12 V means NoGo

NOTE
During the test and while reading out the result at the DTR output the DSR input must be high (approx. 2 min).

3.1.6 Sequence of the AUTO TEST (BITE)

Testpoint	HELP-No.	Group	Tested function	1	2	3	4	5	6
01	---	Display	All LED´s and 7-digit-indications.	off	---	2.5s	---	---	---
02	01 +40	Protector/ Preselect.	Switching-on of the 20 dB-Attenuator with switched-on preselector.	>20dBm	AGC-short	0.5s	---	---	Testsignal 10 dB attenuated
03	01 +40	Protector/ Preselect.	Switching-off of the 20 dB-Attenuator with switched-on preselector.	off	AGC-short	2.0s	---	---	
04	01 +40	Protector/ Preselect.	Switching-on of the 20 dB-Attenuator with preselector switched-off.	>20dBm	AGC-short	0.5s	---	---	Testsignal 10dB attenuated
05	01 +40	Protector/ Preselect.	Switching-off of the 20 dB-Attenuator with preselector switched-off.	off	AGC-short	2.0s	---	---	
			Testpoints 06-11 with built-in preselector only:						
06	11	Buffer-DA	Reference voltage for presel. middle position	off	AGC-short	0.5s	10	H	
07	01 +41	Preselect.	Pass-attenuation 1.6 MHz low pass at 1 MHz (comparison with pass attenuation=Pres.off)	-54dBm	AGC-short	4.0s	---	---	Testsignal 20dB attenuated (switched-on preselector)

REMARK

1 1 MHz-Test-Signal
2 AGC Setting
3 max. Testing time
4 HELP-Input TIME CLOCK PCB ST.D
5 Nominal level
6 Fault simulation

Testpoint HELP-No.	Group	Tested function	1	2	3	4	5	6
08 01 +42	Preselect.	Pass-attenuation 1.6 MHz at 3 MHz (comparison with pass attenuation=Pres.off)	-54dBm	AGC-short	4.0s	—	---	Testsignal 20dB attenuated (switched-on preselector)
09 01 +43	Preselect.	Pass-attenuation 4-8 MHz filter at 7 MHz (comparison with pass attenuation=Pres.off)	-54dBm	AGC-short	4.0s	---	---	Testsignal 20dB attenuated (switched-on preselector)
10 01 +44	Preselect.	Pass-attenuation 8-17 MHz filter at 11 MHz (comparison with pass attenuation=Pres.off)	-54dBm	AGC-short	4.0s	—	—	Testsignal 20dB attenuated (switched-on preselector)
11 01	Preselect.	Pass-attenuation 17-30 MHz filter at 19 MHz	-54dBm	AGC-short	4.0s	—	---	
12 05	Demodul.	Control voltage test	-54dBm	AGC-short	0.5s	21	H	30dB in front of Demodulator
		Testpoints 13-16 with filter 3 kHz:						
13 02	1. Mixer	Amplification with sufficient IF-level	-54dBm	max.ampl.	0.5s	15	H	10dB in front of 1. Mixer
14 03	2. Mixer	Amplification with sufficient IF-level	-54dBm	min.ampl.	0.5s	18	H	10dB in front of 2. Mixer
15 02	1 Mixer	Control with insufficient IF-level	-54dBm	min ampl.	0.5s	15	L	

REMARK

1 1 MHz-Test-Signal
2 AGC Setting
3 max. Testing time
4 HELP-Input TIME CLOCK PCB ST.D
5 Nominal level
6 Fault simulation

Testpoint HELP-No.	Group	Tested function	1	2	3	4	5	6
16 03	2. Mixer	Control with insufficient IF-level	-54dBm	max.ampl.	0.5s	18	L	
		Testpoints 17-24 with filter 6 kHz:						
17 02	1. Mixer	Amplification with sufficient IF-level	-54dBm	max.ampl.	0.5s	16	H	10dB in front of 1. Mixer
18 03	2. Mixer	Amplification with sufficient-IF-level	-54dBm	max.ampl.	0.5s	15	H	10dB in front of 2. Mixer
19 05	Demodul.	AGC-Generation and IF-level	-54dBm	max.ampl.	0.5s	21	H	
20 06	525/10kHz	IF-output level	-54dBm	max.ampl.	0.5s	14	H	10dB in front of IF-output. Cass.
21 02	1. Mixer	Control with insufficient IF-level	-54dBm	min.ampl.	0.5s	15	L	
22 03	2. Mixer	Control with insufficient IF-level	-54dBm	min.ampl.	0.5s	18	L	
23 05	Demodul.	AGC-Generation and IF-level	-54dBm	min.ampl.	7.0s	21	L	
24 06	525/10kHz*	IF-output level	-54dBm	min.ampl.	0.5s	14	L	
25 04	Filterboard	Connect filter 6 kHz on 2. Mixer	-54dBm	AGC-short	1.0s	---	---	
26 04	Filterboard	Pass attenuation (filter 2,4 kHz)	-54dBm	AGC-short	1.0s	---	---	

REMARK
1 1 MHz-Test-Signal
2 AGC Setting
3 max. Testing time
4 HELP-Input TIME CLOCK PCB ST.D
5 Nominal level
6 Fault simulation

* only tested if fitted (S 1/3 and S 2/1 on Audio II PCB)

Testpoint HELP-No.	Group	Tested function	1	2	3	4	5	6
27 04	Filterboard	Pass attenuation (filter 1,5kHz)	-54dBm	AGC-short	1.0s	---	---	
28 04	Filterboard	Pass attenuation (filter 0,6 kHz)	-54dBm	AGC-short	1.0s	---	---	
29 04	Filterboard	Pass attenuation (filter 0,3 kHz)	-54dBm	AGC-short	1.0s	---	---	
30 04	Filterboard	Pass attenuation (filter 0,15 kHz)	-54dBm	AGC-short	1.0s	---	---	
31 04	Filterboard	Pass attenuation (filter 0,1 kHz)	-54dBm	AGC-short	1.0s	---	---	
		The AGC voltage difference between selected Filter and Bypass must not exceed 10 dB.						Use an attenuator in front of the Filterboard during measuring of individual filters.
32 15	I/O PCB	Function of Input/Output Integrated Circuits PIO 1: Write/Read test with A4 and B4-B7 PIO 2: Write/Read test with B0-B7 PIO 3: Write/Read test with B0, check for valid data at A0/A1 PIO 4: Check for valid data at A0-A3	-54dBm	AGC-short	0.02s	---	---	

REMARK

1 1 MHz-Test-Signal
2 AGC Setting
3 max. Testing time
4 HELP-Input TIME CLOCK PCB ST.D
5 Nominal level
6 Fault simulation

HAG/ROD 016-08.92

Testpoint HELP-No.	Group	Tested function	1	2	3	4	5	6
33 63	TTY-Conv.	Test of the connected TTY-Converter (if present) Failure indication of the converter: HELP 61 voltage failure HELP 62 RAM failure HELP 63 Mark-Space-failure Testpoint 34-35 during complete test: (only when S2.4 on I/O-Print is being switched-on)	-54dBm	AGC-short	1.2s	---	---	
34 13	Audio PCB	Test of AF-line by tone generation Condition: Loudspeaker switched-on, volume control adjusted.	>20dBm	AGC-short	1.0s	---	---	
35* 15	I/O PCB	Valid data from keyboard	>50s					Press two keys simultaneously for a short time or
36* 15	I/O PCB	Quiescent position of frequency tuning cct.	>50s					turn the fly wheel knob only once during the test.

REMARK

1 1 MHz-Test-Signal
2 AGC Setting
3 max. Testing time
4 HELP-Input TIME CLOCK PCB ST.D
5 Nominal level
6 Fault simulation

* Only possible when switch S 2/4 on I/O PCB is 'ON'

3.2 Servicing

3.2.1 General

3.2.1.1 Removal of the receiver out of the cabinet

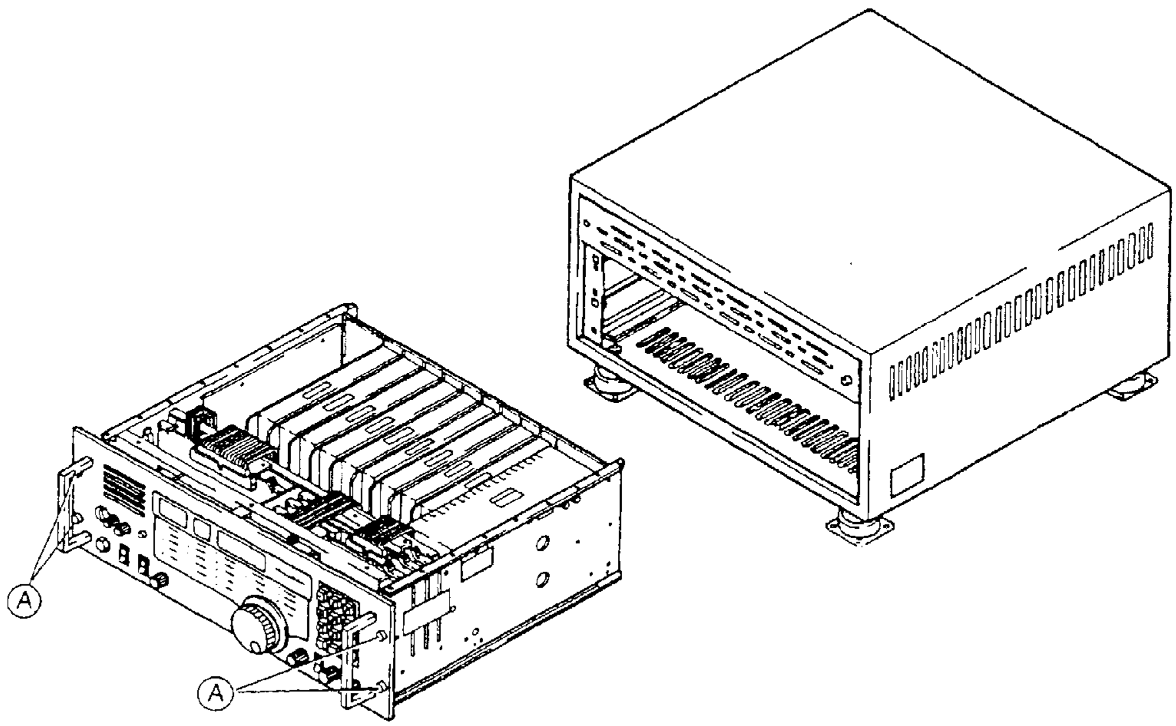


Fig. 3-1 Receiver RX 1001 M/RX 5001with Cabinet

- switch off the receiver
- unscrew mounting screws (A) on the front panel. Captive screws are used.
- remove all cable connections on the rear panel -refer to fig. 3-2-

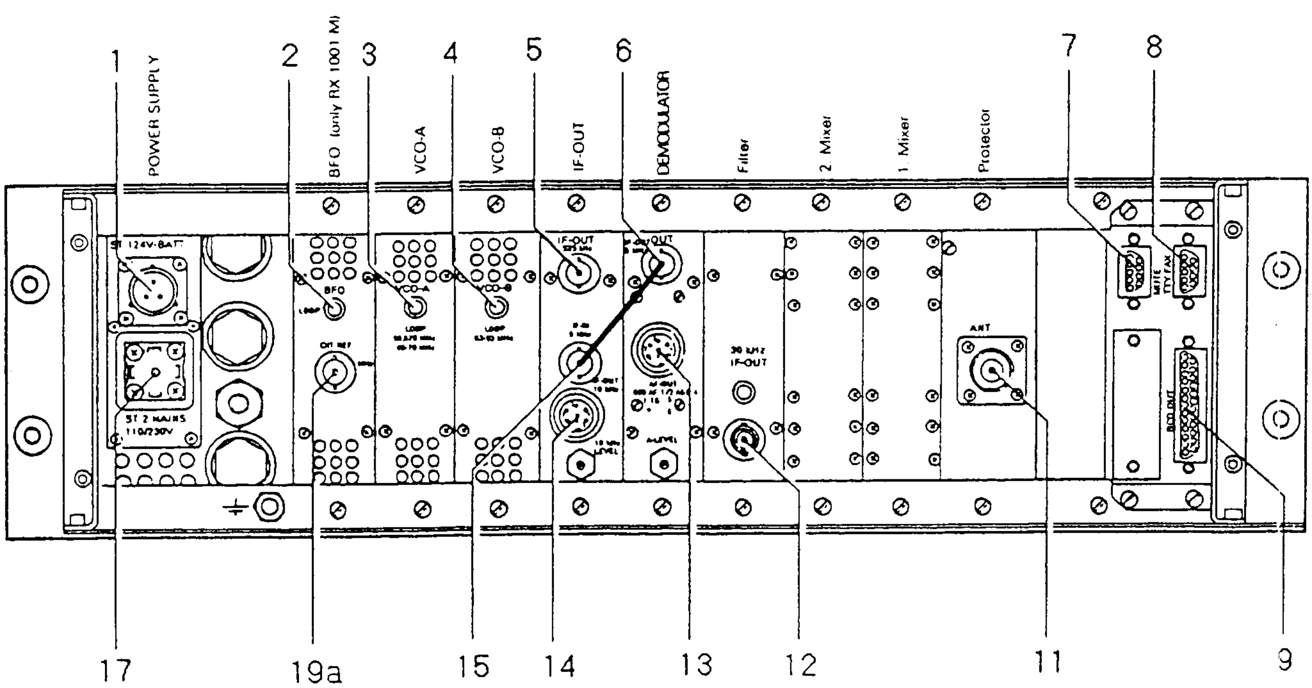
NOTE
Receivers of the series RX 1001 M/RX 5001 have a data protection; if the mains connector is disconnected from the power supply all stored data are deleted.

- remove the receiver out of the cabinet by the handles

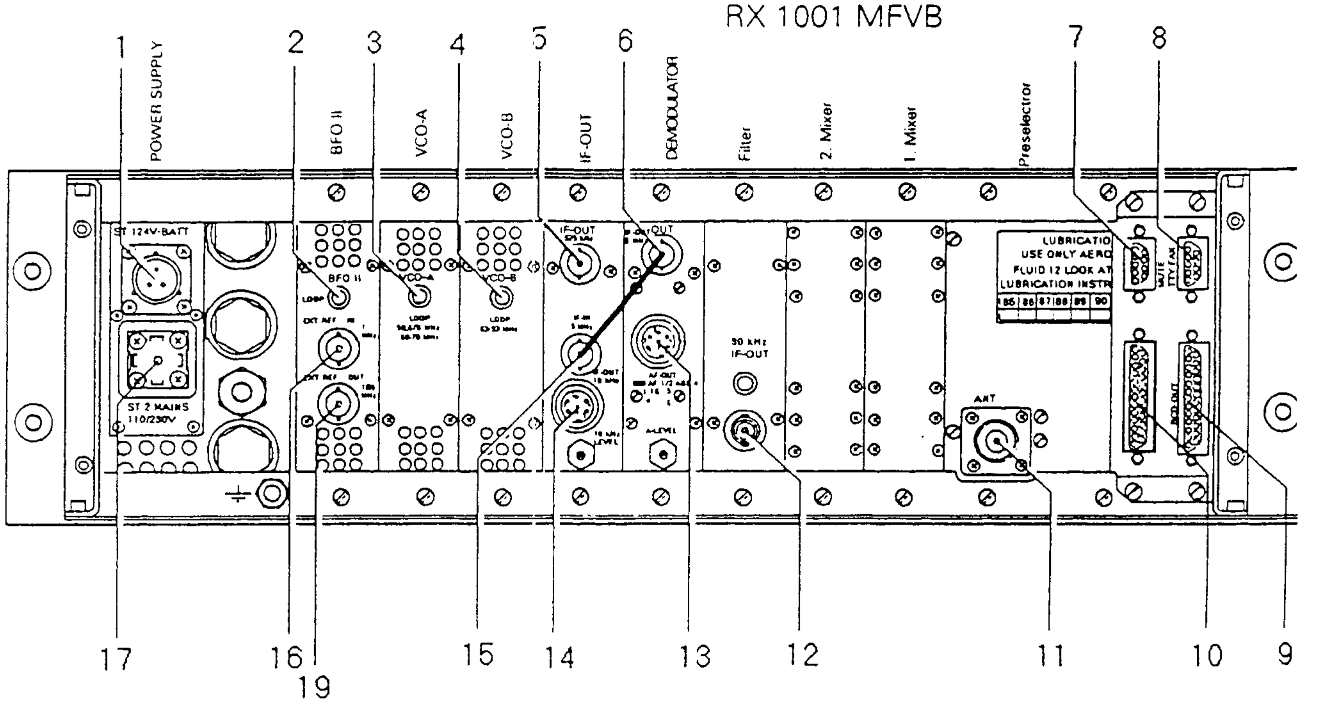
CAUTION
Receiver weight approx. 17 kg

1 ST 1 24 V-BATT
2 BFO-PLL locked LED
3 VCO A PLL's locked LED
4 VCO B PLL locked LED
5 Bu 2 525 kHz IF-OUTPUT
6 St 1 IF-IN
7 St F Extern-Connector
8 St E TTY-FAX Data Connector (TG 1001)
9 Bu 8a BCD-OUT-Connector
10 RS 232-C Remote Connector
11 Antenna input
12 Bu 4 30 kHz IF-OUT
13 Bu 2 AF-OUT
14 Bu 3 10 kHz IF-OUT
15 Bu 1 5 MHz IF-IN
16 Bu 4 1/10 MHz Ext. REF IN
17 St 2 MAINS
19 Bu 10 1/10 MHz Ext. REF OUT
19a Bu 4 1 MHz Ext. REF IN
20 Bu 2 AF 2-OUT

RX 5001 with option IF-OUT
RX 1001 MB



RX 5001 with option Preselector, Remot
and IF-OUT
RX 1001 MFVB



RX 5001 with option Preselector, Remot
and ISB-Demodulator

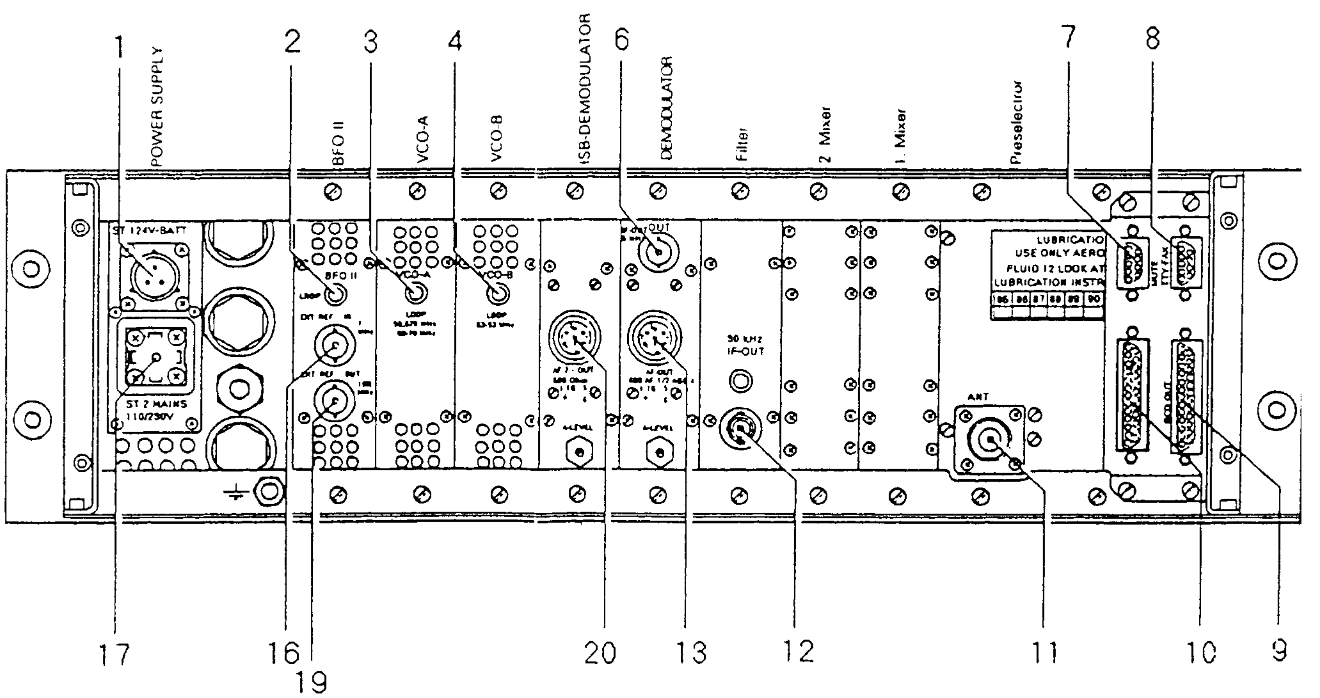


Fig. 3-2
Receiver Rear Panel

3.2.1.2 Preparation for servicing

Receivers of the series RX 1001 M/RX 5001are supplied with an accumulator, which supplies the RAM´s and clock in case of power failure. The accumulator has a capacity of 12 days. Afterwards all data in the RAM´s are deleted-

NOTE
To protect the accumulator against deep discharge, switch off the accumulator during servicing.

3.2.1.3 Switching off the accumulator

- Remove the receiver out of the cabinet.
- At the right hand side of the top cover you will find a DIP switch, next to this a note shows the operation.
- see fig. 3-3

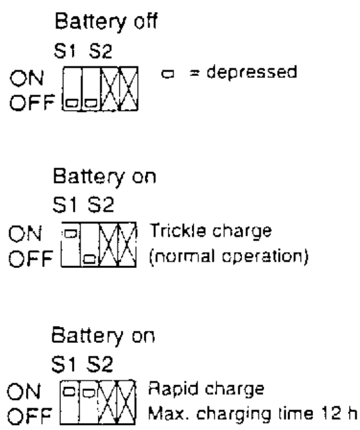


Fig. 3-3 Charging of the Built-in Accumulator

NOTE
A fully charged battery can maintain time and RAM content for 12 days. Never use quick charge setting with a mains plug which has a missing link (pin 3 and GND)

3.2.1.4 Opening of the receiver

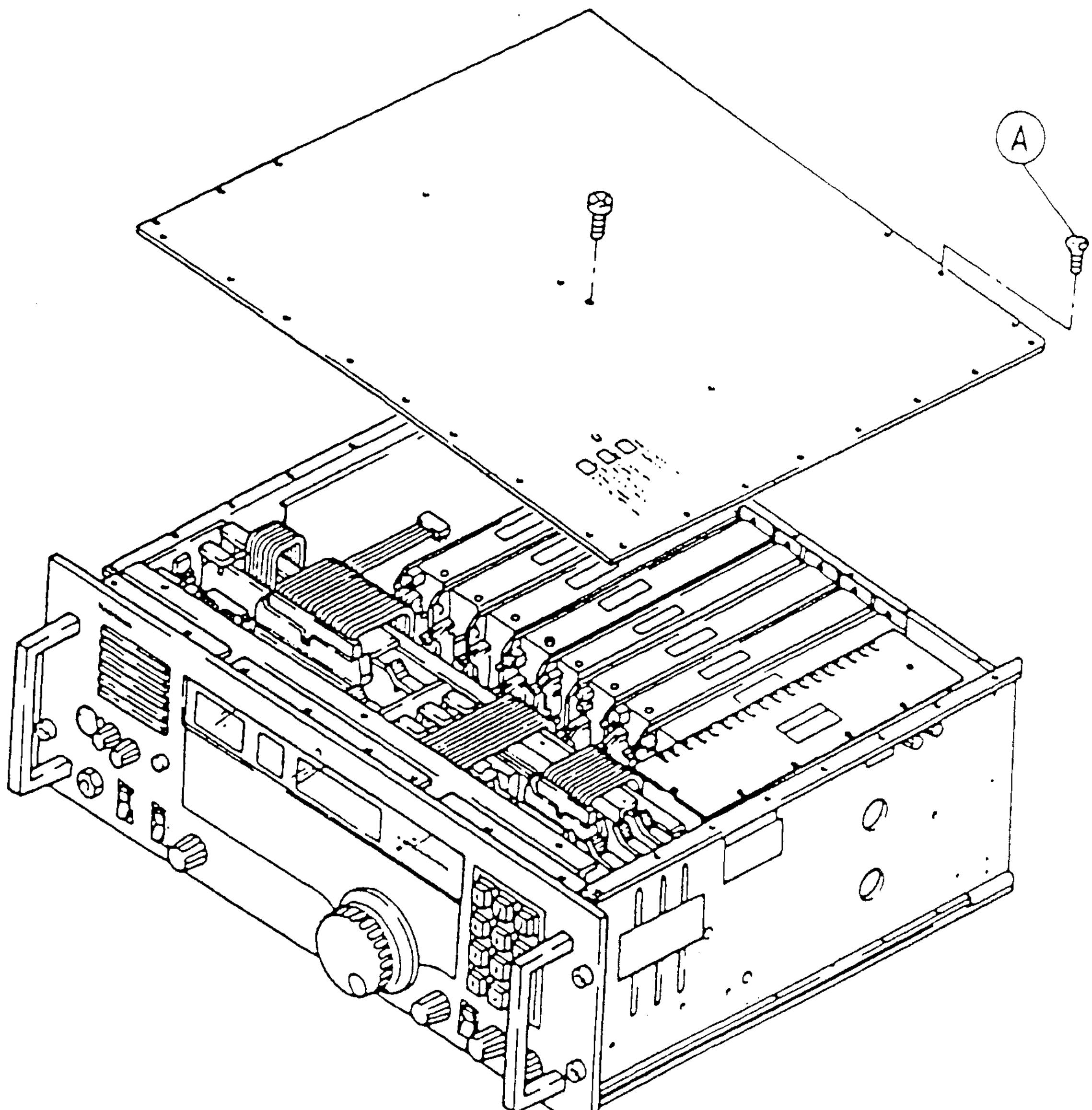
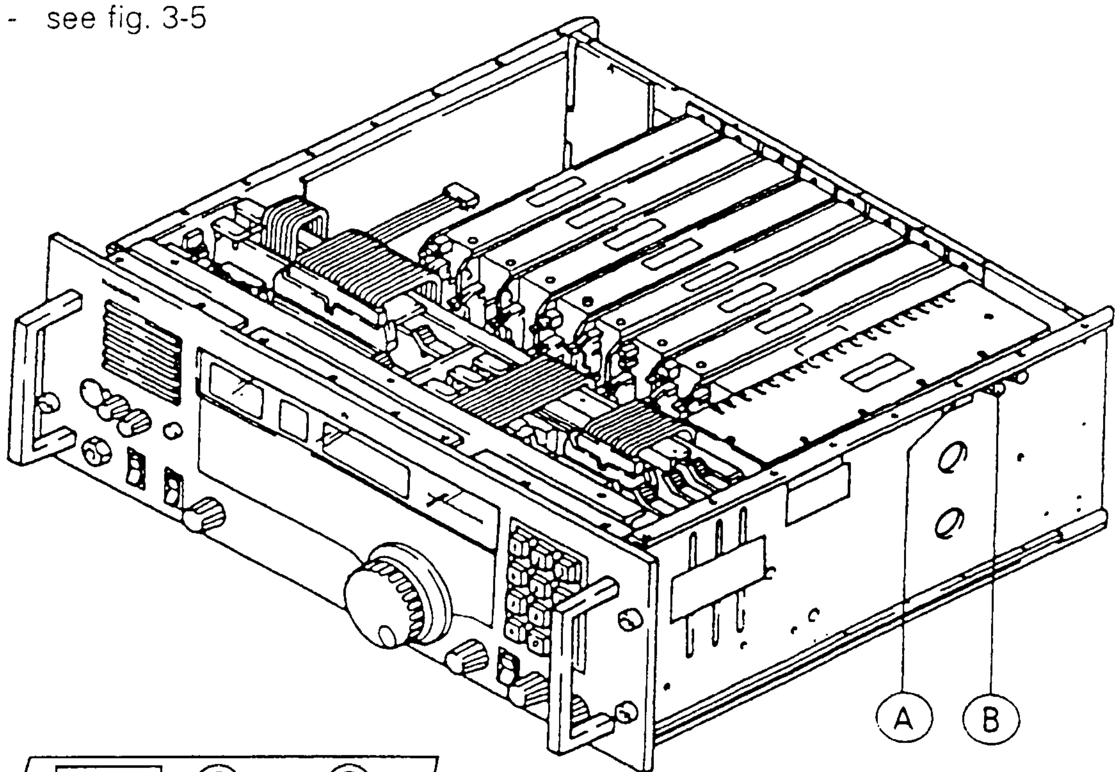


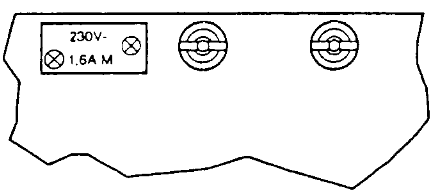
Fig. 3-4 Receiver in -Opened

- unscrew 35 pieces mounting screw (A), to remove the top cover.

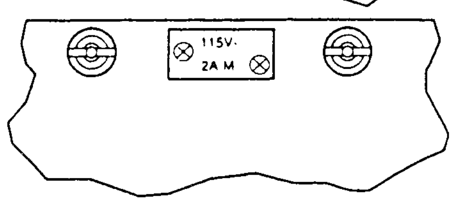
3.2.1.5 Checking the available mains voltage

The receivers series RX 1001 M / RX 5001can be connected to different mains voltages.
Before connecting the receiver to mains check the set mains voltage of the receiver see fig. 3-5.
- Remove the receiver completely out of the cabinet.
- On the right side wall locate the fuse cover of the mains voltage fuse
- see fig. 3-5





Set for 220 - 230 V AC supply



Set for 110 - 115 V AC supply

Fig. 3-5 Fuses for 115/230 V AC

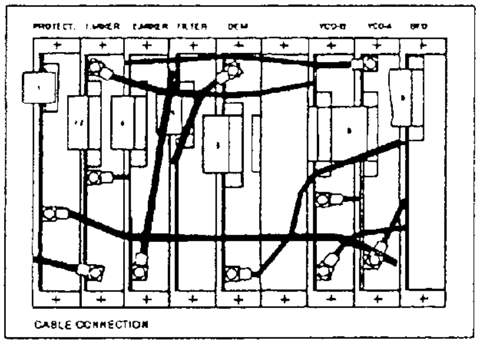
WARNING
Does the voltage specified on the fuse label (A) match the available supply voltage?
Conversion to 115 V AC supply voltage
- Unscrew fuse cap (B)
- Remove fuse label (A) covering the fuse for 115 V AC. Turn label over and use to cover 230 V AC. Replace fuse insert (use 2 AM, from spares bag if necessary) and screw fuse cap into the new fuse holder.

3.2.1.6 Cable connections inside the RX 1001 M / RX 5001

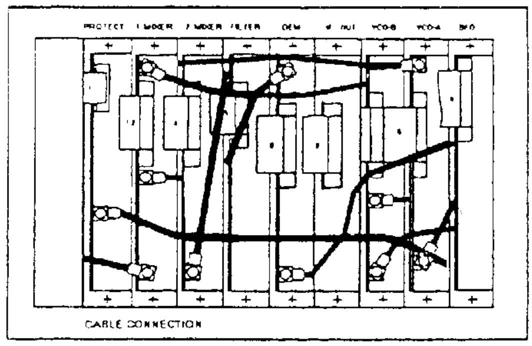
The subassemblies are connected together in different ways
1. By a "motherboard". The subassemblies are plug-in modules, the wiring is on this motherboard.
2. By ribbon cable from the PCB-Buffer D/A Converter via the PCB-interconnection board to the subassemblies of the RF-part.
3. By single ribbon cable & via two subassemblies.
4. By coaxial cables between subassemblies. For general views see fig. 3-6 to 3-8.
5. By a cable loom between power supply, motherboard, interconnection-board and various single components.

3.2.1.7 Interconnection of the Control Part

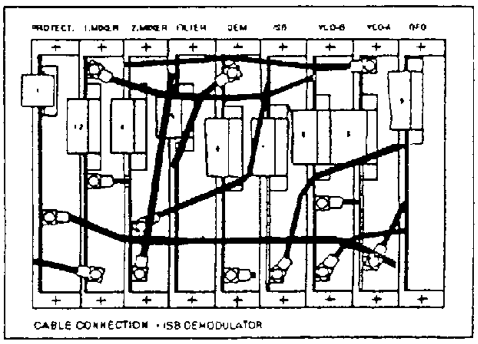
Fig. 3-9 shows the Control Part without Front Panel.



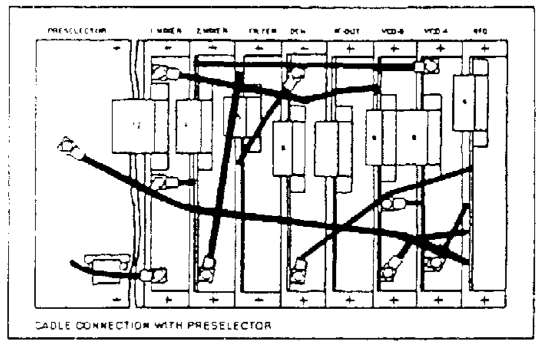
RX 5001 (basic version)



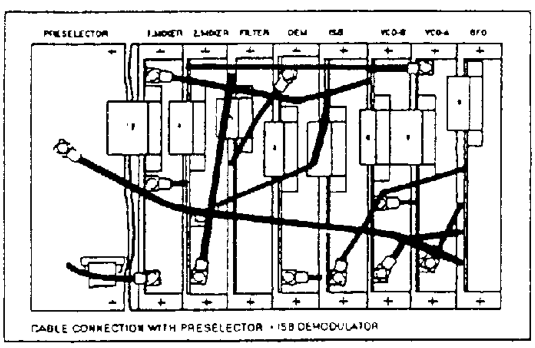
RX 5001 (with option IF-OUT)
RX 1001 MB (basic version)



RX 5001 (with option ISB-Demodulator)



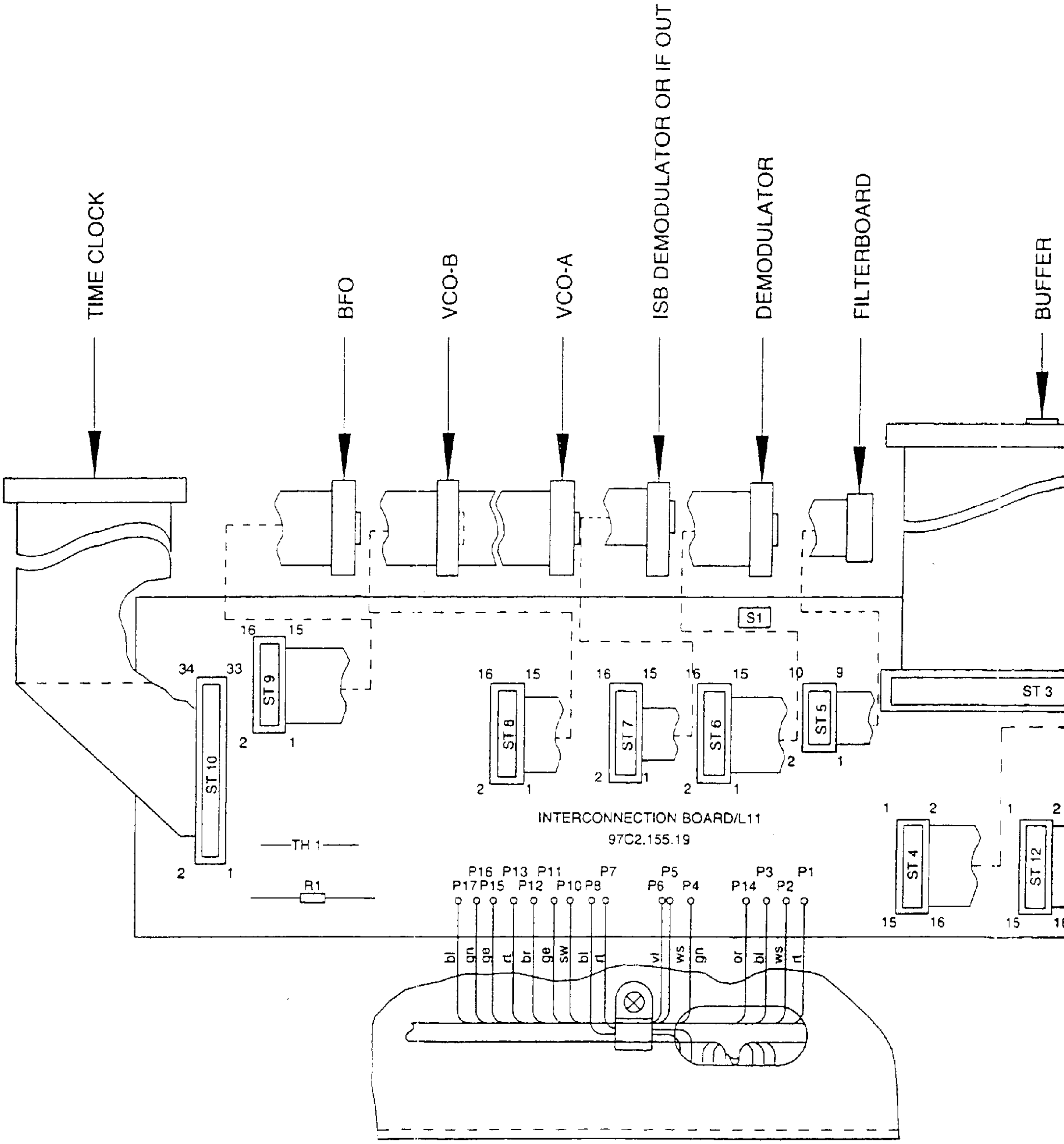
RX 5001 (with option Preselector and IF-OUT) RX 1001 MVB



RX 5001 (with option Preselector and ISB-Demodulator)

Fig. 3-6 Interconnection RF-Part

RX 1001 M / RX 5001
Part 3



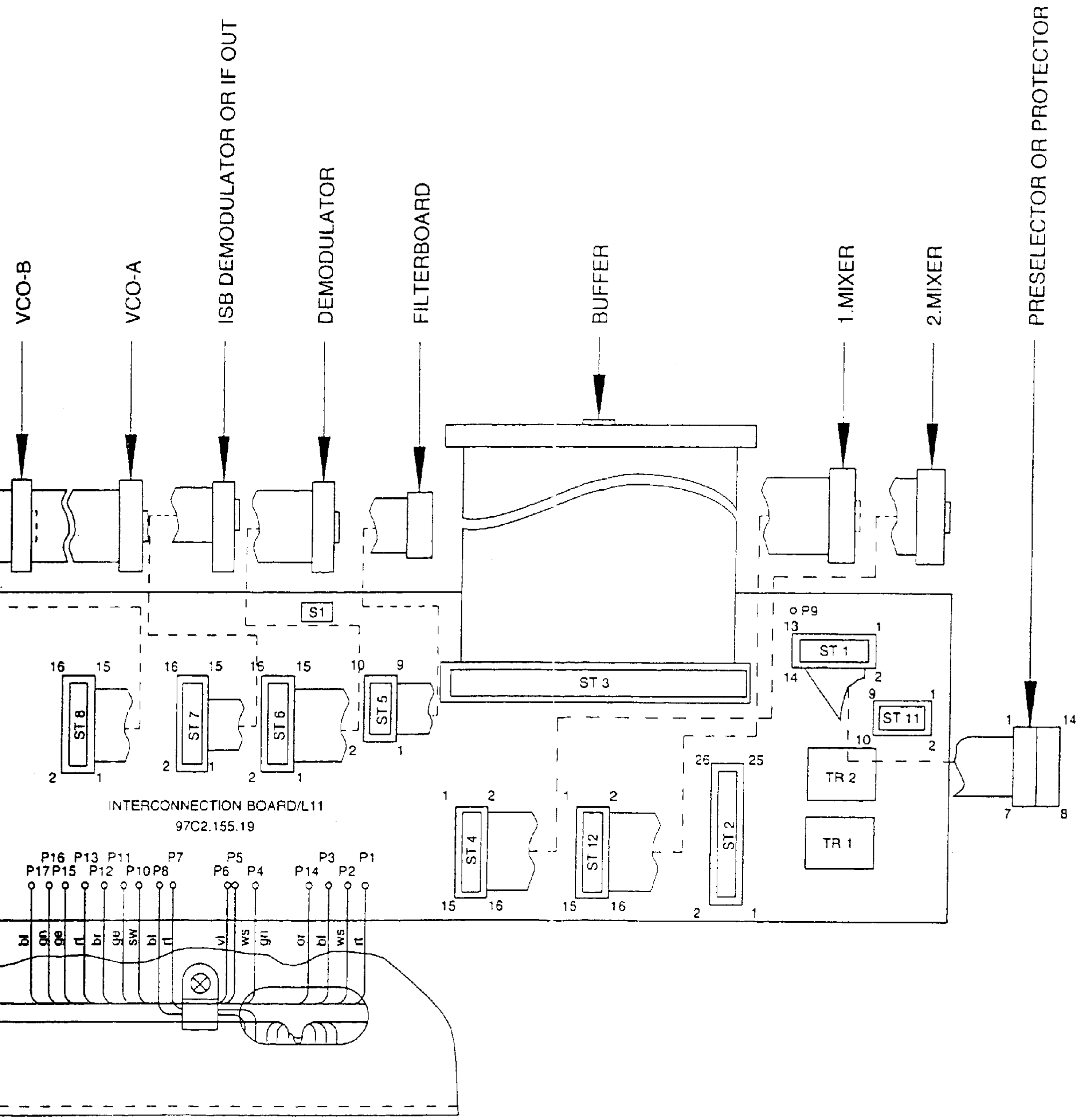
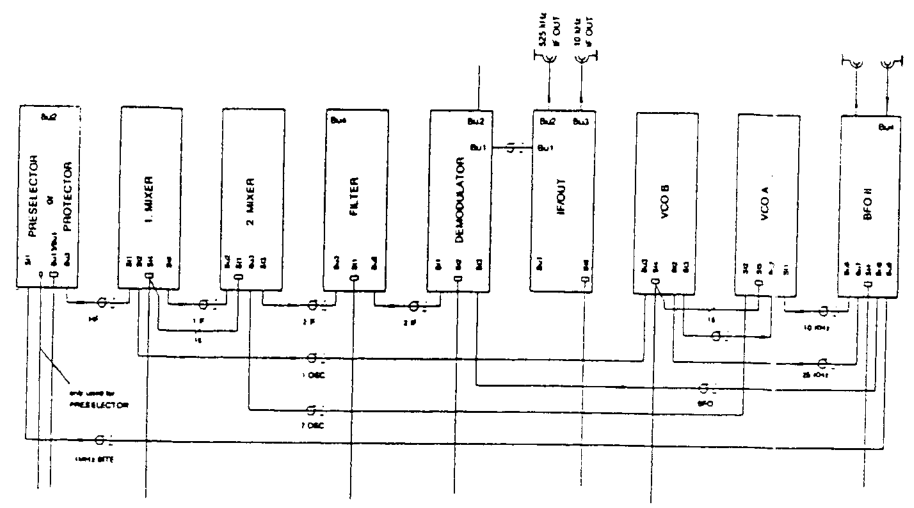
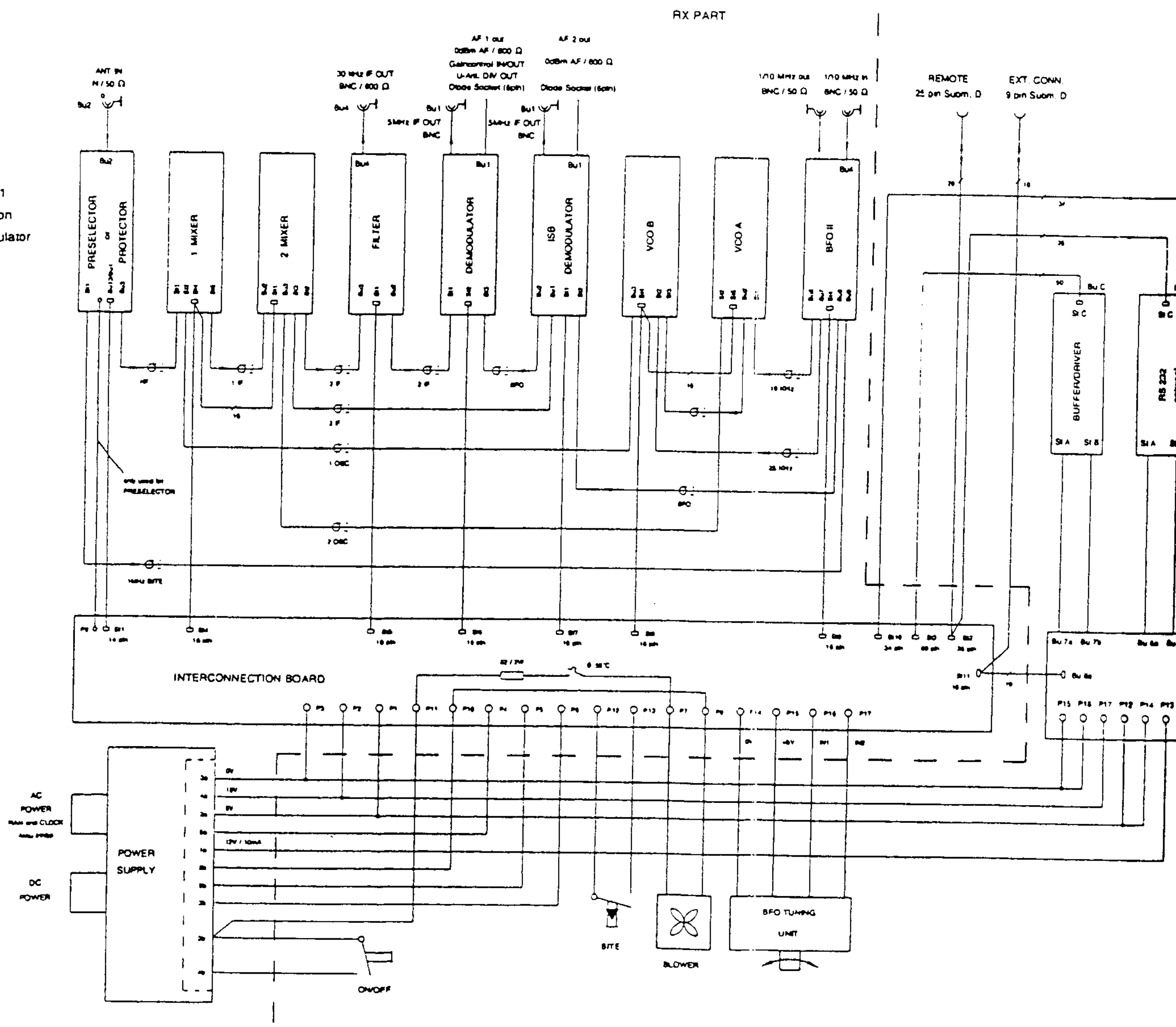


Fig. 3-7
3M Ribbon Cable
RX 1001 M / RX 5001

RX 1001 M
or
RX 5001
with option
IF / OUT



RX 5001
with option
ISB Demodulator



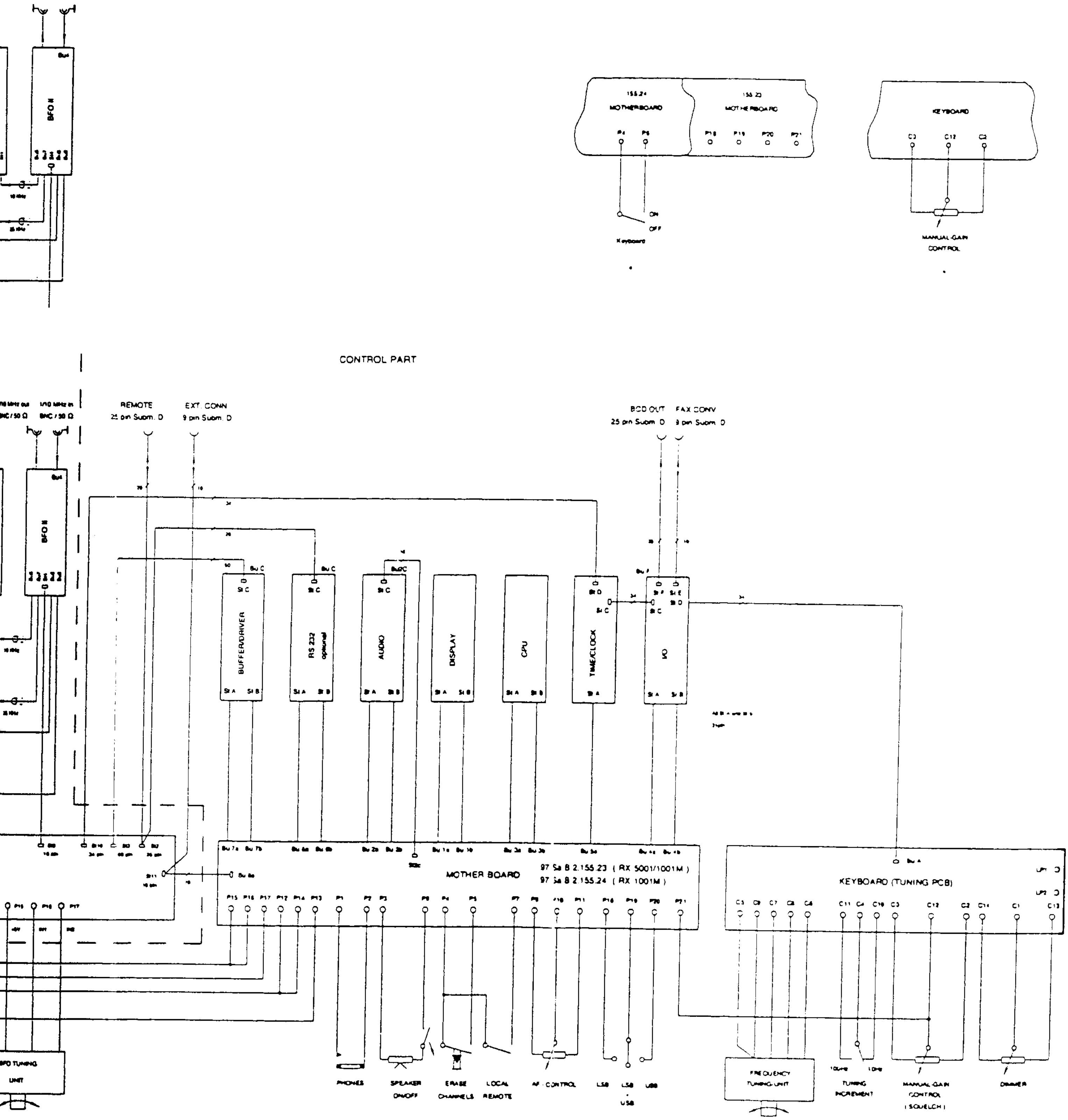
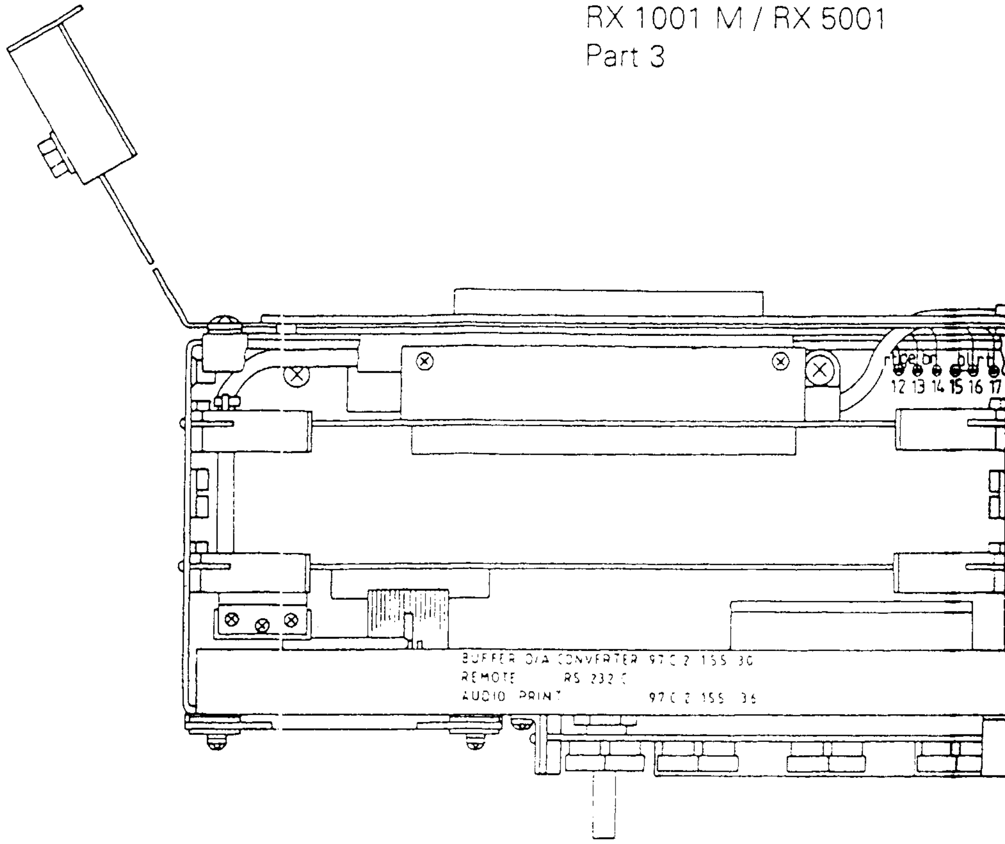
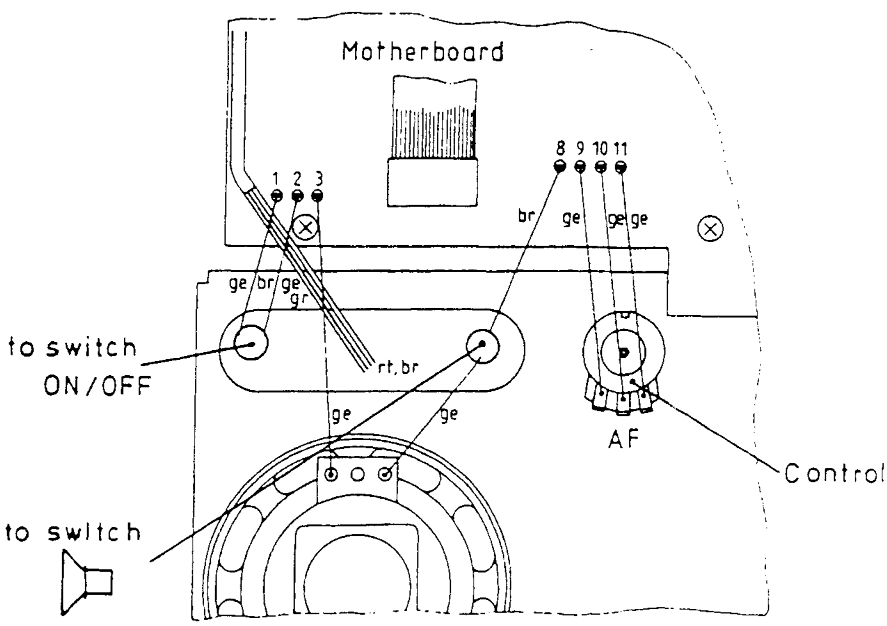
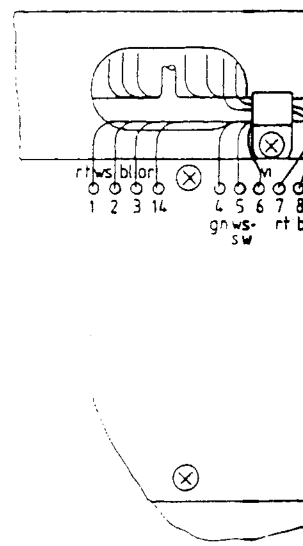


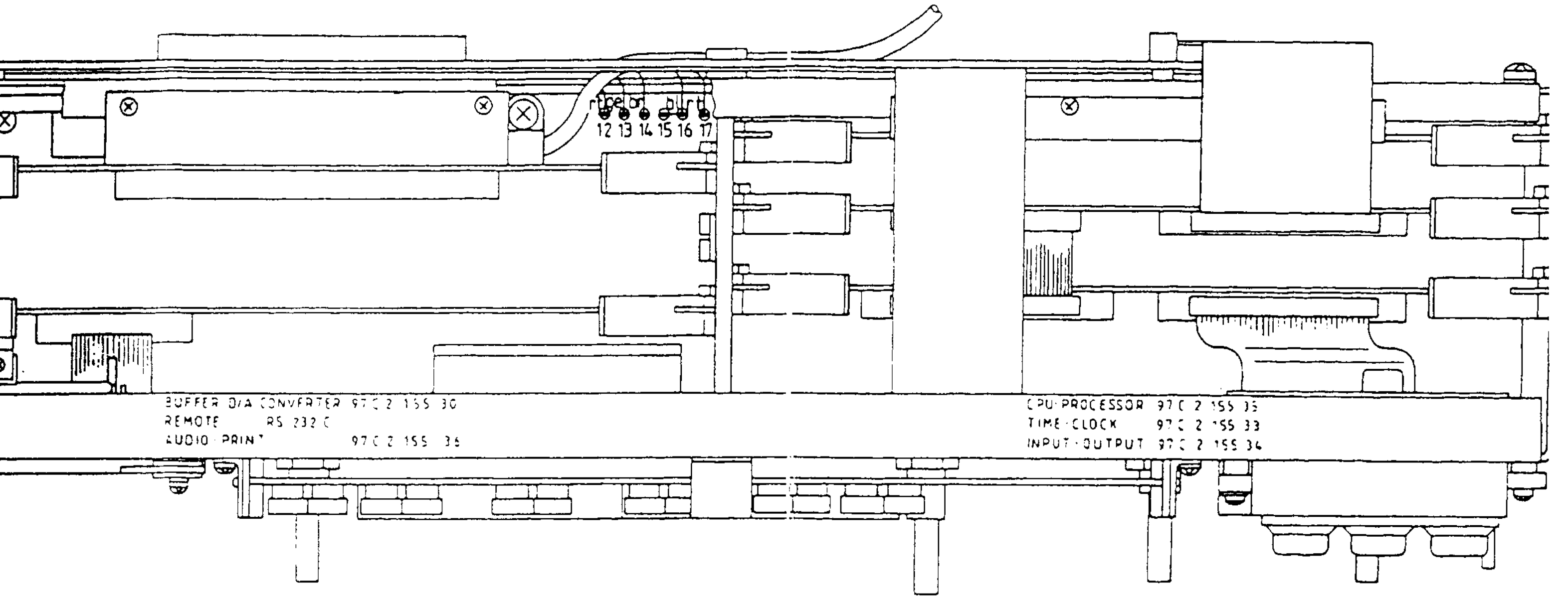
Fig. 3-8
Blockdiagram - Wiring-
RX 1001 M / RX 5001
* RX 1001 M only

RX 1001 M / RX 5001
Part 3









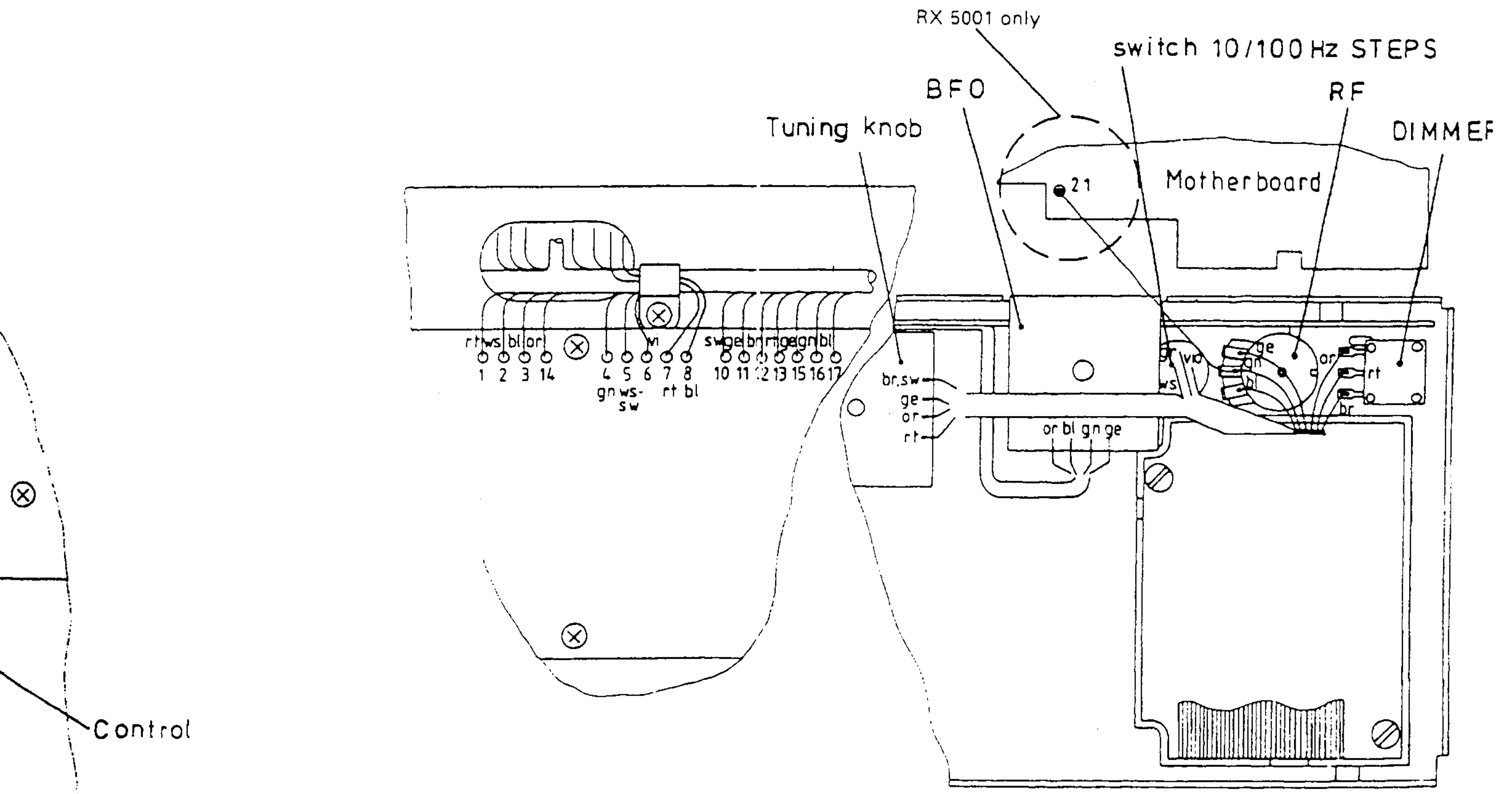


Fig. 3-9
Interconnection Control Part
RX 1001 M / RX 5001

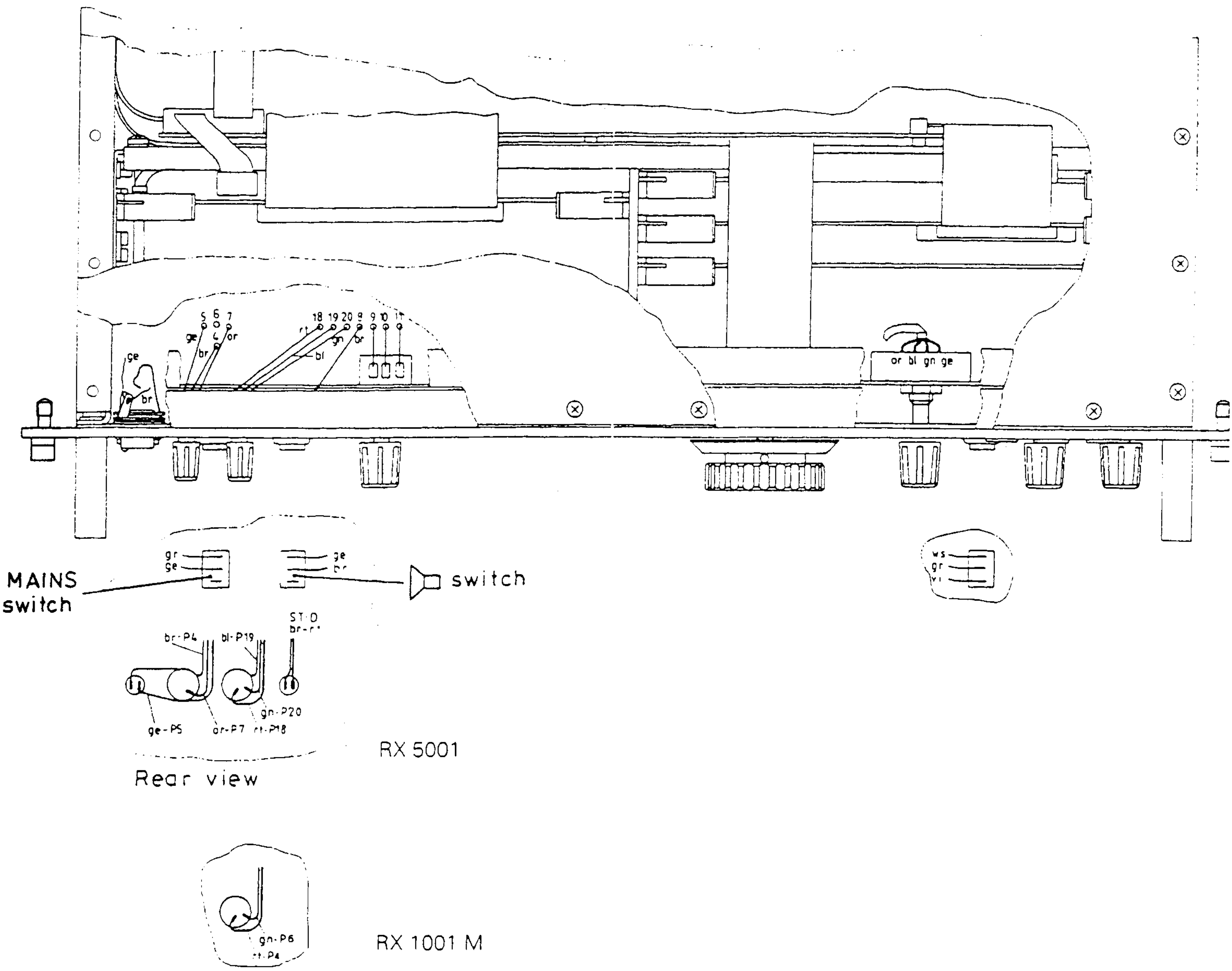


Fig. 3-10
Interconnection of the
Front Panel -Rear Side-
RX 1001 M / RX 5001

3.2.2 Removal and insertion of individual cassettes

3.2.2.1 Removal of a RF-Part's cassette

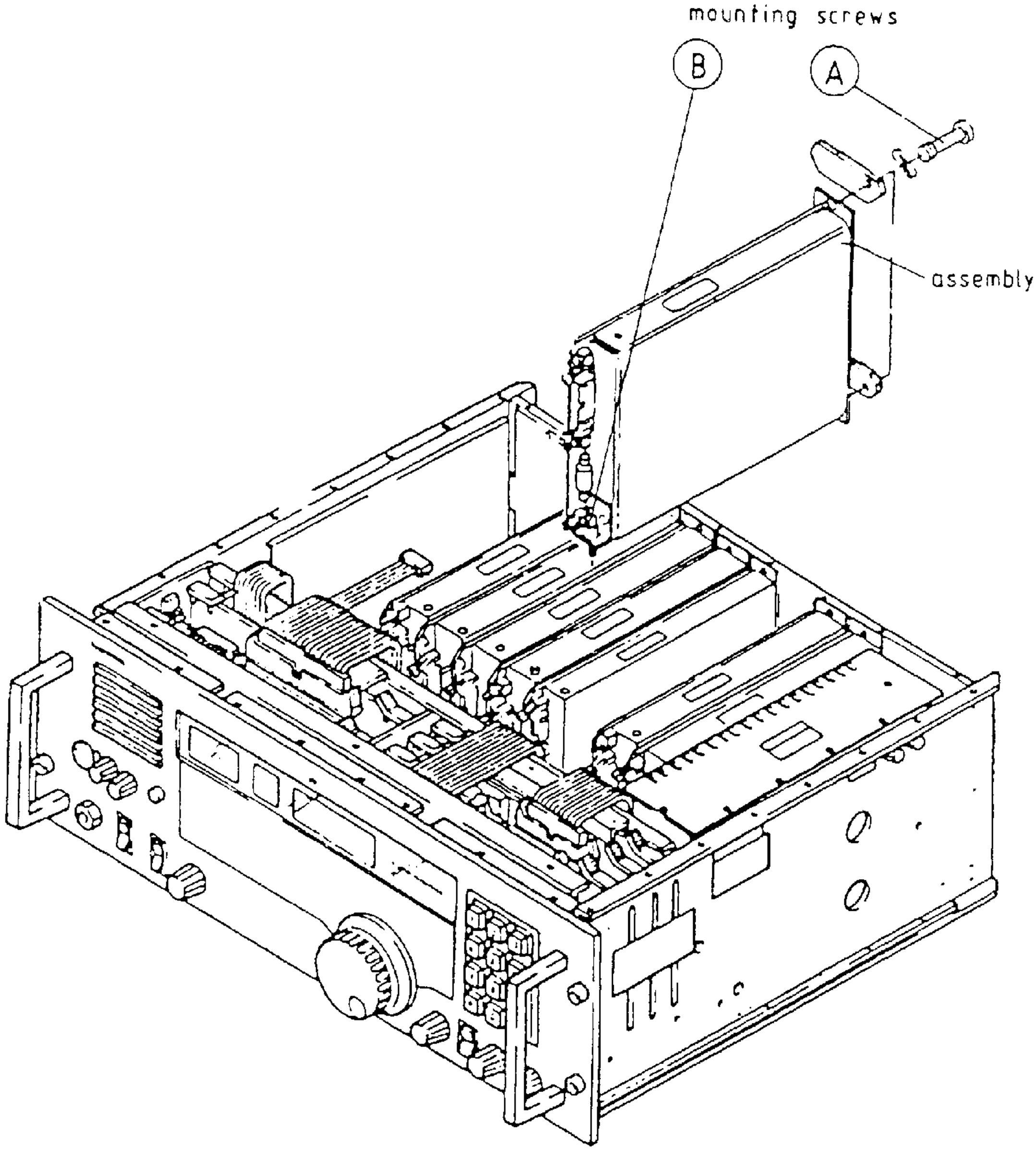


Fig. 3-11 Removal of a Cassette

The RF-Part of RX 1001 M / RX 5001series is modular constructed. Remove cassettes as follows:

1. disconnect mains and battery plug and remove to top cover.
2. disconnect all cable connections of this cassette see fig. 3-6 to 3-8. Unscrew the mounting screws (3 pieces for each cassette).
3. Remove cassette upwards from the RF-Part.
4. Insertion of a cassette is done the opposite way
   - insert the cassette, screw up mounting screws, align the cassette. First set up screws (A), then screw (B).
   - replace all cable connections. Use special tool for coax connectors if available.

3.2.2.2 Removal and insertion of the power supply unit

Before the power supply unit is removed, remove the subassembly BFO first.

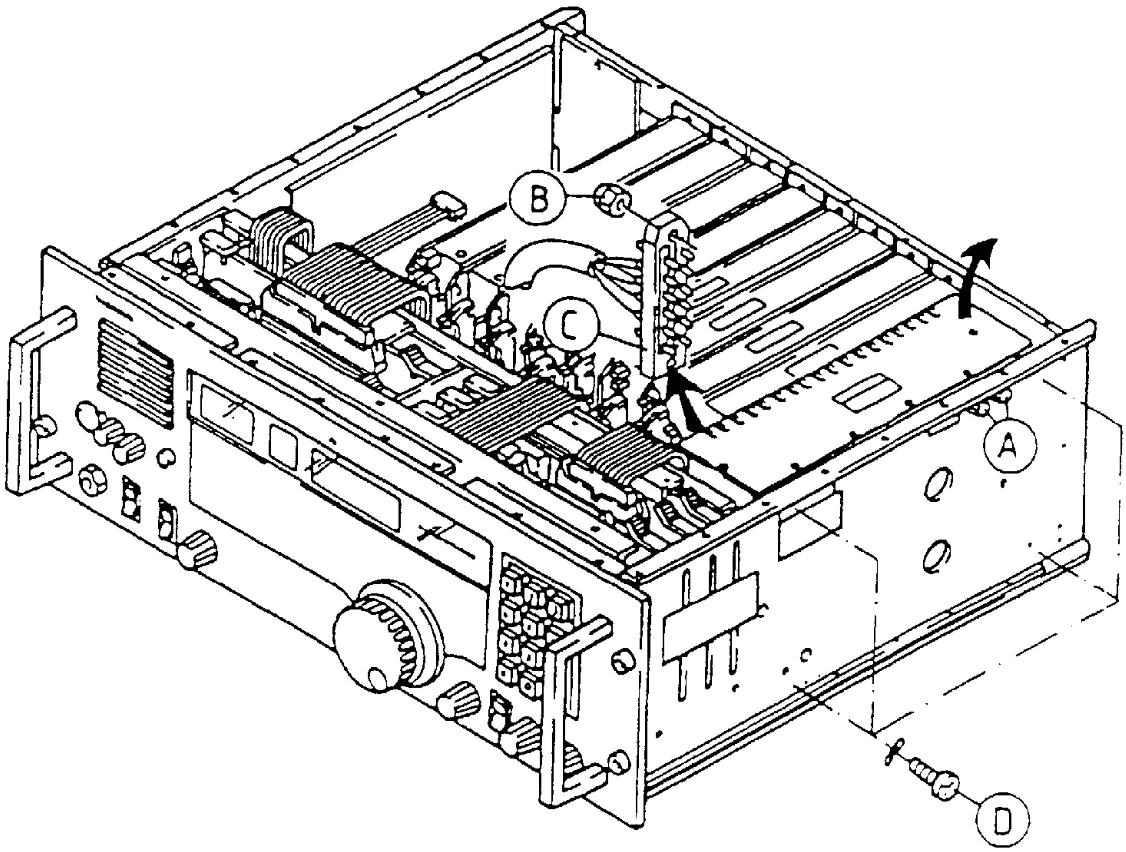


Fig. 3-12 Disconnecting the Power Supply Connector

- Remove mains and battery plug at the power supply unit
- Unscrew the fuse caps (A)
- Unscrew unit (B) and remove plug (C)
- Unscrew fastening screws (D) (4 pieces)

NOTE
If telescopic rails are attached to the RX, unscrew the rail on the powersupply side of the receiver an unscrew the second countersunk screw from the back. This screw is normally hidden by the rail.

- Now remove the power supply unit.

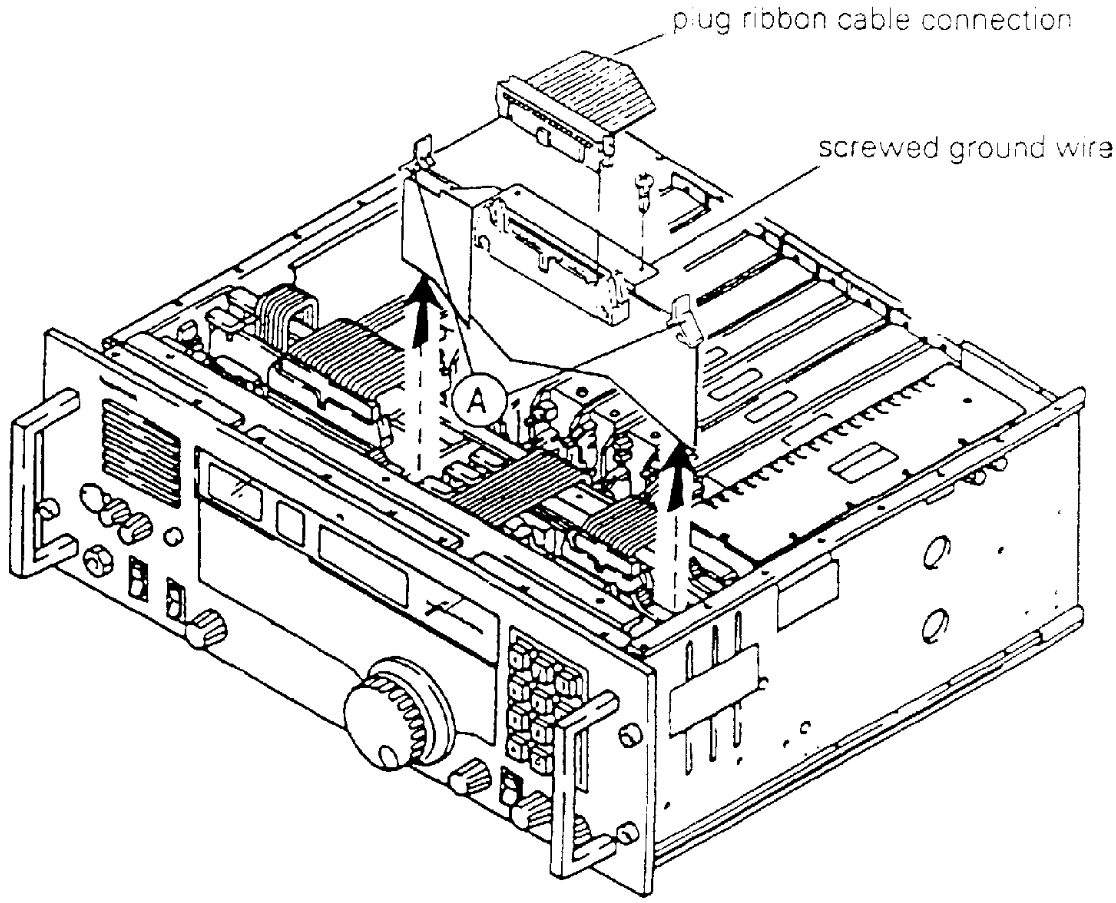


Fig. 3-13 Printed Circuit Board (PCB) Removal in the Control Part

NOTE
During fault finding and servicing it should be noted that on the PCB-TIME CLOCK HELP (Drawing No. 97 C 2.155.33) the accumulator supplies the clock components and the RAMs. If this PCB is removed, the content of the RAMs placed on the PCB-CPU II- are erased; channel inputs, frequencies, SCAN-times, etc. have to be keyed-in again, when the maintenance has been finished. During maintenance the accumulator can supply the RAMs for a maximum of 12 days, but only if the mains connector on the Power Supply Unit is **not** disconnected.

3.2.2.3 Removal of plug-in modules of the Control Part

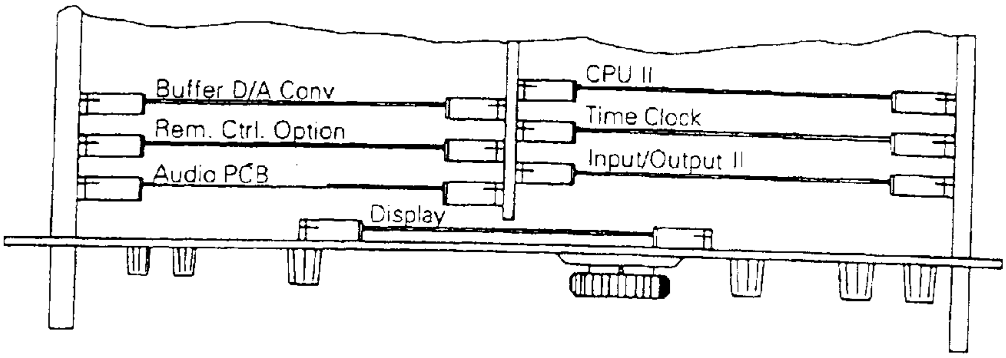


Fig. 3-14 Arrangement of the Individual Components of the Control Part

NOTE
The PCB-TUNING BOARD - is mounted behind the keyboard assembly.

CAUTION
The component groups contain **MOS** components!

All Printed Circuit Boards are plug-in connected to the PCB - MOTHERBOARD -. Additional cable and ground connections are made on the top of the PCBs. These connections have to be removed first.

- Using the two lifting levers (A) release the assembly from the plug-in connection.
- Lift out the assembly.

3.2.3 Dismantling of individual components

3.2.3.1 Dismantling a RF-Cassette

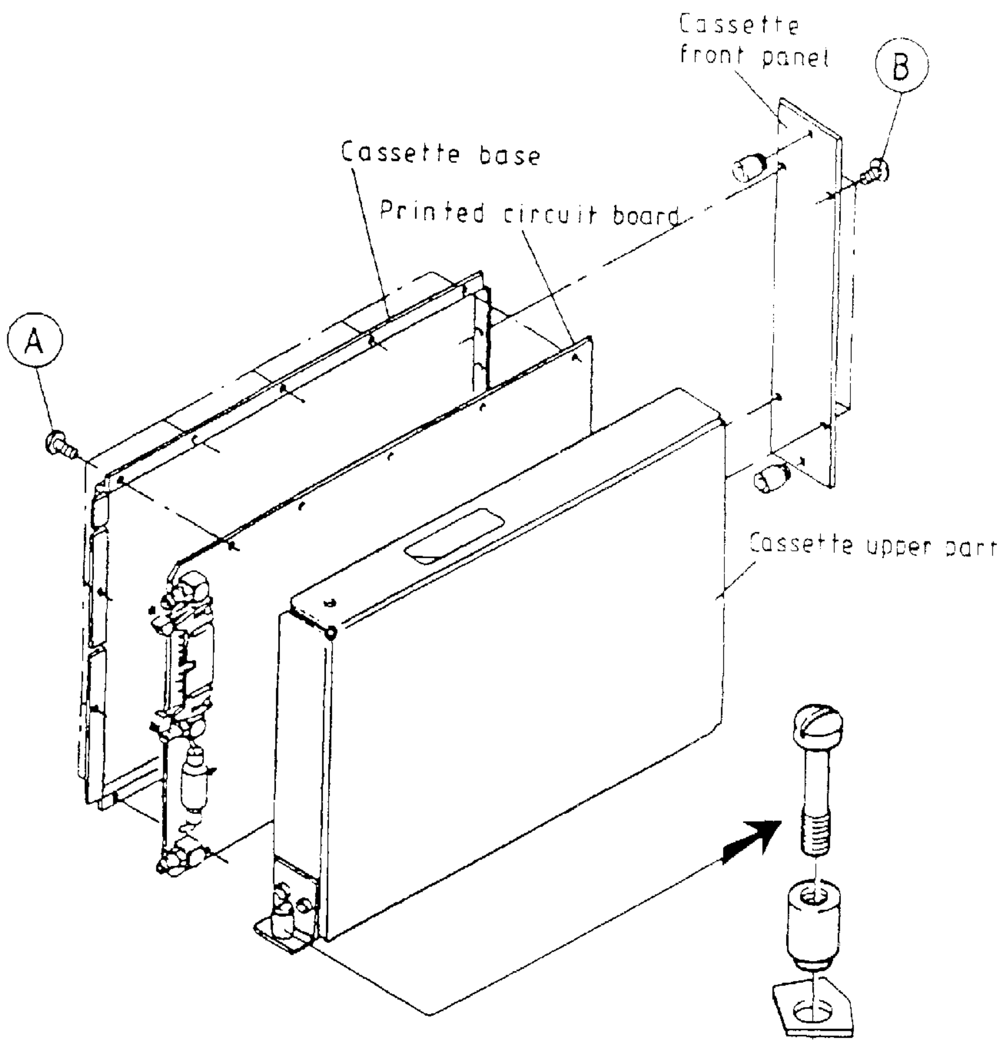
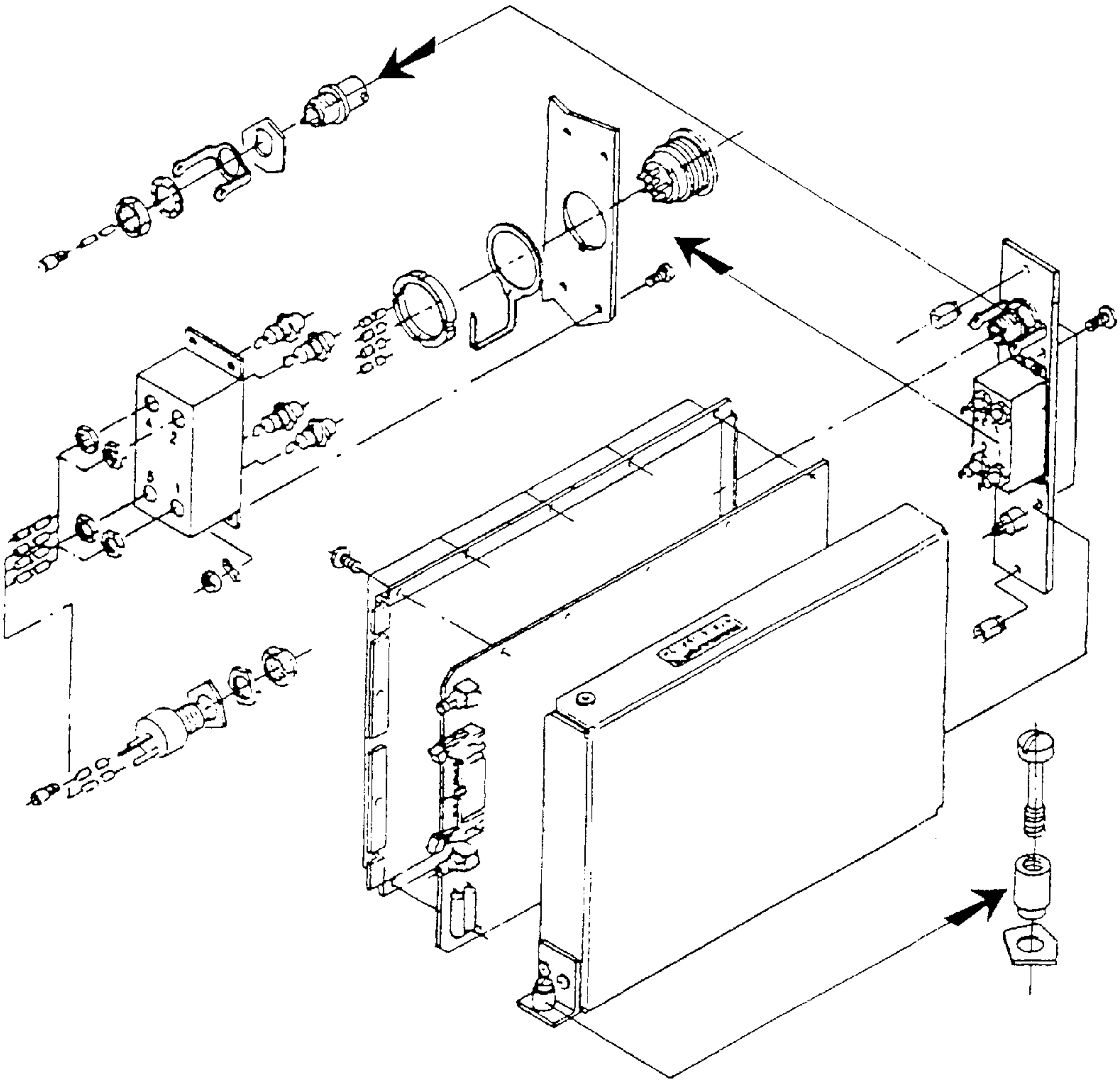


Fig. 3-15 Dismantling a RF-Cassette

- place the cassette on a table, screws should be at the top.
- unscrew mounting screws (A) and (B)
- now the cassette bottom part can be removed

CAUTION
The cassettes BFO, VCO-A, VCO-B, IF-OUT, DEMODULATOR, ISB Dem., FILTERBANK, PRESELECTOR and PROTECTOR have components on the front panel of the cassettes (LEDs, sockets, controls etc.) which are connected by short leads to the printed board. In the dismantled state care should be taken not to damage these leads, see fig. 3-16.


4
2
5
1

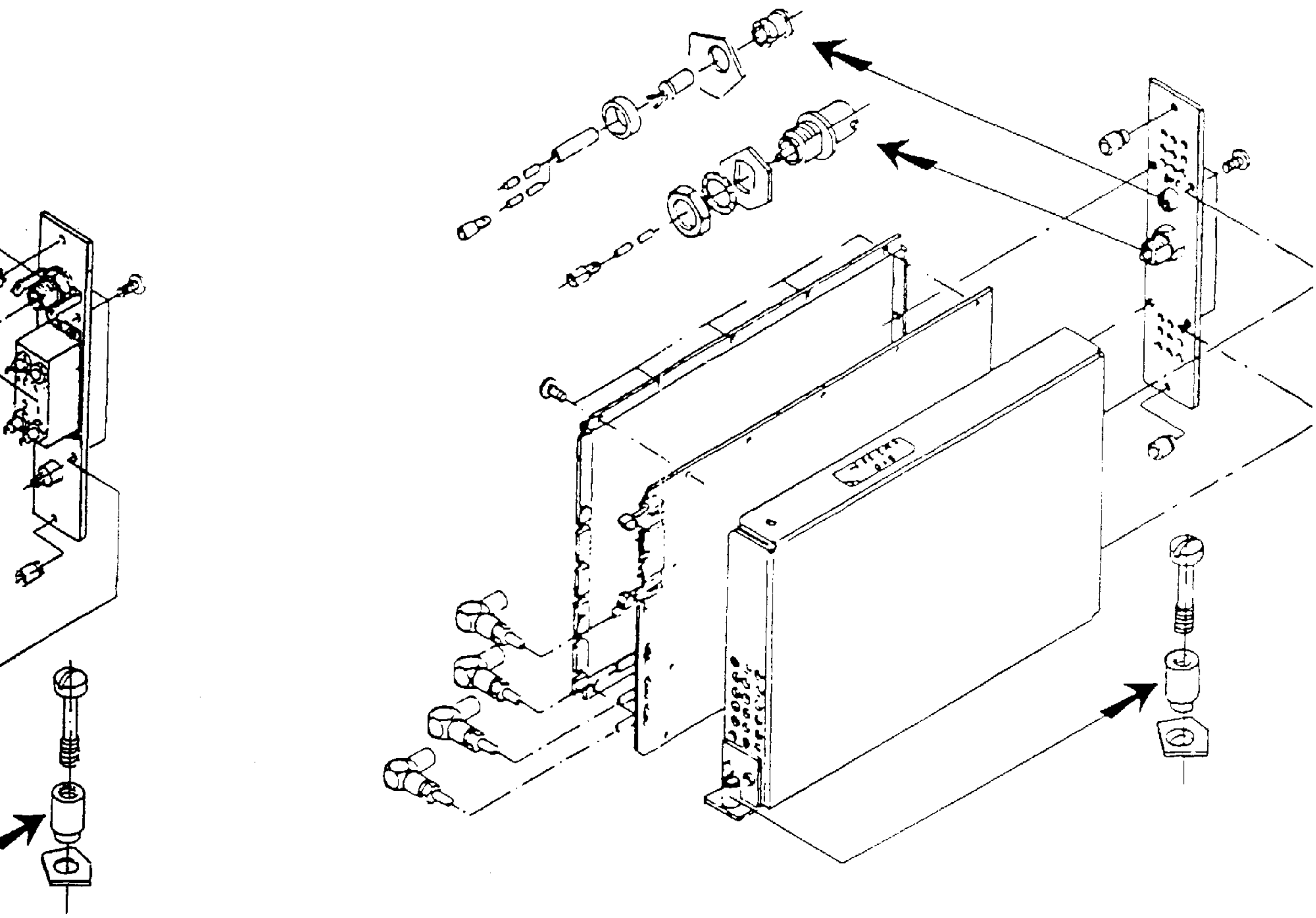


Fig 3-16
Example of a Dismantled
Cassette

3.2.3.2 Dismantling of the Power Supply Unit

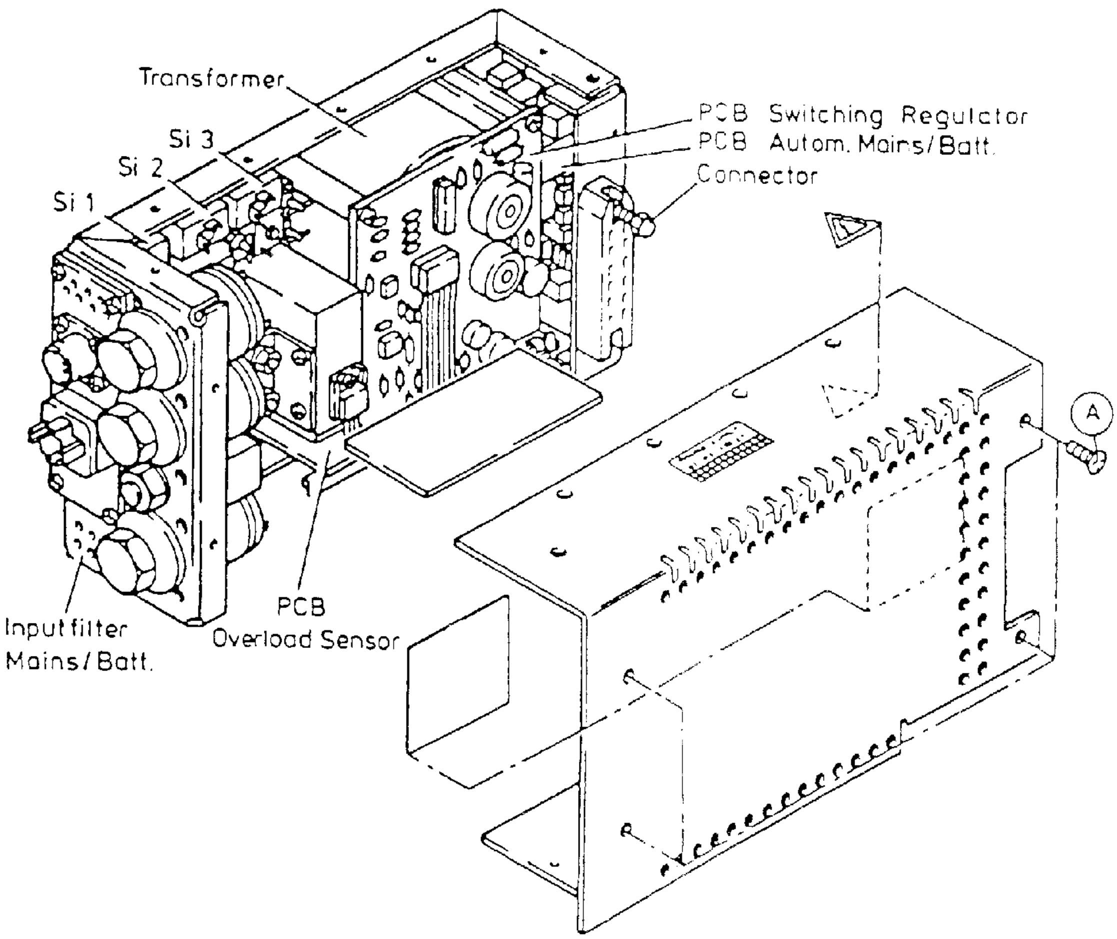


Fig. 3-17 Power Supply Unit -Opened

Unscrew all mounting screws and remove the cover. The Power Supply Unit consists of the following main parts

- mains transformer
- input filter Mains/Batt.
- PCB Overload Sensor
- PCB Switching Regulator
- PCB Auto Mains/Batt.

3.2.3.2.1 Removal of the Input filter Mains/Batt.

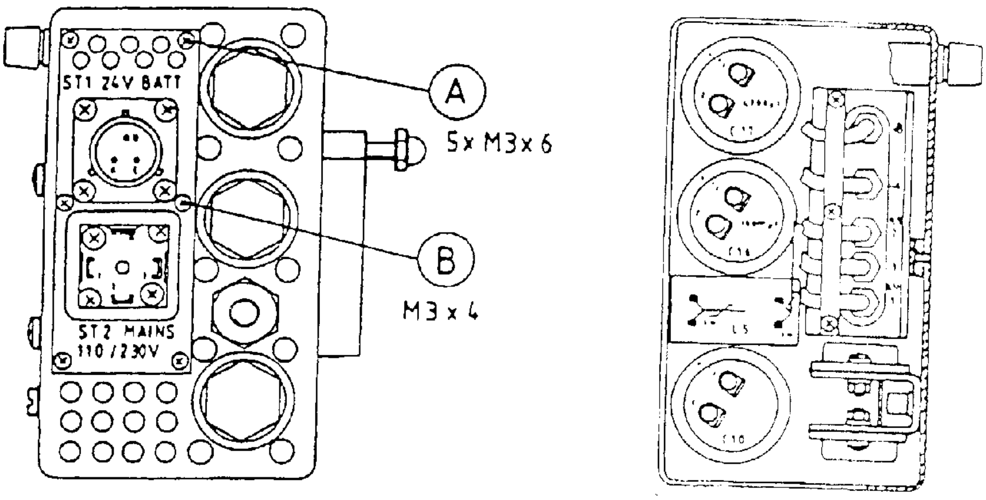


Fig. 3-18 Input Filter Inside the Power Supply Unit

- unsolder connection cable on the rear side of the Input filter (+ B and - A for 24 V DC Batt. and 1 and 2 for mains AC) -see circuit diagram drawing No. 97 Sa B 2.155.21

CAUTION
During the assembly do not mix the different types of screws.

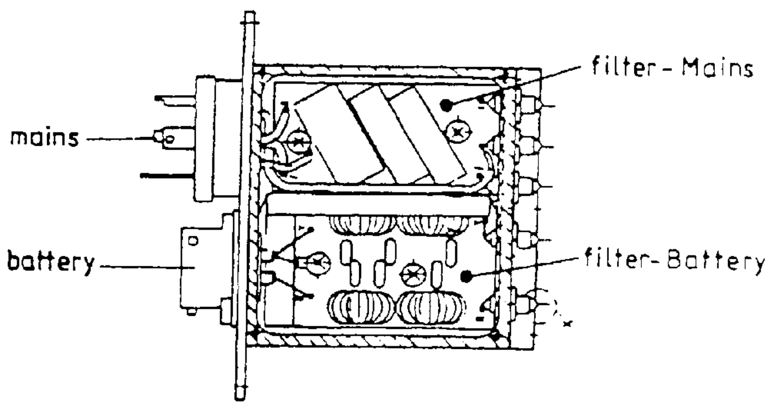
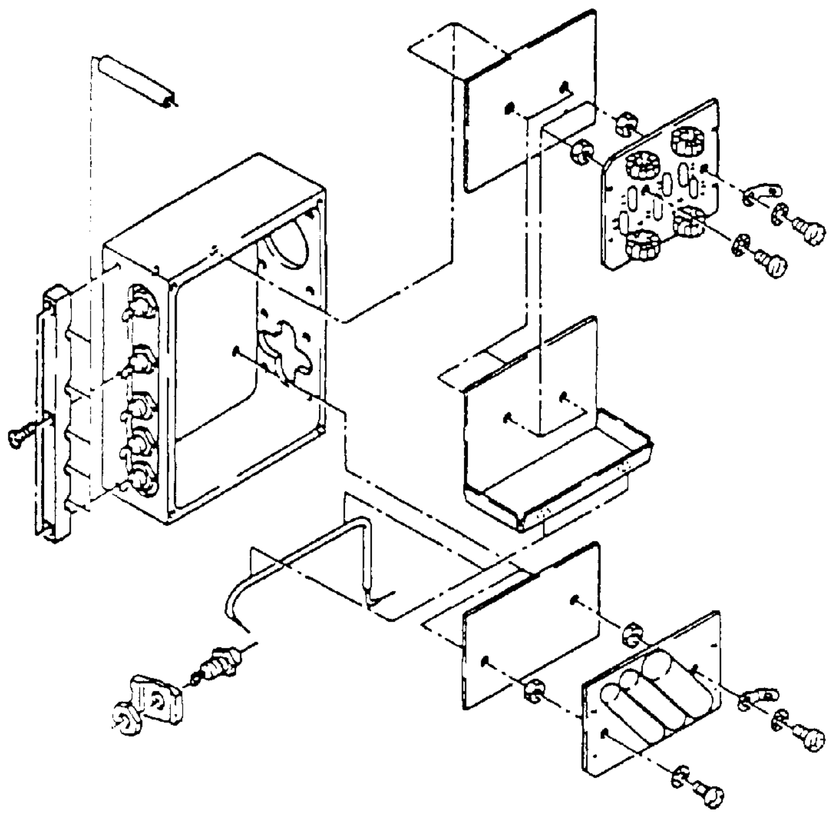
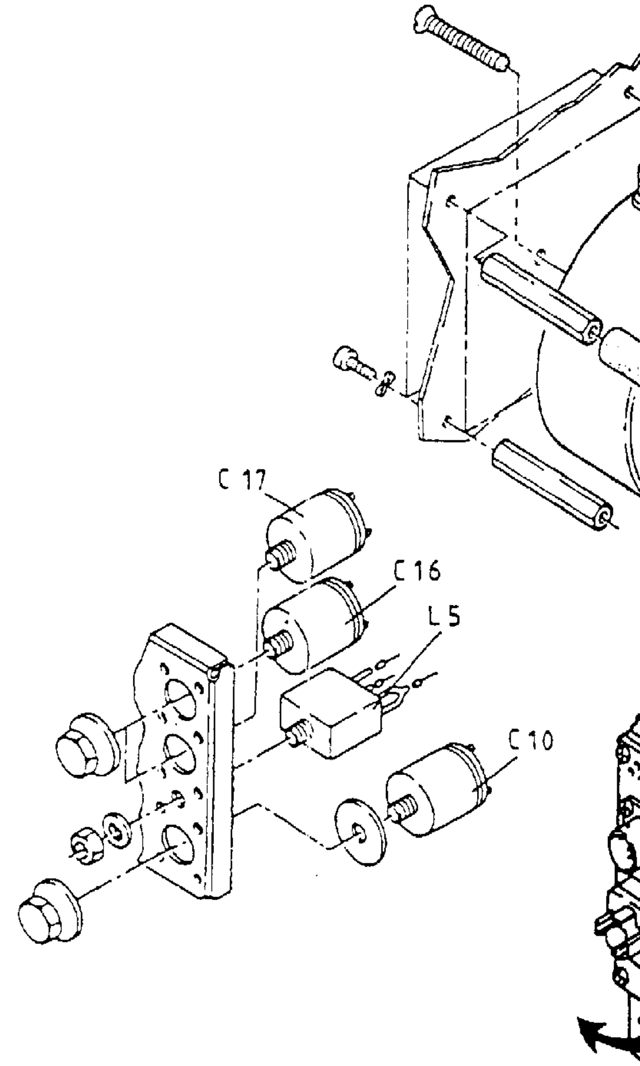


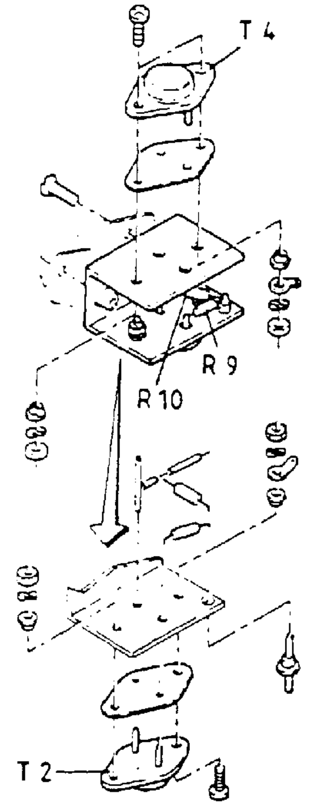
Fig. 3-19 Input Filter -Removed

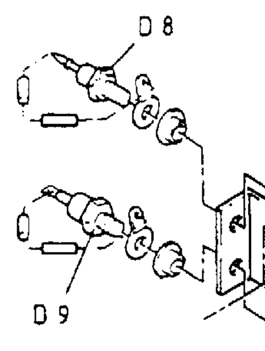
Fig. 3-20 shows further components of the Power Supply Unit. This figure shows components which are not mounted on printed circuit boards.



—— Inputfilter 180° rotated







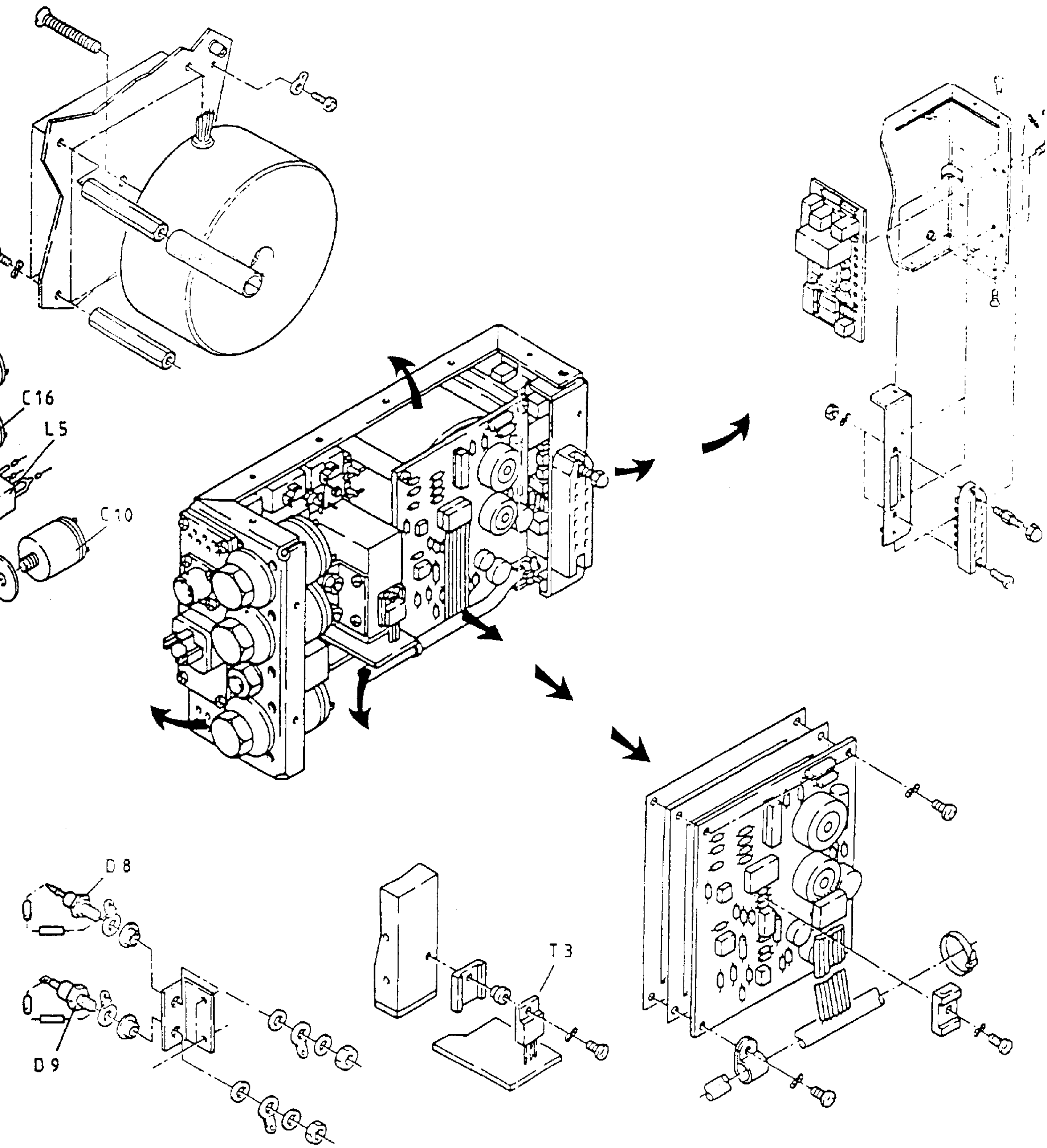


Fig. 3-20
Power Supply Unit and
Individual Components

3.2.3.3 Control Part of RX 1001 M / RX 5001

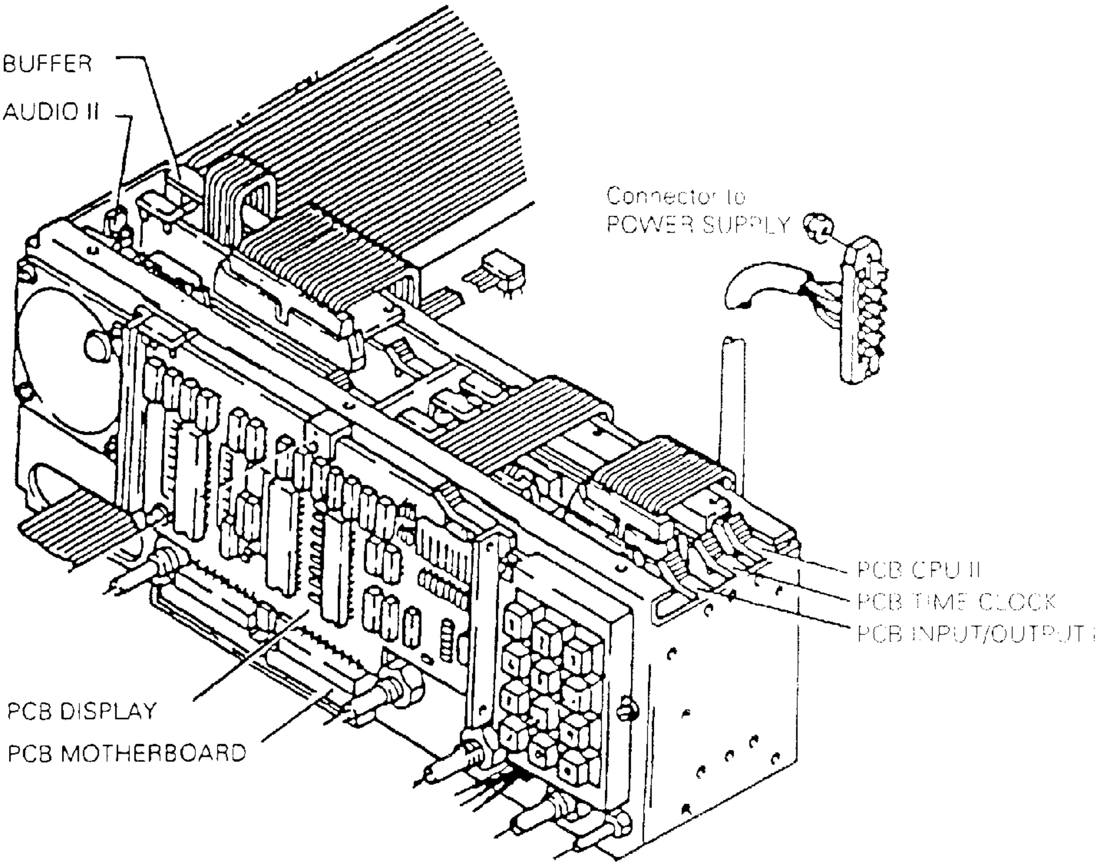
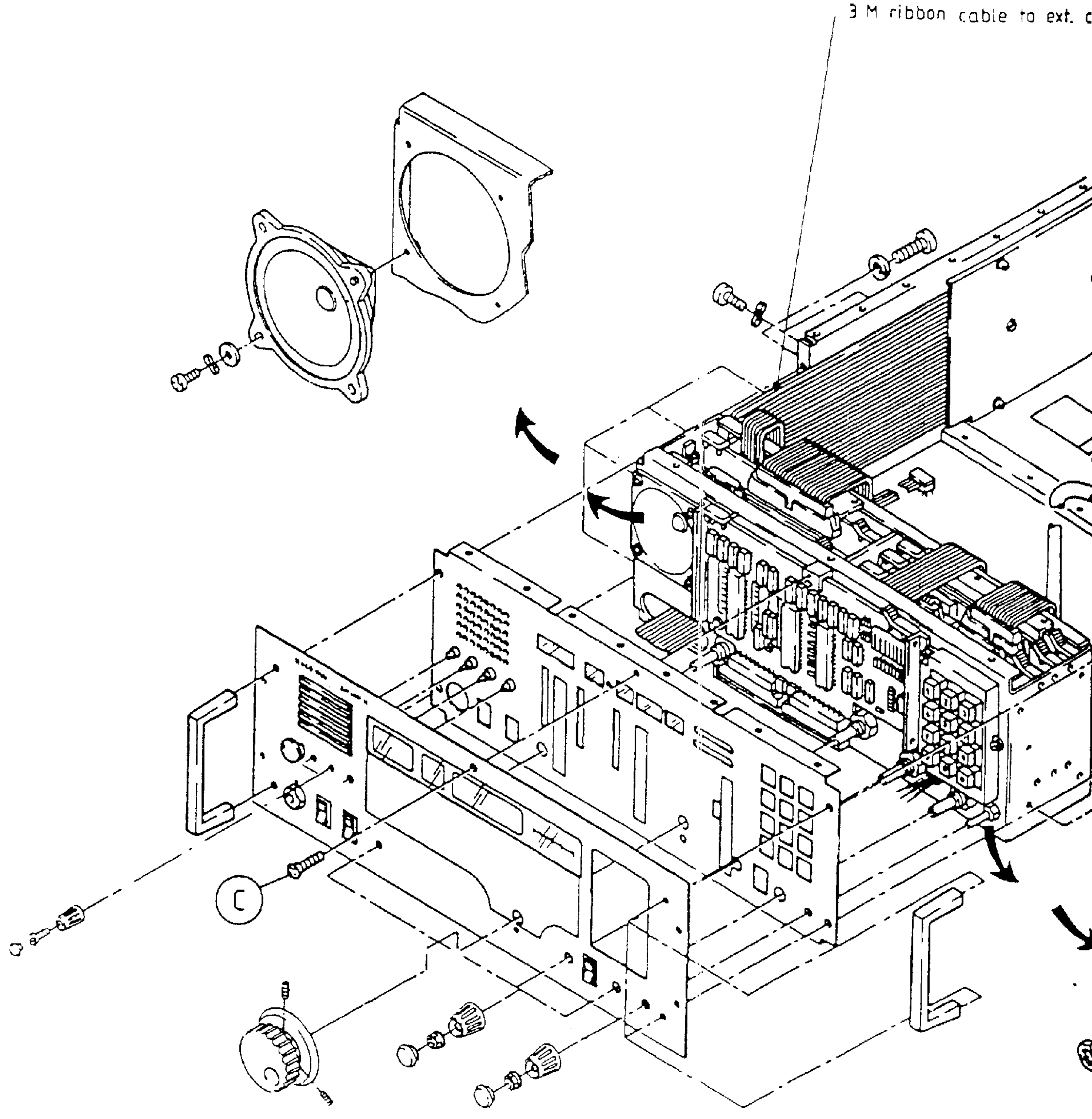


Fig. 3-21 Control Part of RX 1001 without Front Panel

3.2.3.3.1 Removal of the Control Part

- remove the knobs for AF, RF, BFO and DIMMER, see fig. 3-22.
- remove the knobs for CONTROL, ISB-SPEAKER or keyboard ON/OFF and the tuning knob.
- unscrew and remove screw (C) in the middle of the front panel.
- the front panel, the handles and the frame are bolted together by screws (B), 4 pieces.
- now the front panel can be turned down carefully. On the rear side of the panel locate the cables to the headphones socket, the switch mains ON/OFF and the switch STEPS 10/100 Hz. These cables now have to be unsoldered.
- turn down the screening
- unscrew mounting screws (D) of the cover plate and the screws (E) of the shroud for the rear plugs.
- place the shroud with the 3 M ribbon cable inside the cabinet.
- remove 3 M ribbon cable of the BUFFER D/A Converter and remove the cable connection of the Power Supply Unit.
- unscrew the mounting screws (B) 6 pieces of the frame. Now remove the complete Control Part


3 M ribbon cable to ext. c
C

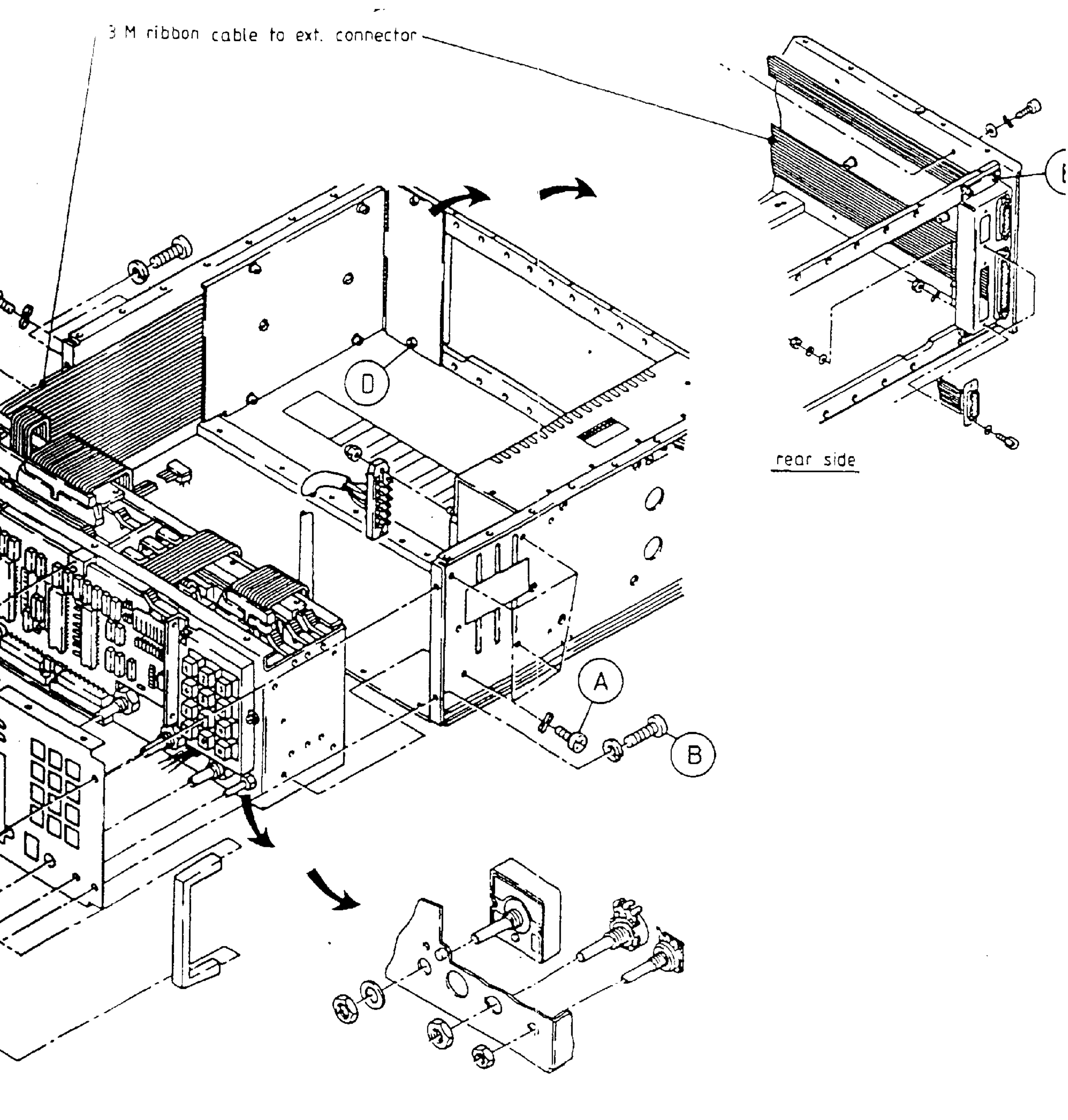


Fig. 3-22
Control Part

3.2.3.3.2 Removal of a potentiometer

- the front panel has to be removed first.
- now remove the relevant printed circuit boards behind the potentiometer, see fig. 3-13.
- unsolder the cables of the potentiometer, see fig. 3-23.

3.2.3.3.3 Removal of the keyboard

- the front panel has to be removed first.
- disconnect the ribbon cable of the PCB INPUT/OUTPUT.
- remove the printed circuit boards behind the keyboard.
- unscrew mounting screws (A), see fig. 3-23, remove keyboard with the TUNING PCB.
- unscrew mounting screws (B) and take off the printed circuit board

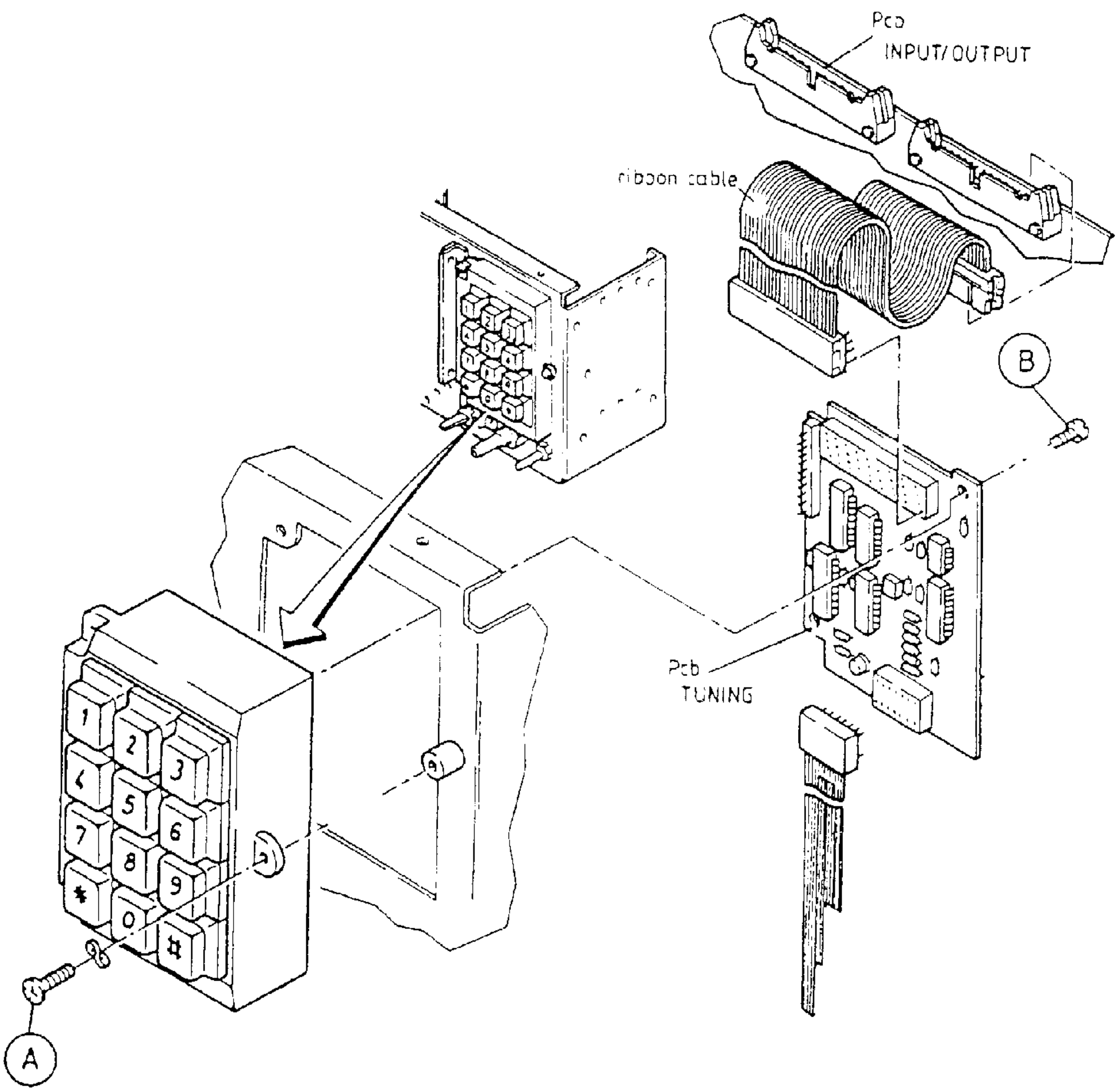


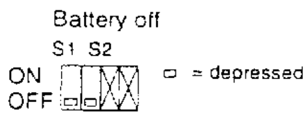
Fig. 3-23 Replacement of the Keyboard

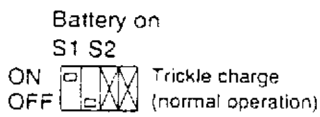
3.3 Putting into operation

3.3.1 Switching on stand alone Receiver

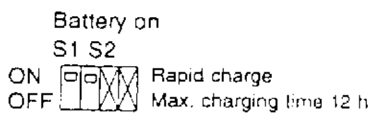
Check following settings:
- Switch CONTROL on position LOC.
- Supply voltage check (see Section 3.2.1.5)

Setting into operation the first time, e.g. after maintenance (with disassambly and transportation). The built in accumulator should be switched off during delivery. When the receiver is set to operation, the accumulator charging has to be switched on.





In this position the battery will be fully charged after 4 days.



The DIL-switch can be switched by means of a screwdriver through the receiver top cover.

NOTE
A fully charged battery can maintain time and RAM content for 12 days. Never use Quick charge setting with a mains plug which has a missing link (pin 3 and GND)

3.3.2 Switching on Remote Controlled Receiver as above, but Control Switch must now be in position REM.

3.3.3 Internal settings for RX 1001 M / RX 5001 remote or local controlled receiver

To change these settings, the top lid of the Receiver RX 1001 M / RX 5001 has to be removed ref to Fig. 3-4, and the respective PCB has to be extracted.

<u>CPU PCB</u>
switch S1: baud rate selector for Serial Interface

Baud	S 1.1	S 1.2	S 1.3	S 1.4
50	ON	ON	OFF	ON
75	ON	ON	OFF	OFF
110	OFF	OFF	OFF	OFF
134,5	ON	OFF	ON	ON
150	OFF	OFF	OFF	ON
200	ON	OFF	ON	OFF
300	OFF	OFF	ON	OFF
600	ON	OFF	OFF	ON
1200	OFF	ON	OFF	OFF
1800	OFF	ON	OFF	ON
2400	ON	OFF	OFF	OFF
2400	OFF	OFF	ON	ON
4800	OFF	ON	ON	OFF
9600	OFF	ON	ON	ON

<u>INPUT/OUTPUT II PCB</u>

Switch S1
Frequency offset for Telexmode (F1B or Telex/FAX))
The receiver receives a frequency, which is actually the displayed frequency minus the selected offset (Mode USB)

Position	offset in kHz
1	1.1
2	1.2
3	1.3
4	1.4
5	1.5
6	1.6
7	1.7
8	1.8
9	1.9
0	2.0

Switch S 2.1 to S 2.3 Remote control mode (function of the Serial Interface)

S 2/1	ON:	Remote PCB built-in
	OFF:	Remote PCB not built-in
S 2/2	ON:	GO/NOGO mode with DSR and DTR signals
	OFF:	Remote controlled operation according to position of S 2.3
S 2/3	ON:	Computer control (ASCII)
	OFF:	Data transmission with LSV 2 protocol

Permitted switch positions of S 2.1 to S 2.3 Position of S 2.4 is independent.

Remote controlled modes	S 2.1	S 2.2	S 2.3
Remote PCB not built-in	OFF	X	X
Remote control with LSV2 protocol	ON	OFF	OFF
Computer control (ASCII)	ON	OFF	ON
GO/NOGO mode with DSR and DTR signals	ON	ON	OFF

Switch S 2.4 HELP 15 generation (refer to Auto Bite sequence step 35, 36)

ON:	generation of HELP 15 during BITE possible
OFF:	no generation possible

<u>Remote RS232 PCB</u>

Switch S 1: Serial Interface
- RS-232-C(V24: with modem and the signals DSR, DTR, RTS and CTS
- TXD/RXD only: without modem, only signals TXD and RXD

Switch S 2: Transmission speed (with modem) resp. number of data bits (with computer control)
- 600 Bd: low transmission speed or 7 data bits
- 1200 Bd: high transmission speed or 8 data bits

REMARK
for GO/NOGO operation S 2 must be switched in position 600 Bd.

Switch S 3: Receiver address for serial interface (RX No)

Switch S 4... S 7 set to position RX.
only on RS232 Mod. PCB

Audio PCB II

S 1/1	ON:	Mode CHANNEL SCAN possible (codes 41, 45, 46, 49)
	OFF:	Mode SCAN CH + CH (41)
S 1/2	ON:	MGC via remote control in 6.5 dB steps additionally resistor R6 on Time Clock Help PCB in receiver and remote control have to be changed to 3.3 kOhm
	OFF:	MGC via remote control in 10 dB steps resistor R6 on Time Clock Help PCB in receiver and remote control has to be 1 kOhm (Normally fitted)
S 1/3	ON:	Mode ISB; If ISB-Demodulator module is fitted
	OFF:	Mode ISB is blocked module IF/OUT is fitted (Both options S 1.3 only possible if S 2.1 is in "OFF" position)
S 1/4	ON:	Mode FREQUENCY-SWEEP is possible (codes 42, 43, 44, 49)
	OFF:	Mode FREQUENCY-SWEEP is blocked
S 2/1	ON:	None of the options IF out or ISB have been fitted
	OFF:	Option ISB or IF out have been fitted
S 2/2		Not used
S 2/3		Not used
S 2/4		Not used

Time Clock PCB

Switch	S 1:	Accumulator
S 1/1	ON:	Accu switched on (trickle charged if Mains connected)
	OFF:	Accu switched off
S 1/2	ON:	Accu quick charge (max. 12 hours) (S 1/1 must be ON as well)
	OFF:	No quick charge
S 1/3		Not used
S 1/4	ON:	U-AGC and UMGC mixed
	OFF:	U-AGC and U-MGC separated (Normal Mode) (Only possible with modified PCB)

Interconnection Board

Switch	S 1:	GO/NOGO input
	ON:	GO/NOGO operation S 2 on Remote PCB in position 600 Bd (pull down for DSR)
	OFF:	Other remote controlled operations

3.4 Installation

Receivers of series RX 1001 M / RX 5001 are 19" Slide-in Units. For this reason they can be installed directly in 19" racks.
Type KG 4/500 can be used as single unit (see Illustration 24).

3.4.1 Establishing the Mains and Battery Connections

Plugs required for this are in the Pack-connector 97 D 2. 173. 13-.
Illustration 25 shows how to make the mains cable.
Illustration 26 shows how to make the battery cable.
Illustration 27 shows how to make the ground connection cable (no material will be supplied for this).

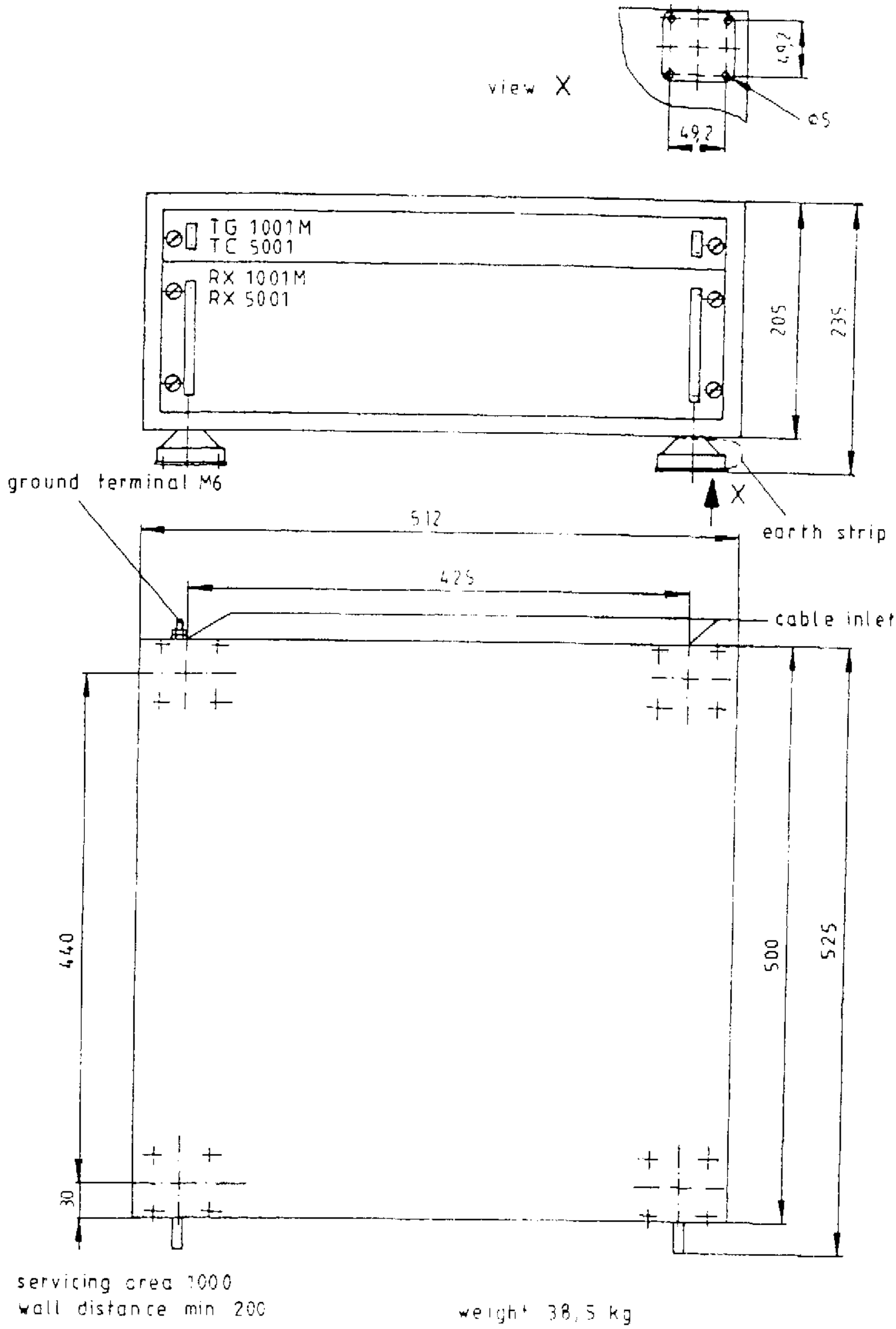


Fig. 3-24 Single Housing of Type 4/500

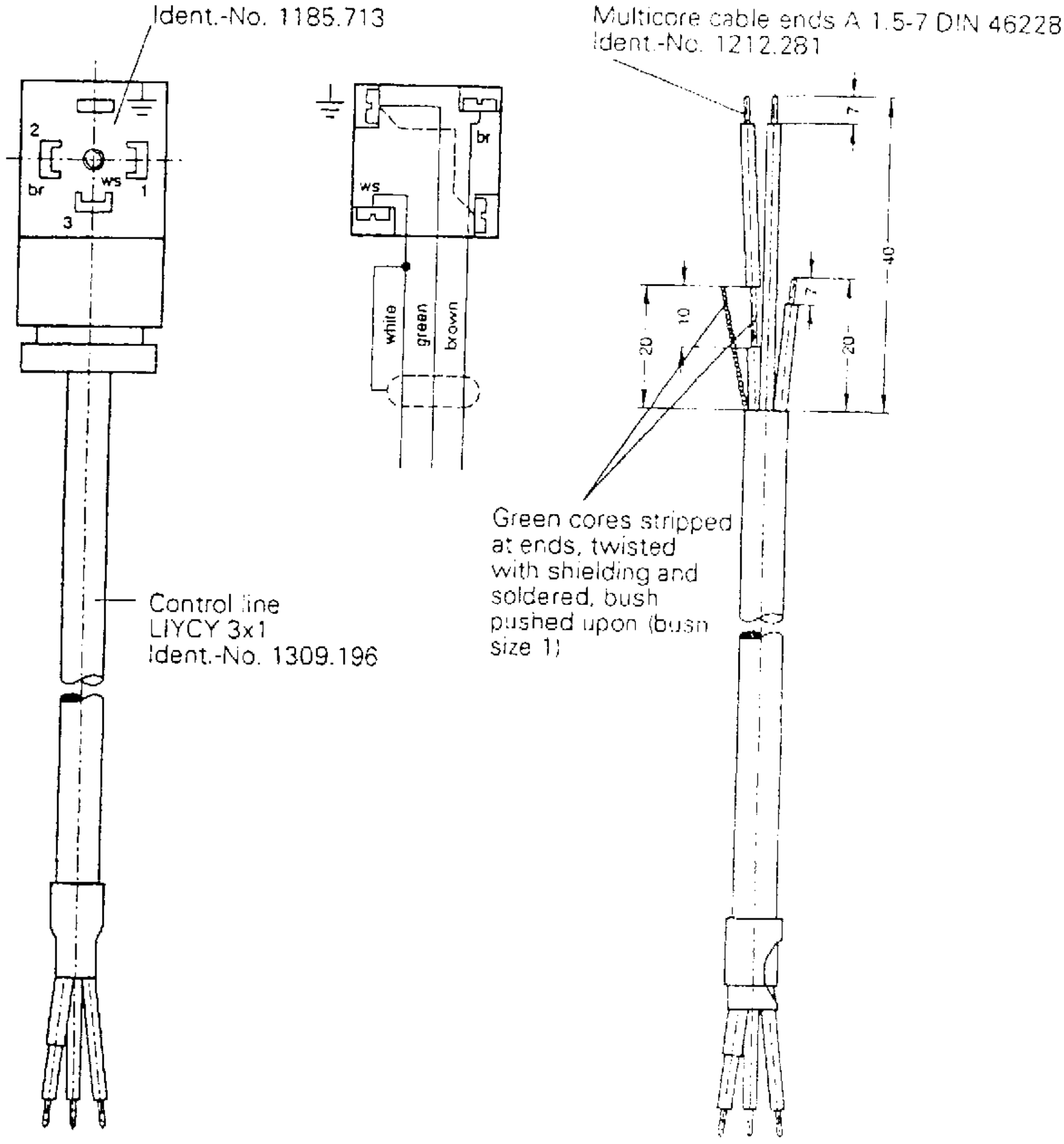


Fig. 3-25 Mains Cable

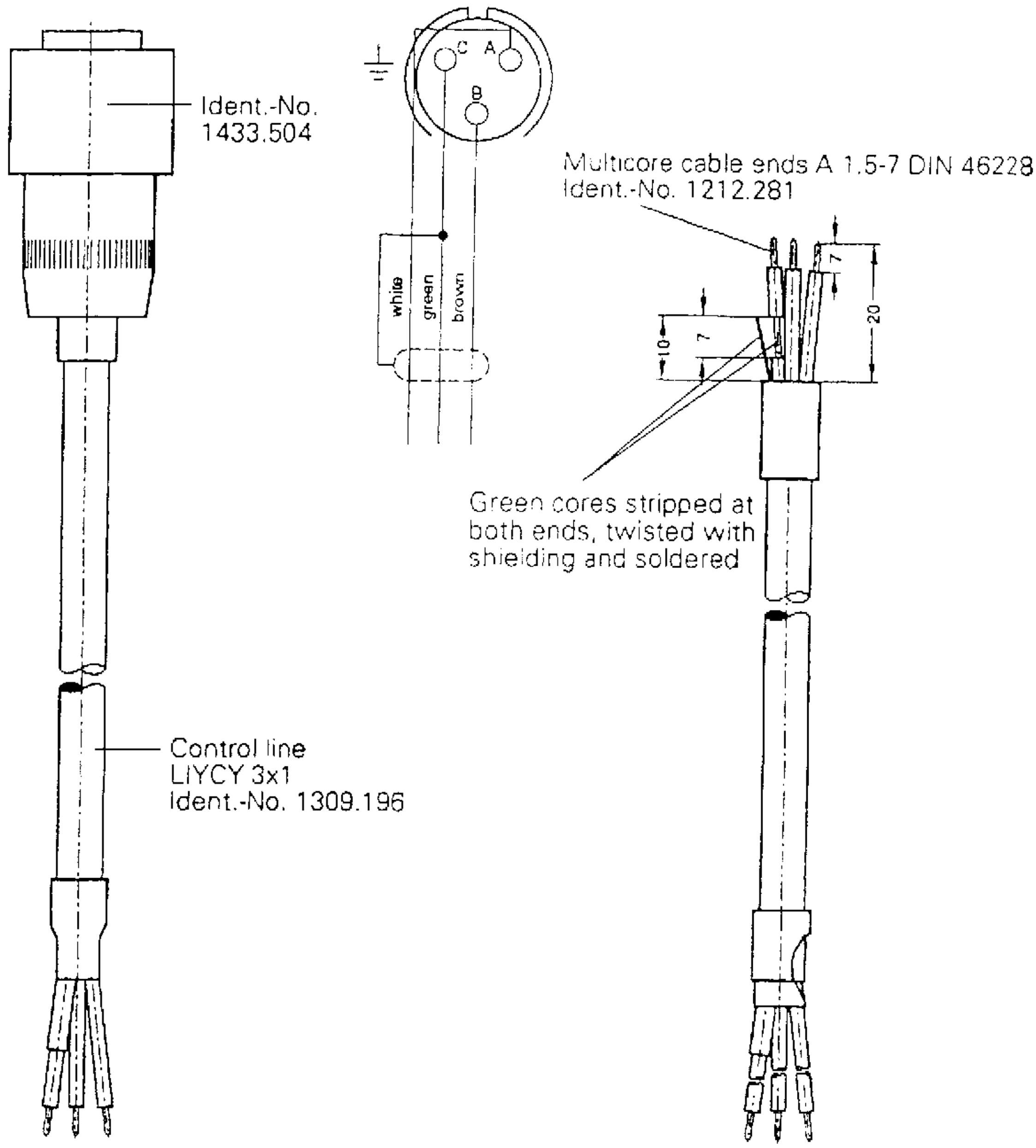


Fig. 3-26 Battery Cable

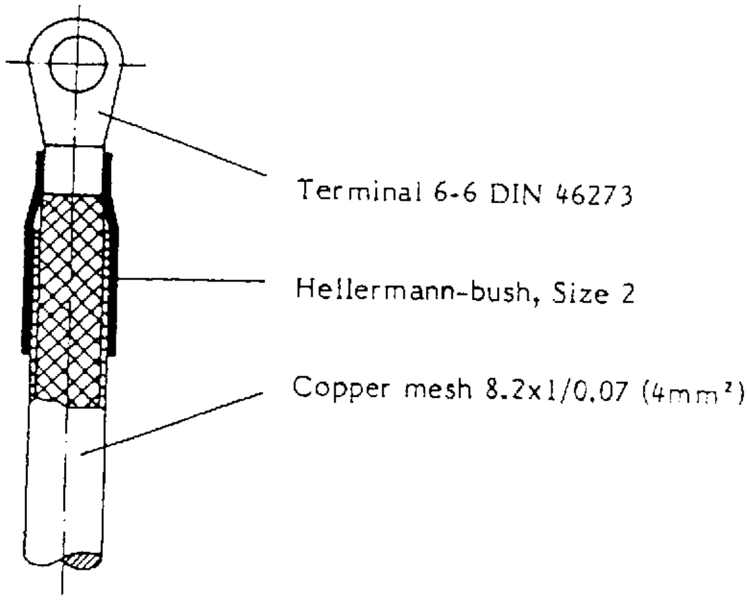
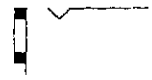


Fig. 3-27 Ground Connection Cable

Frontpanel receptacle:

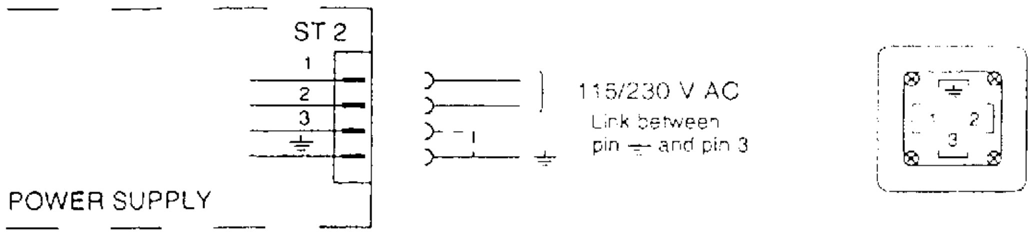


phone output

Mating plug: PL - Plug 8 mm mono

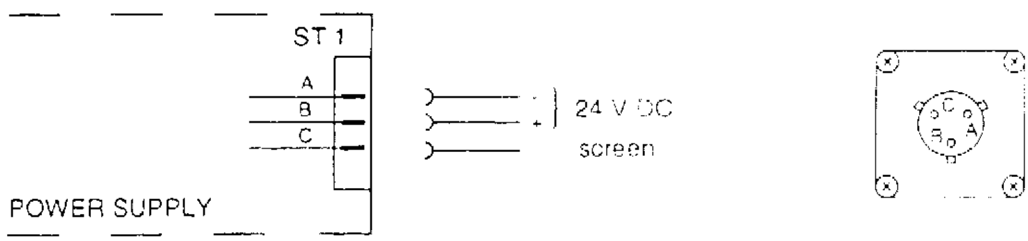
Backpanel receptacles:

MAINS CONNECTOR



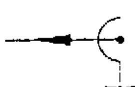
Mating plug: Cable socket FC 164-839 F-4-S132(Amphenol)

BATT. CONNECTOR



Mating plug: Plug 851 06 J 12-3 550 (Souriau)
PT 06 W 12-3 S (female)

1/10 MHZ EXTERN FREQU. STANDARD - IN

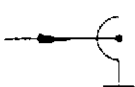


$R_L = 50\ \Omega$
$P = \pm 0dBm : 3dBm$

Mating Plug: BNC - Norm male

10 MHz Selectable only in BFO II Module

1/10 MHZ EXTERN FREQU. STANDARD - OUT



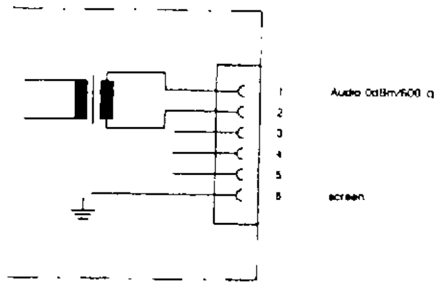
C MOS level

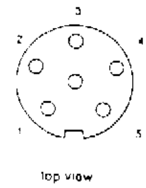
Mating Plug: BNC - Norm male

HAG/ROD 01-09.92

only fitted in BFO II Module

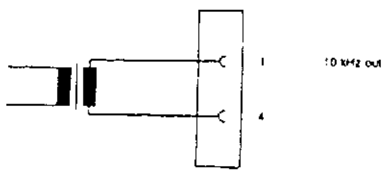
ISB - DEMODULATOR - OUT (option)

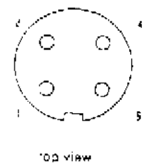




Mating Plug: Plug 6 pole male BNR.T3400/I (Amphenol)

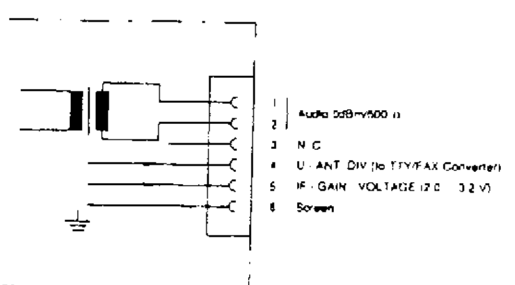
IF - OUT(option RX 5001 standard RX 1001 M)

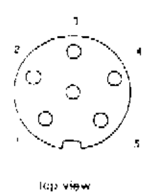




Mating plug: Plug 4 pole male BNR.T3400/I (Amphenol)

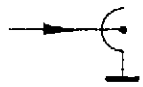
DEMODULATOR - OUT





Mating plug: Plug 6 pole male BNR.T3400/I (Amphenol)

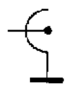
DEMODULATOR



5 MHz IF - OUT

Mating plug: BNC - Norm male

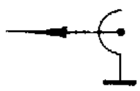
FILTER



30 kHz OUT

Mating plug: BNC - Norm male

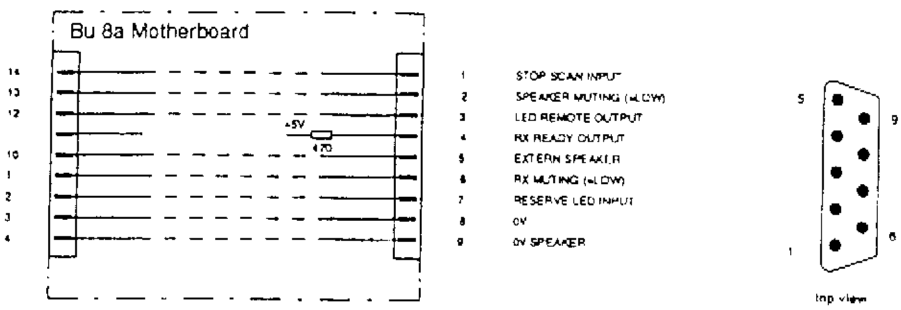
PRESELECTOR/PROTECTOR (ANTENNA INPUT)



10 kHz - 30 MHz 50 Ω

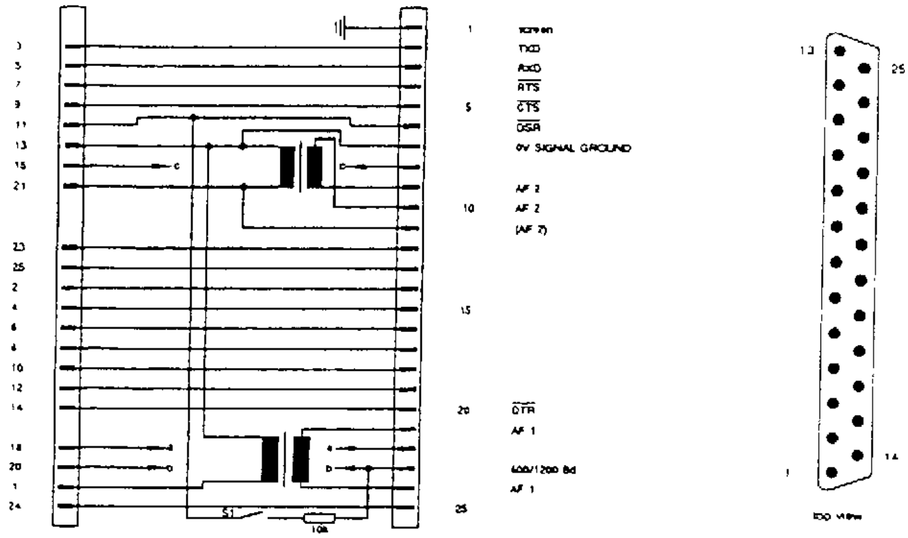
Mating plug: N - Norm male

EXTERN Connector



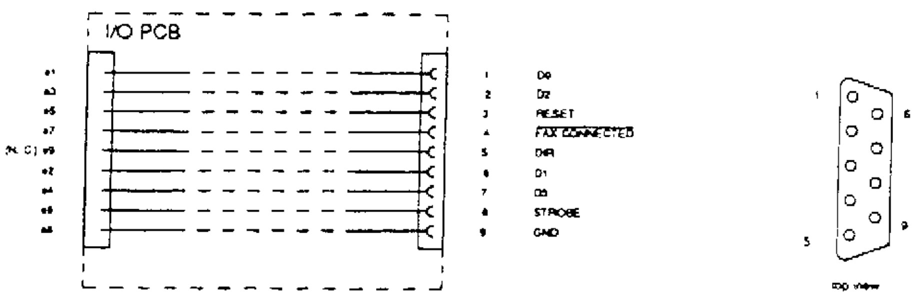
Mating plug: Sub D 9 pole female DE 9S (Cannon)
with cover FMHI and 2 fixing screws FRS IY5

REMOTE CONNECTOR (RS 232 -C) (option)



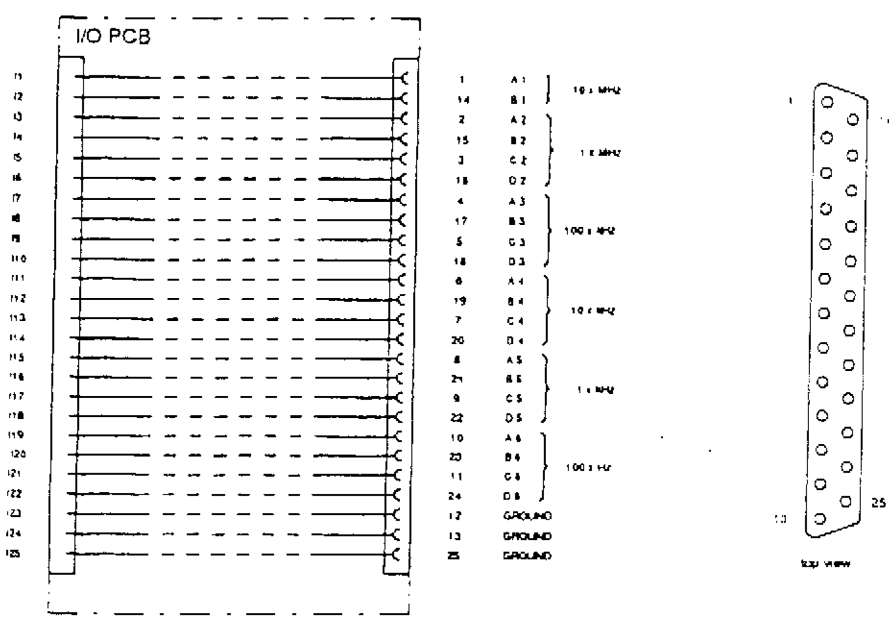
Mating plug: Sub D plug 25 pole female DE 25S(Cannon)
with cover FMH 3 and 2 fixing screws FRS IY5

TTY/FAX Data Connector



Mating plug: Sub D plug 9 pole male DE 9P(Cannon)
with cover FMH I and 2 fixing screws FRS IY5

BCD - OUT Connector



Mating plug: Sub D plug 25 pole male DE 25S(Cannon)
with cover FMH 3 and 2 fixing screws FRS IY5

3.5 Configurations

3.5.1 RX 1001 M Configuration

B (Basic version)	
Protector	97 2.155.95
1. Mixer	97 2.155.83
2. Mixer	97 2.155.90
Filter	97 2.155.76
Demodulator	97 2.155.70
IF Out	97 2.155.100
VCO-A	97 2.155.55
VCO-B	97 2.155.63
BFO	97 2.155.50
or	
BFO II	97 2.155.50 B
Power Supply	97 2.155.21B
Interconnection PCB	97 2.155.19
Motherboard	97 2.155.24
Buffer D/A Converter	97 2.155.30
Audio PCB	97 2.155.36
Containing	
IC E A 1.5	97 E2.155.301
IC D	earased, not programmined
or	
Audio II PCB	97 2.155.37
Containing	
IC E A 1.5	97 E2.155.261
CPU II PCB	97 2.155.35
Containing	
IC N A 7.4	97 E2.155.261
IC O A 7.4	97 E2.155.262
IC R A 7.4	97 E2.155.263
Time Clock PCB	97 2.155.33
Input/Output II PCB	97 2.155.38
Tuning PCB	97 2.155.28
Display PCB	97 2.155.25

Hardware Options

VB (Basic version with preselector)

Preselector	97 2.140.150 B

FVB (Basic version with preselector and Remote control PCB)

Apart from the Standard TCXO various TCXO options are available:

High range	97 2.155.52-3 B
Digital (D-TCXO)	97 2.155.52-5
OVEN (OCXO)	97 2.155.52-6/7

When the BFO II Module is fitted, a 1/10 MHz Reference Frequency output is available. When an Audio II PCB is used, channel scan and Frequency sweep modes can be used by setting the appropriate selector switches on this PCB.
A modified Time clock PCB enables AGC/MGC mixed mode after setting the appropriate switch on this PCB.

NOTE
The following modules out of the RX 1001 M / RX 5001

Demodulator	97 2.155.70
1. Mixer	97 2.155.83
BFO	97 2.155.50
BFO II	97 2.155.50 B

may be replaced by the corresponding modules out of the RX 1001 M / L11 as there are

Demodulator/L11	97 2.183.70
1. Mixer/L11	97 2.183.83
BFO/L11	97 2.183.50.

The L11-modules should not be replaced by the RX 1001 M / RX 5001 basic modules. For circuit diagrams, descriptions and drawings refer to the RX 1001 M/L11 Manual.

3.5.2 RX 5001 Configuration

Protector	97 2.155.95
or	
Preselector (optional)	97 2.140.150 B
1. Mixer	97 2.155.83
2. Mixer	97 2.155.90
Filter	97 2.155.76
Demodulator	97 2.155.70
ISB-Demodulator (optional)	97 2.155.105
or	
IF-Out (optional)	97 2.155.100
VCO A	97 2.155.55
VCO B	97 2.155.63
BFO II	97 2.155.50 B
Power Supply	97 2.155.21
Interconnection PCB	97 2.155.19
Motherboard	97 2.155.23

Buffer D/A Converter	97 2.155.30
Audio II PCB	97 2.155.37
Containing	
IC E A 1.5	97 E2.155.301
CPU II PCB	97 2.155.35
Containing	
IC N A 7.4	97 E2.155.261
IC O A 7.4	97 E2.155.262
IC R A 7.4	97 E2.155.263
Time Clock PCB	97 2.155.33
Input/output II PCB	97 2.155.38
Tuning PCB	97 2.155.28
Display PCB	97 2.155.25

Same Hardware options as for RX 1001 M are available for RX 5001, and additionally an ISB-Demodulator may be fitted and due to a new motherboard and a new 3 position Audio selector switch on the front panel, the two Audios (USB/LSB) can be processed properly. Because an Audio II PCB is always fitted and a wire link from P 21 of the new motherboard to the centerlug of the RF-potentiometer is fitted, the Manual RF-control becomes loudspeaker Audio squelch Control during AGC-Modes if so selected on the Audio II PCB.

NOTE
Some of the RX 5001 basic modules may be replaced by the corresponding modules out of the RX 1001 M/L11 but not vice versa. Refer to chapter 3.5.1.

RX 1001 series

General Description

The receiver is designed to fit the standard 19" rack. It consists of the following three main units.

1. HF unit
2. Power supply
3. Control unit

1. HF Unit

The incoming HF signal from the antenna is converted via the mixer, filter and demodulator to an AF signal. This unit consists of the following sub-assemblies.

Protector or preselector (optional)
1st Mixer
2nd Mixer
Filter board
Demodulator
ISB Demodulator (optional)
or
IF/OUT
BFO
VCO A
VCO B

These sub-assemblies consists of single PCBs which are mounted each in a shielded cassette.

2. Power Supply

The power supply module contains a switching power supply unit using the flyback principle and consists of the following sub-assemblies:

Switching regulator
Overload sensor
Transformer
Automatic switch mains/battery

The sub-assemblies are enclosed in an aluminium case.

3. Control Unit

The control unit consists of nine functional boards:

1. Audio Board
2. Buffer D/A Converter
3. CPU Processor with EPROM
4. Time /Clock/Help board
5. Input/Output board
6. Display board
7. Motherboard (base of control unit)
8. Interconnection board (back of control unit)
9. REMOTE board (option)

Following block diagrams show the principles of the receiver operation. The aerial input is fed to the protector cassette which consists of:

1. Low pass filter which attenuates all frequencies above 30 MHz.
2. 20 db switchable attenuator switched either manually or automatically when the input Rf signal is higher than the recommended tolerance.

Receiver fitted with a preselector have, in additon to the above named circuits, a low pass filter for the frequencies up to 1.6 MHz. The frequency ranges: 1.6 - 3.99; 4.0 - 7.99; 8.0 -16.99; 17.0 - 30.0 MHz have tunable band-pass filters.

The input signal is converted, in the 1st mixer, to an intermediate frequency of 63.078 MHz and in the 2nd mixer to 5 MHz. After further selection by the filter board the signal is then demodulated (dependant on the mode of operation). In the RX 1001 M (or optionally in the RX 5001) an IF Out module is fitted which generates an IF of 525 kHz and 10 kHz in addition to an IF of 30 kHz. The 30 kHz is generated on the filterboard for demodulation in externally connected demodulators.
Optionally the RX 5001 may be fitted with an ISB demodulator to allow ISB operaten. The BFO, VCO A, VCO B supply the frequencies required for the up- and down conversion.

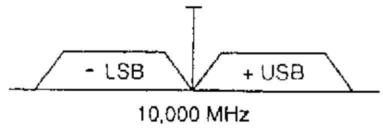
The power supply supplies the required voltages +18 V, +5 V and +12 V for the battery in the TIME-CLOCK-HELP-board. If the supply voltages fail the channel information and mode of operation are not lost. The power supply switches automatically from mains to battery when mains power fails and, upon return of mains, automatically switches back to mains.

The microprocessor in the CPU controls the different functions. The receiving frequency can be entered using either the keyboard or the variable frequency control knob whereas the operation modes can only be changed using the keyboard. When receiving on A1A the pitch of the received signal can be changed using the variable BFO control in 10 Hz steps from +5 kHz to -5 kHz. The selected modes are indicated using LEDs and the receiving frequency, number of the stored channel and the time are displayed with seven segment displays. If the receiver is to be remotely controlled (RS 232 C) an extra serial interface board is required. The receiver has an extensive selftest program which is divided into permanently monitored tests and those which are only monitored in connection with the BITE test.

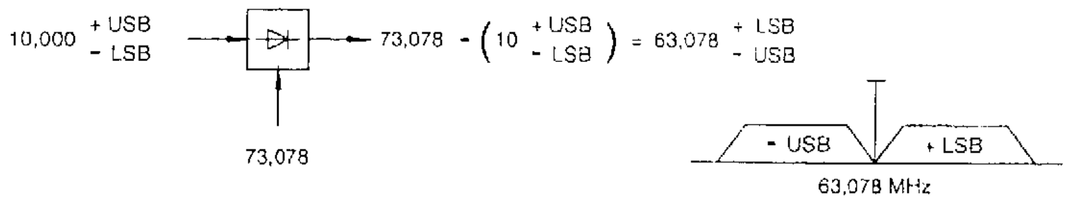
The BITE causes a 1 MHz internally produced signal to be fed to the receiver input. The level of this signal is then monitored in the individual units and, if the measured signal is outside the parameters, indicates a fault condition. Using the RX 1001 RC remote control unit all major functions of up to ten receivers can be controlled with the exception of the ON/OFF switch, dimmer, AF level and monitor loudspeaker. Supplementary to the receiver is the telex/fax converter TG 1001 M (TC 5001) to enable the use of receivers/aerial diversity reception and the reception of telex and facsimile signals. The TG 1001 M (TC 5001) can also be used as a separate self contained unit.

Frequency conversion

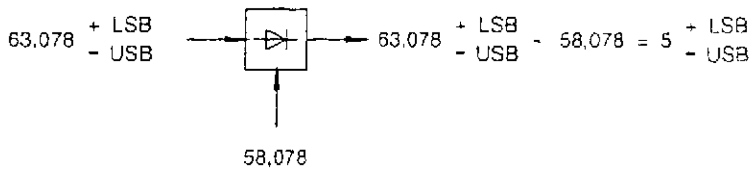
1.) $f_{RX} = 10{,}000 \; {}^{+\,USB}_{-\,LSB}$ MHz

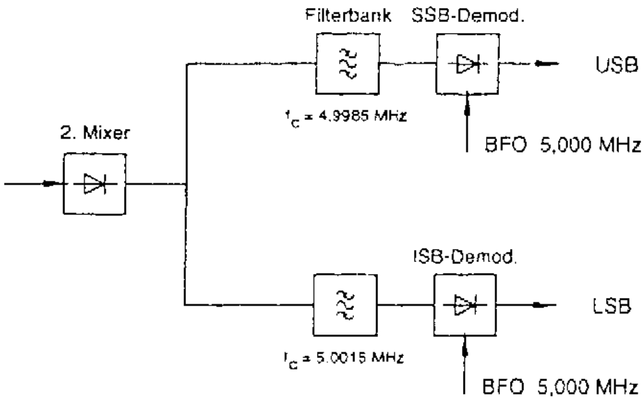


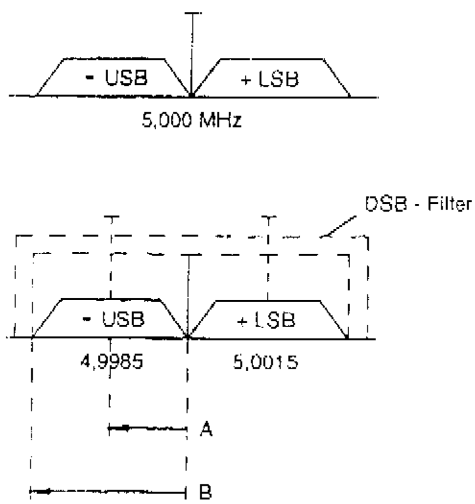
2.) 1. Mixer



3.) 2. Mixer







A ≙ VCO-Deviation for CW-Center	= -1.5 kHz	(all Filters)
B ≙ VCO-Deviation for LSB	= -3.0 kHz	(only Filters 0.1 ... 2.4 kHz)
No VCO-Deviation for USB		(only Filters 0.1 ... 2.4 kHz)
A ≙ VCO-Deviation for DSB	= -1.5 kHz	(all Filters except 6 kHz)

RX 1001 M VCO and BFO frequency offsets

Operating mode	BFO-Freq.	VCO B VCO-Shift	AF Bandwidth	Selected Filter in 2. Mixer
DSB 0.1 kHz	BFO switched off	- 1.5 kHz	0.1 kHz	3 kHz
0.15 kHz	BFO switched off	- 1.5 kHz	0.15 kHz	3 kHz
0.3 kHz	BFO switched off	- 1.5 kHz	0.3 kHz	3 kHz
0.6 kHz	BFO switched off	- 1.5 kHz	0.6 kHz	3 kHz
1.5 kHz	BFO switched off	- 1.5 kHz	1.5 kHz	3 kHz
2.4 kHz	BFO switched off	- 1.5 kHz	2.4 kHz	3 kHz
3.0 kHz	BFO switched off	- 1.5 kHz	3.0 kHz	3 kHz
6.0 kHz	BFO switched off	NONE	6.0 kHz	6 kHz
USB 0.1 kHz	5.000 00 MHz	NONE	1.45 - 1.55 kHz	3 kHz
0.15 kHz	5.000 00 MHz	NONE	1.425- 1.575 kHz	3 kHz
0.3 kHz	5.000 00 MHz	NONE	1.35 - 1.65 kHz	3 kHz
0.6 kHz	5.000 00 MHz	NONE	1.2 - 1.8 kHz	3 kHz
1.5 kHz	5.000 00 MHz	NONE	0.75 - 2.25 kHz	3 kHz
2.4 kHz	5.000 00 MHz	NONE	0.3 - 2.7 kHz	3 kHz
3.0 kHz	5.000 30 MHz	+ 0,3 kHz	0.3 - 3.3 kHz	3 kHz
6.0 kHz	5.003 30 MHz	+ 3.3 kHz	0.3 - 6.3 kHz	6 kHz
LSB 0.1 kHz	4.997 00 MHz	- 3 kHz	1.45 - 1.55 kHz	3 kHz
0.15 kHz	4.997 00 MHz	- 3 kHz	1.425- 1.575 kHz	3 kHz
0.3 kHz	4.997 00 MHz	- 3 kHz	1.35 - 1.65 kHz	3 kHz
0.6 kHz	4.997 00 MHz	- 3 kHz	1.2 - 1.8 kHz	3 kHz
1.5 kHz	4.997 00 MHz	- 3 kHz	0.75 - 2.25 kHz	3 kHz
2.4 kHz	4.997 00 MHz	- 3 kHz	0.3 - 2.7 kHz	3 kHz
3.0 kHz	4.996 70 MHz	- 3.3 kHz	0.3 - 3.3 kHz	3 kHz
6.0 kHz	4.996 70 MHz	- 3.3 kHz	0.3 - 6.3 kHz	6 kHz
A1A 0.1 kHz	depends on	- 1.5 kHz	1.5 kHz ±50 Hz	3 kHz
0.15 kHz	BFO-knob setting	- 1.5 kHz	1.5 kHz ±75 Hz	3 kHz
0.3 kHz		- 1.5 kHz	1.5 kHz ±150 Hz	3 kHz
0.6 kHz	if AF = 1.5 kHz	- 1.5 kHz	1.5 kHz ±300 Hz	3 kHz
1.5 kHz	then 5.000 MHz or	- 1.5 kHz	1.5 kHz ±750 Hz	3 kHz
2.4 kHz	4.9970 MHz	- 1.5 kHz	1.5 kHz ±1.2 kHz	3 kHz
3.0 kHz		- 1.5 kHz	1.5 kHz ±1.5 kHz	3 kHz
6.0 kHz		- 1.5 kHz	1.5 kHz ±4.5 kHz	6 kHz
F1B 0.1 kHz	depends on	- 1.5 kHz	1.5 kHz ±50 Hz	3 kHz
0.15 kHz	Mini-DIP-switch	- 1.5 kHz	1.5 kHz ±75 Hz	3 kHz
0.3 kHz	on I/O board	- 1.5 kHz	1.5 kHz ±150 Hz	3 kHz
0.6 kHz		- 1.5 kHz	1.5 kHz ±300 Hz	3 kHz
1.5 kHz	Pos.1=4.9996 MHz	- 1.5 kHz	1.5 kHz ±750 Hz	3 kHz
2.4 kHz	Pos.5=5.000 00 "	- 1.5 kHz	1.5 kHz ±1.2 kHz	3 kHz
3.0 kHz		- 1.5 kHz	1.5 kHz ±1.5 kHz	3 kHz
6.0 kHz	Pos.0=5.000 50 "	- 1.5 kHz	1.5 kHz +4.5 kHz -1.5 kHz	6 kHz
ISB	5.000 00 MHz	NONE	USB 0.3 - 2.7 kHz other bandwidths are possible	6 kHz
			LSB 0.3 - 2.7 kHz only	6 kHz

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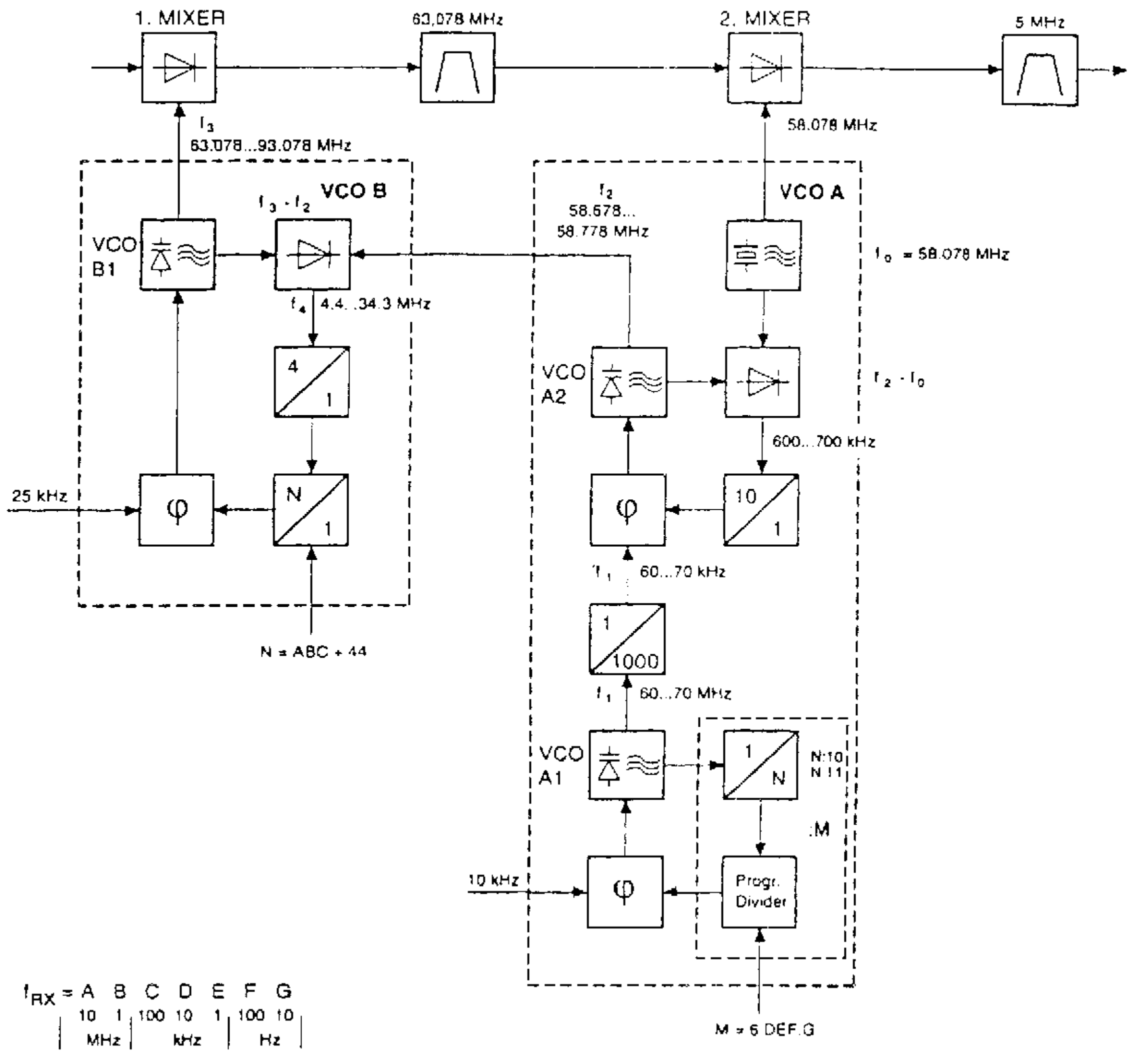


Blockdiagram - VCO A and VCO B

VCO A/B Frequencysynthesis calcualting schedule

	A	B	C	D	E	F	G
f_{RX}							
	10	1	100	10	1	100	10
	MHz			kHz			Hz

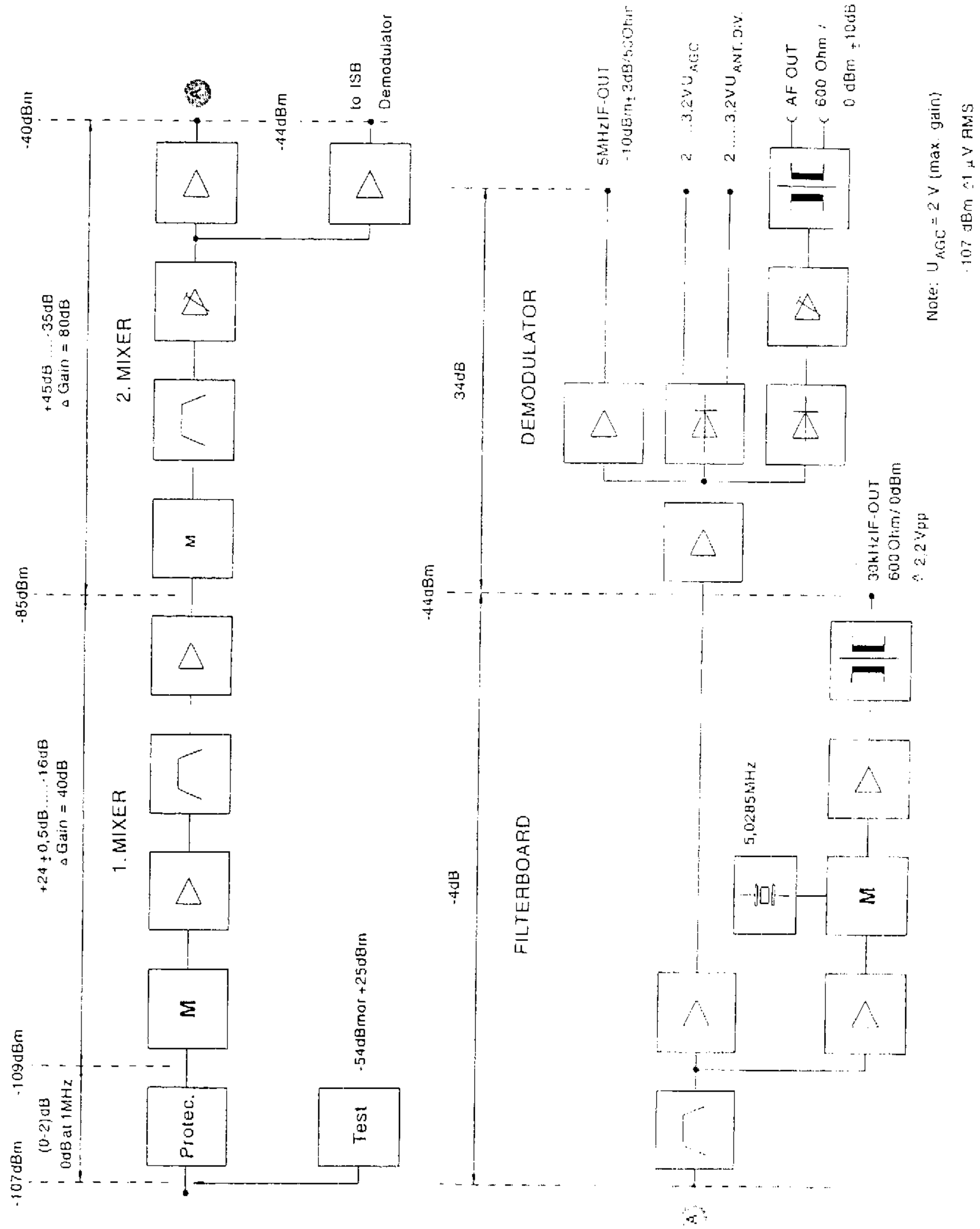
M = 6000.0 + DEF.G

6				

N = ABC + 44

	MHz		kHz			Hz		
	10	1	100	10	1	100	10	1
f_1 (VCO A) = 10 kHz x M								
$'f_1 = f_1 : 1000$								
f_2 (VCO A_2) = $'f_1$ x 10 + 58.078 MHz								
f_4 = 25 kHz x N x 4								
f_3 (VCO B) = $f_2 + f_4$								
1. IF = $f_3 - f_{RX}$								
2. IF = 1. IF - 58.078 MHz								

Above example only valid in USB mode (Filters 0.1 ... 2.4 kHz)
or DSB mode (Filter 6 kHz)



Signal level diagram

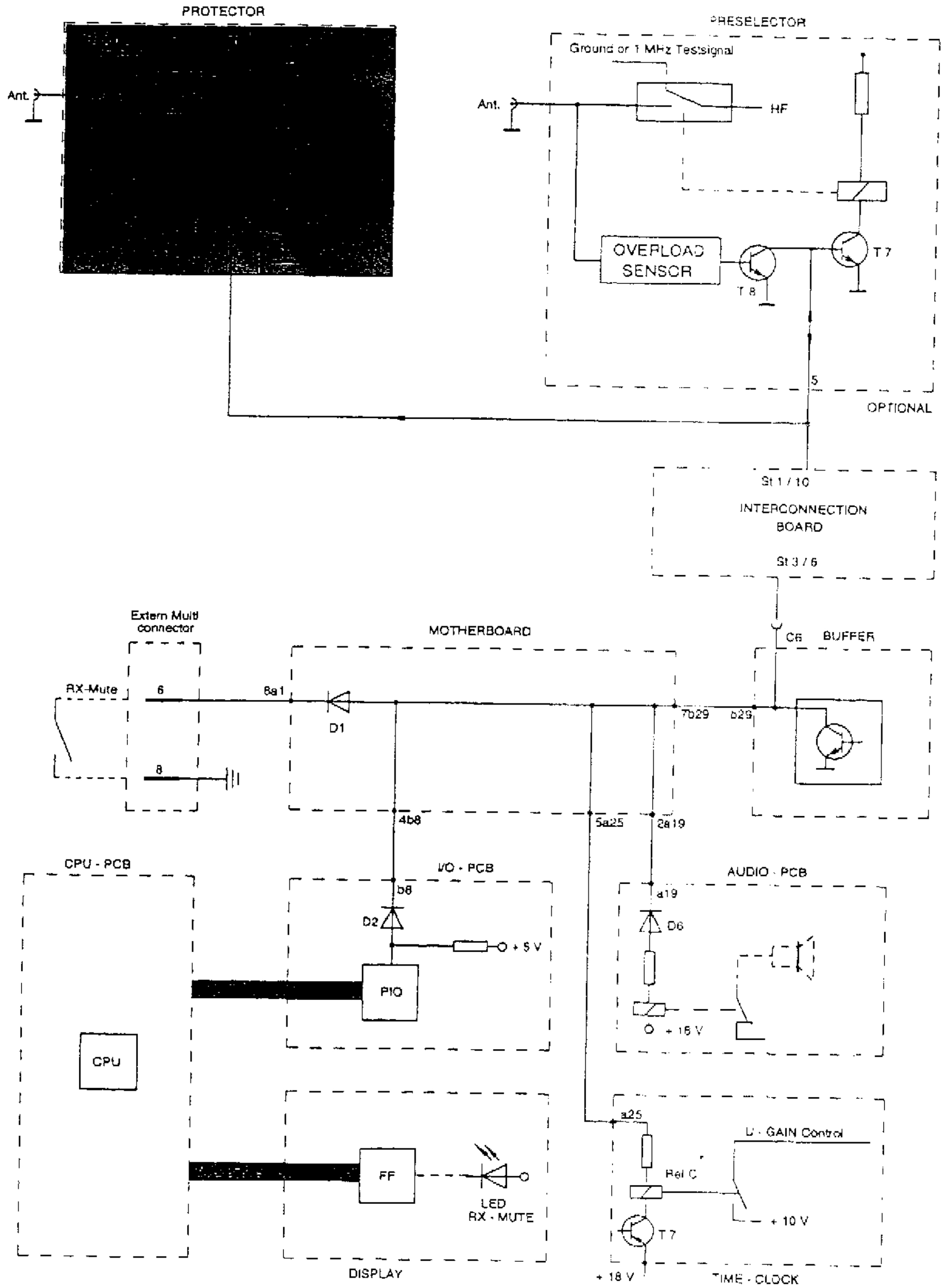
-Protector-

Technical description

The PROTECTOR module includes a low-pass filter (roll off 33 MHz) and an attenuator (20 dB). When the receiver is switched off, the antenna input is automatically disconnected. A gas discharge lamp and a 1 M ohms resistor are connected in parallel to the antenna input. Voltages > 90 V and static electricity are shunted providing an overvoltage protection. At the output of the low-pass filter, a sample of the RF voltage is generated by C44/C43, amplified with T3, rectified by D 1 and fed to the operational amplifier IC - A. This IC acts as a comparator, the reference voltage (= 1 V) is generated by the divider resistors R12/R18. If the level at the antenna input exceeds about 6 dBm (117 ... 123 dBµV), the 20 dB attenuator is automatically switched on.
The attenuator cannot be constructed as a normal π- or T circuit, because of the high antenna input voltage and the possible high power dissipation in the first resistor. For this reason a series resistor R 17 (820 ohms; 1.5 watts) is switched in series with the low-pass filter output only. The characteristic passband and stopband of the low-pass filter is not serverely affected due to this mismatching. When the 20 dB attenuator is switched on, the signal 20 dB ATT. is applied to the control unit; the LED ANT. ATTENUATION 20 dB (31) * indicates this situation. If the 20 dB attenuator is to be switched on permanently, enter code 31 * on the front panel of the receiver. To mute the receiver, switch socket Bu 1 pin 5 (MUTE) to 0 V; relay Rel B drops out and breaks the circuit to the antenna input. For the self-test, the 1 MHz test signal is fed in via St 1. The level is >+22 dBm for testing the RF Level Sensor and - 54 dBm for testing the gain of the cassettes 1st MIXER, 2nd MIXER, FILTERBOARD and DEMODULATOR.
The antenna signal is fed from the PROTECTOR cassette through the RF OUT socket to the 1st MIXER. If the "PRESELECTOR" option is used, the circuitry of the PROTECTOR is integrated in the PRESELECTOR, the cassette PROTECTOR must therefore be omitted.

* Code 31 for RX 1001 M / RX 5001
Code 21 for RX 1001 M / L 11

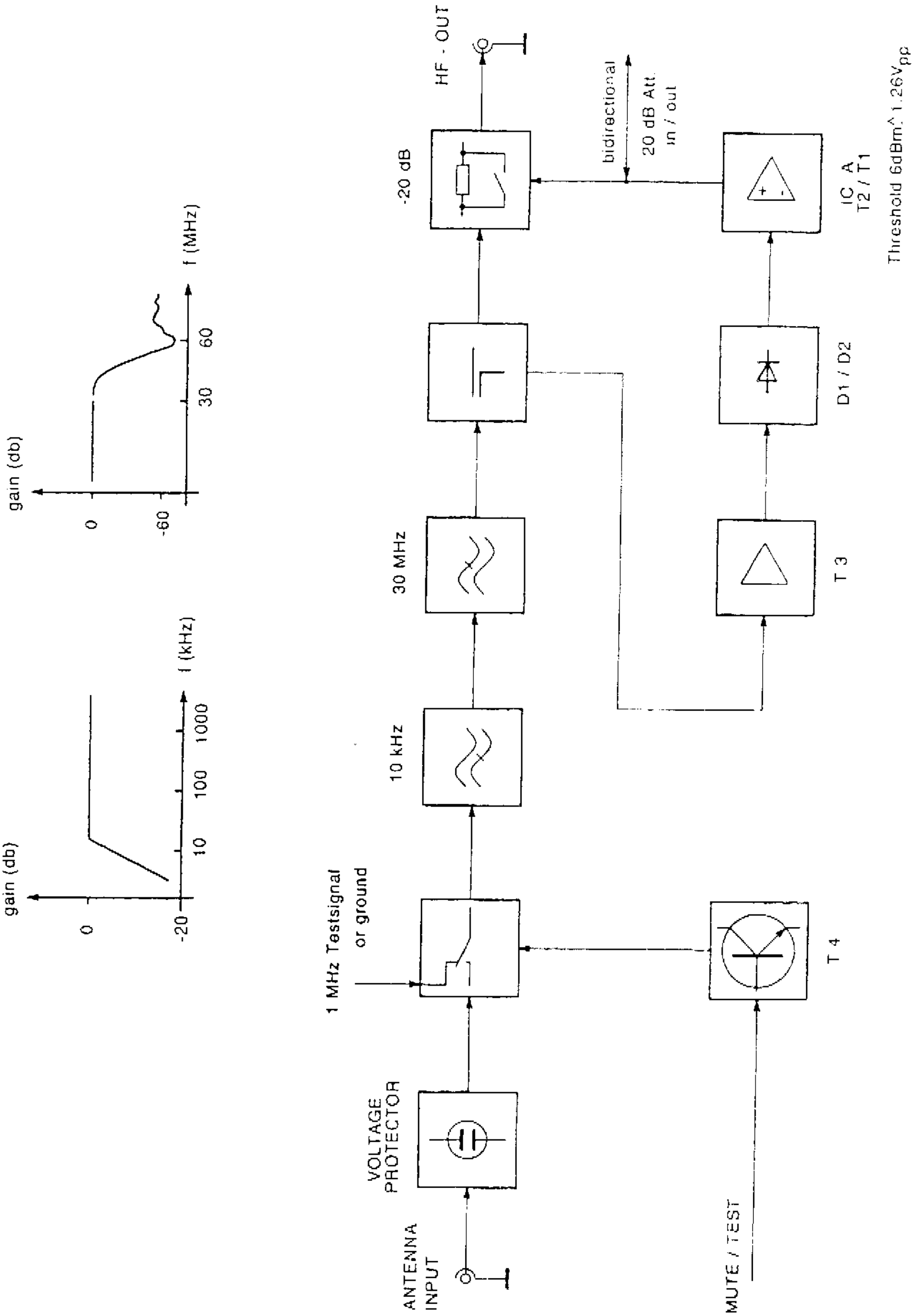
-Protector-



* REL C is disengagnd during BITE TEST

Mute Interconnection

-Protector-



Blockdiagram Protector

-Protector-

Test and alignment instructions

Required: Circuit diagram PROTECTOR -Hagenuk Drawing No. 97 Sa 2.155.95
tracking generator, spectrum analyser.

Test configuration: The PROTECTOR is not removed. The plugs/sockets at the connections ST 1, Bu 2 (ANT.INPUT) and Bu 3 (RF OUT) are pulled off.

Spectrum analyser:	to Bu 3 (RF OUT)
Tracking generator: (level 0 dBm)	to Bu 2 (ANT. INPUT)

Checking the passband and stopband curve of the low-pass filter
Switch on receiver - the LEDs PRESELECTOR ON, ANT ATT. 20 dB and RX MUTE must not be illuminated.

Spectrum analyser settings:	Centre frequency	50 MHz
	Span	100 MHz
	Time/Div.	5 ms

Test values:
Up to 30 MHz passband attenuation < 1 dB. ripple < 2 dB
From 50 MHz stopband attenuation > 60 dB

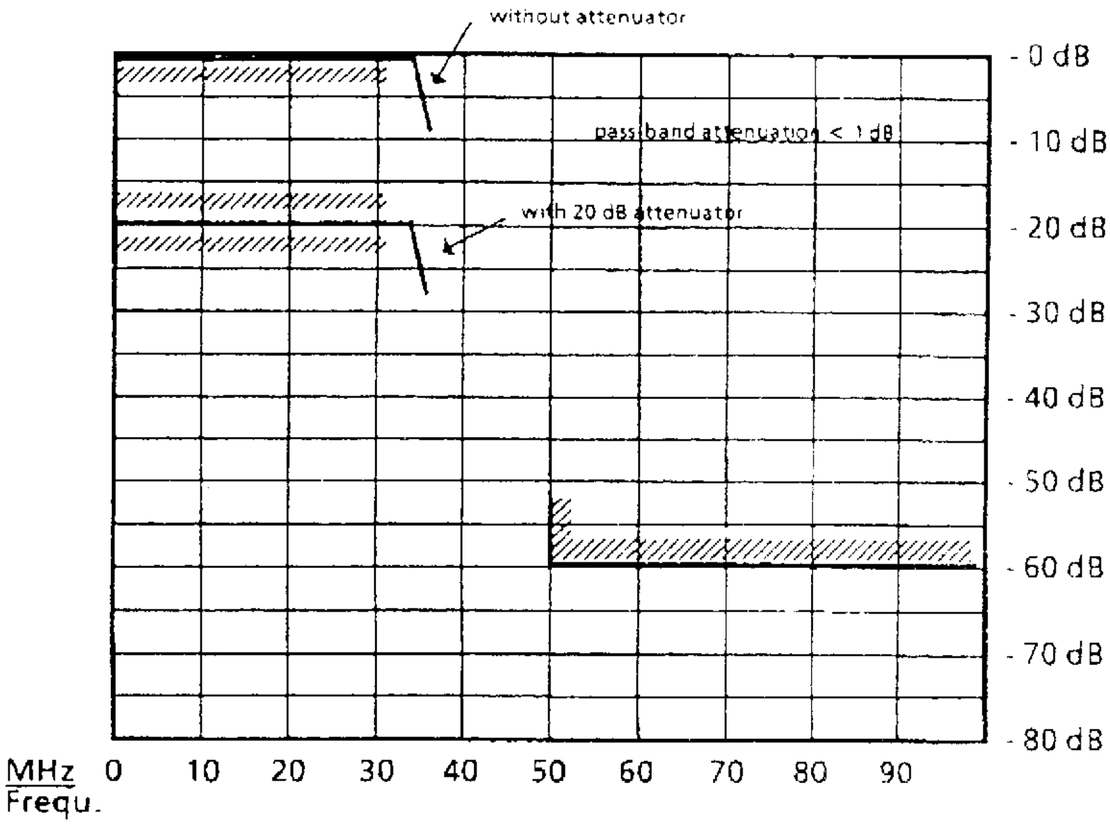
Increase the tracking generator output level to +10 dBm.
Test values:
up to 30 MHz ripple < 3 dB, level -10 dB (when the 20 dB ATT. is switched on!)

Reduce tracking generator output level to -20 dBm and activate RX MUTE:
Test values:
Signal attenuation should be > 35 dB. (i. e. output level < -55 dBm in the passband)

Cancel RX MUTE; activate ATTENUATOR ON.
Test values:
Attenuation in the passband should be 20 dB (tolerance +3 dB to -2 dB).
(output level -40 dBm +3; -2 dBm)

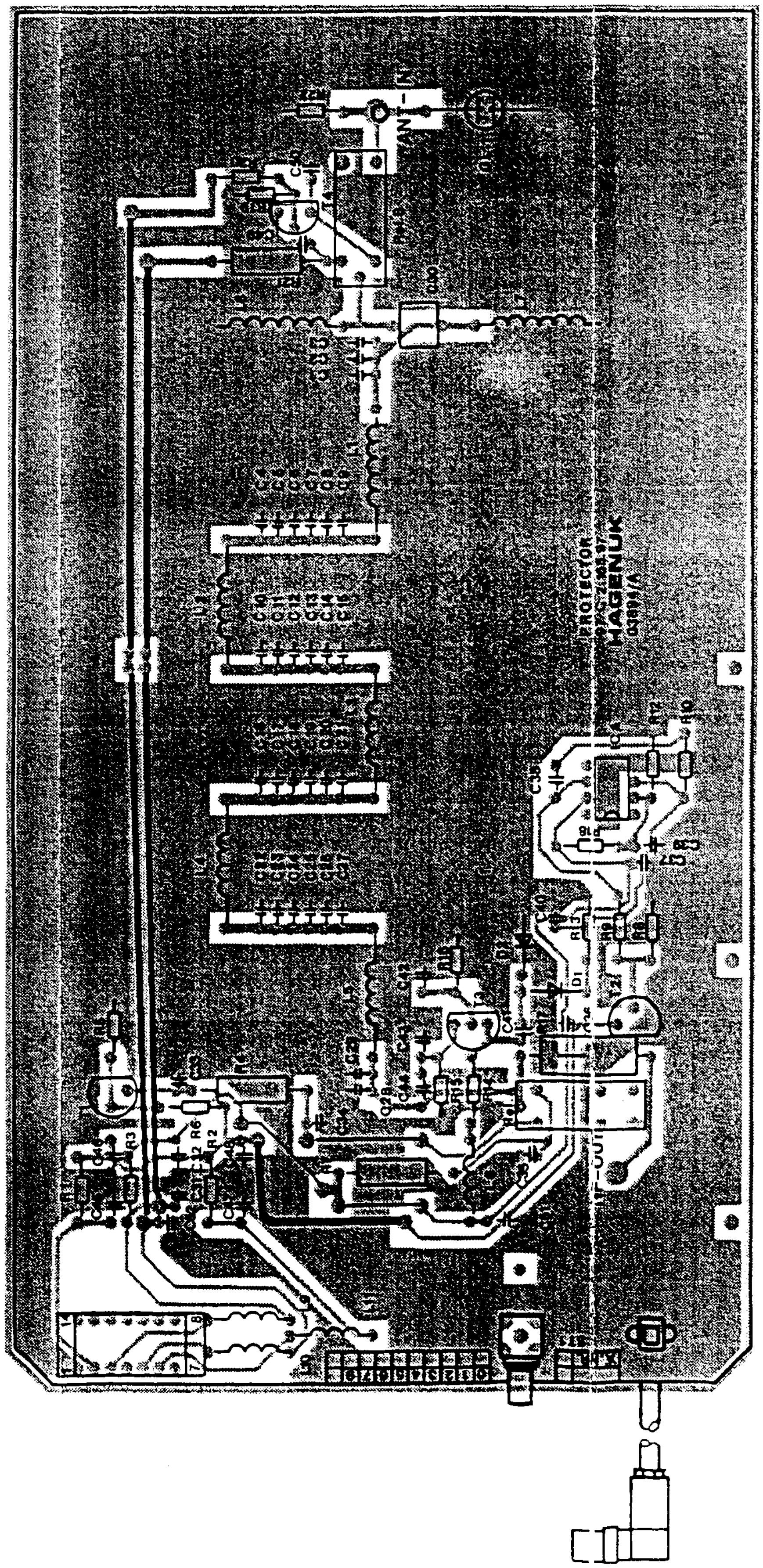
Cancel ATTENUATOR ON and connect tracking generator to plug ST 1 (level 0 dBm).
Test values:
Attenuation in the passband should be < 1 dB and ripple < 2 dB.

-Protector-

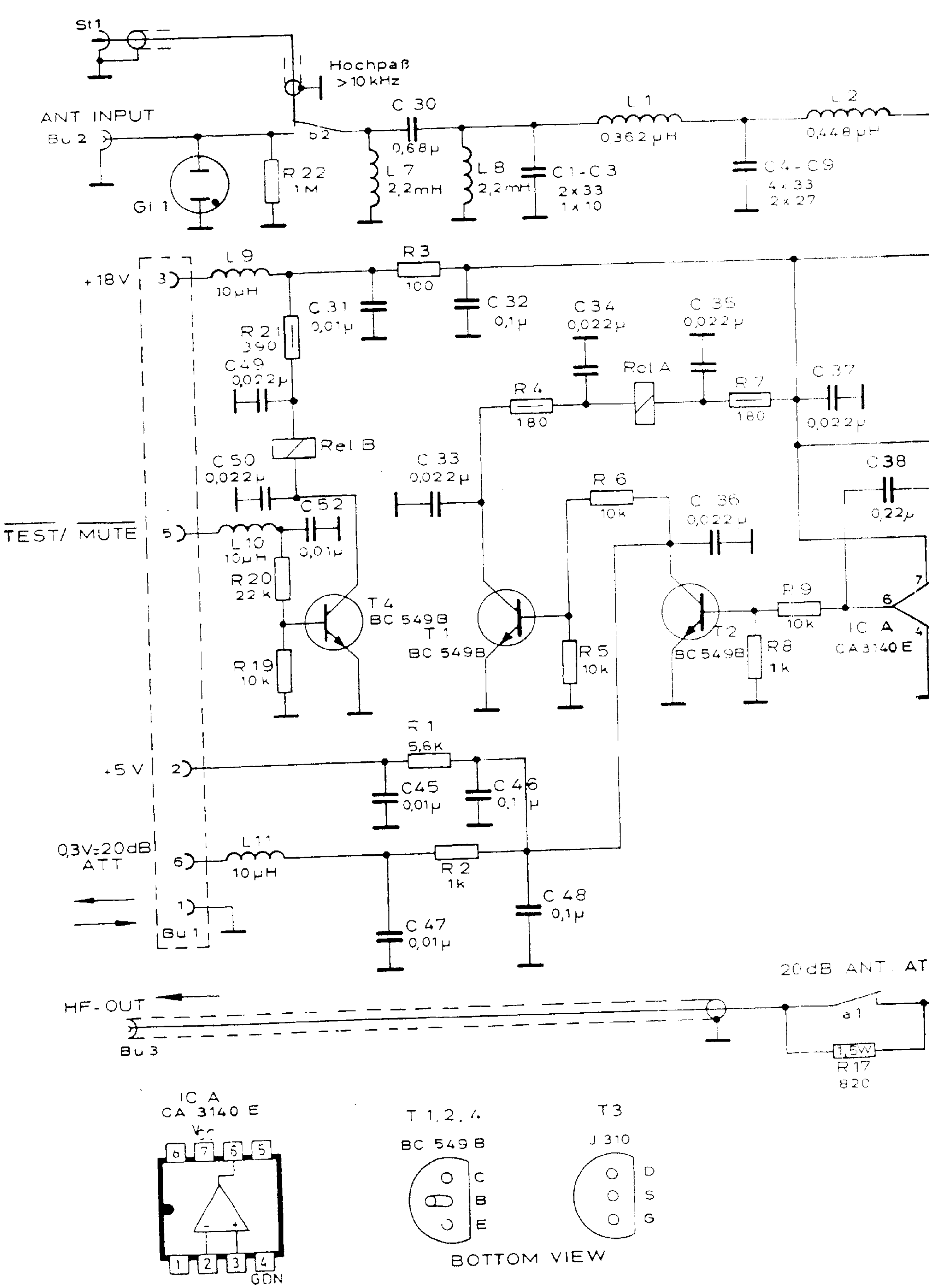


Passband and stopband characteristics of the PROTECTOR with tolerance lines.

see circuit diagram - PROTECTOR 97 Sa D 2.155.95



Printed Circuit Board
Protector
97 C 2.155.97



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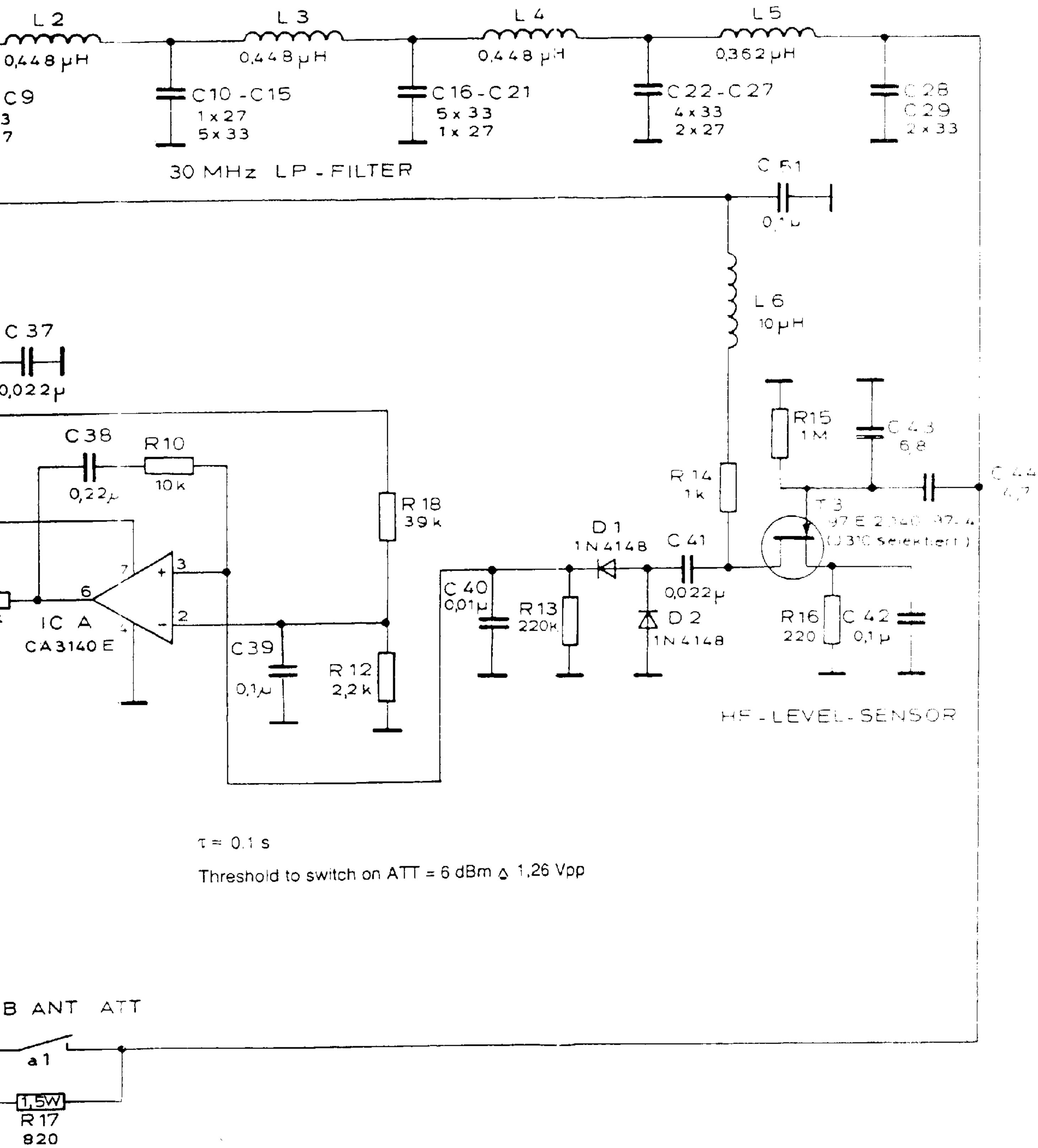


PROTECTOR
Circuit Diagram
97 Sa D 2.155 95

Part lists No.
97 Sa 2 155 95

-Protector-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Capacitors:				
1425.145	C1	33 pF/500 V 2 %	EDPU 222265010339	VALVO
1425.145	C2	33 pF/500 V 2 %	EDPU 222265010339	VALVO
1425.153	C3	10 pF/500 V 2 %	EDPU 222265010109	VALVO
1425.145	C4	33 pF/500 V 2 %	EDPU 222265010339	VALVO
1425.145	C5	33 pF/500 V 2 %	EDPU 222265010339	VALVO
1425.145	C6	33 pF/500 V 2 %	EDPU 222265010339	VALVO
1425.145	C7	33 pF/500 V 2 %	EDPU 222265010339	VALVO
1425.161	C8	27 pF/500 V 2 %	ENPU 222265010279	VALVO
1425.161	C9	27 pF/500 V 2 %	EDPU 222265010279	VALVO
1425.161	C10	27 pF/500 V 2 %	EDPU 222265010279	VALVO
1425.145	C11	33 pF/500 V 2 %	EDPU 222265010279	VALVO
1425.145	C12	33 pF/500 V 2 %	EDPU 222265010279	VALVO
1425.145	C13	33 pF/500 V 2 %	EDPU 222265010279	VALVO
1425.145	C14	33 pF/500 V 2 %	EDPU 222265010279	VALVO
1425.145	C15	33 pF/500 V 2 %	EDPU 222265010279	VALVO
1425.145	C16	33 pF/500 V 2 %	EDPU 222265010279	VALVO
1425.145	C17	33 pF/500 V 2 %	EDPU 222265010279	VALVO
1425.145	C18	33 pF/500 V 2 %	EDPU 222265010279	VALVO
1425.145	C19	33 pF/500 V 2 %	EDPU 222265010279	VALVO
1425.145	C20	33 pF/500 V 2 %	EDPU 222265010279	VALVO
1425.161	C21	27 pF/500 V 2 %	EDPU 222265010279	VALVO
1425.145	C22	33 pF/500 V 2 %	EDPU 222265010279	VALVO
1425.145	C23	33 pF/500 V 2 %	EDPU 222265010279	VALVO
1425.145	C24	33 pF/500 V 2 %	EDPU 222265010279	VALVO
1425.145	C25	33 pF/500 V 2 %	EDPU 222265010279	VALVO
1425.161	C26	27 pF/500 V 2 %	EDPU 222265010279	VALVO
1425.161	C27	27 pF/500 V 2 %	EDPU 222265010279	VALVO
1425.145	C28	33 pF/500 V 2 %	EDPU 222265010279	VALVO
1425.145	C29	33 pF/500 V 2 %	EDPU 222265010279	VALVO
1179.225	C30	0,68 µF/100 V	B32540 A1684-J	SIEMENS
0904.988	C31	0,01 µF/40 V	EDPU/0,6 K10000	VALVO
1423.037	C32	0,1 µF/63 V	MKS 2	WIMA
1116.207	C33	0,022 µF/40 V	EDPU/0,6	VALVO
1116.207	C34	0,022 µF/40 V	EDPU/0,6	VALVO
1116.207	C35	0,022 µF/40 V	EDPU/0,6	VALVO
1116.207	C36	0,022 µF/40 V	EDPU/0,6	VALVO
1116.207	C37	0,022 µF/40 V	EDPU/0,6	VALVO
1400.568	C38	0,22 µF/63 V	MKS 2	WIMA
1423.037	C39	0,1 µF/63 V	MKS 2	WIMA
0904.988	C40	0,01 µF/40 V	EDPU/10000	VALVO
1116.207	C41	0,022 µF/40 V	EDPU/0,6 K10000	VALVO
1423.037	C42	0,1 µF/63 V	MKS 2	WIMA

-Protector-

Parts lists No.
97 Sa 2.155.95

Ident-No.	Mark	Electr. value	Identity	Manufacturer
0945.137	C43	6,8 pF/63 V	NPO/1B EDPU/0,6	VALVO
1425.188	C44	4,7 pFI500 V 2 %	EDPU 222265010478	VALVO
1425.196	C45	0,01 µF/63 V	MKS 2	WIMA
1423.037	C46	0,1 µF/63 V	MKS 2	WIMA
1425.196	C47	0,01 µF/63 V	MKS 2	WIMA
1423.037	C48	0,1 µF/63 V	MKS 2	WIMA
1116.207	C49	0,022 µF/40 V	FDPU/0,6 K10000	VALVO
1116.207	C50	0,022 µF/40 V	EDPU/0,6 K10000	VALVO
1423.037	C51	0,1 µF/63 V	MKS 2	WIMA
0904.988	C52	0,01 µF/40 V	EDPU/0,6 K10000	VALVO

Diodes:

0745.677	D1		1 N 4148	ITT
0745.677	D2		1 N 4148	ITT

Resistors:

0744.840	R1	5,6 K 5 % 1/8 W	DIN 44052
0179.698	R2	1 K 5 % 1/8 W	DIN 44052
0179.639	R3	100 5 % 1/8 W	DIN 44052
0181.005	R4	180 5 % 1/2 W	DIN 44052
0179 701	R5	10 K 5 % 1/8 W	DIN 44052
0179.701	R6	10 K 5 % 1/8 W	DIN 44052
0181.005	R7	180 5 % 1/2 W	DIN 44052
0179.698	R8	1 K 5 % 1/8 W	DIN 44052
0179.701	R9	10 K 5 % 1/8 W	DIN 44052
0179.701	R10	10 K 5 % 1/8 W	DIN 44052
0744.808	R12	2,2 K 5 % 1/8	DIN 44052
0799.416	R13	220 K 5 % 1/8 W	DIN 44052
0179.698	R14	1 K 5 % 1/8 W	DIN 44052
0542.946	R15	1 M 5 % 1/8 W	DIN 44052
0542.983	R16	220 5 % 1/8 W	DIN 44052
1425.226	R17	820 5 % 1,5 W	DIN 44063
0799.300	R18	39 K 5 % 1/8 W	DIN 44052
0179.701	R19	10 K 5 % 1/8 W	DIN 44052
0767.204	R20	22 K 5 % 1/8 W	DIN 44052
0243.647	R21	390 5 % 1/8 W	DIN 44052
0542.946	R22	1 M 5 % 1/8 W	DIN 44052

Parts lists No.
97 Sa 2.155.95

-Protector-

Ident-No.	Mark	Electr. value	Identity	Manufactuter
Coils:				
1425.110	L1	0,362 µH	97 E 2.140.97-2	HAGENUK
1425.129	L2	0,448 µH	97 E 2.140.97-3	HAGENUK
1425.129	L3	0,448 µH	97 E 2.140.97-3	HAGENUK
1425.129	L4	0,448 µH	97 E 2.140.97-3	HAGENUK
1425.110	L5	0,362 µH	97 E 2.140.97-2	HAGENUK
1076.140	L6	10 µH/10 %	72.0	JAHRE
1116.312	L7	2.2 mH	2500-44	AMPHENOL
1116.312	L8	2.2 mH	2500-44	AMPHENOL
1076.140	L9	10 µH/10 %	72.0	JAHRE
1076.140	L10	10 µH/10 %	72.0	JAHRE
1076.140	L11	10 µH/10 %	72.0	JAHRE
Integrated circuits:				
1300.326	IC A		CA 3140 E	
Transistors:				
1291.033	T1		BC 549 B	
1291.033	T2		BC 549 B	
	T3		97 E 2.140.97-4	HAGENUK
1291.033	T4		BC 549 B	
Connectors:				
1189.735	Bu 1	14 pins	DIL B14-P108	BURNDY
	Bu 2	UG 58 A/U	R 161 404	RADIALL
1427.337	Bu 3		97 E 2.140.98	HAGENUK
1422.693	ST 1		R 114 665	RADIAILL
Supplements:				
	GL 1		SIC90/Q69-814	SIEMENS
Relays:				
1186.574	Rel 1	5 V	RH 5 V	NATIONAL
1186.574	Rel 2	5 V	RH 5 V	NATIONAL

-Preselector-

General

In the following pages it will be briefly explained how a PRESELECTOR in a receiver and an INTERSELECTOR in a transmitter can improve the performance of a receiver.

Historically, receivers have always contained selectivity. The tuned radio frequency receiver (TRF) was nothing but a preselector, followed by a demodulator and an amplifier. The superheterodyne type receivers have always had a tracking preselector in the front end. The introduction of the broadband 50-ohm input solid state front ends got away with expensive tracking tuning networks, but the broadband front ends inherited a decrease in receive performance in the presence of strong receiving signals. Especially in those critical applications, were receivers and transmitters together with their associated antennas are collocated (like on ships) the new receivers were at a disadvantage to the old type vacuum tube receivers.

Additionally the tube receivers were much more immune to overload phenomena and to destructive overload stress then the broadband front end receivers. Therefore, if the broadband front end type receivers are used in a collocated HF-system, external selectivity (preselection) is required.

The key to good receiver performance in a collocated situation is to reduce the level of interfering signals so that the distortion products generated in the front end of the receiver are held to an acceptable level relative to the desired signal strength. The easiest way to visualize the helpfull influence of the preselector is to think in terms of the signal level required at the receiver antenna terminals necessary to produce a reference interference level at the output. If the multitone interfering signal is, for example, 0.1 volt/per tone, the addition of a preselector, which demonstrates a 40-dB attenuation to the interfering signal, in series with the receiver antenna input will result in a receiver-preselector subsystem that now requires a 10 volt (40 dB higher) interfering signal to produce the same reference interference level at the receiver output. Thus, a receiver with a 3rd order intermodulation intercept of +30 dBm, with a preselector offering 50 dB of attenuation at the interfering frequencies, now has a 3rd order intermodulation intercept of +80 dBm.

A key point to keep in mind in applying a preselector at a receiver input is that the preselector will be of enormous benefit in attenuating transmitter products outside the desired receive passband, but will have absolutely no effect on transmitter products falling within the desired passband. When the transmitter products are coincident with the desired receiver frequency, they can be reduced only by adding selectivity to the transmitter in order to attenuate all but the desired transmit signal. Interselectors are useful when applied to the low-level transmitter stages like between exciters and power amplifiers.

-Preselector-

The following is a list of characteristics which will be improved by the use of a preselector.

a) Out-of-band intermodulation distortion
This distortion product is caused by mixing, due to front-end nonlinearities, of two undesired signals and their harmonics, all of which are outside the passband of the receiver. The mathematical relationship is such that the tuned frequency of the receiver is equal to the sum or difference of all integer multiples of the interfering signal harmonics. Second order and third order products are typically of most concern in system engineering, as they will have the highest levels. The intermodulation intercept performance of a given receiver will be improved dB for dB by the amount of attenuation given by the preselector at the frequency of the interfering tones. That is to say, the greater the spacing of the interfering signals from the desired signal, the greater they will be attenuated and hence the lower the level of interfering will occur.

b) Cross Modulation
Cross modulation is another third-order intermodulation phenomenon which, when the interfering signal is strong enough, has the effect of transferring the modulation envelope of the interfering signal to the weak desired signal. Again, a preselector will solve this problem by attenuating the interfering signal. Note that an HF preselector will also attenuate such chronic interference sources as AM broadcast stations which are significantly outside the HF passband.

c) Image rejection
In a superheterodyne receiver, the mixer circuits generate both the sum and difference of the desired and local oscillator frequencies. The desired mixing product will be termed the intermediate frequency, and the undesired mixing product is discarded. There exists a second frequency which, when mixed with the local oscillator, also yields a mixing product (sum or difference) equal to the intermediate frequency. This is defined as the image frequency. The image frequency will be twice the IF frequency in separation from the desired signal, and will be on the high side of the local oscillator if the desired signal is on the low side, and vice versa. A key receiver design criterion is to choose the frequency scheme so that the image frequency does not fall within the operating frequency range of the receiver, making it easy to attenuate the image frequency by bandpass filtering. A preselector improves the image rejection of a receiver by the amount of attenuation at the image frequency.

d) IF rejection
The IF rejection of a receiver is the measure of attenuation by the receiver to an input signal at an intermediate frequency of the receiver while the receiver is tuned to another frequency. For example, if the receiver's rated sensitivity is 1 µV for a 10 dB (S+N)N, the receiver will have 80 dB of IF rejection if a 1 mV signal at the 455 kHz IF frequency produces a 10 dB (S+N)/N when it is applied to the antenna input. A preselector further improves IF rejection by attenuating out-of-channel signals, including the IF frequency (s).

e) Noise modulation and desensitization
Noise modulation (also called "reciprocal mixing") occurs in a superheterodyne receiver due to the mixing action of a strong interfering signal with the phase noise of the local oscillator. In effect, this noise of the local oscillator signal is transferred to the interfering signal, and hence that portion of the noise within the receive passband will degrade the sensitivity of the receiver. This effect is called desensitization, and decreases sensitivity in two ways: by reducing (S+N)/N by increasing N (noise power in the passband), and also by causing the AGC to reduce the receiver gain if the noise is sufficient in level. Again the key is the reduction on the interfering signal, since the resulting noise level in the receiver passband will be proportional to the level of interfering signal at the receiver input. The desensitization performance will be improved by the amount of additional selectivity applied by the preselector at the interfering signal frequency.

f) High voltage protection

The attenuation characteristics of a preselector can reduce out-of-channel signals to nondamaging levels at the receiver input. Damaging signal levels in-channel as well as out-of-channel are prevented from reaching the receiver input by a preselector overload protection circuit. Units such as the Hagenuk preselector will give protection up to 100 V_{rms} input voltage.

The following is a list of characteristics which will be improved by the use of an interselector in a transmitter path.

a) Broadband noise
The noise shelf associated with the output spectrum of an interfering transmitter will result in noise power falling within the receiver passband. This noise will effectively degrade the noise figure and sensitivity of the receiver. Historically, the majority of this broadband noise comes from the local oscillator injections in the low level stages of the transmitter. Very little noise contribution is generally caused by the high power amplifier stages.

Thus, the interselector is a natural solution on the broadband noise problem because, when applied in series with low-level transmitter stages, e. g. between the output at the Hagenuk exciter EX 1010 and a power amplifier like the PA 500, PA 1510 the out-of-passband noise level is reduced by the amount of attenuation exhibited by the interselector at the desired out-of-channel frequency.

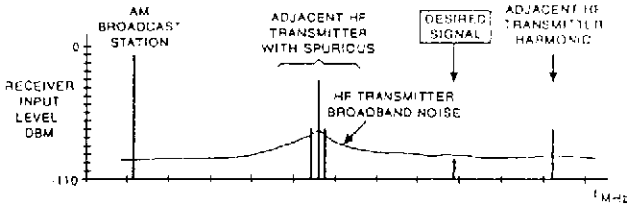
b) Spurious outputs
Nonharmonically related products present in the transmitter output spectrum are generally caused by synthesizer spurious responses at the low level stages. The interselector may be used to advantage in the low-level transmitter stages to reduce the out-of-passband spurious responses. Barring a parasitic oscillation, very little is generated in the way of spurious responses in the high power stages of a transmitter.

c) Harmonics
To the extent that harmonics are generated in the low-level stages of a transmitter, the interselector will attenuate them. However, most harmonics are generated in the high-power stages of a transmitter, and hence the interselector will offer only a limited improvement in performance. As it is obvious by now, there are certain characteristics that a preselector will not affect. Basically, any signal that falls within the desired passband of the receiver cannot be attenuated by a preselector at the receiver. Similarly, an interfering signal within the transmitter passband cannot be attenuated there by an interselector. The parameters which will not be improved by a selector include receive and transmit in-band-intermodulation distortion, in-band broadband noise, and in-band spurious harmonics, that is, where a spurious or harmonic discrete signal falls directly within the receiver passband. The key to this criterion is whether or not the receiver is able to (frequency) discriminate between an undesired and a desired signal.

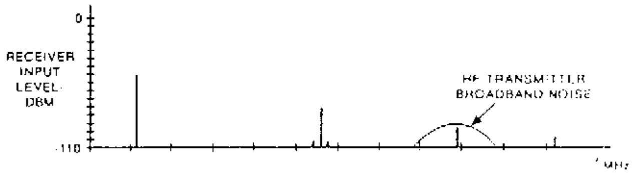
The special characteristics described by the above parameters are summarized in the following figures. These figures show a typical HF receiver spectrum that would cause interference, and the effects of adding a preselector and an interselector to the system.

-Preselector-

Typical preselector and interselector characteristics

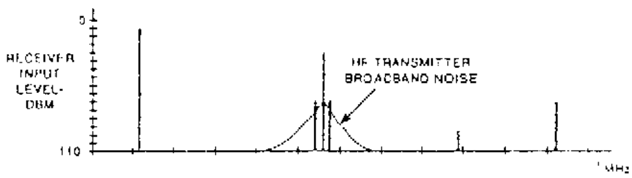


RX input spectrum with no preselection



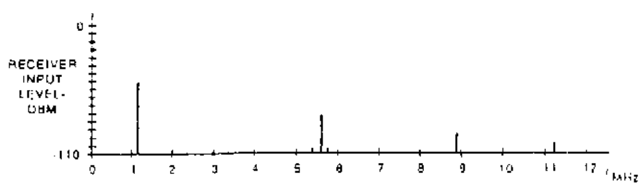
RX input spectrum with preselection

Receive preselector effects:
AM-broadcast level reduced
Adjacent HF-transmitter spectrum reduced.
In-band adjacent HF-noise still burries desired signal although out of band level is reduced.



RX input spectrum with no preselection and interselection of interfering transmitter

Transmit interselector effects:
Broadband noise significantly reduced
Main signal, harmonics and AM-broadcast level unchanged



RX input spectrum with preselection and interselection of interfering transmitter

Combined preselector and interselector effects:
Broadband noise no longer noticable.
AM-broadcast level reduced
Adjacent HF-transmitter spectrum reduced

-Preselector-

Technical description

If the receiver is fitted with a PRESELECTOR, the PROTECTOR cassette is no longer required, since the preselector also fulfils this function. Preselection makes possible the use of receivers and transmitters at collocated sites. Even where the antenna distances are not favourable, concurrent transmission and reception is made possible with a frequency interval > 10 %. For frequencies under 1.6 MHz, the automatically tuning preselector contains a low pass filter, for the frequency range 1.6... 30 MHz, four three circuit band filters are present. Since tuning of a three circuit filter is only possible in a frequency ratio of about 2:1, the pre-selector has four ranges: 1.6 ... 4; 4 ... 8; 8 ...17; 17 ... 30 MHz. Filter attenuation (10 % offset from the pass frequency) related to the pass band attenuation is at least 40 dB. The preselection tuning is inductive, the tuning cores move within fixed coils. The position of the tuning core in the filter coils is specified by an analogue voltage U REF from 5 ... 10 V to the motor control circuit of the preselector which comes from the D/A converter on the Buffer D/A converter board. Data for the D/A converter are stored in an EPROM on the audio board. The tuning position is therefore stored in an EPROM. A 30 MHz low pass filter is also permanently switched on at the output of the filter trains. The 1 MHz signal from the BFO is fed in for the self-test. Apart from adjustment motor and servo-potentiometer, all electrical components are located on replaceable boards.
These are:

a) LP protector board
b) 1.6 - 4 MHZ/8 - 17 MHz filter
c) 4 - 8 MHz/17 - 30 MHz filter
d) Relay board
e) Motor control board

a) The LP protector board contains the connector for the ribbon cable to the control unit of the receiver. Relay board and motor control are attached to the LP protector board via connectors.

Four protective circuits are installed to prevent overload of the preselector or receiver:

1) 20 dBm Level Sensor
   The level sensor protects the receiver input from voltages that are too high. As soon as the input signal at the output of the preselector reaches more than 20 dBm or 6 V_{pp}, the level sensor switches the 20 dB attenuation unit (20 dB ATT) on.
   The LEVEL SENSOR with the transistors T1 to T4 consists of two branches with different gain. The amplification of the stages T1/T3 is lower than that of the stages T1/T2/T4. At the output of T3 and T4 is connected a rectifier (D1/D8 or D7/D6 respectively) which are linked to the comparator IC A via the NC contact or the NO contact of Rel A. If the rectified voltage exceeds the reference voltage specified with resistors R22/R23, the relay switches on the 20 dB attenuation unit.

Since the level measured at the output of the 30 MHz low pass filter is now less, the level sensor would no longer recognise an "overload status", the relay F would therefore release and thus a too high voltage would be recognised again. The relay would energize again etc.. In order to prevent the "oscillation" of the relay F, the amplification of the stages T1/T2/T4 was selected so high that when Rel F has been energized and Rel A has switched over to the more sensitive branch, an overload is still recognised at the output of the 30 MHz low pass filter, oscillation of Rel F is thus prevented.

2) Filter protector
The first resonance circuit of each band filter is connected via a coupling capacitor (C314, 315, 330, 340) with the FILTER PROTECTOR circuit. The input of the 1.6 MHz low pass filter is also connected with the protector circuit via C75. These capacitors form a capacitive voltage divider with C204. The high frequency is rectified by means of D202 and D203 and fed to the IC A, connected as a comparator, via the normally closed contact of relay A. If the rectified voltage is greater than the reference voltage formed by R22/R23, Rel A and F respond, the 20 dB is switched on. This prevents the coils of the band filters and the 1.6 MHz low pass being damaged by overheating. Because the NC contact of the relay A disconnects the error signal from the comparator when the 20 dB attenuator is active, the attenuator switches on and off rapidly if the filter input voltages are too high.

If triggered by the filter protector circuit, the circuit will hold for about 250 ms and then switches back to normal and then switches back in about 10 - 50 ms time if the high voltages still persist. At high voltages near the trigger level the 'ON'delay time will be 50 ms. At high voltages far above the trigger level the 'ON'delay time will be about 10 ms. At high voltages across the first filter coil just above trigger level, with the filter protection circuit in action, the 20 dB switch will be activated for about 250 ms and deactivated for about 50 ms.

The circuit operation described above can just be seen by the flickering 20 dB attenuator LED (constantly on for 250 ms and off for 50 ms) When the first filter coil voltage increases, the OFF time of the LED cannot be recognized, although the oscillation of the 20 dB attenuator switch can be heard in the preselector unit.

3) Overload switch
The overload switch protects the preselector in case either the input voltage exceeds 100 V or the input current exceeds 2 A. Protection against excess current is necessary, since the filters can have a very low impedance outside their pass range and current above 2 A would destroy the coils. For this reason the overload switch separates the antenna input from the filters by means of the relay G. If the overload switch is activated, the receiver is at the same time disabled and the LED RX MUTE lights up on the front panel.

4) In addition to the overload switch, the input is protected from static discharge and voltages > 100 Veff from the antenna by a surge arrester and a 1 M Ohm resistance.
In addition to the addressed protection circuits the low pass and protector board contains the following function groups:
- 30 MHz low pass filter
- 1.6 MHz low pass filter

1.6 MHz low pass filter (Cauer low pass)
With a pass range from 0.01 ... 1.6 MHz and a pass attenuation less than 3 dB and attenuation of more than 40 dB above 1.76 MHz.
Low pass filter 30 MHz (chebyshev low pass)
With the pass range 0.01... 30 MHz and a pass attenuation less than 3 dB. If the pre-selector is turned off, the two bypass relays B and C bridge the tuned filter or the 1.6 MHz low pass.

Inputs and Outputs to the Preselector
In addition to the bypass control and the 20 dB attenuator which can be switched on/off by the receive front panel, the microprocessor must also select the various filter ranges. The interface to the processor thus goes via the buffer D/A converter board. The filter ranges are connected via the output memory and driver ICs.
Tuning of the filters (position of the adjustment cores in the filter coil) is specified via an analogue voltage U_{REF} from 5 ... 10 V to the motor control circuit of the preselector which comes from the D/A converter on the buffer D/A converter board. The data for the D/A converter are stored in an EPROM on the audio board.

b) 1.6 - 4 MHz and 8 - 17 MHz Filter
This module contains two three circuit matched band filters. Each band filter is constructed on its own board. Two of the boards are compiled to a filter module.

c) 4 - 8 MHz and 17 - 30 MHz Filter
This filter module is constructed in a similar way to the filter described above, only the values of the capacitors and the coils are different.

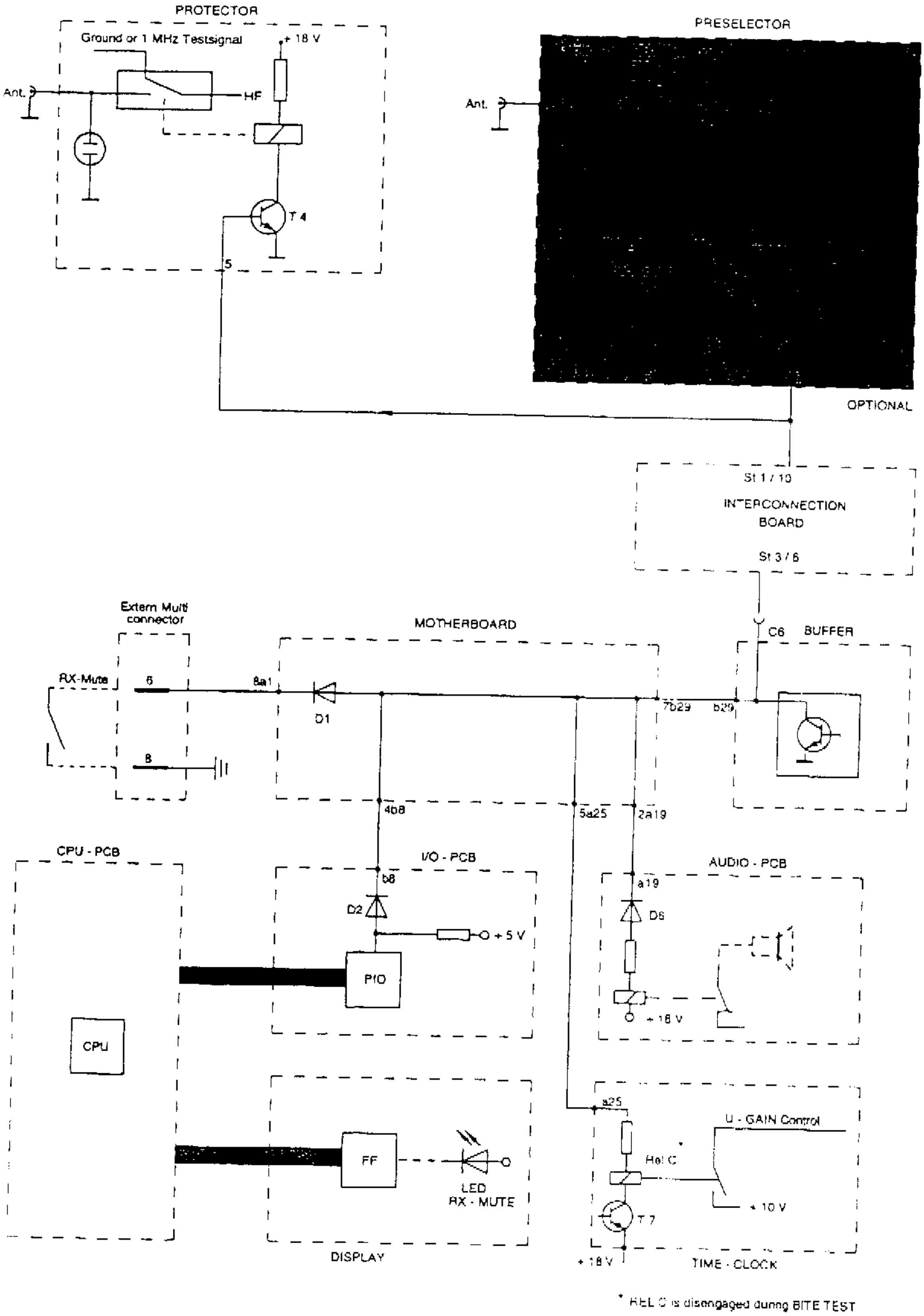
-Preselector-

d) Relay board
The relays are used for switching on the relevant three circuit filter; the boards also contain the rectifier and filtering of the circuit for filter protection.

e) Motor Control Board
The matching of the band filter takes place by means of a direct current motor which is controlled by the motor control board. With the servo-potentiometer R12, a statement is obtained on the position of the coil cores in the band filter coils. Tuning cores, servo-potentiometer and motor are linked via a mechanical gear. The matching voltage U_{REF} is stored digitally in an EPROM and is converted into an analogue voltage in the D/A converter on the buffer D/A converter board. This voltage is the nominal value of the preselector. The actual position of the preselector is picked up from the servo-potentiometer. A comparator on the motor control board compares the two voltages and controls the motor in the right direction until the two voltages are matched.
The switch-on delay keeps the motor still after the mains has been switched on until all data have been delivered from microprocessor to the DA converter.

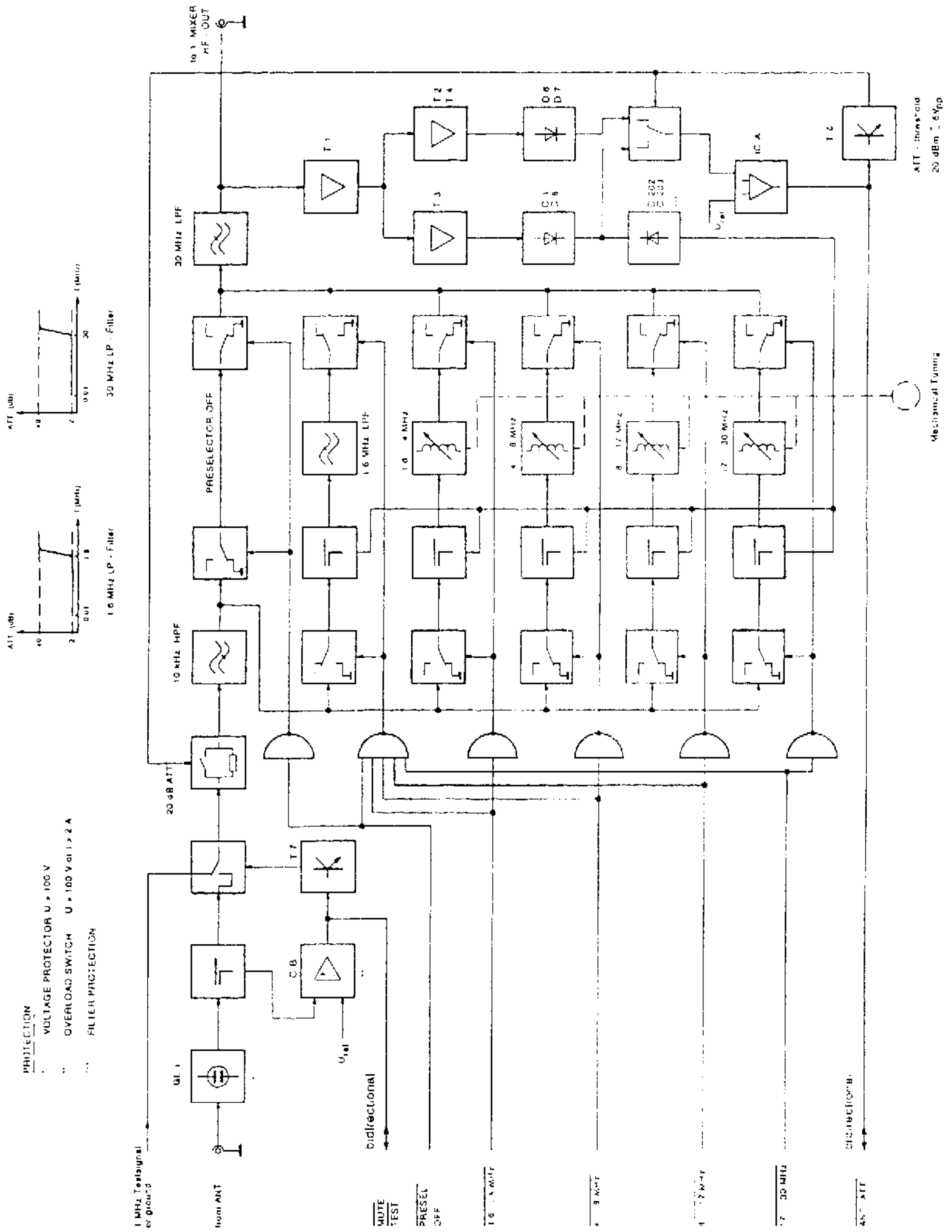
For error recognition, a comparison is carried out between the reference voltage U_{REF} of the D/A converter and the servo-potentiometer voltage. When the two voltages deviate, an error is notified. The P output then goes to LOW. When the preselector is switched off, the motor moves to the middle position, the potentiometer voltage is then
5 V + 2.5 V = 7.5 V. This value is also monitored in the voltage comparator and when it deviates it is notified as a fault.

-Preselector-



Mute Interconnection

-Preselector-



Blockdiagram Preselector

Test and alignment instructions

Required:	Circuit diagram PRESELECTOR automatic/manual Drawing No. 97 Sa B 2.140.150 B tracking generator, spectrum analyser, digital voltmeter
Test configuration and instruments:	The PRESELECTOR module remains installed. The plugs/sockets on the connections Bu 14 (IN 1 MHz TEST), Bu 12 (ANT.INPUT) and RF OUT are disconnected. Spectrum analyser: to socket RF OUT Tracking generator: to socket Bu 12 (ANT.INPUT)

Checking operation of the band-pass filters
Switch on receiver and switch on preselector; the LEDs ANT.ATT. 20 dB and RX MUTE must be off.

Spectrum analyser settings:			
	Centre frequency	20	MHz
	Span	40	MHz
	Reference level	0	dBm
	Tracking generator-level	0	dBm

Select the following frequencies on the receiver in succession:
01.000.00 MHz, 01.600.00 MHz, 04.000.00 MHz, 08.000.00 MHz, 17.000.00 MHz and 29.999.99 MHz.
Check operation of filters.

Activate RX MUTE, then select all frequencies as in item 1.
Test values:
The attenuation should increase by min. 35 dB for each filter activated.
Cancel RX MUTE, and then activate ANT.ATT. 20 dB. Switch all frequencies as in item 1.

Test values:
The attenuation should be 20 dB (tolerance +3 dB -2 dB) for each filter activated.

Cancel ANT.ATT. 20 dB and set the receiver to a frequency of 01 599.99 MHz.

Spectrum analyser settings:			
	Centre frequency	1.6	MHz
	Span	1	MHz
	Reference level	0	dBm
	Tracking generator-level	0	dBm

-Preselector-

Test values:
Passband attenuation < 3 dB at 1.6 MHz
Stopband attenuation > 40 dB at 1.76 MHz
Set the receiver to 1.601 MHz

Spectrum analyser settings:	Centre frequency	50	MHz
	Span	100	MHz
	Reference level	0	dBm
	Tracking generator-level	0	dBm

Test values:
Passband attenuation < 2 dB in the frequency rage 0 - 30 MHz
Offband attenuation > 60 dB at frequencies above 50 MHz

Alignment of the 1.6-4 MHz band-pass filter cassette
Set the receiver to a frequency of 02 700.00 MHz and check the reference voltage U_{REF}= 2.444 V (measuring on the outer pins of the servopotentiometer). If necessary, readjust the center frequency of the passband bandfilter to this frequency.
Test values:
Check reference voltage and passband characteristic of the filter, when the receiver is set to the following operating frequencies.

f(MHz)	U_{Ref}(V)
01 600.00	0.106
02 000.00	1.340
02 500.00	2.182
02 700.00	2.444
03 000.00	2.807
03 500.00	3.393
03 990.00	4.961

Spectrum analyser settings:	Centre frequency	3	MHz
	Span	6	MHz
	Reference level	0	dBm
	Tracking generator-level	0	dBm

Set the receiver to a frequency of 1.600.00 MHz

Spectrum analyser settings:	Centre frequency	1.6	MHz
	Span	0.5	MHz
	Reference level	0	MHz
	Tracking generator-level	0	dBm

-Preselector-

Test values:
Passband attenuation should be < 10 dB.
Adjust the reference level of the spectrum analyser in a manner that the passband of the filter touches the 0 dB reference line.
Measure the attenuation at f = 1.44 MHz and f = 1.76 MHz.
Stopband attenuation should be > 40 dB.

Set the receiver to 2.700.00 MHz.

Spectrum analyser settings:			
	Centre frequency	2.7	MHz
	Span	0.5	MHz
	Reference level	0	dBm
	Tracking generator-level	0	dBm

Test values:
Passband attenuation should be < 10 dB.
Adjust the filter pass curve on to the reference line on the spectrum analyser and measure the stopband attenuation at f = 2.43 MHz and f = 2.97 MHz.
Stopband attenuation should be > 40 dB.

Alignment of the 4-8 MHz band-pass filter cassette
Tune the receiver to 06.000.00 MHz and check the reference voltage U_{REF}= 3.090 V. If necessary, adjust the center frequency of band filter to this frequency.

Test values:
Check the reference voltage and passband characteristics, set the receiver to the following operating frequencies.

f(MHz)	U_{REF}(V)
04.000.00	1.650
04.500.00	2.254
05.000.00	2.596
05.500.00	2.858
06.000.00	3.090
06.500.00	3.309
07.000.00	3.541
07.500.00	3.841
07.980.00	5.041

Spectrum analyser settings:			
	Centre frequency	6	MHz
	Span	6	MHz
	Reference level	0	dBm
	Tracking generator-level	0	dBm

Tune receiver to 04.000.00 MHz.

Spectrum analyser settings:	Centre frequency	4	MHz
	Span	2	MHz
	Reference level	0	dBm
	Tracking generator-level	0	dBm

Test values:
Passband attenuation should be < 10 dB.
Adjust the filter pass curve on to the reference line on the spectrum analyser and measure the stopband attenuation at f = 3.6 MHz and f = 4.4 MHz.
Stopband attenuation should be > 40 dB.

Tune receiver to 06.000.00 MHz.

Spectrum analyser settings:	Centre frequency	6	MHz
	Span	2	MHz
	Reference level	0	dBm
	Tracking generator-level	0	dBm

Passband attenuation should be < 10 dB.
Adjust the filter pass curve on to the reference line on the spectrum analyser and measure the stopband attenuation at f = 5.4 MHz and f = 6.6 MHz.
Stopband attenuation should be > 40 dB.

Alignment of the 8-17 MHz band-pass filter cassette
Set the receiver to 12.500.00 MHz and check the reference voltage U_{REF} = 2.613 V. If necessary, adjust the center frequency of band filter to this frequency.
Test values:
Check reference voltage and passband characteristics, set the receiver to the following operating frequencies.

f(MHz)	U_{REF}(V)
8.0	0.495
9.0	1.548
10.0	1.978
11.0	2.269
12.5	2.613
14.0	2.929
15.0	3.153
16.0	3.452
16.95	4.704

-Preselector-

Spectrum analyser settings:

Centre frequency	13.5	MHz
Span	20	MHz
Reference level	0	dBm
Tracking generator level	0	dBm

Tune the receiver to 08.000.00 MHz (U_{REF} = 0.495 V)

Spectrum analyser settings:

Centre frequency	8	MHz
Span	2	MHz
Reference level	0	dBm
Tracking generator-level	0	dBm

Test values:
Passband attenuation should be < 10 dB.
Adjust the filter pass curve on to the reference line on the spectrum analyser and measure the stopband attenuation at f = 7.2 MHz and f = 8.8 MHz.
Stopband attenuation should be > 40 dB.

Alignment of the 17-30 MHz band-pass filter cassettes
Tune the receiver to 23.500.00 MHz and check reference voltage U_{REF} = 2.193 V. If necessary, adjust the band filter to this frequency.
Test values:
Check reference voltage and passband characteristics, set the receiver to the following operating frequencies.

f(MHz)	U_{REF}(V)
17.000.00	0.103
19.000.00	0.889
21.000.00	1.513
23.500.00	1.193
25.000.00	2.573
27.000.00	3.103
29.000.00	3.813
29.900.00	4.900

Spectrum analyser settings:

Centre frequency	23.5	MHz
Span	20	MHz
Reference level	0	dBm
Tracking generator-level	0	dBm

-Preselector-

Tune receiver to 17.000.00 MHz.

Spectrum analyser settings:

Centre frequency	17.0	MHz
Span	5	MHz
Reference level	0	dBm
Tracking generator-level	0	dBm

Test values:
Passband attenuation should be < 10 dB.
Adjust the filter pass curve on to the reference line on the spectrum analyser and measure the stopband attenuation at f = 15.30 MHz and f = 18.70 MHz.

Tune receiver to 23.500.00 MHz.

Spectrum analyser settings:

Centre frequency	23.50	MHz
Span	10	MHz
Reference level	0	dBm
Trecking generator-level	0	dBm

Test values:
Passband attenuation should be < 10 dB.
Adjust the filter pass curve on to the reference line on the spectrum analyser and measure the stopband attenuation at f = 21.25 MHz and f = 25.85 MHz.
Stopband attenuation should be > 40 dB.

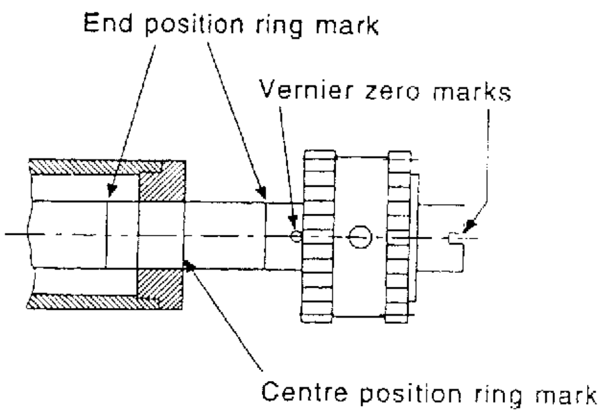
NOTE
All tuning slugs in the band filters are secured with paint.
After adjusting apply paint again.

-Preselector-

Mechanical centering of preselector
If due to a faulty D/A converter or a faulty motor control PCB the moving plate runs to a dead stop, the friction clutch on the potentiometer shaft may have slipped. The preselector ends up in a latched condition and can only be reset by mechanically moving the moving plate towards center position.

Misalignment between filter and potentiometer will be recognized when all filters are detuned to one direction of the center frequency. Tuning can be accomplished by fixing the potentiometer shaft with a 14 mm open end spanner and tuning the filter to the proper center frequency again. Before the preselector is tuned in the factory it will be electromechanically centered, i. e. at a ref voltage of 2.56 V the preselector has to move to the mechanical center position. This circumstance can help to retune a preselector.

The receiver generates exactly 2.56 V when the preselector is switched off from the frontpanel. The mechanical center position can be recognized, if the nut connected to the moving plate just covers the center ring on the shaft, and the vernier mark is positioned on top.



Moving plate at centre position

-Preselector-

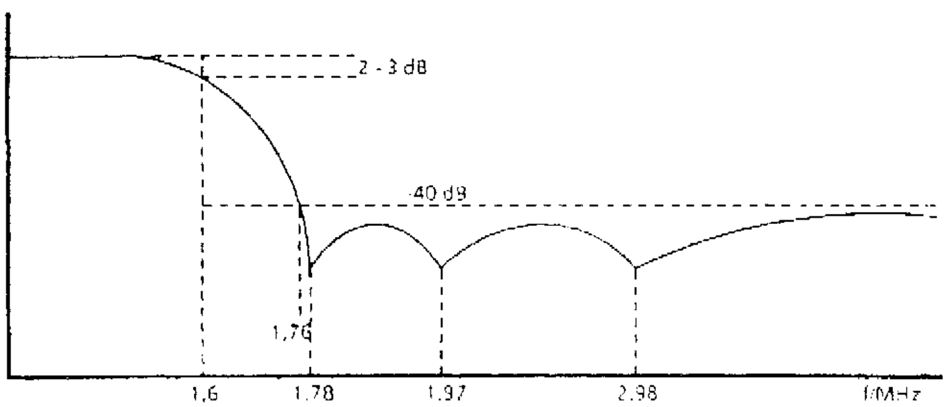
Test and alignment instructions (LP Protector)

Required:	Circuit diagram PRESELECTOR automatic/manual - drawing No. 97 Sa B.140.150 B spectrum analyser, tracking generator
Test configuration	Remove PRESELECTOR module and reconnect flat cable to receiver. Connect socket Bu 12 ANT.INPUT to trecking generator. (Test configuration No. 1) Switch on preselector (PRESL. ON 21), tune the receiver to f < 01.600.00 MHz; e.g. 01.000.00 MHz.

Tracking generator settings:	Output level	0	dBm
	Centre frequency	3	MHz
	Span	6	MHz

Connect spectrum analyser to socket CA 1 RF OUT.

Testing the 1.6 MHz low-pass filter
Test values:
Adjust the passband of the low-pass filter to the reference line of the spectrum analyser. Three discontinuities will be observed in the stopband of the low-pass filter; these must be aligned with the tuning slugs of coils L 12, 13 and 14, the overall frequency response conforming to the following curve:



-Preselector-

Testing the 30 MHz low-pass filter

Set the test equipment to PRESEL.OFF. Connect the equipment "Impedancer" as shown in test configuration No. 2, but without link C.

Spectrum analyser settings:	Centre frequency	20	MHz
	Span	40	MHz
	Tracking generator-level	0	dBm

The spectrum analyser display shows a line, adjust it on to the 0 dBm reference line. Insert link C, the reflection loss is displayed.
Test values: In the frequency range up to 30 MHz the reflection loss should be > 15 dB. Reaching this reflection loss is obtained by squeezing the two outer coils and lengthening the pitch of the turns of the three inner coils. Compare the spectrum analyser's display after each new alignment with the stored display of the alignment action before.

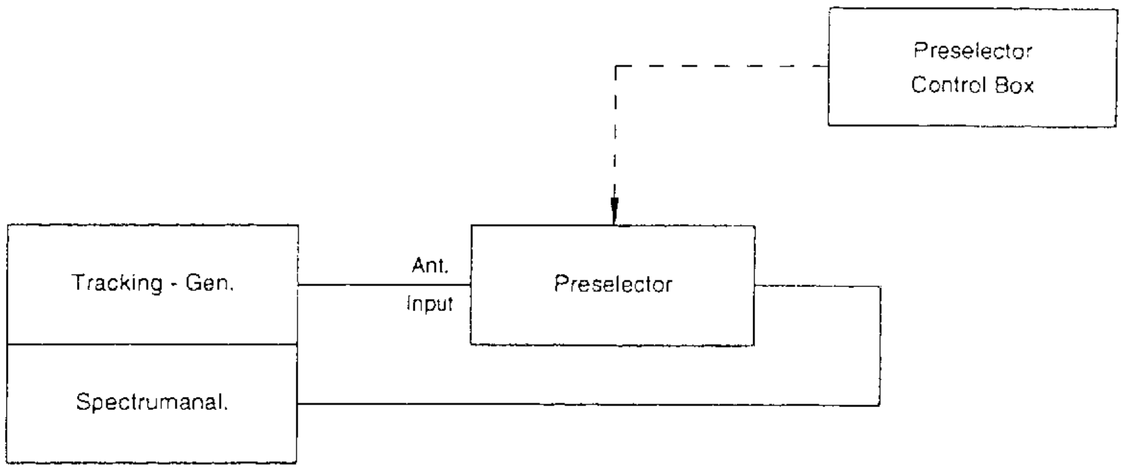
Check the MUTE-function. Activate MUTE, connect pin 6 with pin 8 of the EXTERNAL connector. Connect the spectrum analyser's input to CA 1 and the tracking generator to the antenna input connector.
Test value: Attenuation should be > 35 dB.

Check the connection between BU 14 and CA 1, if the MUTE selector of the test equipment is switched to position ON. (BU 13 pin 5 is now +18 V DC)
Connect a high power Rf-signal generator and an oscilloscope to the antenna input connector. Set the Rf-signal generator to f = 4.2 MHz and connect a terminal resistor of 50 ohms to CA 1.
Set the test equipment selector to position "PRES. OFF"
Increase the input level until the 20 dB attenuator is switched on at a level of 125 ... 135 $dB\mu V_{EMK}$, resp. 2.5 ... 7.95 V_{pp}.

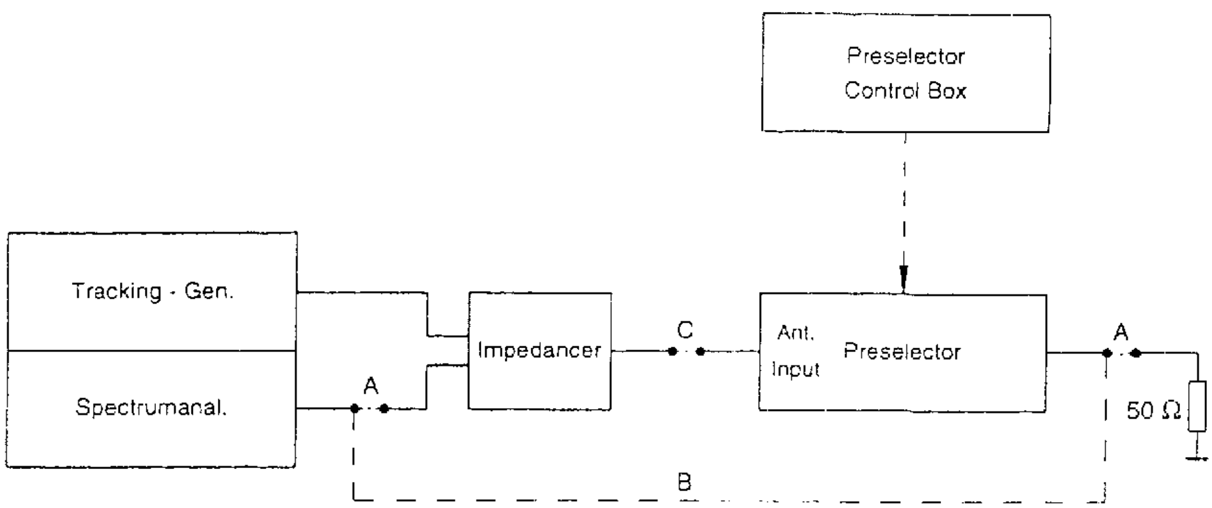
-Preselector-

Test configuration

Test configuration No. 1

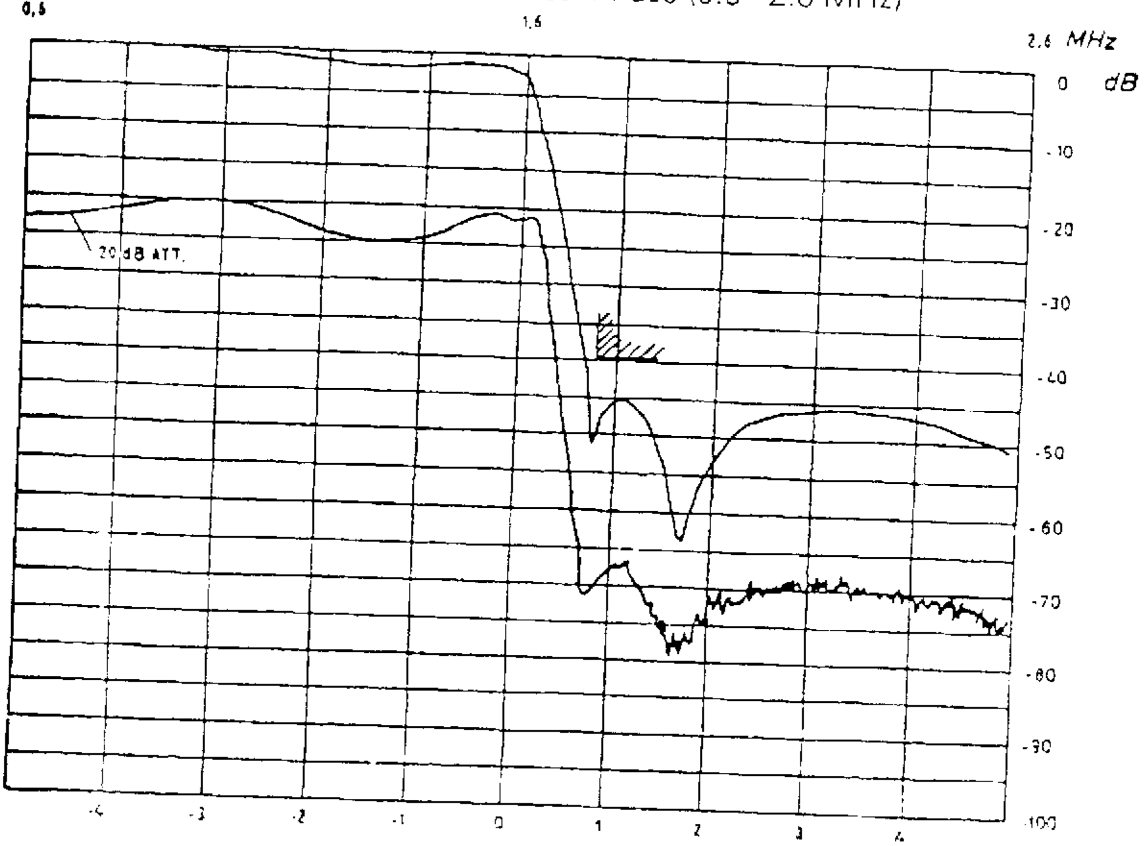


Test configuration No. 2

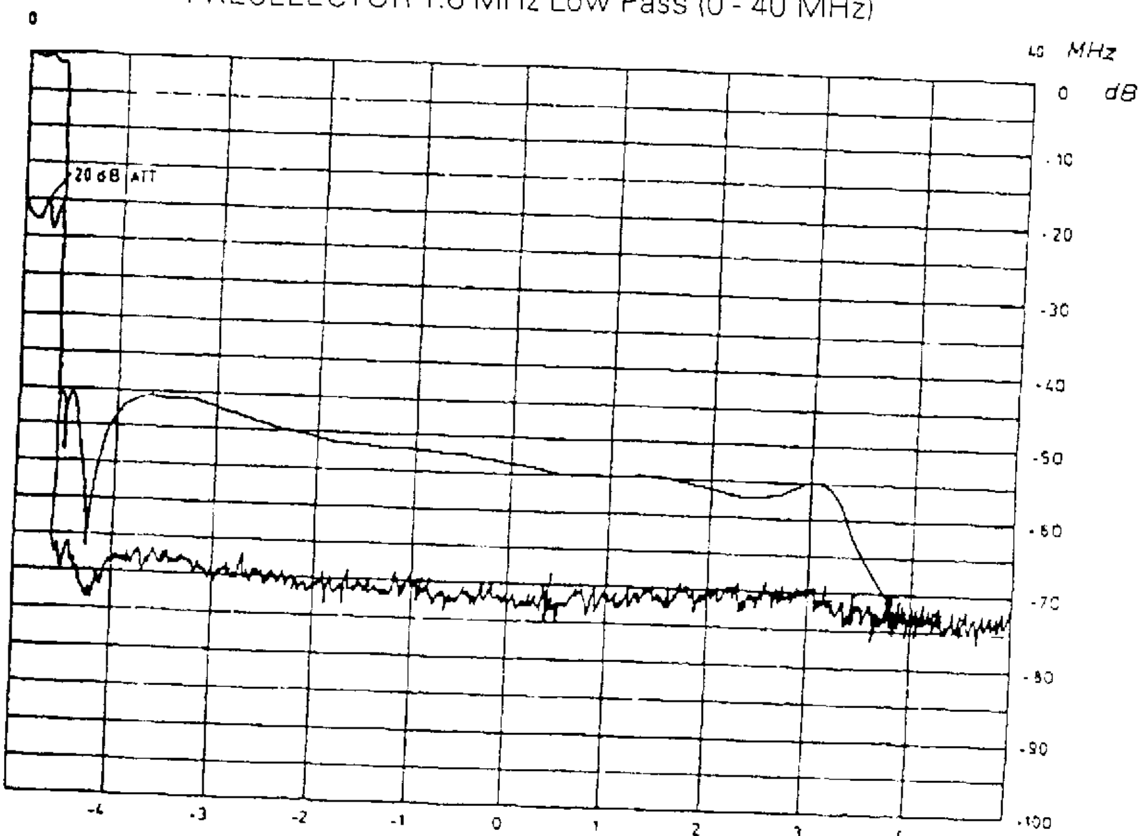


-Preselector-

PRESELECTOR 1.6 MHz Low Pass (0.6 - 2.6 MHz)

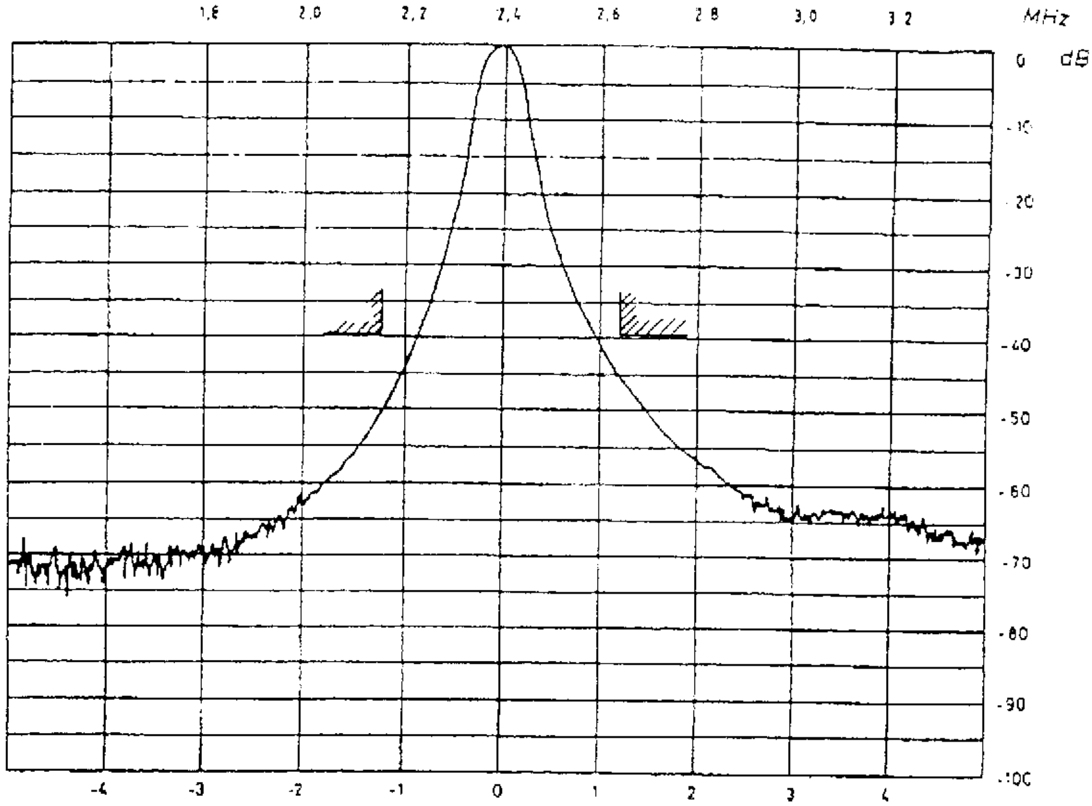


PRESELECTOR 1.6 MHz Low Pass (0 - 40 MHz)

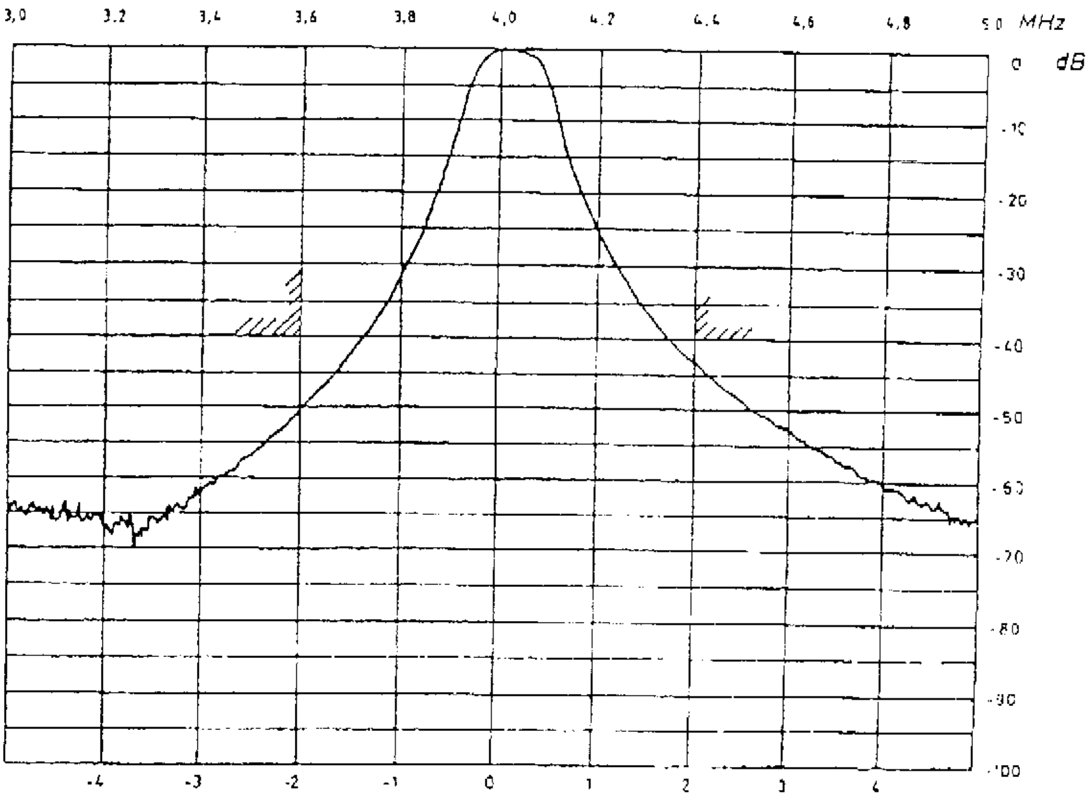


-Preselector-

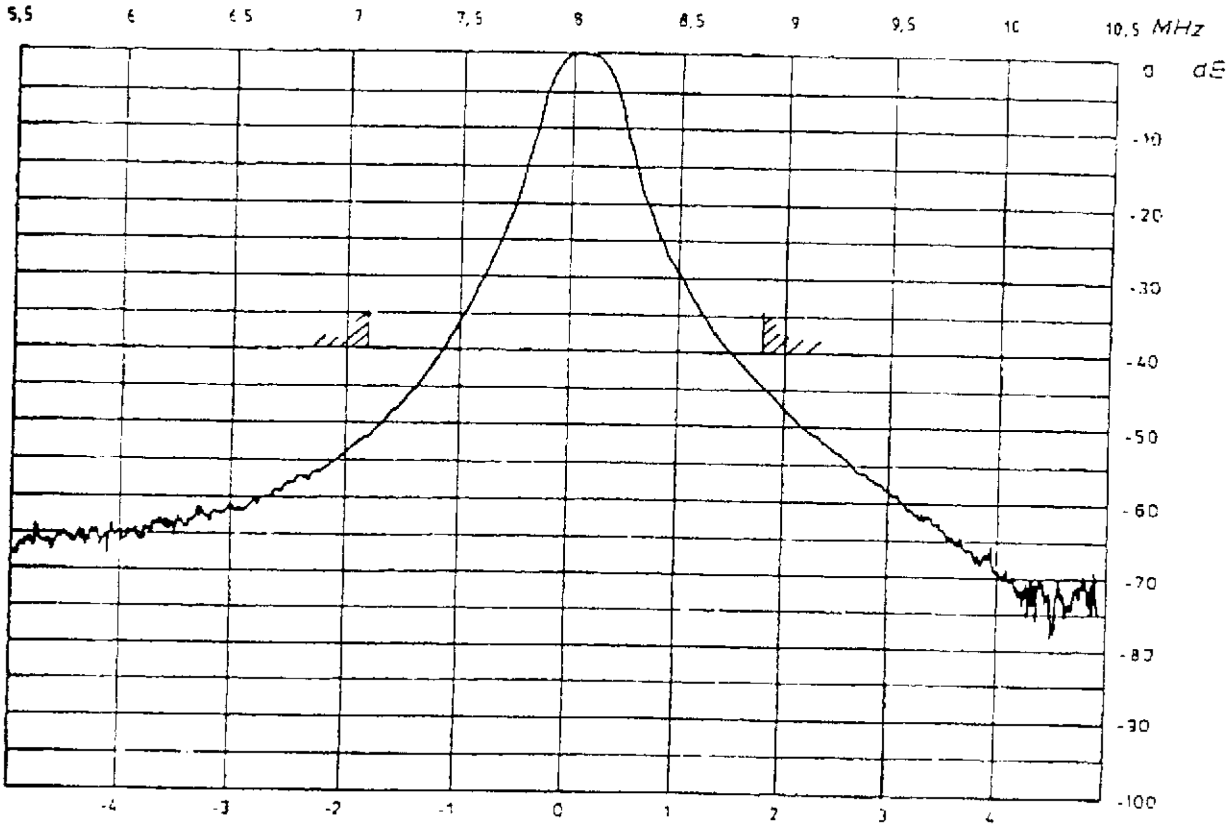
PRESELECTOR 2.4 MHz Insertion Loss 5.5 dB



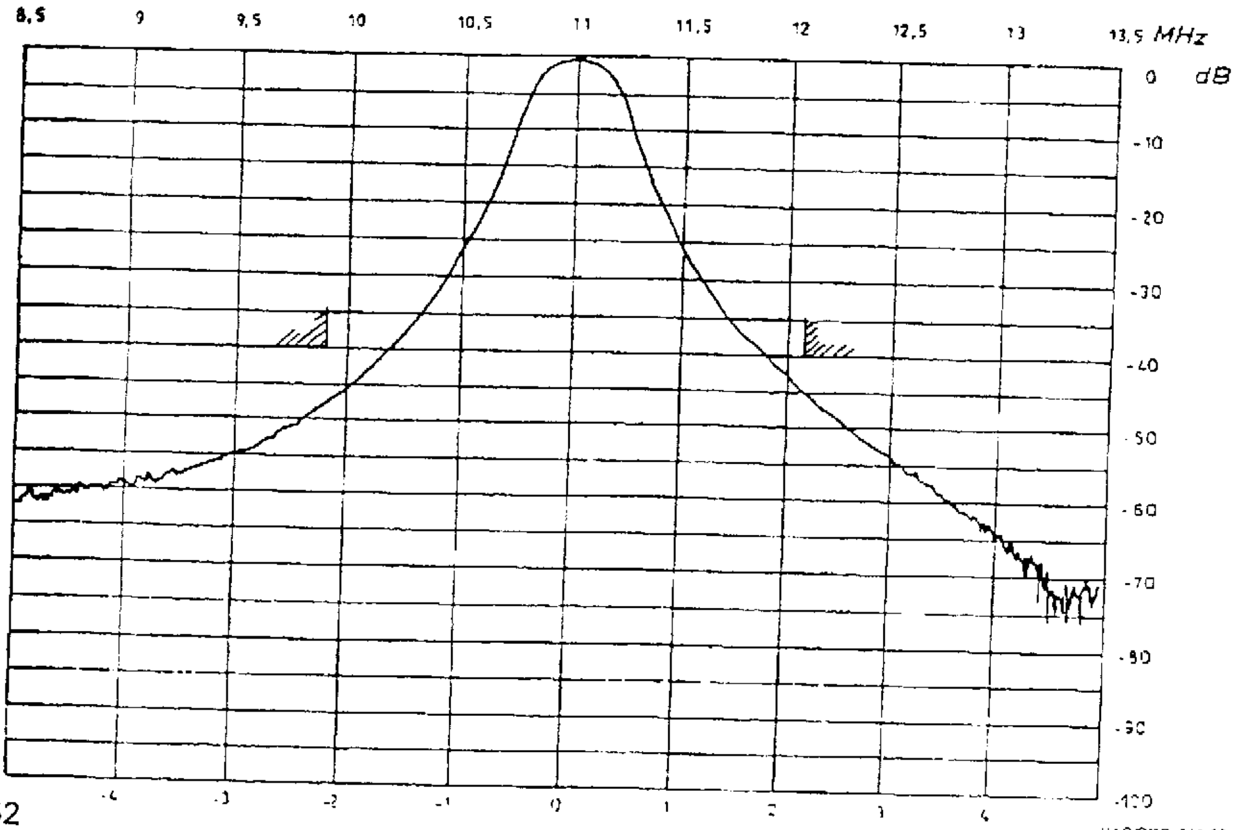
PRESELECTOR 4.0 MHz Insertion Loss 4.7 dB



PRESELECTOR 8 MHz Insertion Loss 6 dB



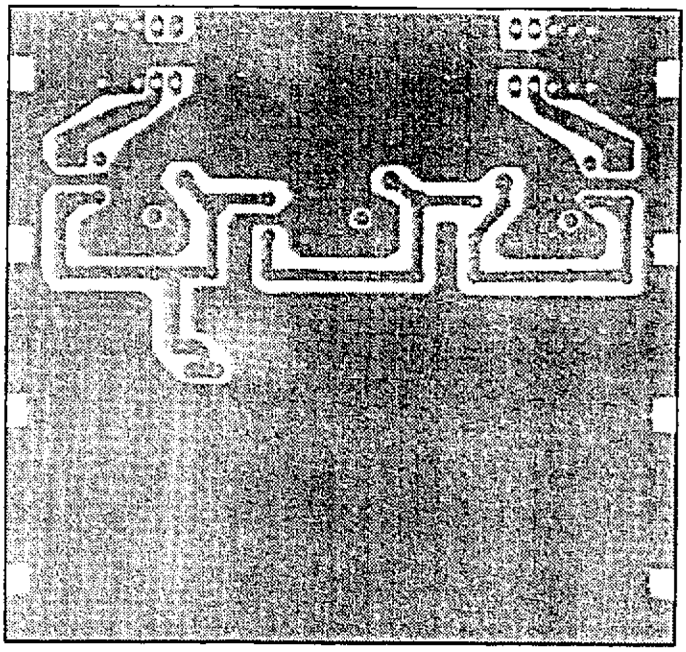
PRESELECTOR 11 MHz Insertion Loss 6.3 dB

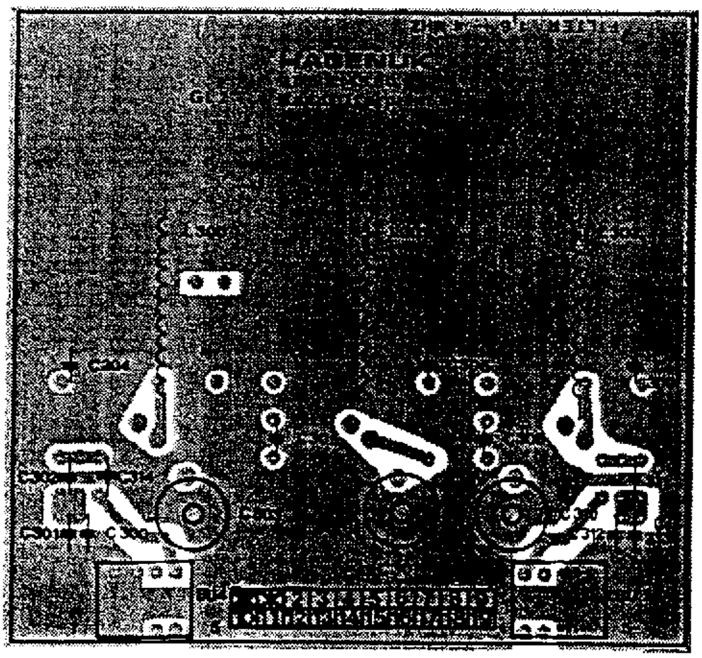


HAG/RCD 016 09 92

-Preselector-

see circuit diagram - PRESELECTOR 97 Sa B 2.140.150 B

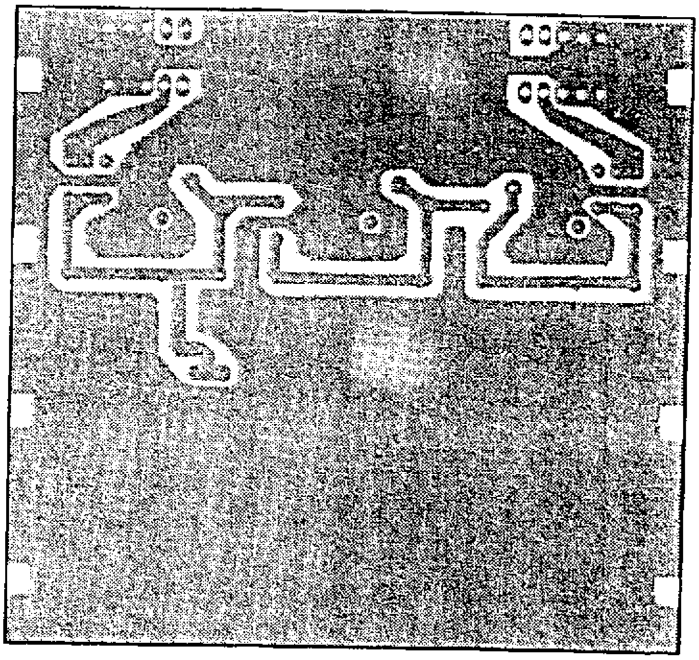


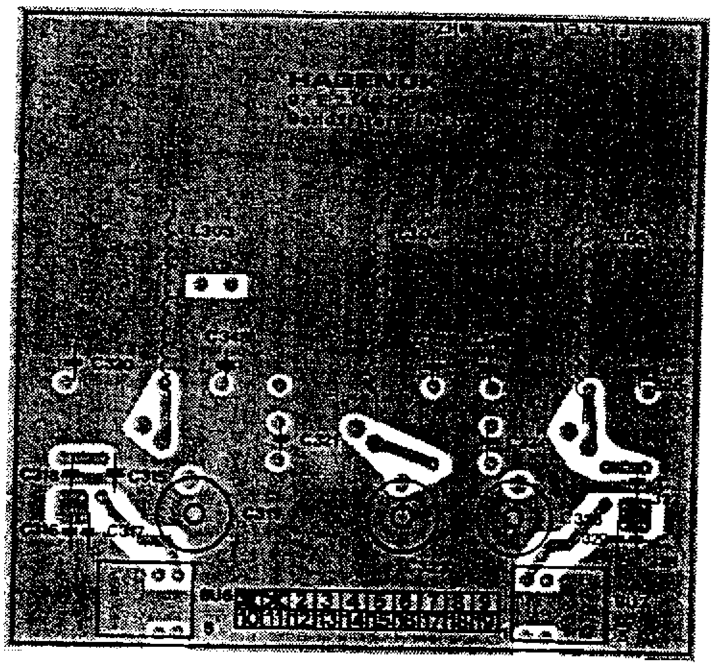


1.6-4 MHz Filter - 97 E 2.145.60-1

-Preselector-

see circuit diagram - PRESELECTOR 97 Sa B 2.140.150 B

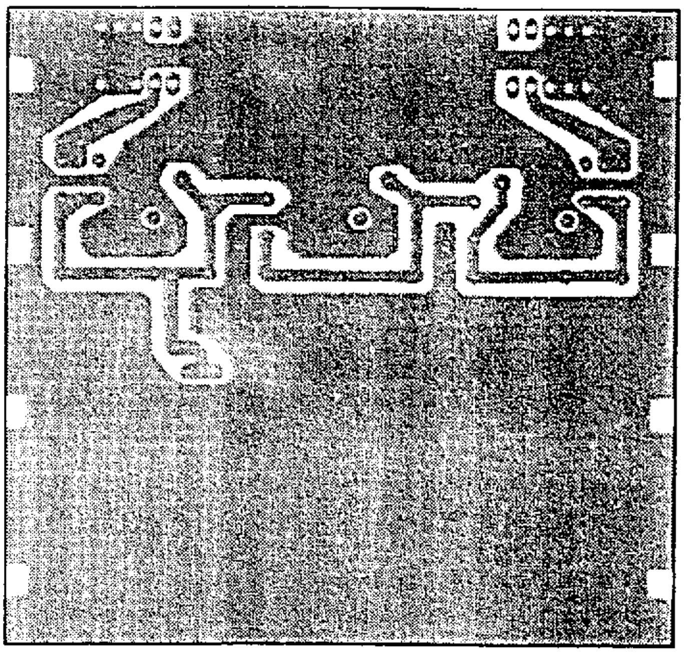


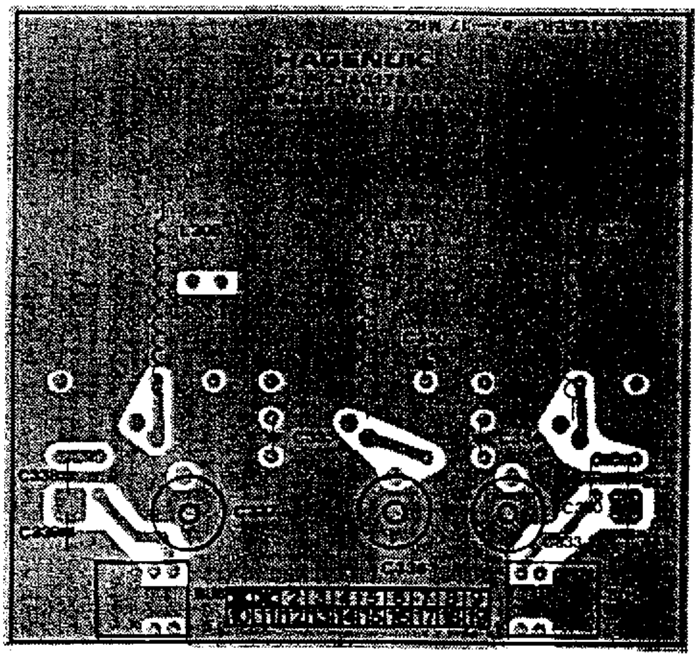


4-8 MHz Filter - 97 E 2.140.170

-Preselector-

see circuit diagram - PRESELECTOR 97 Sa B 2.140.150 B

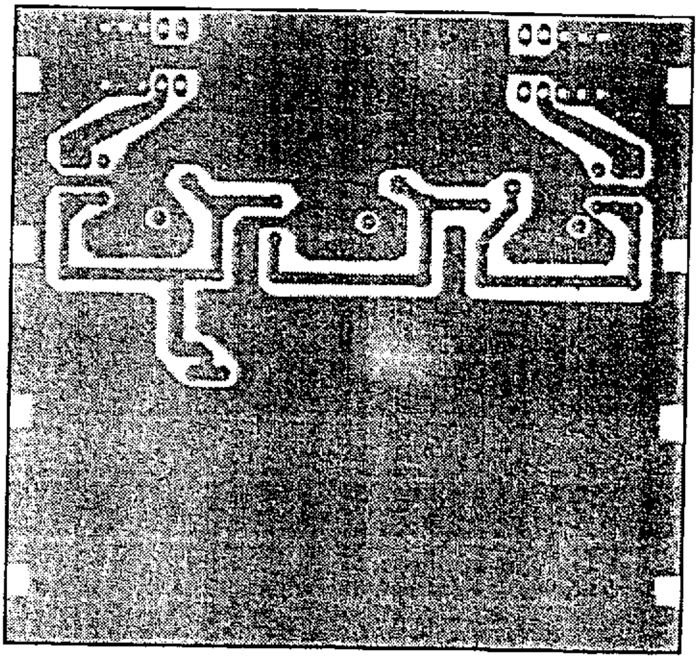


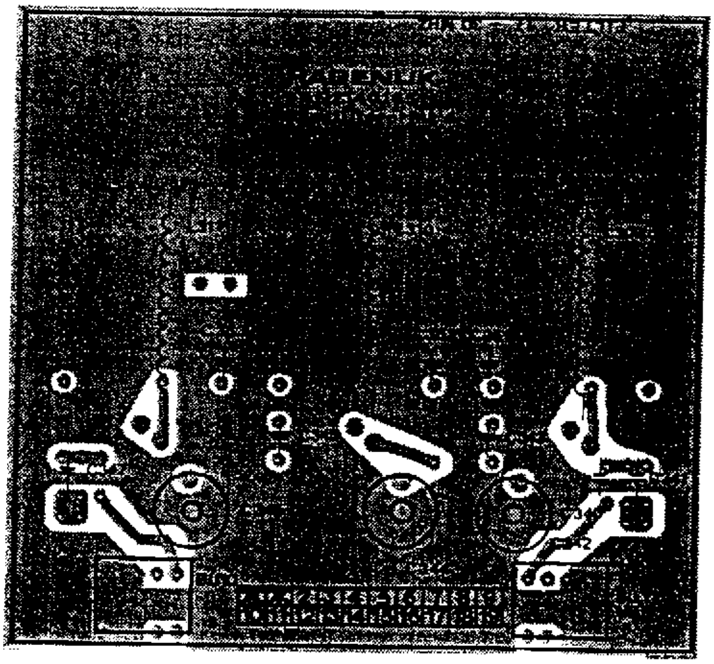


8-17 MHz Filter - 97 E 2.140.178

-Preselector-

see circuit diagram - PRESELECTOR 97 Sa B 2.140.150 B

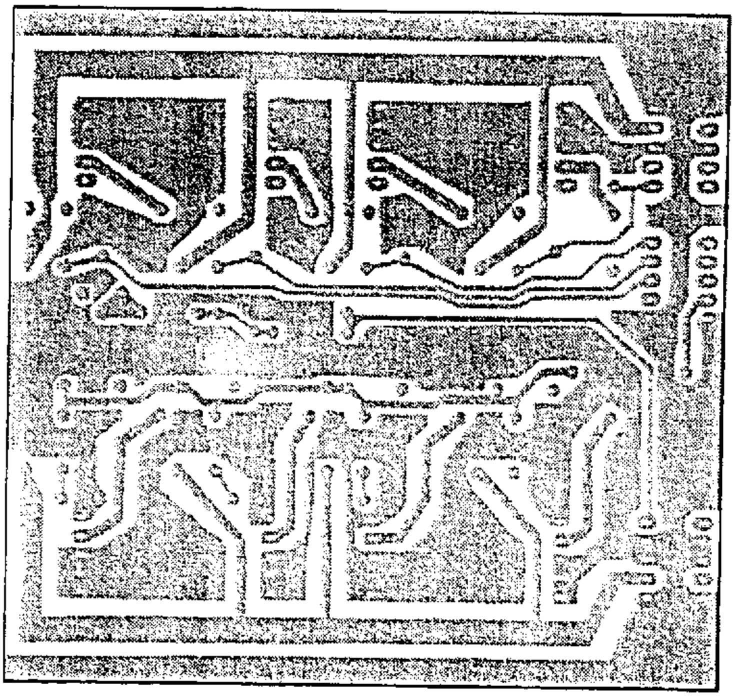


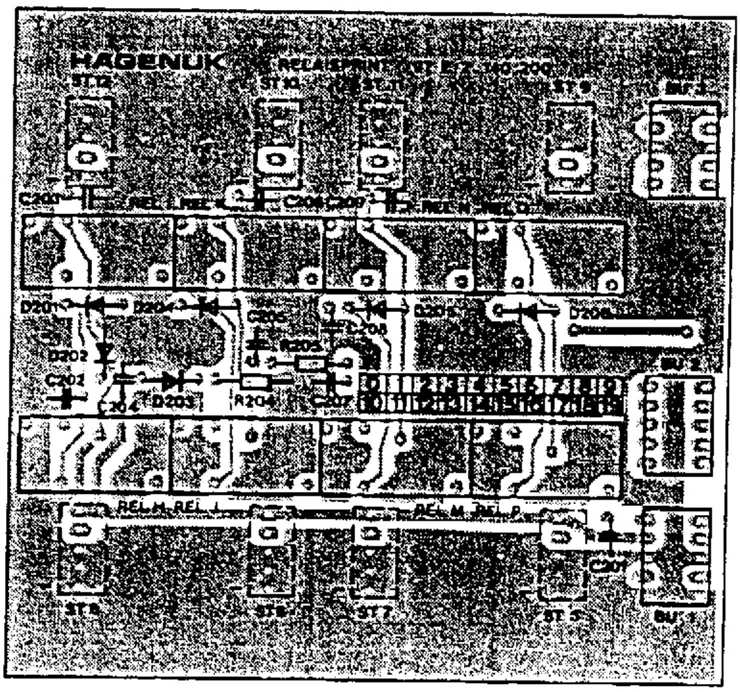


17-30 MHz Filter - 97 E 2.140.185

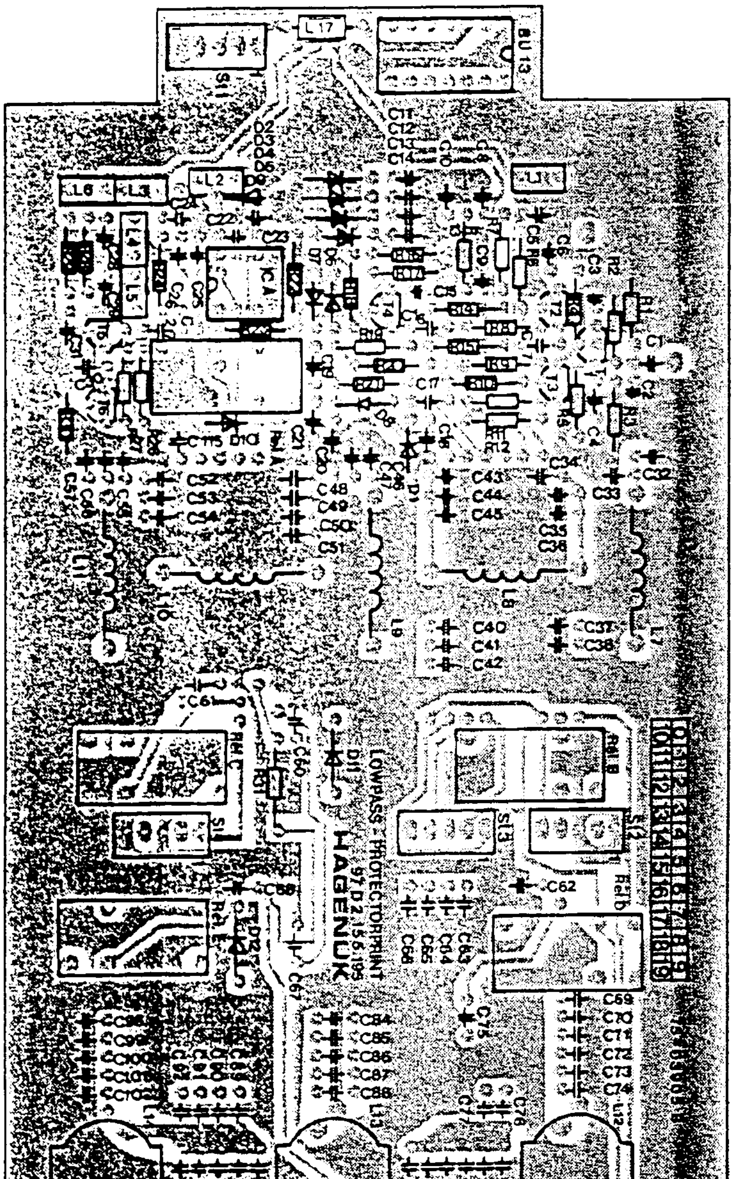
-Preselector-

see circuit diagram - PRESELECTOR 97 Sa B 2.140.150 B

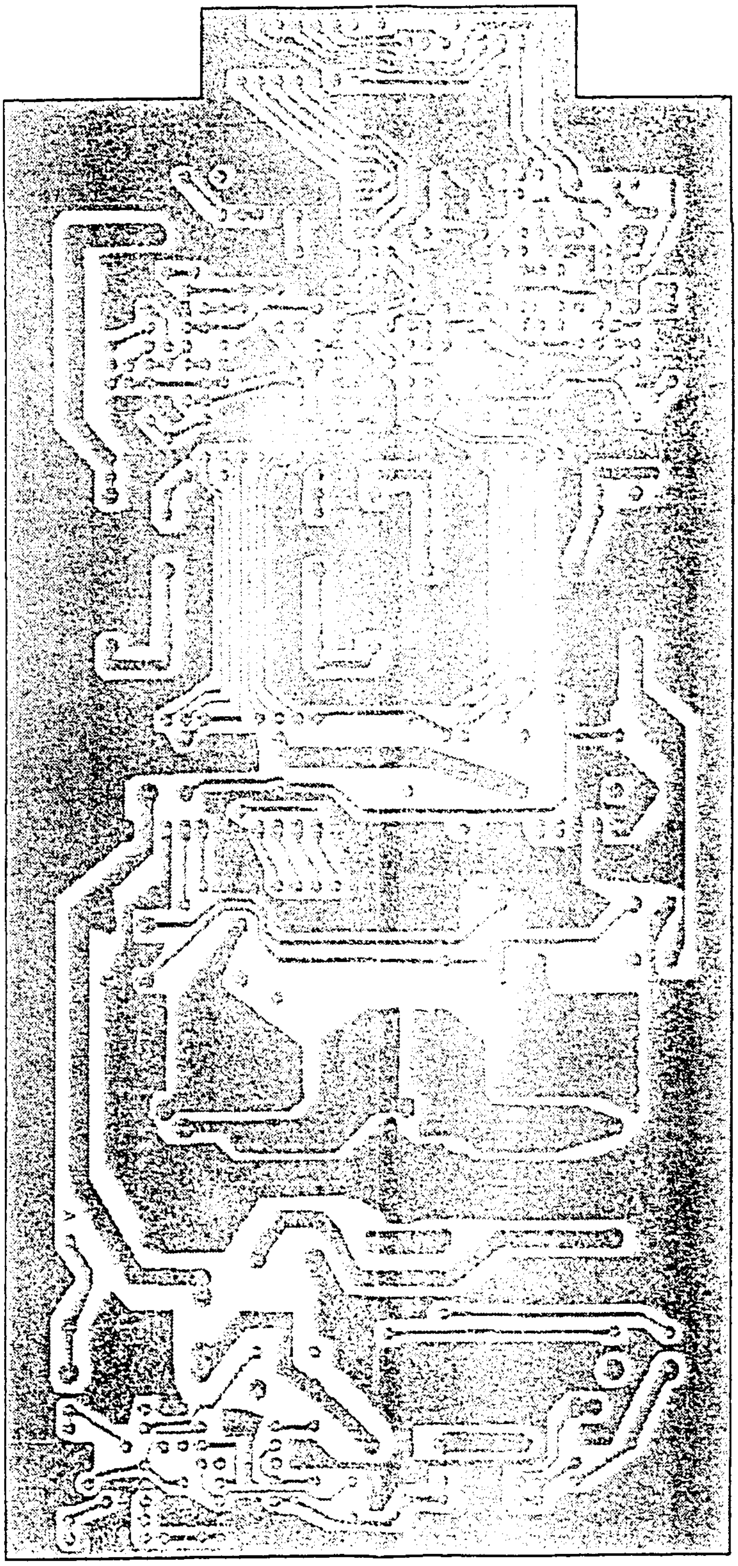




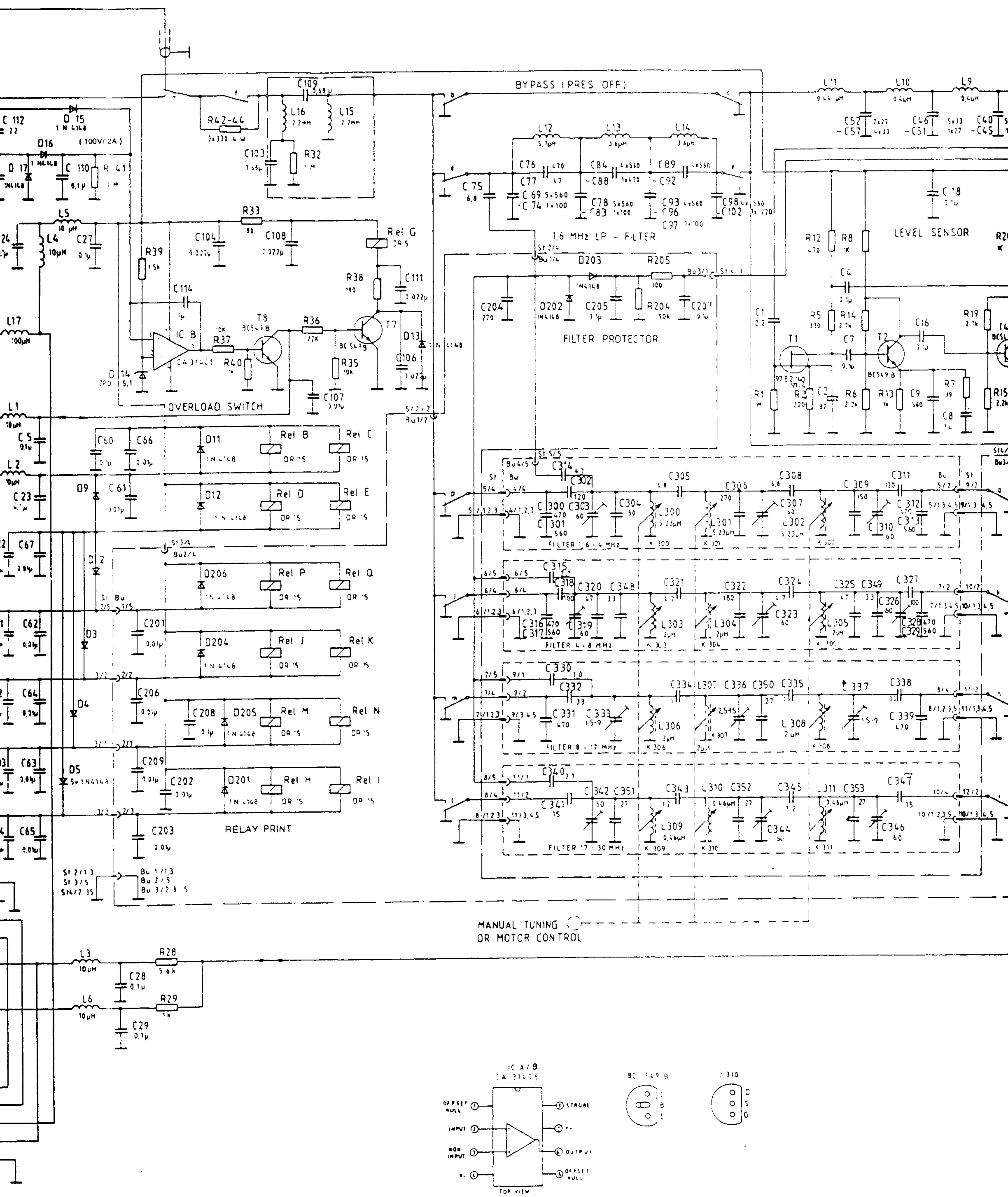
Relay Board - 97 E 2.140.200

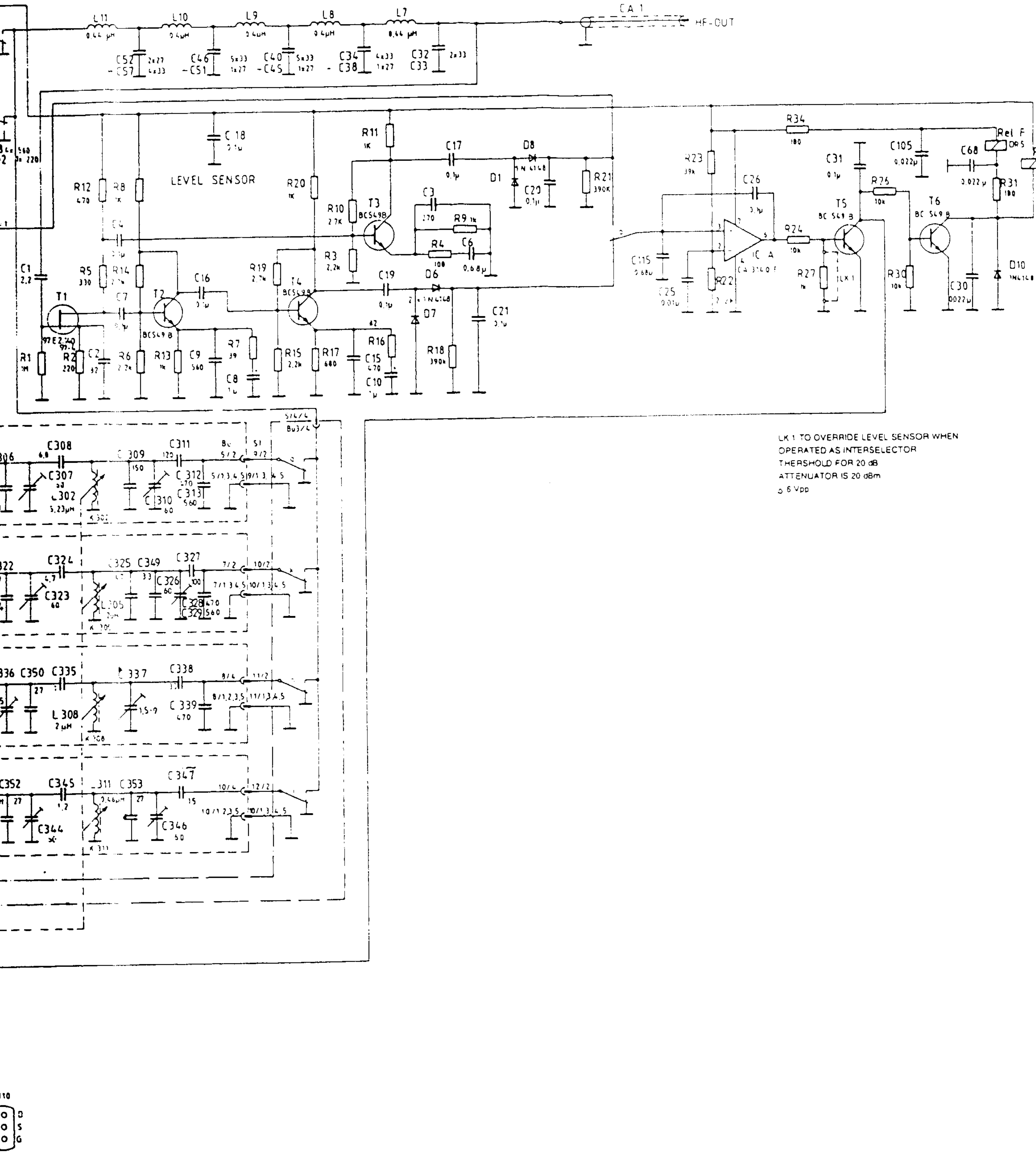

LOWPASS - PROTECTORPRINT
HAGENUK

see circuit diagram - PRESELECTOR 97 Sa B 2.140.150



Printed Circuit Board
LP-Protector
97 C 2.155.195


BYPASS (PRES OFF)
1,6 MHz LP - FILTER
FILTER PROTECTOR
LEVEL SENSOR
OVERLOAD SWITCH
RELAY PRINT
FILTER 1,6 - 4 MHz
FILTER 4 - 8 MHz
FILTER 8 - 17 MHz
FILTER 17 - 30 MHz
MANUAL TUNING
OR MOTOR CONTROL
IC A/B
CA 3140E
OFFSET NULL
INPUT
NON INPUT
V-
STROBE
V+
OUTPUT
OFFSET NULL
TOP VIEW
BC 549 B



PRESELECTOR
Circuit Diagram
97 Sa B 2.140.150 B

-Preselector- Automatic/Manual

Parts lists No
97 Sa 2 140.150 B

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Capacitors				
1521.691	C1	2,2 pF/2 %/500 V	EDPU 222265010228	VALVO
1116.231	C2	82 pF/2 %/63 V	EDPU DIN 41923	VALVO
1157.108	C3	270 pF/2 %/63 V	EDPU N 750-IB	VALVO
1423.037	C4	0,1 µ/20 %/63 V	MKS 2	WIMA
1505.629	C6	0,68 µ/10 %/50 V	MKS 2	WIMA
1423.037	C7	0,1 µ/20 %/63 V	MKS 2	WIMA
1453.173	C8	1 µ/20 %/25 V	SAL 122	VALVO
1115.804	C9	560 pF/2 %/63 V	EDPU N 1500	VALVO
1453.173	C10	1 µF/20 %/25 V	SAL 122	VALVO
	C11	0,1 µ/50 V	CK 05 BX 104 K	
	C12	0,1 µ/50 V	CK 05 BX 104 K	
	C13	0,1 µ/50 V	CK 05 BX 104 K	
	C14	0,1 µ/50 V	CK 05 BX 104 K	
0945.757	C15	470 pF/10 %/63 V	EDPU 0,6 N 1500	VALVO
1423.037	C16	0,1 µ/20 %/63 V	MKS 2	WIMA
1423.037	C17	0,1 µ/20 %/63 V	MKS 2	WIMA
1423.037	C18	0,1 µ/20 %/63 V	MKS 2	WIMA
1423.037	C19	0,1 µ/20 %/63 V	MKS 2	WIMA
1423.037	C20	0,1 µ/20 %/63 V	MKS 2	WIMA
1423.037	C21	0,1 µ/20 %/63 V	MKS 2	WIMA
1078.615	C22	0,1 µ/50 V	CK 05 BX 104 K	
1078.615	C23	0,1 µ/50 V	CK 05 BX 104 K	
1078.615	C24	0,1 µ/50 V	CK 05 BX 104 K	
1425.196	C25	0,01 µ/20 %/63 V	MKS 2 RM 5	WIMA
1423.037	C26	0,1 µ/20 %/63 V	MKS 2	WIMA
1078.615	C27	0,1 µ/50 V	CK 05 BX 104 K	
1078.615	C28	0,1 µ/50 V	CK 05 BX 104 K	
1078.615	C29	0,1 µ/50 V	CK 05 BX 104 K	
	C30	0,022 µ/20 %/63 V	MKS 2	WIMA
1423.037	C31	0,1 µ/20 %/63 V	MKS 2	WIMA
1425.145	C32	33 pF/2 %/500 V	EDPU 222265010339	VALVO
1425.145	C33	33 pF/2 %/500 V	EDPU 222265010339	VALVO
1425.145	C34	33 pF/2 %/500 V	EDPU 222265010339	VALVO
1425.145	C35	33 pF/2 %/500 V	EDPU 222265010339	VALVO
1425.145	C36	33 pF/2 %/500 V	EDPU 222265010339	VALVO
1425.145	C 37	33 pF/2 %/500 V	EDPU 222265010339	VALVO
	C38	27 pF/2 %/500 V	EDPU 222265010279	VALVO
1425.145	C40	33 pF/2 %/500 V	EDPU 222265010339	VALVO
1425.145	C41	33 pF/2 %/500 V	EDPU 222265010339	VALVO
1425.145	C42	33 pF/2 %/500 V	EDPU 222265010339	VALVO
1425.145	C43	33 pF/2 %/500 V	EDPU 222265010339	VALVO
1425.145	C44	33 pF/2 %/500 V	EDPU 222265010339	VALVO
	C45	27 pF/2 %/500 V	EDPU 222265010279	VALVO

-Preselector- Automatic/Manual

Parts lists No.
97 Sa 2.140.150 B

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1425.145	C46	33 pF/2 %/500 V	EDPU 222265010339	VALVO
1425.145	C47	33 pF/2 %/500 V	EDPU 222265010339	VALVO
1425.145	C48	33 pF/2 %/500 V	EDPU 222265010339	VALVO
1425.145	C49	33 pF/2 %/500 V	EDPU 222265010339	VALVO
1425.145	C50	33 pF/2 %/500 V	EDPU 222265010339	VALVO
	C51	27 pF/2 %/500 V	EDPU 222265010279	VALVO
	C52	27 pF/2 %/500 V	EDPU 222265010279	VALVO
	C53	27 pF/2 %/500 V	EDPU 222265010279	VALVO
1425.145	C54	33 pF/2 %/500 V	EDPU 222265010339	VALVO
1425.145	C55	33 pF/2 %/500 V	EDPU 222265010339	VALVO
1425.145	C56	33 pF/2 %/500 V	EDPU 222265010339	VALVO
1425.145	C57	33 pF/2 %/500 V	EDPU 222265010339	VALVO
1423.037	C60	0,1 µ/20 %/63 V	MKS 2	WIMA
1425.196	C61	0,01 µ/20 %/63 V	MKS 2	WIMA
1425,196	C62	0,01 µ/20 %/63 V	MKS 2	WIMA
1425.196	C63	0,01 µ/20 %/63 V	MKS 2	WIMA
1425.196	C64	0,01 µ/20 %/63 V	MKS 2	WIMA
1425.196	C65	0,01 µ/20 %/63 V	MKS 2	WIMA
1425.196	C66	0,01 µ/20 %/63 V	MKS 2	WIMA
1425.196	C67	0,01 µ/20 %/63 V	MKS 2	WIMA
	C68	0,022 µ/20 %/63 V	MKS 2	WIMA
	C69	560 pF/2 %/200 V	COG 8131A-200/001-COG-561 G	ERIE
	C70	560 pF/2 %/200 V	COG 8131A-200/001-COG-561 G	ERIE
	C71	560 pF/2 %/200 V	COG 8131A-200/001-COG-561 G	ERIE
	C72	560 pF/2 %/200 V	COG 8131A-200/001-COG-561 G	ERIE
	C73	560 pF/2 %/200 V	COG 8131A-200/001-COG-561 G	ERIE
	C74	100 pF/2 %/200 V	COG 8131A-200/001-COG-561 G	ERIE
	C75	6,8 pF/2 %/500 V	EDPU 222265010688	VALVO
	C76	470 pF/2 %/200 V	COG 8131A-200/001-COG-471 G	ERIE
	C77	47 pF/2 %/500 V	EDPU 222265010479	VALVO
	C78	560 pF/2 %/200 V	COG 8131A-200/001-COG-561 G	ERIE
	C79	560 pF/2 %/200 V	COG 8131A-200/001-COG-561 G	ERIE
	C80	560 pF/2 %/200 V	COG 8131A-200/001-COG-561 G	ERIE
	C81	560 pF/2 %/200 V	COG 8131A-200/001-COG-561 G	ERIE

dent-No.	Mark	Electr. value	Identity	Manufacturer
	C82	560 pF/2 %/200 V	COG 8131A-200/001-COG-561 G	ERIE
	C83	100 pF/2 %I200 V	COG 8131A-200/001-COG-101 G	ERIE
	C84	560 pF/2 %/200 V	COG 8131A-200/001-COG-561	ERIE
	C85	560 pF/2 %/200 V	COG 8131A-200/001-COG-561 G	ERIE
	C86	560 pF/2 %/200 V	COG 8131A-200/001-COG-561 G	ERIE
	C87	560 pF/2 %/200 V	COG 8131A-200/001-COG-561 G	ERIE
	C88	470pF/2%/200 V	COG 8131A-200/001-COG-471 G	ERIE
	C89	560pF/2%/200 V	COG 8131A-200/001-COG-561 G	ERIE
	C90	560pF/2%/200 V	COG 8131A-200/001-COG-561 G	ERIE
	C91	560 pF/2 %/200 V	COG 8131A-200/001-COG-561 G	ERIE
	C92	560 pF/2 %/200 V	COG 8131A-200/001-COG-561 G	ERIE
	C93	560 pF/2 %/200 V	COG 8131A-200/001-COG-561 G	ERIE
	C 94	560 pF/2 %/200 V	COG 8131A-200/001-COG-561 G	ERIE
	C95	560 pF/2 %/200 V	COG 8131A-200/001-COG-561 G	ERIE
	C96	560 pF/2 %/200 V	COG 8131A-200/001-COG-561 G	ERIE
	C97	100 pF/2%/200 V	COG 8131A-200/001-COG-101 G	ERIE
	C98	560 pF/2 %/200 V	COG 8131A-200/001-COG-561 G	ERIE
	C99	560 pF/2 %/200 V	COG 8131A-200/001-COG-561 G	ERIE
	C100	560pF/2%/200 V	COG 8131A-200/001-COG-561 G	ERIE
1521.586	C101	560 pF/2 %/200 V	COG 8131A-200/001-COG-561 G	ERIE
1521.683	C102	220 pF/2 %/200 V	COG 8131A-200/001-COG-221 G	ERIE
1179.225	C103	0,68 µF/5 %/100 V	B 32540-A1684 J	SIEMENS
1445.596	C104	0,022 µ/20 %/63 V	MKS 2	WIMA
1445.596	C105	0,022 µ/20 %/63 V	MKS 2	WIMA

-Preselector- Automatic/Manual

Parts lists No.
97 Sa 2.140.150 B

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1445.596	C106	0,022 µ/20 %/63 V	MKS 2	WIMA
1425.196	C107	0,01 µ/20 %/63 V	MKS 2	WIMA
1445.596	C108	0,022 µ/20 %/63 V	MKS 2	WIMA
1179.225	C109	0,68 µF/5 %/100 V	B 32540-A1684 J	SIEMENS
1423.037	C110	0,1 µ/20 %/63 V	MKS 2	WIMA
1445.596	C111	0,022 µ/20 %/63 V	MKS 2	WIMA
1521.691	C112	2,2 pF/2 %/500 V	EDPU 222265010228	VALVO
1521.705	C113	100 pF/2 %/100 V	EDPU RM 5 2222638-10101	VALVO
1479.644	C114	1 µF/10 %/50 V	MKS 2	WIMA
1505.629	C115	0,68 µ/10 %/50 V	MKS 2	WIMA
1425.196	C201	0,01 µ/20 %/63 V	MKS 2	WIMA
1425.196	C202	0,01 µ/20 %/63 V	MKS 2	WIMA
1425.196	C203	0,01 µ/20 %/63 V	MKS 2	WIMA
	C204	270 pF/2 %/200 V	COG 8131A-200/001-COG-271 G	ERIE
1423.037	C205	0,1 µ/20 %/63 V	MKS 2	WIMA
1425.196	C206	0,01 µ/20 %/63 V	MKS 2	WIMA
1423.037	C207	0,1 µ/20 %/63 V	MKS 2	WIMA
1423.037	C208	0,1 µ /20 %/63 V	MKS 2	WIMA
	C209	0,01 µ/20 %/63 V	MKS 2	WIMA
	C300	470 pF/2 %/200 V	COG 8131A-200/001-COG-471 G	ERIE
	C301	560 pF/2 %/200 V	COG 8131A-200/001-COG-561 G	ERIE
	C302	120 pF/2 %/500 V	4815F/120/2/500	JAHRE
	C303	4,5-60 pF/200 V	119.4901.060	DAU
	C304	150 pF/2 %/500 V	4815/F150/2/500	JAHRE
	C305	6,8 pF/2 %/500 V	EDPU 222265010688	VALVO
	C306	270 pF/2 %/500 V	4815F/270/2/500	JAHRE
	C307	4,5-60 pF/200 V	119.4901.060	DAU
	C308	6,8 pF/2 %/500 V	EDPU 222265010688	VALVO
	C309	150 pF/2 %/500 V	4815/F/150/2/500	JAHRE
	C310	4,5-60 pF/200 V	119.4901.060	DAU
	C311	120 pF/2 %/500 V	4815/F/120/2/500	JAHRE
	C312	470 pF/2 %/200 V	COG 8131A-200/001-COG-471 C	ERIE
	C313	560 pF/2 %/200 V	COG 8131A-200/001-COG-561 C	ERIE
	C314	4,7 pF/2 %/500 V	EDPU 222265010478	VALVO
	C315	2,7 pF/2 %/500 V	EDPU 222265010278	VALVO
1521.578	C316	470 pF/2 %/200 V	COG 8131A-200/001-COG-471 G	ERIE

-Preselector- Automatic/Manual

Parts lists No.
97 Sa 2.140.150 B

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1521.586	C317	560 pF/2 %/200 V COG-561 G	COG 8131A-200/001-	ERIE
1521.594	C318	100 pF/2 %/500 V	4815/F/100/2/500	JAHRE
1521.543	C319	4,5-60 pF/200 V	119.4901.060	DAU
1521.527	C320	47 pF/2 %/500 V	EDPU 222265010479	VALVO
1425.188	C321	4,7 pF/2 %/500 V	EDPU 222265010478	VALVO
1521.616	C322	180 pF/2 %/500 V	4815/F/180/2/500	JAHRE
1521.543	C323	4,5-60 pF/200 V	119.4901.060	DAU
1521.188	C324	4,7 pF/2 %/500 V	EDPU 222265010478	VALVO
1521.527	C325	47 pF/2 %/500 V	EDPU 222265010479	VALVO
1521.543	C326	4,5-60 pF/200 V	119.4901.060	DAU
1521.594	C327	100 pF/2 %/500 V	4815/F/100/2/500	JAHRE
1521.578	C328	470 pF/2 %/200 V	COG 8131A-200/001- COG-471 G	ERIE
1521.586	C329	560 pF/2 %/200 V	COG 8131A-200/001- COG-561 G	ERIE
1521.519	C330	1,0 pF/2 %/500 V	EDPU 222265010108	VALVO
1521.578	C331	470 pF/2 %/200 V	COG 8131A-200/001- COG-471 G	ERIE
1425.145	C332	33 pF/2 %/500 V	EDPU 222265010339	VALVO
	C333	1,5 - 9 pF	Type 119.1901.009	DAU
1960.083	C334	1,8 pF/2 %/500 V	EDPU 222265009188	VALVO
1960.083	C335	1,8 pF/2 %/500 V	EDPU 222265009188	VALVO
	C336	2,5 - 15 pF	Type 119.1901.015	DAU
	C337	1,5 - 9 pF	Type 119.1901.009	DAU
1425.145	C338	33 pF/2 %/500 V	EDPU 222265010339	VALVO
1521.578	C339	470 pF/2 %/200 V	COG 8131A-200/001- COG-471 G	ERIE
1521.500	C340	2,7 pF/2 %/500 V	EDPU 222265010278	VALVO
	C341	15 pF/2 %/500 V	EDPU 222265010159	VALVO
	C342	4,5-60 pF/200 V	119.4901.060	DAU
	C343	1,2 pF/2 %/500 V	EDPU 222265010128	VALVO
	C344	4,5-60 pF/200 V	119.4901.060	DAU
	C345	1,2 pF/2 %/500 V	EDPU 222265010128	VALVO
	C346	4,5-60 pF/200 V	119.4901.060	DAU
	C347	15 pF/2 %/500 V	EDPU 222265010159	VALVO
1425.145	C348	33 pF/2 %/500 V	EDPU 222265010339	VALVO
1425.145	C349	33 pF/2 %/500 V	EDPU 222265010339	VALVO
	C350	27 pF/2 %/500 V	EDPU 222265010279	VALVO
	C351	27 pF/2 %/500 V	EDPU 222265010279	VALVO
	C352	27 pF/2 %/500 V	EDPU 222265010279	VALVO
	C353	27 pF/2 %/500 V	EDPU 222265010279	VALVO
1960.083	C356	1,8 pF/2 %/500 V	222265009188	VALVO
1960.083	C357	1,8 pF/2 %/500 V	222265009188	VALVO

Parts lists No.
97 Sa 2.140.150 B

-Preselector- Automatic/Manual

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Diodes:				
0745.677	D1		1 N 4148	ITT
0745.677	D2		1 N 4148	ITT
0745.677	D3		1 N 4148	ITT
0745.677	D4		1 N 4148	ITT
0745.677	D5		1 N 4148	ITT
0745.677	D6		1 N 4148	ITT
0745.677	D7		1 N 4148	ITT
0745.677	D8		1 N 4148	ITT
0745.677	D9		1 N 4148	ITT
0745.677	D10		1 N 4148	ITT
0745.677	D11		1 N 4148	ITT
0745.677	D12		1 N 4148	ITT
0745.677	D13		1 N 4148	ITT
0758.353	D14		ZPD 5,1	ITT
0745.677	D15		1 N 4148	ITT
0745.677	D16		1 N 4148	ITT
0745.677	D17		1 N 4148	ITT
0745.677	D201		1 N 4148	ITT
0745.677	D202		1 N 4148	ITT
0745.677	D203		1 N 4148	ITT
0745.677	D204		1 N 4148	ITT
0745.677	D205		1 N 4148	ITT
0745.677	D206		1 N 4148	ITT
Resistors:				
0542.946	R1	1 M/5 %/0207	DIN 44052	
0542.938	R2	220/5 %/0207	DIN 44052	
0744.808	R3	2,2 K/5 %/0207	DIN 44052	
0179.639	R4	100/5 %/0207	DIN 44052	
0744.859	R5	330/5 %/0207	DIN 44052	
0744.808	R6	2,2 K/5 %/0207	DIN 44052	
0744.824	R7	39/5 %/0207	DIN 44052	
0179.698	R8	1 K/5 %/0207	DIN 44052	
0179.698	R9	1 K/5 %/0207	DIN 44052	
0745.820	R10	2,7 K/5 %/0207	DIN 44052	
0179.698	R11	1 K/5 %/0207	DIN 44052	
0554.898	R12	470/5 %/0207	DIN 44052	
0179.698	R13	1 K/5 %/0207	DIN 44052	
0745.820	R14	2,7 K/5 %/0207	DIN 44052	
0744.808	R15	2,2 K/5 %/0207	DIN 44052	

-Preselector- Automatic/Manual

Parts Lists No.
97 Sa 2.140.150 B

Ident-No.	Mark	Electr. value	Identity	Manufacturer
0744.913	R16	82/5 %/0207	DIN 44052	
0698.172	R17	680/5 %/0207	DIN 44052	
0542.806	R18	390 K/5 %/0207	DIN 44052	
0745.820	R19	2,7 K/5 %/0207	DIN 44052	
0179.698	R20	1 K/5 %/0207	DIN 44052	
0542.806	R21	390 K/5 %/0207	DIN 44052	
0744.808	R22	2,2 K/5 %/0207	DIN 44052	
0799.300	R23	39 K/5 %/0207	DIN 44052	
0179.701	R24	10 K/5 %/0207	DIN 44052	
0179.701	R26	10 K/5 %/0207	DIN 44052	
0179.698	R27	1 K/5 %/0207	DIN 44052	
0744.840	R28	5,6 K/5 %/0207	DIN 44052	
0179.698	R29	1 K/5 %/0207	DIN 44052	
0179.701	R30	10 K/5 %/0207	DIN 44052	
0744.883	R31	180/5 %/0207	DIN 44052	
0542.946	R32	1 M/5 %/0207	DIN 44052	
0744.883	R33	180/5 %/0207	DIN 44052	
0744.883	R34	180/5 %/0207	DIN 44052	
0179.701	R35	10 K/5 %/0207	DIN 44052	
0767.204	R36	22 K/5 %/0207	DIN 44052	
0179.701	R37	10 K/5 %/0207	DIN 44052	
0744.883	R38	180/5 %/0207	DIN 44052	
0480.444	R39	1,5 K/5 %/0207	DIN 44052	
0179.698	R40	1 K/5 %/0207	DIN 44052	
0542.946	R41	1 M/5 %/0207	DIN 44052	
1084.461	R42	330 Ohm/5 %/4 W	SXA-0922	DRALORIC
1084.461	R43	330 Ohm/5 %/4 W	SXA-0922	DRALORIC
1084.461	R44	330 Ohm/5 %/4 W	SXA-0922	DRALORIC
0799.408	R45	47 Ohm/5 %/0414	DIN 44052	
0542.806	R204	390 K/5 %/0207	DIN 44052	
0179.639	R205	100 Ohm/5 %/0207	DIN 44052	

Coils:

1500.678	L1	10 µH ± 5 %	Best.-Nr. Sd7500612200	NEOSID
1500.678	L2	10 µH ± 5 %	Best.-Nr. Sd7500612200	NEOSID
1500.678	L3	10 µH ± 5 %	Best.-Nr. Sd7500612200	NEOSID
1500.678	L4	10 µH ± 5 %	Best.-Nr. Sd7500612200	NEOSID
1500.678	L5	10 µH ± 5 %	Best.-Nr. Sd7500612200	NEOSID
1500.678	L6	10 µH ± 5 %	Best.-Nr. Sd7500612200	NEOSID
1526.065	L7	0,44 µH	97 E 2.140.195-8	HAGENUK
1425.129	L8	0,4 µH	97 E 2.140.97-3	HAGENUK
1425.129	L9	0,4 µH	97 E 2.140.97-3	HAGENUK

Parts lists No.
97 Sa 2.140.150 B

-Preselector- Automatic/Manual

Ident-No	Mark	Electr. value	Identity	Manufacturer
1425.129	L10	0,4 µH	97 E 2.140.97-3	HAGENUK
1526.065	L11	0,44 µH	97 E 2.140.195-8	HAGENUK
1521.160	L12	5,7 µH	97 E 2.140.197	HAGENUK
1521.179	L13	3,6 µH	97 E 2.140.198	HAGENUK
1521.187	L14	3,6 µH	97 E 2.140.199	HAGENUK
1116.312	L15	2,2 mH	Nr. 2500-44	AMPHENOL
1116.312	L16	2,2 mH	Nr. 2500-44	AMPHENOL
1929.879	L17	100 µH 5 %	Best.-Nr. 78108-S1104-J	SIEMENS
1521.012	L 300	1,6-4 MHz 5,23 µH	97 E 2.140.168	HAGENUK
1521.012	L 301	1,6-4 MHz 5,23 µH	97 E 2.140.168	HAGENUK
1521.012	L302	1,6-4 MHz 5,23 µH	97 E 2.140.168	HAGENUK
1521.063	L303	4-8 MHz, 8-17 MHz 2 µH	97 E 2.140.172	HAGENUK
1521.063	L304	4-8 MHz, 8-17 MHz 2 µH	97 E 2.140.172	HAGENUK
1521.063	L305	4-8 MHz, 8-17 MHz 2 µH	97 E 2.140.172	HAGENUK
1521.063	L306	4-8 MHz, 8-17 MHz 2 µH	97 E 2.140.172	HAGENUK
1521.063	L307	4-8 MHz, 8-17 MHz 2 µH	97 E 2.140.172	HAGENUK
	L308	4-8 MHz, 8-17 MHz 2 µH	97 E 2.140.172	HAGENUK
	L309	17-30 MHz 0,46 µH	97 E 2.140.187	HAGENUK
	L310	17-30 MHz 0,46 µH	97 E 2.140.187	HAGENUK
	L311	17-30 MHz 0,46 µH	97 E 2.140.187	HAGENUK

Integrated circuits:

1300.326	IC A		CA 3140 E	RCA
	IC B		CA 3140 E	RCA

Transistors:

1425.137	T1		J 310	SILICONIX
1291.033	T2		BC 549 B	THOMSEN
1291.033	T3		BC 549 B	THOMSEN
1291.033	T4		BC 549 B	THOMSEN
1291.033	T5		BC 549 B	THOMSEN
1291.033	T6		BC 549 B	THOMSEN
1291.033	T7		BC 549 B	THOMSEN
1291.033	T8		BC 549 B	THOMSEN

-Preselector- Automatic/Manual

Parts lists No.
97 Sa 2.140.150 B

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Connectors:				
	Bu1	5-pins	Best.-Nr. 316-80105	ODU KON.
	Bu2	5-pins	Best.-Nr. 316-80105	ODU KON.
	Bu3	5-pins	Best.-Nr. 316-80105	ODU KON.
	Bu4	5-pins	Best.-Nr. 316-80105	ODU KON.
	Bu5	5-pins	Best.-Nr. 316-80105	ODU KON.
	Bu6	5-pins	Best.-Nr. 316-80105	ODU KON.
	Bu7	5-pins	Best.-Nr. 316-80105	ODU KON.
	Bu8	5-pins	Best.-Nr. 316-80105	ODU KON.
	Bu9	5-pins	Best.-Nr. 316-80105	ODU KON.
	Bu10	5-pins	Best.-Nr. 316-80105	ODU KON.
	Bu11	5-pins	Best.-Nr. 316-80105	ODU KON.
	Bu12		UG 58 A/U R 161404	RADIALL
1189.735	Bu13		DIL B 14-P 108	BURNDY
	St1	5-pins	Best.-Nr. 310-70105	ODU-Kontakt
	St2	5-pins	Best.-Nr. 310-70105	ODU-Kontakt
	St3	5-pins	Best.-Nr. 310-70105	ODU-Kontakt
	St4	5-pins	Best.-Nr. 310-70105	ODU-Kontakt
	St5	5-pins	Best.-Nr. 310-70105	ODU-Kontakt
	St6	5-pins	Best.-Nr. 310-70105	ODU-Kontakt
	St7	5-pins	Best.-Nr. 310-70105	ODU-Kontakt
	St8	5-pins	Best.-Nr. 310-70105	ODU-Kontakt
	St9	5-pins	Best.-Nr. 310-70105	ODU-Kontakt
	St10	5-pins	Best.-Nr. 310-70105	ODU-Kontakt
	St11	5-pins	Best.-Nr. 310-70105	ODU-Kontakt
	St12	5-pins	Best.-Nr. 310-70105	ODU-Kontakt
	St13		R 114553	RADIALL
Supplement:				
	GL1	S 1-A 230	Best.Nr.069-X801	SIEMENS
	CA1		97 E 2.140.202	HAGENUK
	K300	1,6-4 MHz, 4-8 MHz and 8-17 MHz range	97 E 2.140.153 B	HAGENUK
	K301	1,6-4 MHz, 4-8 MHz and 8-17 MHz range	97 E 2.140.153 B	HAGENUK
	K302	1,6-4 MHz, 4-8 MHz and 8-17 MHz range	97 E 2.140.153 B	HAGENUK

-**Preselector**- Automatic/Manual

Parts lists No.
97 Sa 2.140.150 B

Ident-No.	Mark	Electr. value	Identity	Manufacturer
	K303	1,6-4 MHz, 4-8 MHz and 8-17 MHz range	97 E 2.140.153 B	HAGENUK
	K304	1,6-4 MHz, 4-8 MHz and 8-17 MHz range	97 E 2.140.153 B	HAGENUK
	K305	1,6-4 MHz, 4-8 MHz and 8-17 MHz range	97 E 2.140.153 B	HAGENUK
	K306	1,6-4 MHz, 4-8 MHz and 8-17 MHz range	97 E 2.140.153 B	HAGENUK
	K307	1,6-4 MHz, 4-8 MHz and 8-17 MHz range	97 E 2.140.153 B	HAGENUK
	K308	1,6-4 MHz, 4-8 MHz and 8-17 MHz range	97 E 2.140.153 B	HAGENUK
	K309	17-30 MHz range	97 E 2.140.152	HAGENUK
	K310	17-30 MHz range	97 E 2.140.152	HAGENUK
	K311	17-30 MHz range	97 E 2.140.152	HAGENUK

Relays:

	Rel A	DR-15 V		SDS-ELEKTRO
	Rel B	DR-15 V		SDS-ELEKTRO
	Rel C	DR-15 V		SDS-ELEKTRO
	Rel D	DR-15 V		SDS-ELEKTRO
	Rel E	DR-15 V		SDS-ELEKTRO
	Rel F	DR-5 V		SDS-ELEKTRO
	Rel G	DR-5 V		SDS-ELEKTRO
	Rel H	DR-15 V		SDS-ELEKTRO
	Rel I	DR-15 V		SDS-ELEKTRO
	Rel J	DR-15 V		SDS-ELEKTRO
	Rel K	DR-15 V		SDS-ELEKTRO
	Rel L	DR- 15 V		SDS-ELEKTRO
	Rel M	DR-15 V		SDS-ELEKTRO
	Rel N	DR-15 V		SDS-ELEKTRO
	Rel O	DR-15 V		SDS-ELEKTRO
	Rel P	DR-15 V		SDS-ELEKTRO
	Rel Q	DR-15 V		SDS-ELEKTRO

Transformers:

	Tr1		97 E 2.140.196	HAGENUK

-Preselector- Automatic/Manual

Parts lists No.
97 Sa E 2.155.205

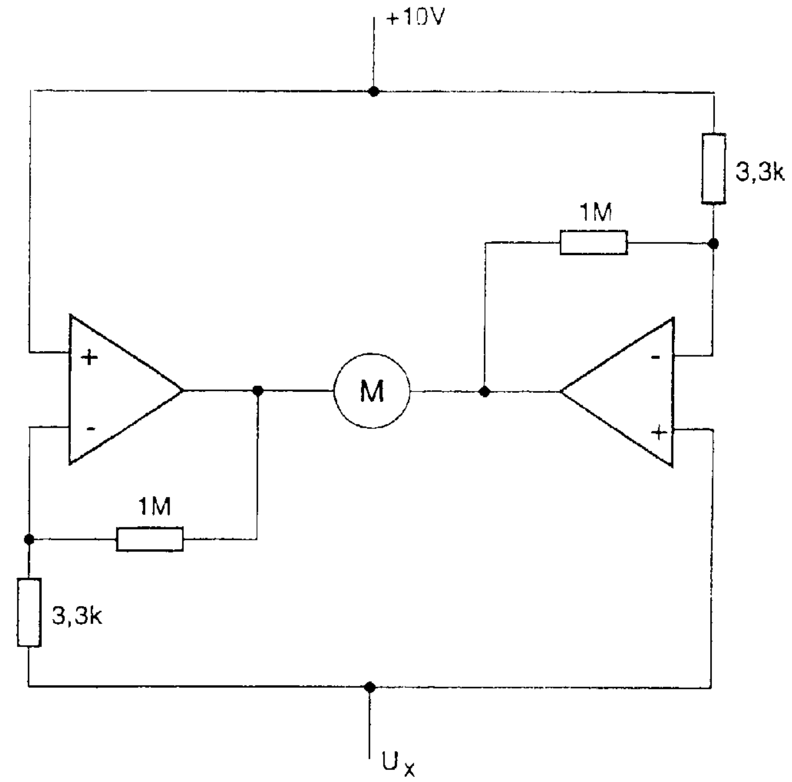
Ident-No.	Mark	Electr. value	Identity	Manufacturer
Capacitors:				
1423.304	C1	10 µF/25 V	222.122 90006	VALVO
1404.822	C2	0,1 µF/10 %/63 V	MKS 2	WIMA
1423.304	C3	10 µF/25 V	222 122 90006	VALVO
1078.585	C4	0,022 µF/40V	0,022/2/40 EDPU	VALVO
1400.568	C5	0,22 µF/63 V	MKS 2	WIMA
1423.304	C6	10 µF/25 V	2222 122 90006	VALVO
1404.822	C7	0,1 µF/10 %/63 V	MKS 2	WIMA
1078.585	C8	0,022 µF/40V	0,022/2/40 EDPU	VALVO
1479.644	C9	1 µF/50 V	MKS 2	WIMA
Diodes:				
0745.677	D1		1 N 4148	
0745.677	D2		1 N 4148	
0745.677	D3		1 N 4148	
Resistor:				
1521.241	R1	180K 0,1 % 1/8 W	DIN 44061	
1047.345	R2	3,3K 1 % 1/8 W	DIN 44061	
1047.345	R3	3,3K 1 % 1/8 W	DIN 44061	
1521.241	R4	180K 0,1 % 1/8 W	DIN 44061	
1047.345	R5	3,3K 1 % 1/8 W	DIN 44061	
1047.345	R6	3,3K 1 % 1/8 W	DIN 44061	
0542.946	R8	IM 5 % 1/8 W	DIN 44052	
	R9	5,6 25°C/25 %	Best-Nr. 2322662	VALVO
0626.708	R10	10 5 % 1/8 W	DIN 44052	
0542.946	R11	IM 5 % 1/8 W	DIN 44052	
	R12	5K/5 %/±0,25 %L	AL2410	MEGATRON
0179.701	R13	10K 5 % 1/8 W	DIN 44052	
0766.190	R14	100K/5 % 1/8 W	DIN 44052	
0767.190	R15	100K/5 %/0207	DINM 44052	
0179.701	R16	10K/5 %/0207	DIN 44052	
0542.946	R18	IM 5 % 1/8W	DIN 44052	
1521.241	R19	180K 0,1 % 1/8 W	DIN 44061	
0767.190	R20	100K/5 %/0207	DIN 44052	
0767.190	R21	100K/5 %/0207	DIN 44052	
0767.190	R22	100K/5 %/0207	DIN 44052	
0179.701	R23	10K/5 %/0207	DIN 44052	
0542.806	R24	390K/5 %/0207	DIN 44052	

Parts lists No.
97 Sa E 2.155.205

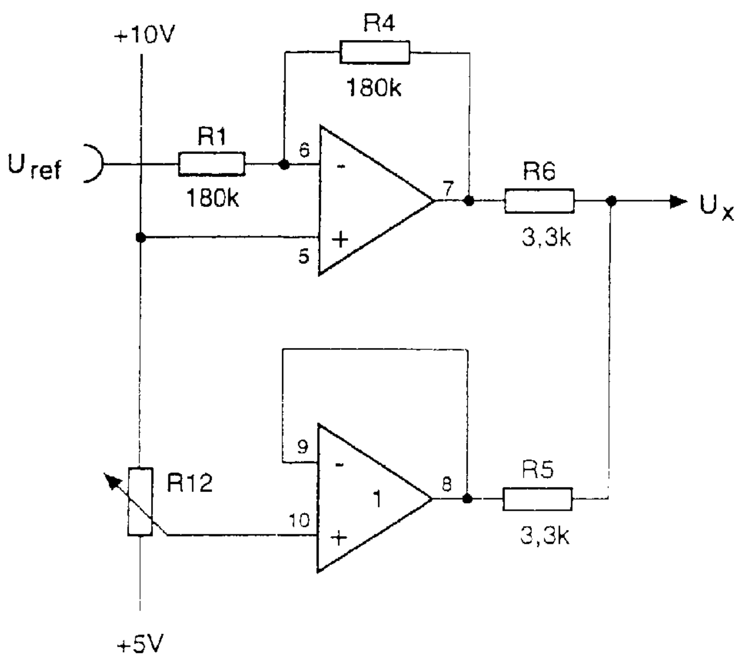
-**Preselector**- Automatic/Manual

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Integrated circuits:				
1427.172	IC A		LM 224	
1177.265	IC B		CA 741 CE	RCA
1630.180	IC C		ICL 7665 BCPA	INTERSIL
Transistors:				
1175.351	T1		BD 675	SIEMENS
1175.378	T2		BD 676	SIEMENS
1175.351	T3		BD 675	SIEMENS
1175.378	T4		BD 676	SIEMENS
1291.033	T5		BD 549 B	
Connectors:				
	Bu A	5-pins	Best-Nr. 316-80105	
1355.678	ST A	11-pins	2,5 MSF 11	LUMBERG
1295.667	ST B		RTM 12M630	BURKLIN
Supplements:				
1095.668	Rel.A	RG-16V		SDS
1186.574	Rel.B	RH-5V		NATIONAL
1118.226	GL 1	B80 C800		SES COSEM
	M	4.81	Best-Nr.2233R0126	FAULHABER

-Preselector-



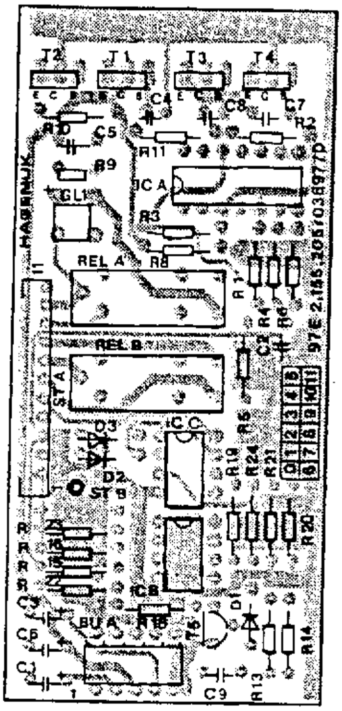
Motor control principle

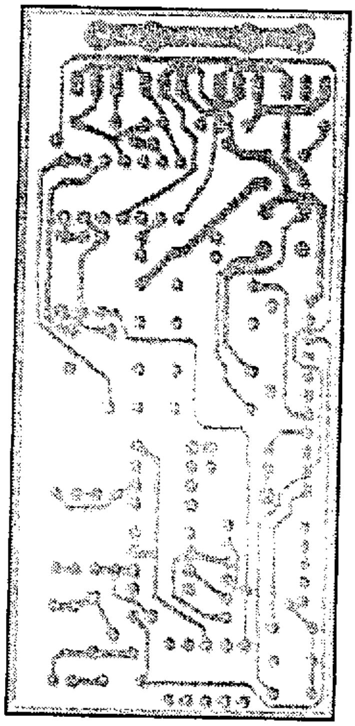


Voltage comparision principle

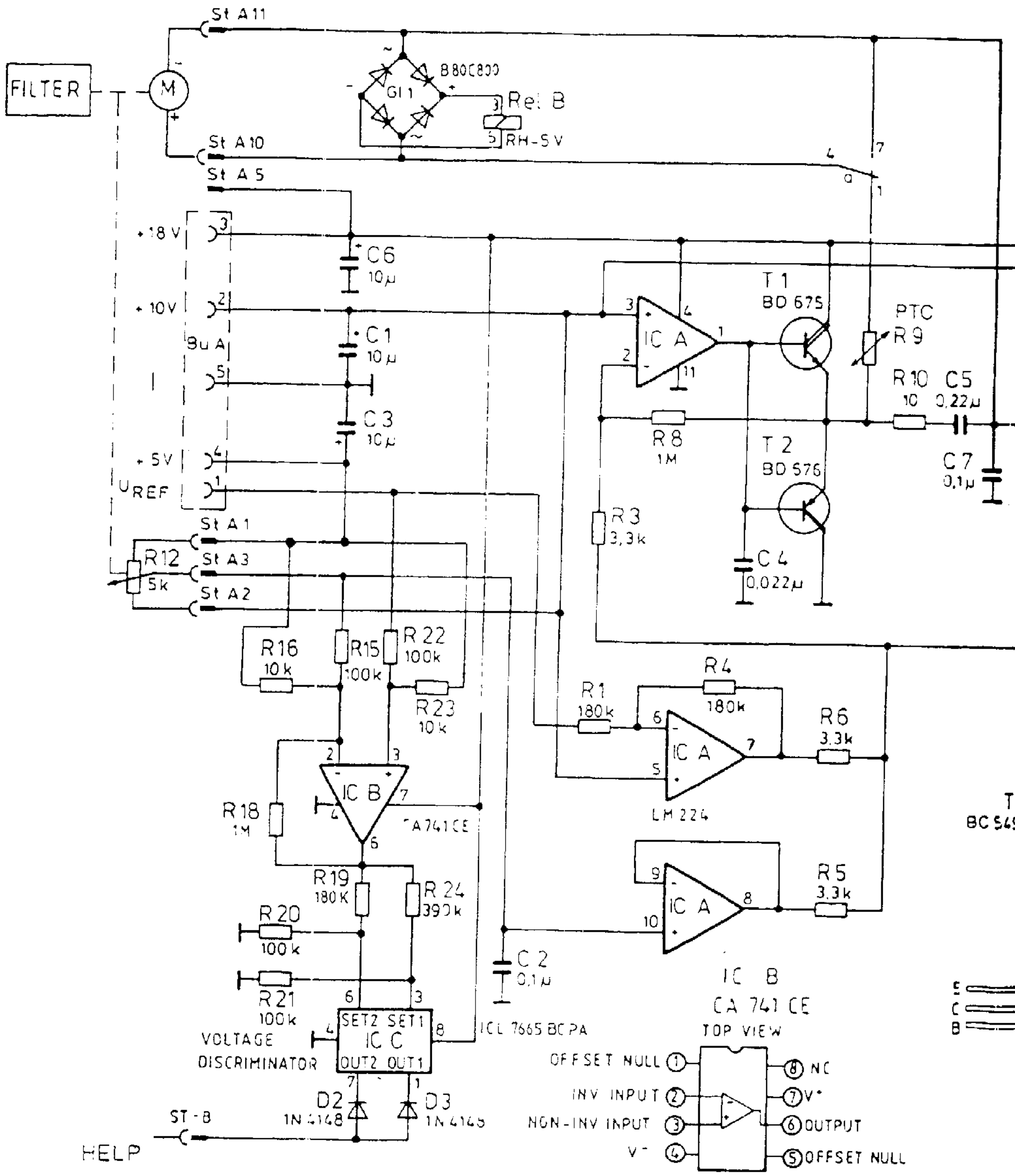
-Preselector-

see circuit diagram - MOTOR CONTROL 97 Sa E 2.155.205





Motor Control PCB - 97 E 2.155.205


FILTER
M
St A11
St A10
St A5
B80C800
Gl 1
Rel B
RH-5V
+18 V
+10 V
+5 V
U_{REF}
Bu A
C6 10µ
C1 10µ
C3 10µ
St A1
St A3
St A2
R12 5k
R16 10k
R15 100k
R22 100k
R23 10k
IC B
CA741CE
R18 1M
R19 180K
R24 390k
R20 100k
R21 100k
IC C
SET2 SET1
OUT2 OUT1
VOLTAGE DISCRIMINATOR
ICL 7665 BCPA
D2 1N4148
D3 1N4148
ST-B
HELP
IC A
T1 BD 675
T2 BD 676
PTC R9
R10 10
C5 0,22µ
C7 0,1µ
R8 1M
R3 3,3k
C4 0,022µ
R1 180k
R4 180k
R6 3,3k
LM 224
R5 3,3k
C2 0,1µ
IC B
CA 741 CE
TOP VIEW
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NON-INV INPUT
V⁻
NC
V⁺
OUTPUT
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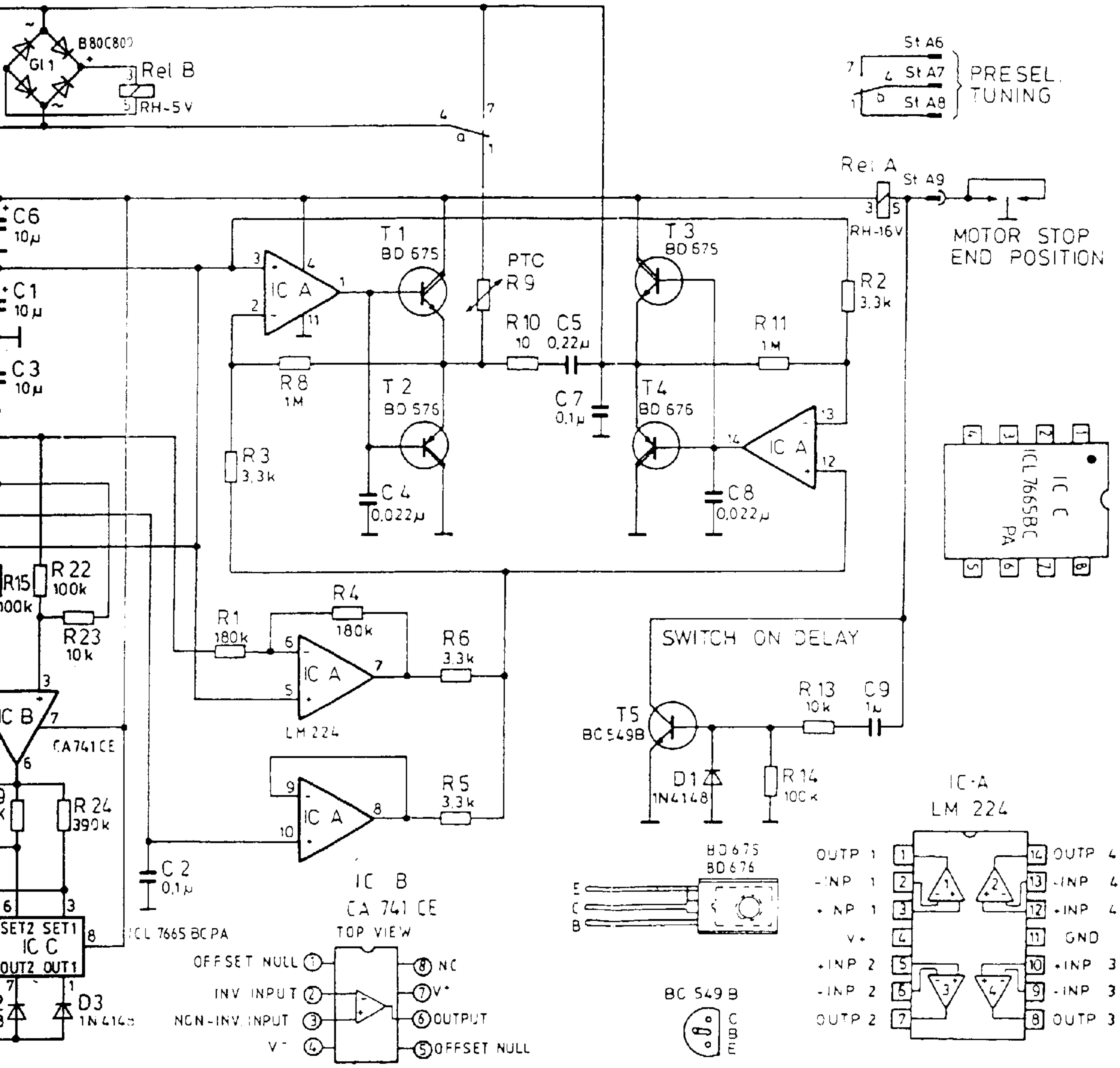
BC 54



MOTOR CONTROL
PRESELECTOR
Circuit Diagram
97 Sa E 2.155.205

Parts lists No.
97 Sa 2.155.205

-Preselector- Motor Control

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Capacitors:				
1423.304	C1	10 µF/25 V	222 122 90006	VALVO
1404.822	C2	0,1 µF/10 %/63 V	MKS 2	WIMA
1423.304	C3	10 µF/25 V	222 122 90006	VALVO
1078.585	C4	0,022 µF/40 V	0,022/2/40 EDPU	VALVO
1400.568	C5	0,22 µF/63 V	MKS 2	WIMA
1423.304	C6	10 µF/25 V	2222 122 90006	VALVO
1404.822	C7	0,1 µF/10 %/63 V	MKS 2	WIMA
1078.585	C8	0,022 µF/4O V	0,022/2/40 EDPU	VALVO
1479.644	C9	1 µF/50 V	MKS 2	WIMA
Diodes:				
0745.677	D1		1 N 4148	
0745.677	D2		1 N 4148	
0745.677	D3		1 N 4148	
Resistor:				
1521.241	R1	180 K 0,1 % 1/8 W	DIN 44061	
1047.345	R2	3,3 K 1 % 1/8 W	DIN 44061	
1047.345	R3	3,3 K 1 % 1/8 W	DIN 44061	
1521.241	R4	180 K 0,1 % 1/8 W	DIN 44061	
1047.345	R5	3,3 K 1 % 1/8 W	DIN 44061	
1047.345	R6	3,3 K 1 % 1/8 W	DIN 44061	
0542.946	R8	IM 5 % 1/8 W	DIN 44052	
	R9	5,6 25°C/25 %	Best-Nr. 2322662	VALVO
0626.708	R10	10 5 %/1/8 W	DIN 44052	
0542.946	R11	IM 5 %/ 1/8 W	DIN 44052	
	R12	5 K/5 %/± 0,25 %L	AL2410	MEGATRON
0179.701	R13	10 K/5 %/1/8 W	DIN 44052	
0766.190	R14	100 K/5 %/1/8 W	DIN 44052	
0767.190	R15	100 K/5 %/0207	DINM 44052	
0179.701	R16	10 K/5 %/0207	DIN 44052	
0542.946	R18	IM 5 %/1/8 W	DIN 44052	
1521.241	R19	180 K/0,1 %/1/8 W	DIN 44061	
0767.190	R20	100 K/5 %/0207	DIN 44052	
0767.190	R21	100 K/5 %/0207	DIN 44052	
0767.190	R22	100 K/5 %/0207	DIN 44052	
0179.701	R23	10 K/5 %/0207	DIN 44052	
0542.806	R24	390 K/5 %/02207	DIN 44052	

-Preselector- Motor Control

Parts lists No.
97 Sa 2.155.205

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Integrated circuits:				
1427.172	IC A		LM 224	
1177.265	IC B		CA 741 CE	RCA
1630.180	IC C		ICL 7665 BCPA	INTERSIL
Transistors:				
1175.351	T1		BD 675	SIEMENS
1175.378	T2		BD 676	SIEMENS
1175.351	T3		BD 675	SIEMENS
1175.378	T4		BD 676	SIEMENS
1291.033	T5		BD 549 B	
Connectors:				
	Bu A	5-pins	Best-Nr. 316-80105	
1355.678	ST A	11-pins	2,5 MSF 11	LUMBERG
1295.667	ST B		RTM 12M630	BÜRKLIN
Supplements:				
1095.668	Rel.A		RG-16V	SDS
1186.574	Rel.B		RH-5V	NATIONAL
1118.226	GL1		B80 C800	SES COSEM
	M	4.81	Best-Nr.2233R0126	FAULHABER

-1. Mixer-

Technical description

The HF signal goes via the Hf input from the protector or preselector to the 1st Mixer. This is fitted with a +17 dBm high level Schottky diode mixer module. A ring mixer module, three low pass filters and the amplifier for the oscillator signal are installed in their own housing with individual chambers, called the MIXER MODULE. A 30 MHz low pass filter in front of the ring mixer and is fitted so that neither VHF and UHF frequencies can reach the input. The other two ports of the mixer are also equipped with low pass filters. The low pass filter for the oscillator must allow frequencies up to 93.078 MHz to pass, while the IF output must pass the IF frequencies up to 63.078 MHz. The high stop band attenuation of the low passes and the decoupling of the three mixer ports are accomplished by the chamber construction of the MIXER MODULE.

The oscillator signal from the VCO B reaches the 1st MIXER MODULE at a level of +7 dBm, where it is amplified up to the nominal level of 17 dBm. Amplification is by means of the transistors, T3 and T4 which operate in C mode and are connected in parallel.

The output level of this amplifier is monitored in the IC B by rectification and comparison with the reference voltage generated with D6. If the oscillator signal drops below the specified level, the IC B sends a fault signal to the microprocessor.

To minimize intermodulation, the mixer ports are terminated with 50 ohms. The transistors T5 and T6 as the first IF amplifiers, are connected in parallel. Due to the gate circuit and selected FETs, this stage has an input impedance of 50 ohms.

Immediately after this first amplifier follows the quartz filter QF with 63.078 MHz center frequency and a bandwidth of around 12 kHz. For gain control, a pin diode regulator with the diodes D7, D8 and D9 is inserted after the quartz filter. This pin diode regulator has a max. attenuation of 40 dB. The control threshold and the regulation gain is determined by the two operation amplifiers in IC A. At a control voltage U_{AGC} = 2.0 V, no attenuation should take place but if the control voltage U_{AGC} is 3.2 V, the signal coming from the quartz filter should be attenuated by 40 dB.

The control voltage is generated on the DEMODULATOR module. The influence of high frequency interference on control voltage is dealt with by the two stage low pass filter at the input of the first op amp. (IC A).

The pin diode attenuator is followed by a low noise amplifier with the dual gate MOSFET T9. Its bias is stabilized by the Z-diode in the source line and the voltage dividers at gates 1 and 2, and the bias temperature stability within the working temperature range of the receiver is achieved by the diodes D15 to D18.

-1. Mixer-

The amplified signal is coupled via the resonant circuit L11, C23, C28, C29. The resistance R13 in the drain line of the transistors stops spurious oscillations in the UHF range.

At 12 kHz the filter bandwidth of the 63.068 MHz quartz filter is relatively large but also necessary in order to be able to demodulate double side band modulated signals without distortion. When single side band modulated signals are received, only a bandwidth < 3 kHz is necessary, this bandwidth is obtained in the RX 1001 M / RX 5001 only by the SSB filter on the FILTER BOARD after the 2nd mixer.

The receiver RX 1001 M / RX 5001 should also have high sensitivity in the VLF frequency range (VLF = very low frequency). Increasing mixer attenuation caused by too low frequencies, however reduces the sensitivity. Specs of the Schottky diode ring mixer itself is guaranteed down to the input frequency of 50 kHz, but it also functions at lower frequencies. Due to the limited isolation between local oscillator port and IF-port of 40 dB there is an local oscillator interfering signal at the IF port of +17 dBm -40 dBm = -23 dBm.

The outside bands of this local oscillator signal (phase noise) are not sufficiently suppressed by the 1st quartz filter in the case of low input frequencies and thus also reduce sensitivity of the RX 1001 M / RX 5001 when it receives low frequencies.

So when frequencies in the 10 kHz to 80 kHz range are received, the relays A and B connect a VLF amplifier between antenna signal and the input (RF port) of the mixer module. At the input of this amplifier is a 2 stage pass filter, with a roll off frequency of 100 kHz. The amplifier is composed of the transistors T2, T7 and T8. Amplification is around 25 dB in the frequency range 10 - 80 kHz. T7 and T8 are a complementary emitter follower in order to generate a low output impedance.

Gain of T2 is set by the negative feedback of R39/C72 and R17. At very low input frequencies negative feedback of R39/C72 decreases and T2 gain will increase, this effect gives the desired frequency response as described earlier.

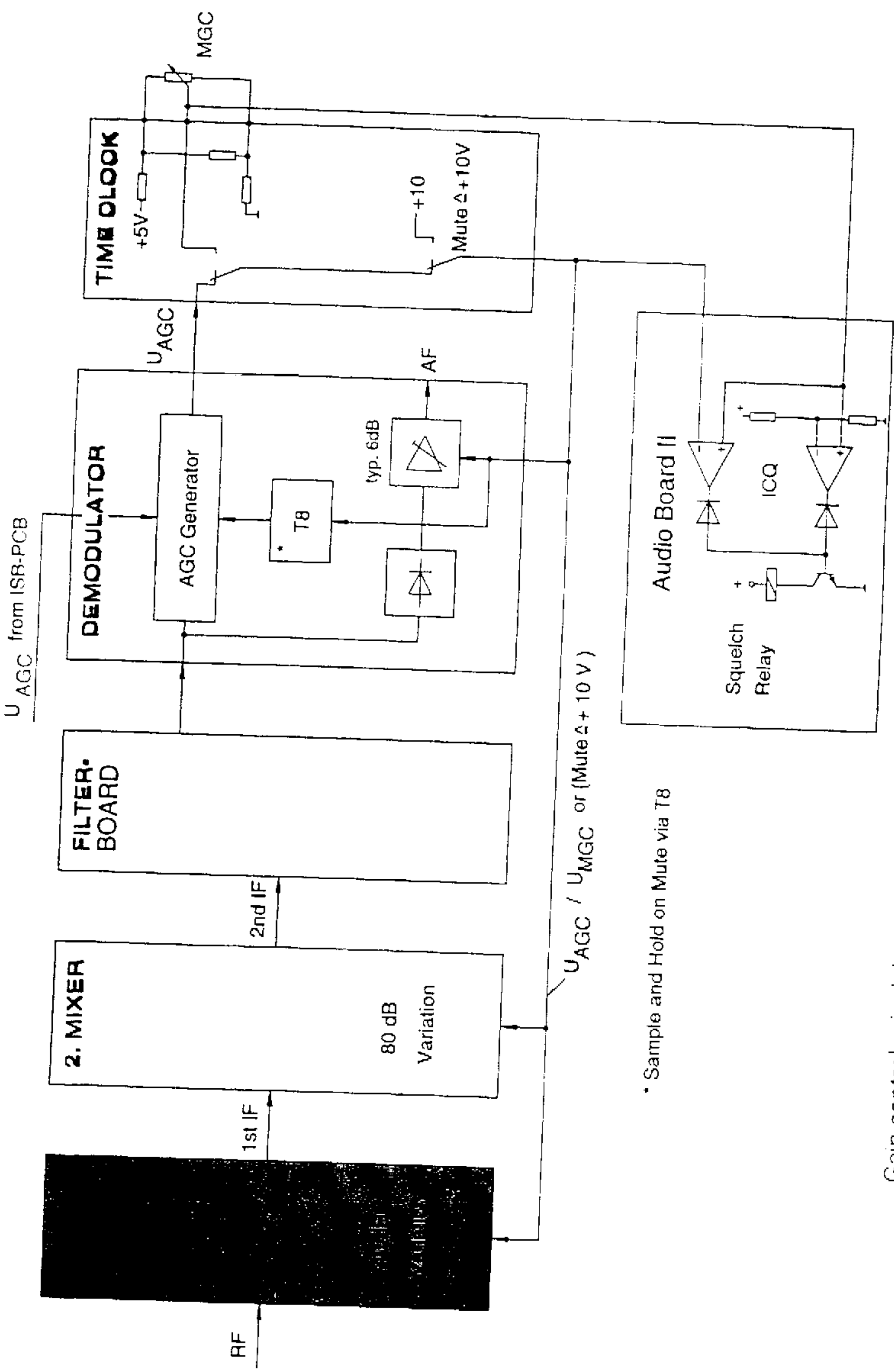
Diodes D2 and D3 protect the amplifier input against too high input voltages. Due to the VLF amplification, the dynamic range of the receiver in the frequency range from 10 - 80 kHz is reduced by the amount of the VLF amplifier gain.

The amplification of the entire 1st MIXER without the VLF amplifier should be 24 dB ±3 dB. When the self-test (BITE) is triggered, the test signal of 1 MHz and -54 dBm level is inserted via the PROTECTOR or PRESELECTOR from the BFO cassette. The oscillator signal of the VCO B is then 64.078 MHz (set by the microprocessor).

-1. Mixer-

During BITE test the control voltage U_{AGC} is set to 2.0 V (no attenuation). Thus the IF output of the 1^{st} MIXER (ST6) a 63.078 MHz signal should have a level of -54 dBm +24 dBm = -30dBm ±3 dBm when the 1^{st} MIXER is in order. This signal is amplified with the broad band amplifier IC C, rectified with D4 and compared in the comparator IC B with a highly accurate temperature controlled reference voltage generated by D4. If the rectified voltage drops below the reference voltage, which signals a faulty 1^{st} MIXER, the output of IC A changes to LOW. This fault condition is read by the microprocessor.

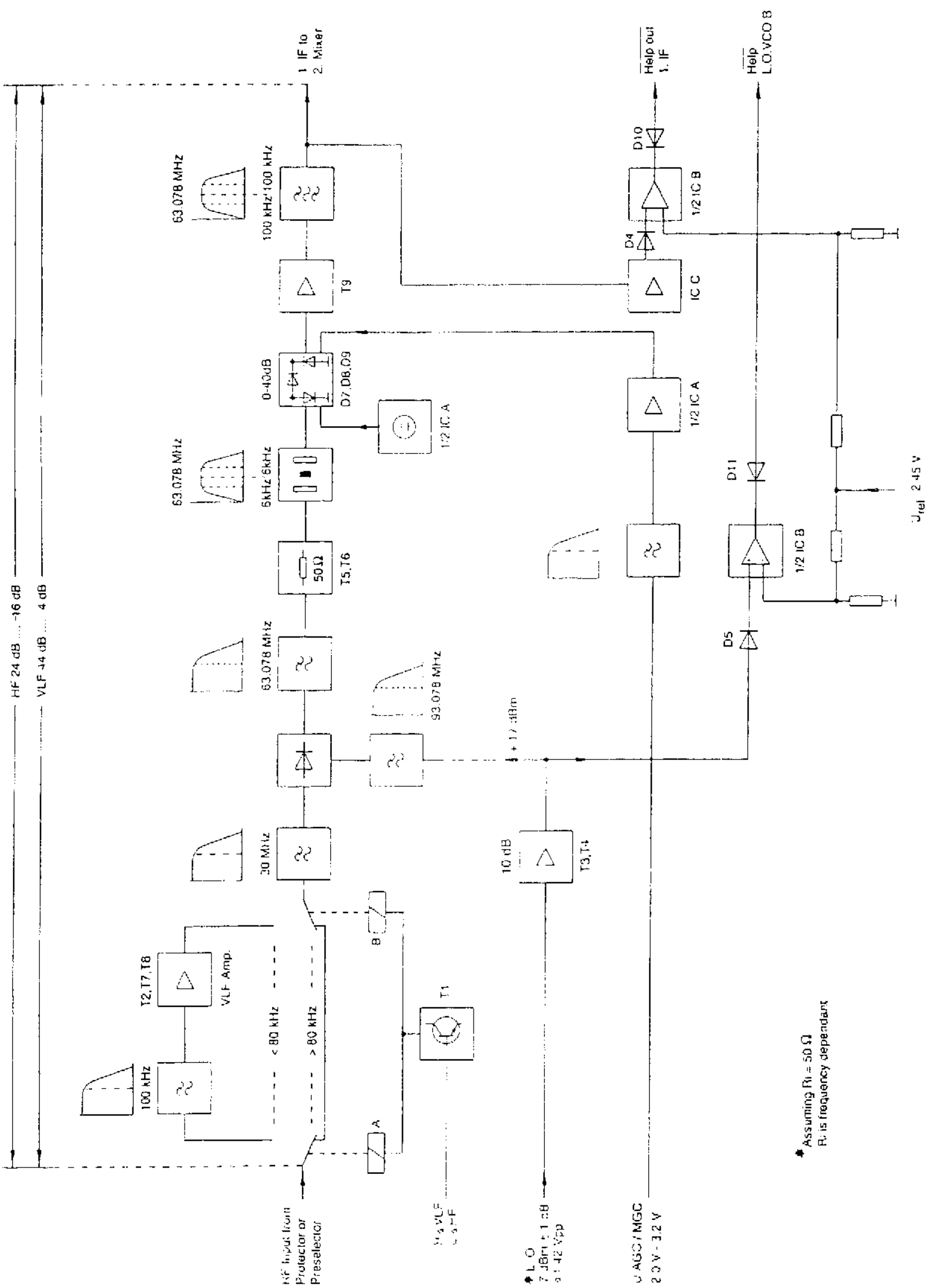
-1. Mixer-



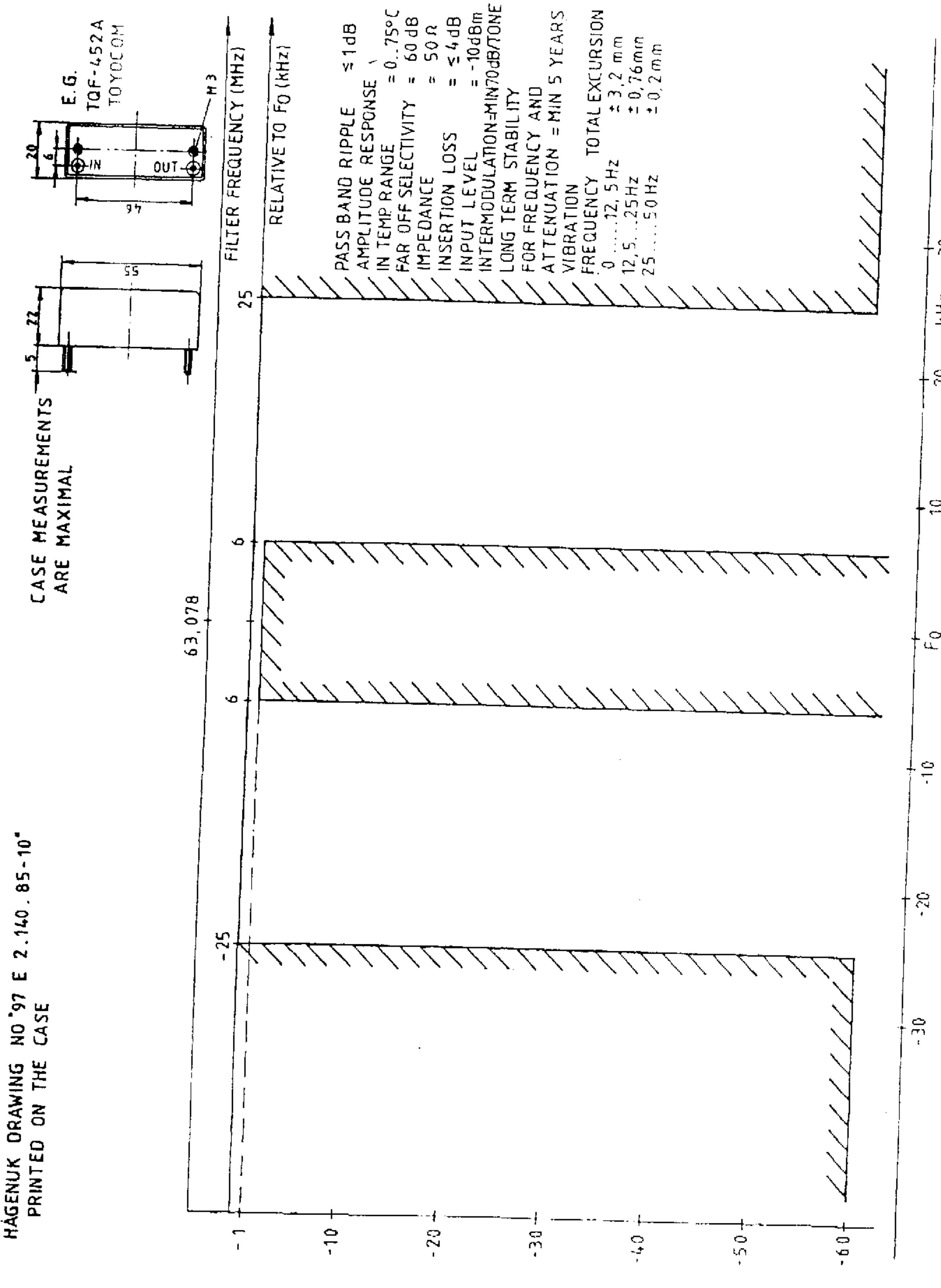
Gain control principle

HAG/HOD 016-09.97

-1. Mixer-



Blockdiagram 1. MIXER


E.G.
TQF-452A
TOYOCOM
M3
IN
OUT
20
6
97
55
22
5
CASE MEASUREMENTS
ARE MAXIMAL
HAGENUK DRAWING NO'97 E 2.140.85-10'
PRINTED ON THE CASE
FILTER FREQUENCY (MHz)
RELATIVE TO Fo (kHz)
PASS BAND RIPPLE ≤1dB
AMPLITUDE RESPONSE
IN TEMP RANGE = 0..75°C
FAR OFF SELECTIVITY = 60dB
IMPEDANCE = 50Ω
INSERTION LOSS = ≤4dB
INPUT LEVEL = -10dBm
INTERMODULATION=MIN70dB/TONE
LONG TERM STABILITY
FOR FREQUENCY AND
ATTENUATION = MIN 5 YEARS
VIBRATION
FREQUENCY TOTAL EXCURSION
0....12,5Hz ±3,2 mm
12,5...25Hz ±0,76mm
25....50Hz ±0,2mm
25
6
63,078
6
-25
-1
-10
-20
-30
-40
-50
-60
30
kHz
20
10
Fo
-10
-20
-30

-1. Mixer-

Test and alignment instructions

Required: Circuit diagram 1st MIXER - Hagenuk Drawing No. 97 Sa B 2.155.83
Power supply 5 V/18 V, digital voltmeter, milliampmeter, two RF generators, spectrum analyser, tracking generator

Test configuration: The 1st MIXER module must be removed.

instruments:	RF generator 10 kHz - 30 MHz	to plug ST 1 RF INPUT
	RF generator	to plug ST 2 LO INPUT
	Spectrum analyser	to plug ST 6 IF OUTPUT
	Power supply:	
	ground	to plug ST 4 pins 1, 16
	+ 18 V	to plug ST 4 pins 3, 14, 15
	+ 5 V	to plug St 4 pins 2, 13

Measurement of current consumption
Current consumption measured without input signals.
Test values:

Current consumption	I = 190 mA ± 40 mA/18 V
	I = 70 mA ± 10 mA/5 V

Testing the gain of the VLF-amplifier
Switch the selector of the test equipment to position VLF, remove the connection between the test equipment and the LO - generator (socket LO-In). Solder a cable to measuring point MP 2, connect this cable to the input of the spectrum analyser. Connect the tracking generator to socket RF-In of the test equipment.

Spectrum analyser settings:	Centre frequency	280 kHz
	Span	50 kHz/div.
	Resulution bandwidth	10 kHz
	Video filter bandwidth	10 kHz
	Reference level	-10 dBm
	Tracking generator - level	-37 dBm

Test values:

Output level should be	10 ...80 kHz	- 20 dBm ± 2 dB
	400 kHz ...30 MHz	< - 65 dBm

Switch the selector of the test equipment to position HF.
Test value:
Output level should be constant -37 dBm.

-1. Mixer-

Testing the IF amplifiers
Plug ST 4 pin 12 to 0 V
Plug ST 4 pin 4: apply U_{AGC} = 2.00 V ± 5 mV
RF INPUT level -60 dBm
Spectrum analyser and tracking generator settings:

	Centre frequency	63.078	MHz
	Span	10	kHz
	Resolution bandwidth	300	Hz
	Ref. level	-27	dBm

Alignment of IF amplifier
- Set R 75 to centre position
- Set L 8 for minimum ripple at maximum output
- Set L 11 for maximum output
- Set L 10 for maximum output
- Using R 75, set output level to -31 dBm ± 0.5 dB at f = 63.078 MHz.
- If the ripple exceeds 1.7 dB, turn core further into L 10 until <1.7 dB ripple is achieved.
  NOTE
  The output level must not be reduced by more than 1.5 dB.
- Readjust R 75 to -31 dBm ± 0.5 dB.

Testing ripple (on AGC variation)

Test values	Settings
Ripple < 1.7 dB	RF INPUT level -60 dBm U_{AGC} 2.00 V
Ripple < 2.6 dB	RF INPUT level -50 dBm U_{AGC} 2.60 V
Ripple < 3.5 dB	RF INPUT level -20 dBm U_{AGC} 3.20 V

Testing the gain of the complete mixer
Plug ST 4 pin 4 U_{AGC} = 2.00 V
LO INPUT level +7 dBm f = 64.078 MHz
RF INPUT level -57 dBm f = 1 MHz
Connect IF OUTPUT to spectrum analyser.
Test values:
IF OUTPUT level -33 dBm (adjust with R 57) at f = 63.078 MHz
IF OUTPUT level <-48 dBm at f = 64.078 MHz

-1. Mixer-

Testing the control characteristic
LO INPUT level +7 dBm f = 64.078 MHz
RF INPUT level -50 dBm f = 1 MHz

Test values: IF OUTPUT level	Settings: U_{AGC}
-26 dBm ± 0.5 dB	2.00 V
-29 dBm ± 2 dB	2.20 V
-33 dBm ± 2.5 dB	2.40 V
-37 dBm ± 3 dB	2.60 V
-42 dBm ± 4 dB	2.80 V
-68 dBm ± 5 dB	3.00 V

Testing the filter frequency response
LO INPUT level +7 dBm f = 64.078 MHz
Plug ST 4 pin 4 U_{AGC} = 2.00 V

Test values IF OUTPUT leve	Settings RF INPUT level -40 dBm
> -19 dBm ripple < 3 dB	f = 1 MHz ± 6 kHz
< -45 dBm	f = 1 MHz ± 13 kHz
< -76 dBm	f = 1 MHz ± 25 kHz

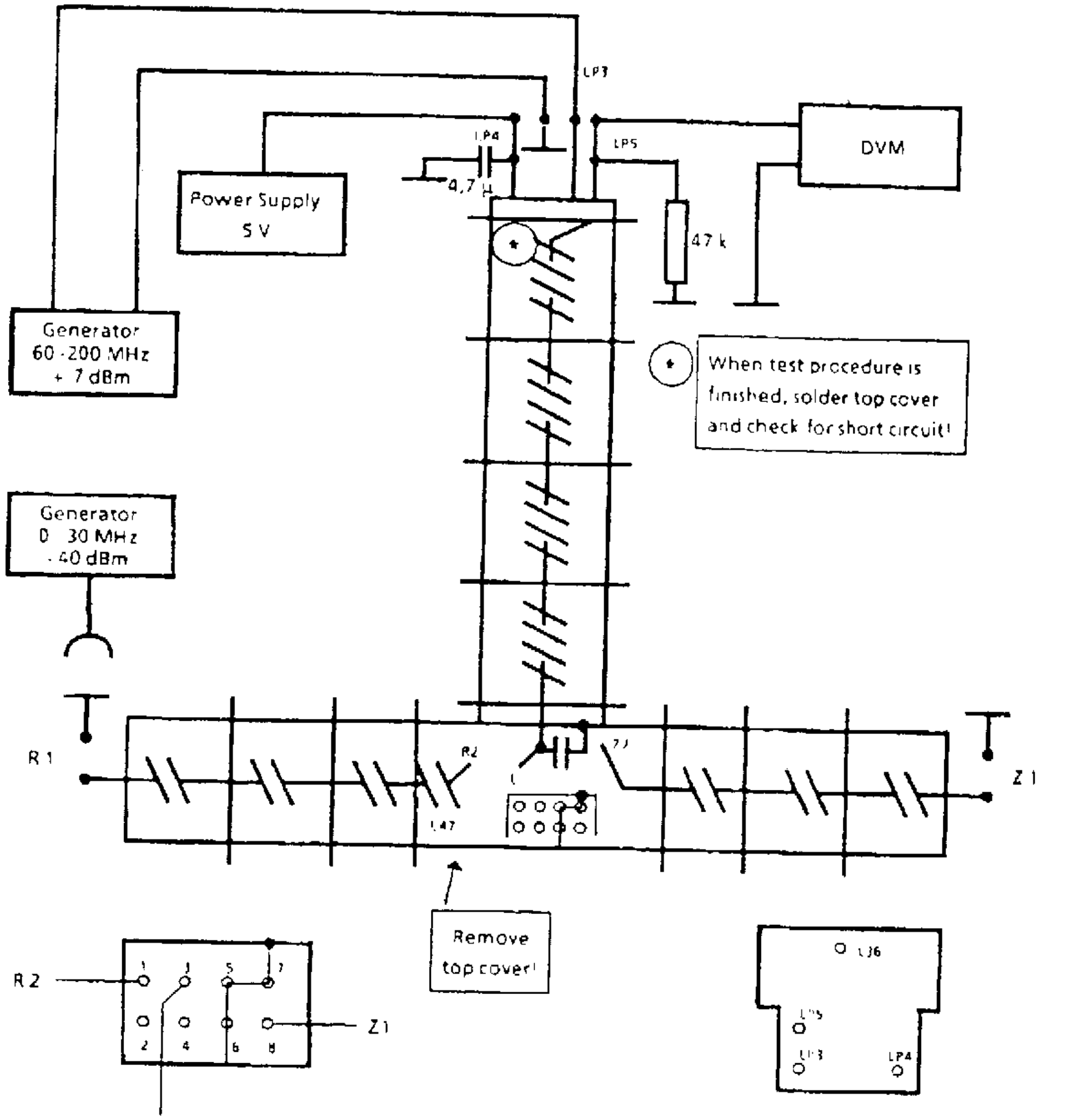
-1. Mixer-

Test and alignment instruction for 1st MIXER (mixer module)

Required: Signal generator 0 ... 30 MHz, signal generator 60 - 200 MHz, power supply, digital voltmeter, soldering iron

Test configuration: The mixer module is unsoldered from the 1st mixer board and removed.

Test configuration:



Assembly 1. MIXER (mixer module)

-1. Mixer-

Unsolder R 2, L and Z 2 from ring mixer. Solder LP 3, LP 4 and LP 5 according to drawing.
Measure frequency response of RF filter branch.
Connect tracking generator to R1 and the spectrum analyser input to R2.

Spectrum analyser settings:	Centre frequency	45 MHz
	Span	90 MHz
	Reference level	-10 dBm
	Tracking generator-level	-10 dBm

Measure levels at the following frequencies:

Specified levels: 0...	30 MHz	-10 dBm ± 0.7 dB
	60 MHz	< -45 dBm
	90 MHz	< -70 dBm

Measure frequency response of IF filter.

Spectrum analyser settings:	Centre frequency	63 MHz
	Span	0.5 MHz
	Reference level	-10 dBm
	Tracking generator-level	-10 dBm
Specified output level	-10 dBm ± 0.5 dB	

Spectrum analyser settings:	Centre frequency	150 MHz
	Span	200 MHz
	Reference level	-10 dBm
	Tracking generator-level	-10 dBm

Measure level at the following frequencies:

Frequency	Specified levels
63 ... 124 MHz	-10 dBm ± 1 dB
210 MHz	< -30 dBm
250 MHz	< -50 dBm

Test LO filter with amplifier.
Connect an RF generator (frequency range 63 - 200 MHz, level +7 dBm) to LP 3. Connect spectrum analyser to L. Measure output level at the following frequencies:

Frequency	Specified levels
63 MHz	+17 dBm ± 5 dB
79 MHz	+17 dBm ± 5 dB
94 MHz	+17 dBm ± 5 dB
140 MHz	< -20 dBm
180 MHz	< -45 dBm

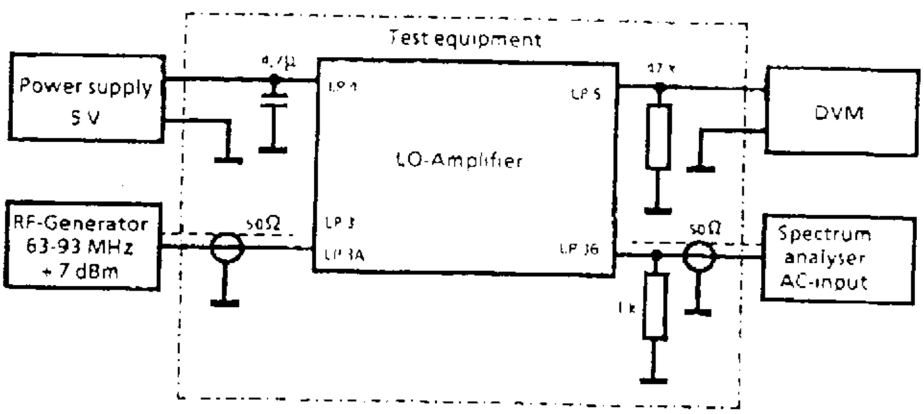
-1. Mixer-

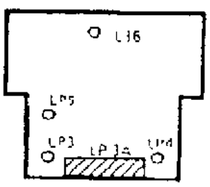
Overall test of module
Solder R 2 to pin 1, L to pins 3 and 4 and Z 2 to pin 8 of the mixer. Connect a generator (f = 0 - 30 MHz, level -40 dBm) to R 1 and a second generator (60 - 200 MHz, level +7 dBm) to LP 3. Measure levels on Z 1 with the spectrum analyser.

Frequency LO generator 1 (MHz)	Frequency RF generator 2 (MHz)	Level on Z 1 (63.78 MHz)	Residual LO level	Voltage on LP 5
a) 93.078	30	-46 dBm ± 2 dB	-10 dBm	2.5 V
b) 85.078	22	-46 dBm ± 2 dB	-10 dBm	2.5 V
c) 73.078	10	-46 dBm ± 2 dB	-15 dBm	2.5 V
d) 63.178	0.1	-46 dBm ± 2 dB	-15 dBm	2.5 V

Test and alignment instructions (1st mixer LO amplifier)
Required: Power supply, signal generator 63 - 93 MHz, digital voltmeter, spectrum analyser

Test configuration: The LO amplifier is in the mixer module of the 1st mixer. For testing, the board is removed and placed in a screened test facility.





LO amplifier PCB

Measure current consumption with generator switched off. Specified value: 70 mA ± 10 mA.

NOTE
The two transistors are selected in groups according to current gain. The base series resistors R 68, R 69 have group-specific values.

-1. Mixer-

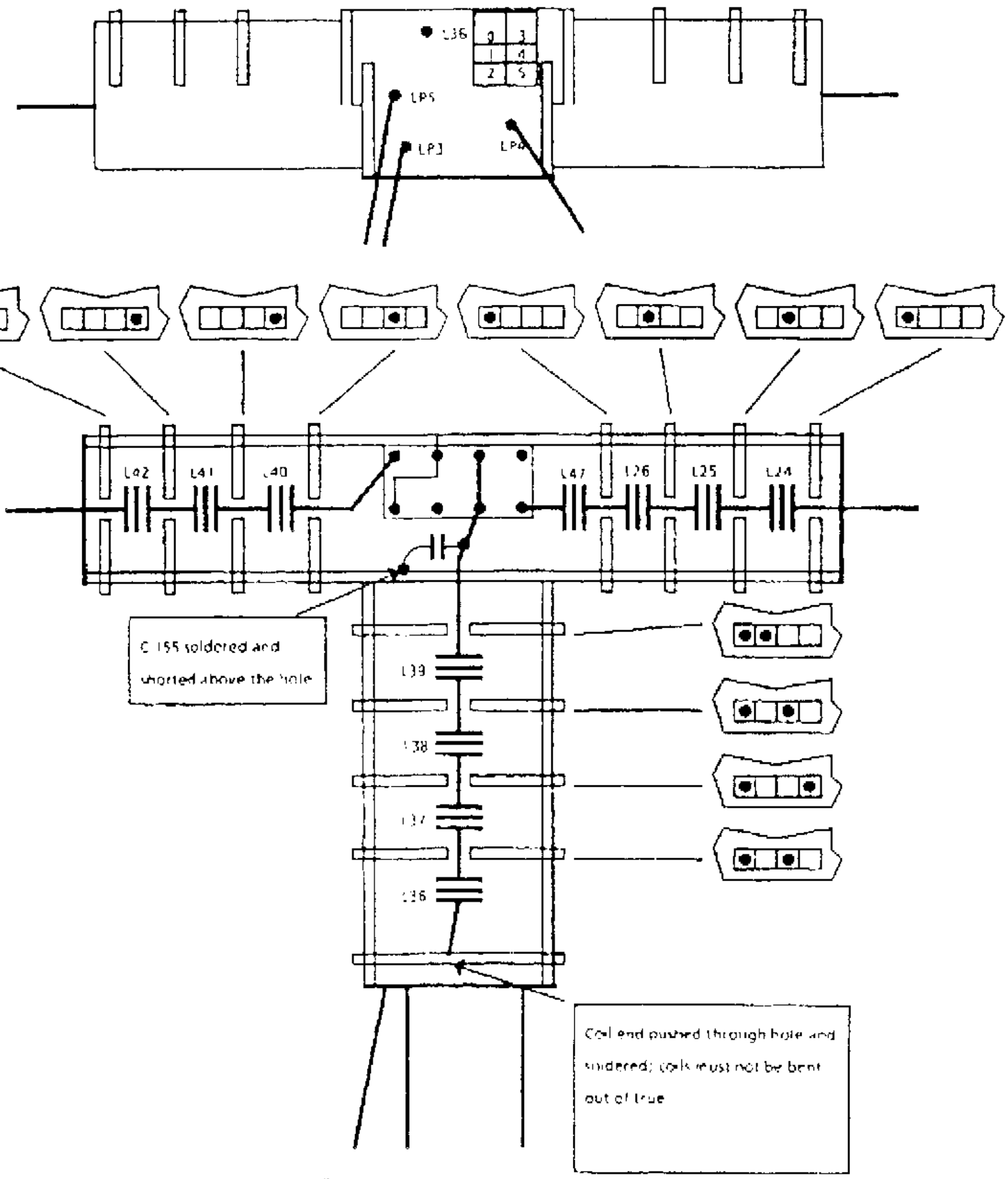
Measure the output signal of the LO amplifier with a generator input signal of +7 dBm and at frequencies of 63, 73, 83 and 93 MHz

Since the LO amplifier is a switching amplifier and its output contains many harmonics, the level must be measured by the spectrum analyser at the fundamental of the output.

Specified output level +20 dBm ± 2 dB.

Take care not to overload the input of the spectrum analyser (if necessary connect a 10 dB attenuator in the circuit).

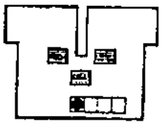
Measure the control voltage with a DVM at the four frequencies 63, 73, 83 and 93 MHz
Specified value: U 2.6 V.



Arrangement of 1. Mixer LP-Filters

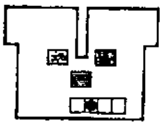
-1. Mixer-

97 E 2.155.178



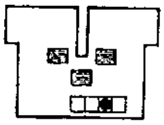
27 pF/5/63 V KEFQ 0800519 NPO

97 E 2.155.179



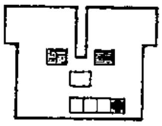
56 pF/5/63 V KEFQ 0800519 NPO

97 E 2.155.180

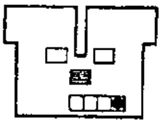


2,7 pF/5/63 V KEFQ 0800519 NPO

97 E 2.155.181

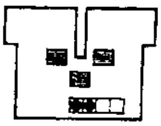


10 pF/5/63 V KEFQ 0800519 NPO



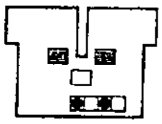
12 pF/5/63 V KEFQ 0800519 NPO

97 E 2.155.182

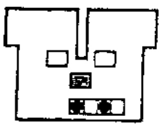


6,8 pF/5/63 V KEFQ 0800519 NPO

97 E 2.155.183

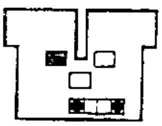


15 pF/5/63 V KEFQ 0800519 NPO

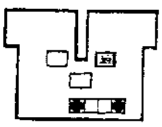


22 pF/5/63 V KEFQ 0800519 NPO

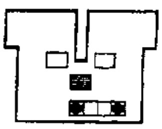
97 E 2.155.184



15 pF/5/63 V KEFQ 0800519 NPO



18 pF/5/63 V KEFQ 0800519 NPO



22 pF/5/63 V KEFQ 0800519 NPO

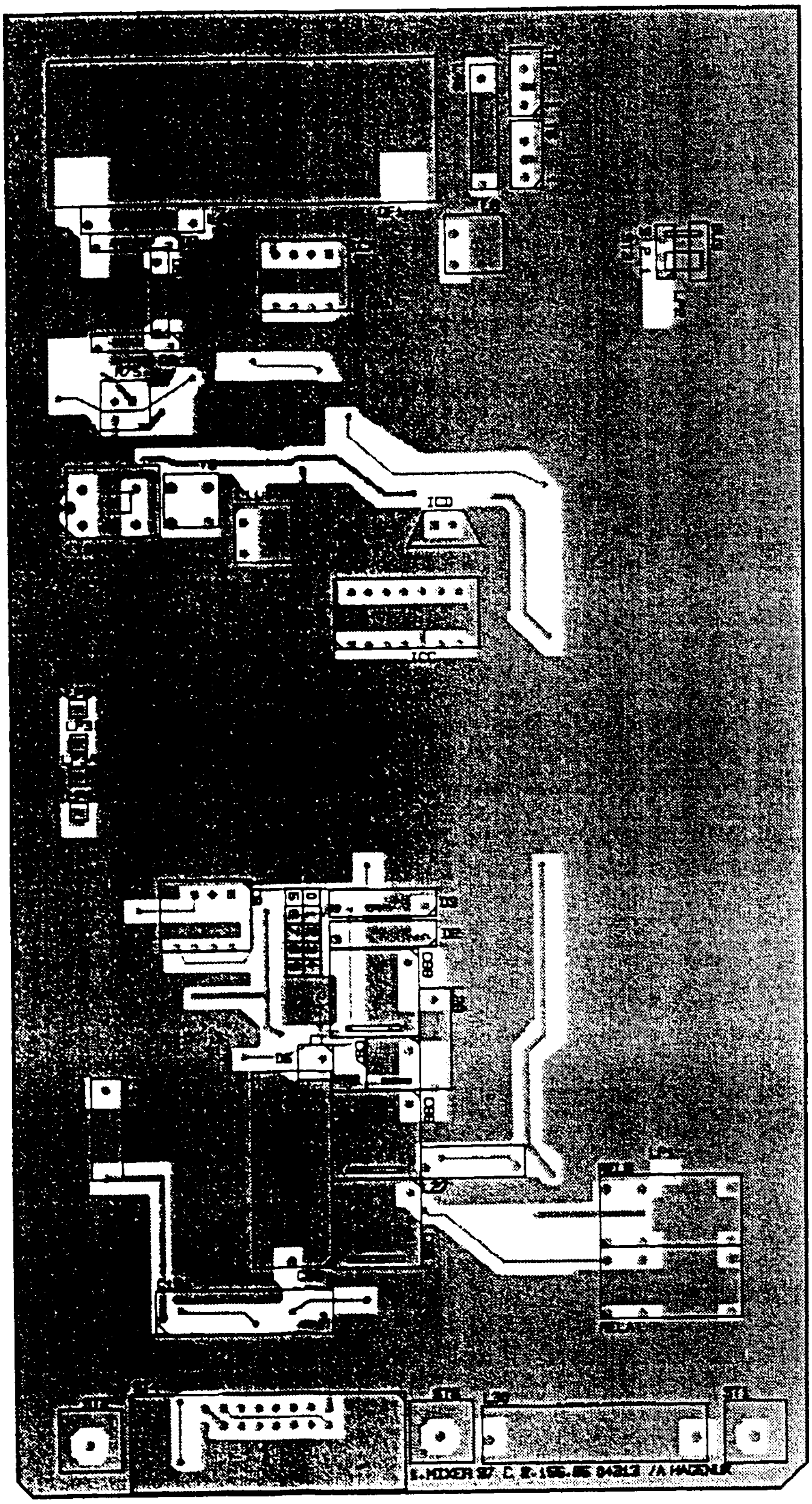
1. Mixer LP Filter module PCBs

-1. Mixer-

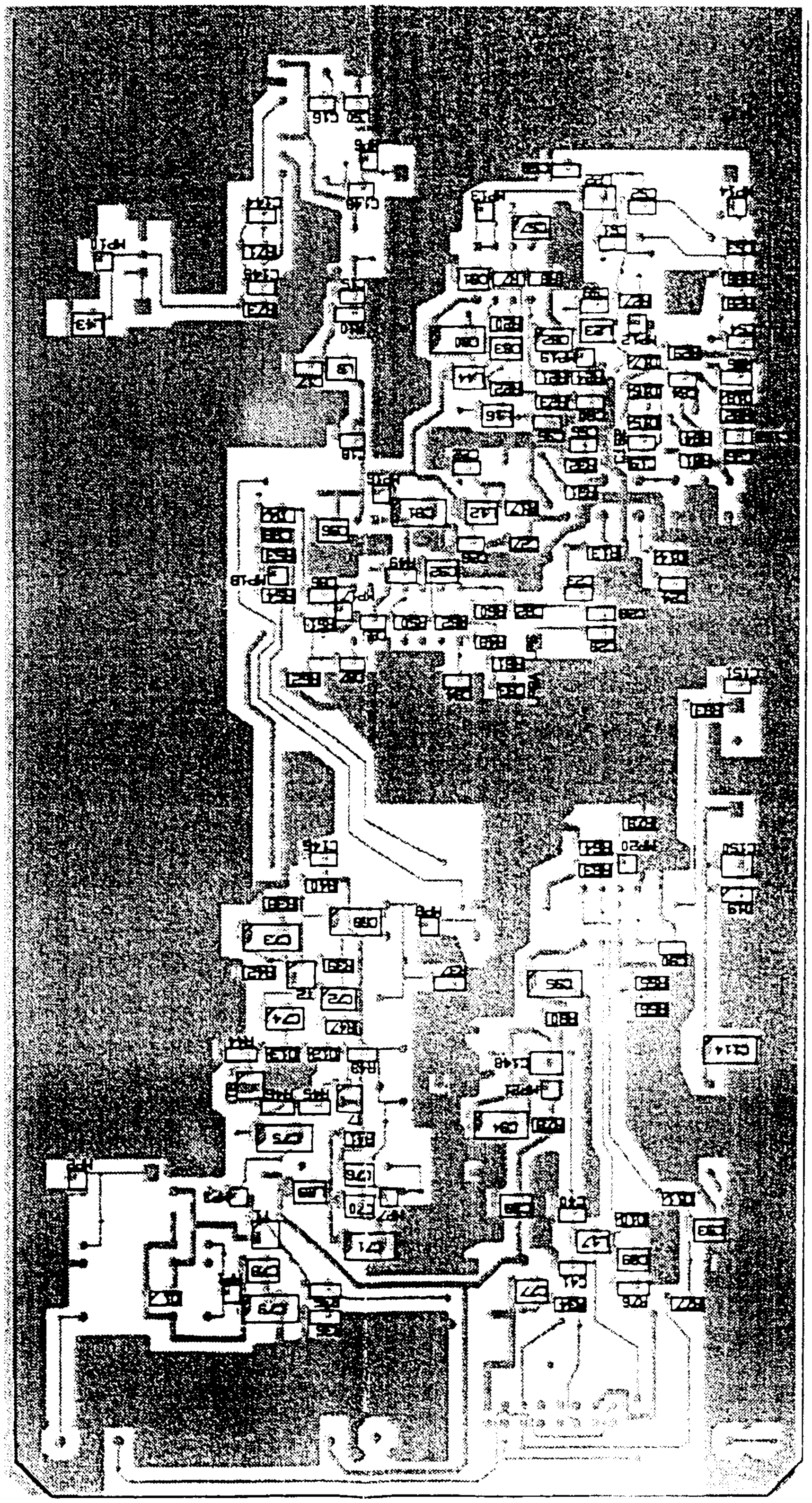
see circuit diagram - 1. MIXER 97 Sa C 2.155.83

LO-Amplifier 1. MIXER PCB - 97 D 2.155.190

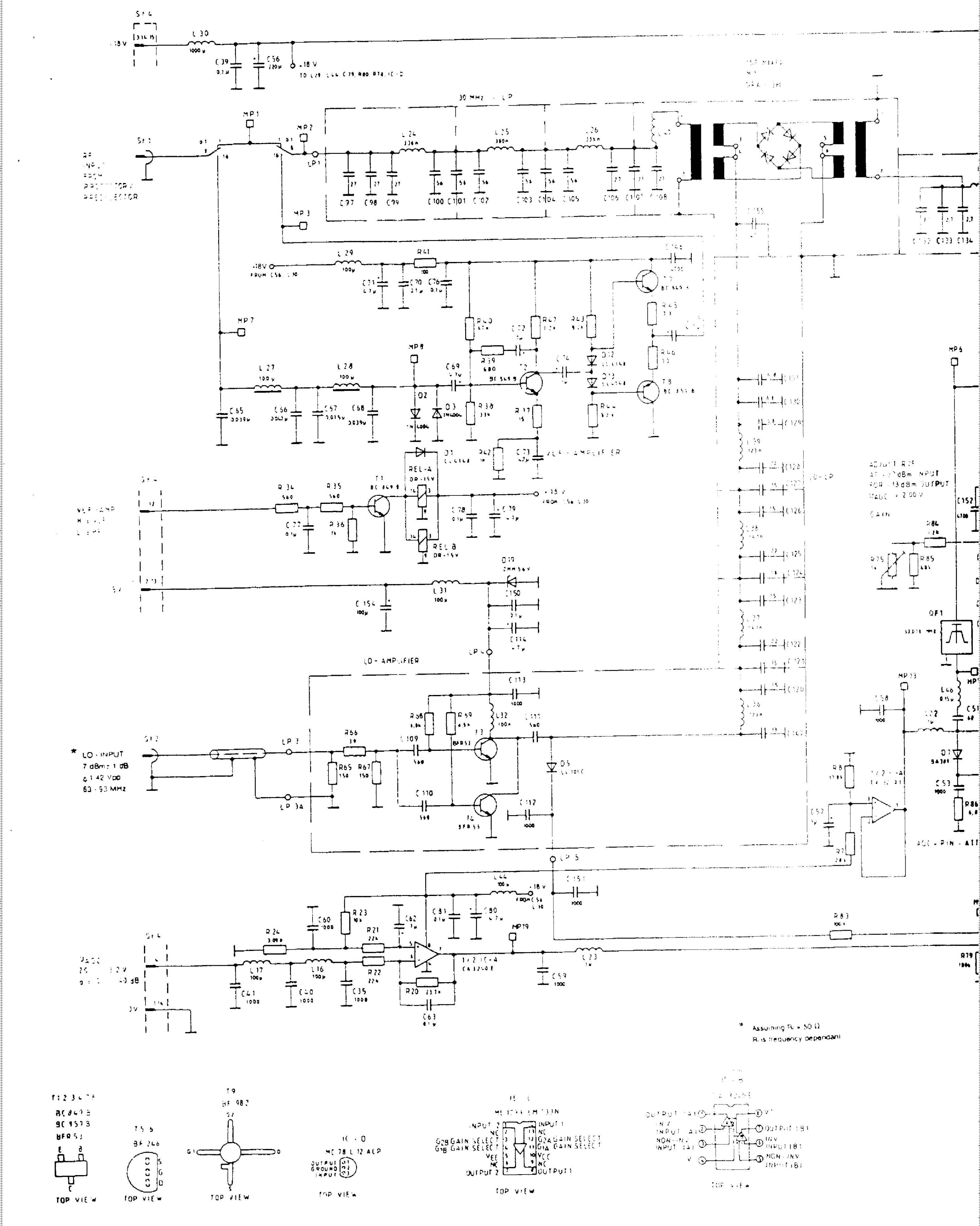
1. Mixer Module PCB - 97 E 2.155.178-184

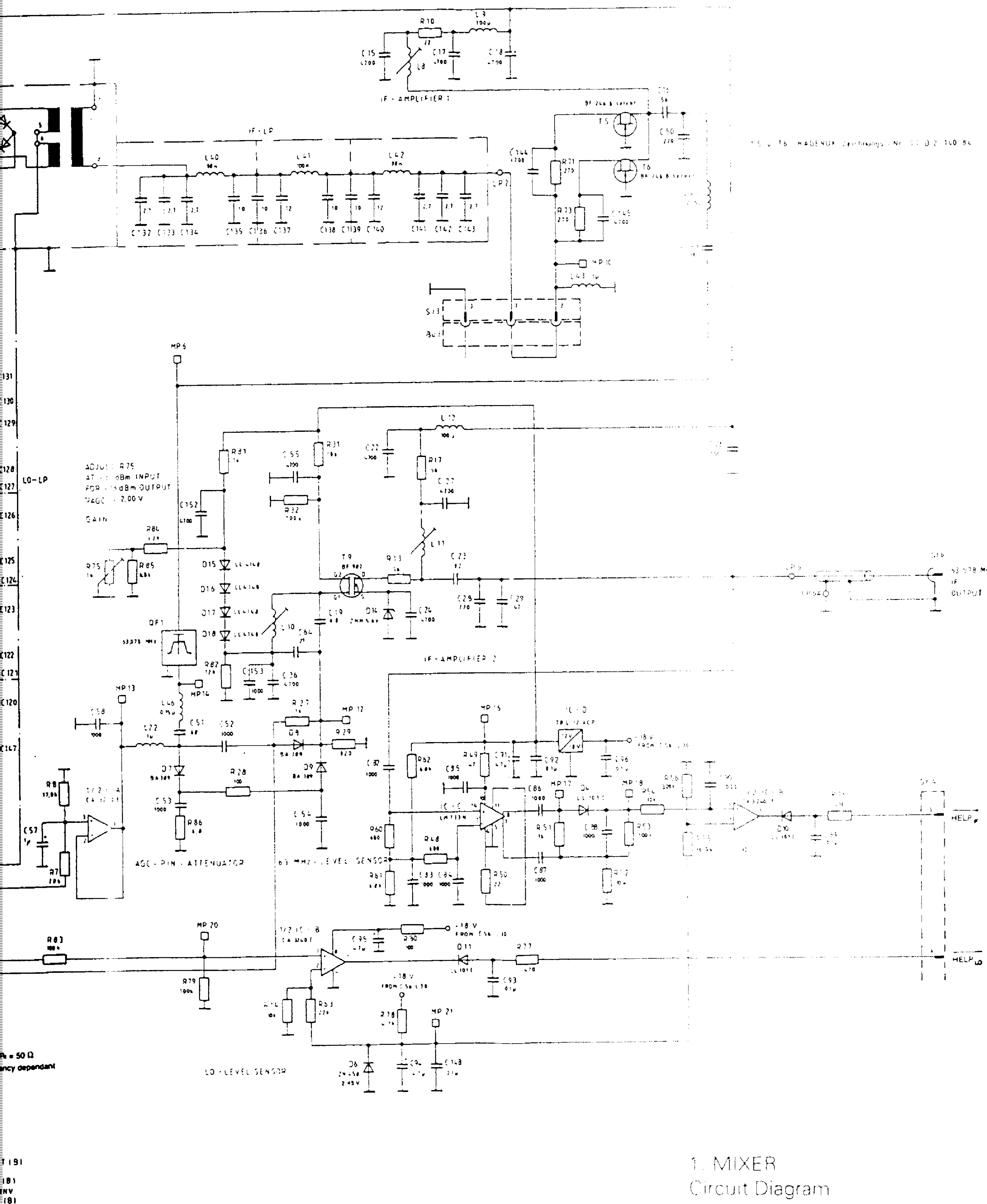


see circuit diagram - 1. MIXER 97 Sa B 2.155.83



Printed Circuit Board
1. Mixer
97 C 2.155.85


30 MHz - LP
LO - INPUT
7 dBm ± 1 dB
63 - 93 MHz
LO - AMPLIFIER
+18 V
+15 V
REL-A
REL B
BFR 53
BF 982
BF 246
BC 847 B
BC 557 B
TOP VIEW
Assuming RL = 50 Ω
RL is frequency dependant



1. MIXER
Circuit Diagram
97 Sa B 2.155.83

-1. Mixer-

Ident-No.	Mark	Electr. value	Identity

Capacitors:

Ident-No.	Mark	Electr. value	Identity
1647.067	C15	SMD 4700 pF/10/63 V	KEFQ 0805 X7R
1646.877	C16	SMD 56 pF/5/63 V	KEFQ 0805 NPO
1647.067	C17	SMD 4700 pF/10/63 V	KEFQ 0805 X7R
1647.067	C18	SMD 4700 pF/10/63 V	KEFQ 0805 X7R
1745.948	CI9	SMD 6,8 pF/0,25/63 V	KEFQ 0805 N750
1647.067	C22	SMD 4700 pF/10/63 V	KEFQ 0805 X7R
1646.915	C23	SMD 82 pF/5/63 V	KEFQ 0805 NPO
1647.067	C24	SMD 4700 pF/10/63 V	KEFQ 0805 X7R
1647.067	C26	SMD 4700 pF/10/63 V	KEFQ 0805 X7R
1647.067	C27	SMD 4700 pF/10/63 V	KEFQ 0805 X7R
1647.008	C28	SMD 220 pF/10/63 V	KEFQ 0805 NPO
1643.932	C29	SMD 47 pF/5/63 V	KEFQ 0805 X7R
1646.885	C35	SMD 1000 pF/5/63 V	KEFQ 0805 NPO
1647.067	C36	SMD 4700 pF/10/63 V	KEFQ 0805 X7R
1646.990	C39	SMD 0,1 µF/10/63 V	KEFQ 1212 X7R
1646.885	C40	SMD 1000 pF/5/63 V	KEFQ 0805 NPO
1646.885	C41	SMD 1000 pF/5/63 V	KEFQ 0805 NPO
1647.008	C50	SMD 220 pF/5/63 V	KEFQ 0805 NPO
1643.967	C51	SMD 68 pF/5/63 V	KEFQ 0805 NPO
1646.885	C52	1000 pF/5/63 V	KEFQ 0805 NPO
1646.885	C53	1000 pF/5/63 V	KEFQ 0805 NPO
1646.885	C54	1000 pF/5/63 V	KEFQ 0805 NPO
1647.067	C55	4700 pF/10/63 V	KEFQ 0805 NPO
1067.923	C56	ELIKO AA 220-25 GPF	DIN 41316 G
1887.580	C57	SMD 1 µF/10/35 V	267L3502105 KF
1646.885	C58	SMD 1000 pF/5/63 V	KEFQ 0805 NPO
1646.885	C59	SMD 1000 pF/5/63 V	KEFQ 0805 NPO
1646.885	C60	SMD 1000 pF/5/63 V	KEFQ 0805 NPO
1887.580	C62	SMD 1 µF/10/63 V	Typ 267 3,4x2,8
1646.990	C63	SMD 0,1 µF/10/63 V	KEFQ 0805 NPO
1646.966	C64	SMD 27 pF/5/63 V	KEFQ 0805 NPO
1887.629	C65	0,039 µF/1/63 V	B 31531 B 5393 F
1887.637	C66	0,047 µF/1/63 V	B 31531-B 5473-F
1887.610	C67	0,015 µF/1/63 V	B 31531-B 5153 F
1887.629	C68	0,039 µF/1/63 V	B 31531-B 5393-F
1916.076	C69	SMD 4,7 µF/10/25 V	267L2502475 KF
1646.990	C70	0,1 µF/10/63 V	KEFQ 1210 X7R
1916.076	C71	SMD 4,7 µF/10/25 V	Typ 267 5,6x3,3
1887.580	C72	SMD 1 µF/10/35 V	TyP 267 3,4x2,8
1916.076	C73	SMD 4,7 µF/10/25 V	Typ 267 5,6x3,3
1887.580	C74	SMD 1 µF/10/35 V	Typ 267 3,4x2,8
1916.076	C75	SMD 4,7 µF/10/25 V	Typ 267 5,6x3,3

Parts lists No.
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Ident-No.	Mark	Electr. value	Identity	Manufacturer
1646.990	C76	SMD 0,1 µF/10/63 V	KEFQ 1210 X7R	
1646.990	C77	SMD 0,1 µF/10/63 V	KEFQ 1210 X7R	
1646.990	C78	SMD 0,1 µF/10/63 V	KEFQ 1210 X7R	
1916.076	C79	SMD 4,7 µF/10/25 V	Typ 267 5,6x3,3	
1916.076	C80	SMD 4,7 µF/10/25 V	TYP 267 5,6x3,3	
1646.990	C81	SMD 0,1 µF/10/63	KEFQ 1210 X7R	
1646.885	C82	SMD 1000 pF/5/63 V	KEFQ 0805 NPO	
1646.885	C83	SMD 1000 pF/5/63 V	KEFQ 0805 NPO	
1646.885	C84	SMD 1000 pF/5/63 V	KEFQ 0805 NPO	
1646.885	C85	SMD 1000 pF/5/63 V	KEFQ 0805 NPO	
1646.885	C86	SMD 1000 pF/5/63 V	KEFQ 0805 NPO	
1646.885	C87	SMD 1000 pF/5/63 V	KEFQ 0805 NPO	
1646.885	C88	SMD 1000 pF/5/63 V	KEFQ 0805 NPO	
1646.990	C89	SMD 0,1 µF/10/63	KEFQ 1210 X7R	
1646.885	C90	SMD 1000 pF/5/63 V	KEFQ 0805 NPO	
1916.076	C91	SMD 4,7 µF/10/25 V	Typ 267	
1646.990	C92	SMD 0,1 µF/10/63	KEFQ 1210 X7R	
1646.990	C93	SMD 0,1 µF/10/63	KEFQ 1210 X7R	
1916.076	C94	SMD 4,7 µF/10/25 V	Typ 267	
1916.076	C95	SMD 4,7 µF/10/25 V	Typ 267	
1646.990	C96	SMD 0,1 µ1F/10/63	KEFQ 1210 X7R	
1646.966	C97	SMD 27 pF/5/63 V	KEFQ 0805 NPO	
1646.966	C98	SMD 27 pF/5/63 V	KEFQ 0805 NPO	
1646.966	C99	SMD 27 pF/5/63 V	KEFQ 0805 NPO	
1646.877	C100	SMD 56 pF/5/63 V	KEFQ 0805 NPO	
1646.877	C101	SMD 56 pF/5/63 V	KEFQ 0805 NPO	
1646.877	C102	SMD 56 pF/5/63 V	KEFQ 0805 NPO	
1646.877	C103	SMD 56 pF/5/63 V	KEFQ 0805 NPO	
1646.877	C104	SMD 56 pF/5/63 V	KEFQ 0805 NPO	
1646.877	C105	SMD 56 pF/5/63 V	KEFQ 0805 NPO	
1646.966	C106	SMD 27 pF/5/63 V	KEFO 0805 NPO	
1646.966	C107	SMD 27 pF/5/63 V	KEFQ 0805 NPO	
1646.966	C108	SMD 27 pF/5/63 V	KEFQ 0805 NPO	
1643.983	C109	SMD 560 pF/5/63 V	KEFQ 0805 NPO	
1643.983	C110	SMD 560 pF/5/63 V	KEFQ 0805 NPO	
1643.983	C111	SMD 560 pF/5/63 V	KEFQ 0805 NPO	
1646.885	C112	SMD 1000 pF/5/63 V	KEFQ 0805 NPO	
1646.885	C113	SMD 1000 pF/5/63 V	KEFQ 0805 NPO	
1916.076	C114	SMD 4,7 µF/10/25 V	Typ 267	
1647.032	C120	15 pF/5/63 V	KEFQ 0805 NPO	
1647.032	C121	15 pF/5/63 V	KEFQ 0805 NPO	
1647.172	C122	22 pF/5/63 V	KEFQ 0805 NPO	
1647.032	C123	15 pF/5/63 V	KEFQ 0805 NPO	
1650.157	C124	18 pF/5/63 V	KEFQ 0805 NPO	

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Ident-No.	Mark	Electr. value	Identity	Manufacturer
1647.172	C125	22 pF/5/63 V	KEFQ 0805 NPO	
1647.032	C126	15 pF/5/63 V	KEFQ 0805 NPO	
1647.032	C127	15 pF/5/63 V	KEFQ 0805 NPO	
1647.172	C128	22 pF/5/63 V	KEFQ 0805 NPO	
1646.834	C129	6,8 pF/5/63 V	KEFQ 0805 NPO	
1646.834	C130	6,8 pF/5/63 V	KEFQ 0805 NPO	
1646.834	C131	6,8 pF/5/63 V	KEFQ 0805 NPO	
1672.681	C132	2,7 pF/5/63 V	KEFQ 0805 NPO	
1672.681	C133	2,7 pF/5/63 V	KEFQ 0805 NPO	
1672.681	C134	2,7 pF/5/63 V	KEFQ 0805 NPO	
1646.982	C135	10 pF/0,25/63 V	KEFQ 0805 NPO	
1646.982	C136	SMD 10 pF/5/63 V	KEFQ 0805 NPO	
1672.703	C137	SMD 12 pF/5/63 V	KEFQ 0805 NPO	
1646.982	C138	SMD 10 pF/5/63 V	KEFQ 0805 NPO	
1646.982	C139	SMD 10 pF/5/63 V	KEFQ 0805 NPO	
1672.703	C140	SMD 12 pF/5/63 V	KEFQ 0805 NPO	
1672.681	C141	SMD 2,7 pF/0,25/63 V	KEFQ 0805 NPO	
1672.681	C142	SMD 2,7 pF/0,25/63 V	KEFQ 0805 NPO	
1672.681	C143	SMD 2,7 pF/0,25/63 V	KEFQ 0805 NPO	
1647.067	C144	SMD 4700 pF/10/63 V	KEFQ 0805 X7R	
1647.067	C145	SMD 4700 pF/10/63 V	KEFQ 0805 X7R	
1647.067	C146	SMD 4700 pF/10/63 V	KEFQ 0805 X7R	
1650.181	C147	SMD-KO 33p/5/63	KEFQ 0805 NPO	
1646.990	C148	SMD 0,1 µF/10/63 V	KEFQ 1210 X7R	
1643.967	C149	SMD 68 pF/5/63 V	KEFQ 0805 NPO	
1646.990	C150	SMD 0,1 µF/10/63 V	KEFQ 1210 X7R	
1646.885	C151	SMD 1000 pF/5/63 V	KEFQ 0805 NPO	
1647.067	C152	SMD 4700 pF/10/63 V	KEFQ 0805 X7R	
1646.885	C153	SMD 1000 pF/5/63 V	KEFQ 0805 NPO	
1423.010	C154	Elko AA 100-10 GPF	DIN 41316-G	ROE
0921.882	C155	47 pF/2/63 V	EDPU/NPO	

Diodes:

1613.162	D1	LL 4148	1,5x3,5
0763.764	D2	1 N 4004	
0763.764	D3	1 N 4004	
1760.068	D4	LL 101 C	1,5x3,5
1760.068	D5	LL 101 C	1,5x3,5
1865.668	D6	ZN 458 2,45 V	
1744.240	D7	BA 389	
1744.240	D8	BA 389	
1744.240	D9	BA 389	

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-1. Mixer

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1760.068	D10	LL 101 C	1,5x3,5	
1760.068	D11	LL 101 C	1,5x3,5	
1613.162	D12	LL 4148	1,5x3,5	
1613.162	D13	LL 4148	1,5x3,5	
1916.084	D14	ZMM 5,6 V		
1613.162	D15	LL 4148		
1613.162	D16	LL 4148		
1613.162	D17	LL 4148		
1613.162	D18	LL 4148		
1916.084	D19	ZMM 5,6 V		

Resistors:

1887.734	R7	SMD 28k-1-0,125 W	HN 329 T.3	
1795.104	R8	SMD 17,8k-1-0,125 W	HN 329 T.3	
1643.304	R10	SMD 22-5-0,125 W	HN 239 T.4	
1878.050	R13	SMD 56-5-0,125 W	HN 239 T.4	
1878.050	R17	SMD 56-5-0,125 W	HN 329 T.4	
1930.885	R20	SMD 23,7k-1-0,125 W	HN 329 T.3	
1650.130	R21	SMD 22k-5-0,125 W	HN 329 T.4	
1642.391	R22	SMD 22k-1-0,125 W	HN 329 T.3	
1670.611	R23	SMD 10k-1-0,125 W	HN 329 T.3	
1647.482	R24	SMD 3,09-1-0,125 W	HN 329 T.3	
1643.460	R27	SMD lk-5-0,125 W	HN 329 T.4	
1647.105	R28	SMD 100-5-0,125 W	HN 329 T.4	
1649.086	R29	SMD 820-5-0,125 W	HN 329 T.4	
1663.828	R31	SMD 18k-5-0,125 W	HN 329 T.4	
1612.980	R32	SMD 100k-5-0,125 W	HN 329 T.4	
1643.428	R34	SMD 560-5-0,125 W	HN 329 T.4	
1643.428	R35	SMD 560-5-0,125 W	HN 329 T.4	
1643.460	R36	SMD lk-5-0,125 W	HN 329 T.4	
1643.630	R38	SMD 33k-5-0,125 W	HN 329 T.4	
1647.075	R39	SMD 680-5-0,125 W	HN 329 T.4	
1643.673	R40	SMD 47k-5-0,125 W	HN 329 T.4	
1647.105	R41	SMD 100-5-0,125 W	HN 329 T.4	
1643.460	R42	SMD lk-5-0,125 W	HN 329 T.4	
1709.569	R43	SMD 8,2k-5-0,125 W	HN 329 T.4	
1709.569	R44	SMD 8,2k-5-0,125 W	HN 329 T.4	
1887.696	R45	SMD 3,3-5-0,125 W	HN 329 T.4	
1887.696	R46	SMD 3,3-5-0,125 W	HN 329 T.4	
1808.524	R47	SMD 1,2k-5-0,125 W	HN 329 T.4	
1647.075	R48	SMD 680-5-0,125 W	HN 329 T.4	
1647.180	R49	SMD 47-5-0,125 W	HN 329 T.4	

Parts lists No.
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-1. Mixer-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1643.304	R50	SMD 22-5-0,125 W	HN 329 T.4	
1643.460	R51	SMD lk-5-0,125 W	HN 329 T.4	
1612.948	R52	SMD 10k-5-0,125 W	HN 329 T.4	
1612.980	R53	SMD 100k-5-0,125 W	HN 329 T.4	
1612.948	R54	SMD 10k-5-0,125 W	HN 329 T.4	
1677.764	R55	SMD 16,9k-1-0,125 W	HN 329 T.3	
1647.482	R56	SMD 3,09-1-0,125 W	HN 329 T.3	
1647.075	R60	SMD 680-5-0,125 W	HN 329 T.4	
1647.091	R61	SMD 6,8k-5-0,125 W	HN 329 T.4	
1647.091	R62	SMD 6,8k-5-0,125 W	HN 329 T.4	
1642.391	R63	SMD 22k-5-0,125 W	HN 329 T.3	
1670.611	R64	SMD 10k-1-0,125 W	HN 329 T.4	
1930.915	R65	SMD 150-5-0,062 W	HN 329 T.2	
1930.907	R66	SMD 39-5-0,062 W	HN 329 T.2	
1930.915	R67	SMD 150-5-0,062 W	HN 329 T.2	
1995.677	R68	9,1k/5/0805	DBL 6160000/C01B	
1995 677	R69	9,1k/5/0805	DBL 6160000/C01B	
1612.875	R71	SMD 270-0-0,125 W	HN 329 T.4	
1612.875	R73	SMD 270-5-0,125 W	HN 329 T.4	
1930.893	R75	Potentiometer 1k	typ 170/6 MOL	
1704.621	R76	SMD 470-5-0,125 W	HN 329 T.4	
1704.621	R77	SMD 470-5-0,125 W	HN 329 T.4	
1612.913	R78	SMD 4,7k-5-0,125 W	HN 329 T.4	
1678.752	R79	SMD 100k-1-0,125 W	HN 329 T.3	
1647.105	R80	SMD 100-5-0,125 W	HN 329 T.4	
1643.460	R81	SMD 1k-5-0,125 W	HN 329 T.4	
1647.202	R82	SMD 12k-5-0,125 W	HN 329 T.4	
1678.752	R83	SMD 100k-1-0,125 W	HN 329 T.4	
1808.524	R84	SMD 1,2K-5-0,125 W	HN 329 T.4	
1647.091	R85	SDM 6,8K-5-0,125 W	HN 329 T.4	
1612.816	R86	SDM 6,8-10-0,125 W	3,2 x 1,6	
1612.832	R87	SMD 15-5-0,125 W	3,2 x 1,6 x 0,58	

Coils:

1871.854	L8	Spule 291 GNS-2089 FSK		
1916.106	L9	SMD 100 µH/10 %	FA 101 K	
1422.545	L10	Spule 0,34 µH/5 %	97 E 2.140.86	HAGENUK
1871.854	L11	Spule 291 GNS-2089 FSK		
1916.106	L12	SMD 100 µH/10 %	FA 101 K	
1916.106	L16	SMD 100 µH/10 %	FA 101 K	
1916.106	L17	SMD 100 µH/10 %	FA 101 K	
1916.092	L22	SMD 1 µH/20 %	FA 1 ROM	

-1. Mixer-

Ident-No	Mark	Electr. value	Identity	Manufacturer
1916.092	L23	SMD 1 µH/20 %	RA 1 ROM	
	L24	Spule 336 nH		
1915.967	L25	Spule 380 nH	97 E 2.155.175-7	
	L26	Spule 336 nH		
1965.387	L27	100 µH	97 E 2.155.87	
1965.387	L28	100 µH	97 E 2.155.87	
1916.106	L29	SMD 100 µH/10 %	FA 101 K	
1887.688	L30	1000 µH/20 %	Typ 77.50	
1929.879	L31	100 µH/5 %	B 78108-S1104 J	
1930.877	L32	100 nH	97 E 2.155.190-2	
	L36	123 nH		
	L37	141 nH		
1915.983	L38	141 nH	97 E 2.155.175-9	
	L39	123 nH		
	L40	88 nH		
1915.975	L41	100 nH	97 E 2.155.175-8	
	L42	88 nH		
1916.092	L43	SMD 1 µH/20 %	FA 1 ROM	
1916.106	L44	SMD 100 µH/10 %	FA 101 K	
1068.105	L45	0,15 µH/10 %	Typ 72.0	
1068.105	L46	0,15 µH/10 %	Typ 72.0	
	L47		97 E 2.155.175-10	

Integrated circuits:

1427.156	IC A		CA 3240 E	
1427.156	IC B		CA 3240 E	
1815.105	IC C		IC UA 733 N	
1865.676	IC D		IC LM 78 L 12 AC	

Transistors:

1710.575	T1		BC 849 B 23 A3	
1710.575	T2		BC 849 B 23 A3	
1916.122	T3		BFR 53	
1916.122	T4		BFR 53	
1478.834	T5		2xBF 246 B	
1478.834	T6		97 D 2.140.84	
1710.575	T7		BC 849 B 23 A3	
1740.520	T8		BC 859 B 23 A3	
1887.742	T9		BF 982	

Parts lists No.
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-1. Mixer-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Connectors:				
1705.504	ST1		11,1520,001	
1705.504	ST2		11,1520,001	
1827.642	ST3		0-826629-3. 3-polig	
1826.514	ST4		609-1604 E 16polig	
1705.504	ST6		11,1520,001	
Supplements:				
1420.836	QF1	63,078 MHz	97 E 2.140.85-10	
1420.828	M1		SRA-3H	
1930.761	BU3		97 E2.155.86	
1521.446	REL.A	DR-15 V		
1521.446	REL.B	DR-15 V		

-2.Mixer-

Technical description

The 2nd mixer module converts the IF signal from the 1st mixer (63.078 MHz) to 5 MHz. At the same time the output level can be controlled with a dynamic range of 80 db by varying the AGC voltage U_{AGC} (2.0 V min. attenuation to 3.2 V max. attenuation). By using two switchable crystal filters the bandwidths 6 kHz and 3 kHz can be selected. Narrower bandwidths are selected on the Filterboard but either of the two filters in the 2. mixer has to be active. The bandwidth selection is controlled by the processor. The 2nd mixer has two 5 MHz IF outputs decoupled from each other; during the bite test the level is monitored only at output ST 2 (5 MHz IF OUT to filterbank) as only this output has a defined 50 ohm termination. The output ST3 (5 MHz IF OUT to ISB Demodulator) can remain open. The signal from the 1st mixer socket BU2, 63.078 MHz FROM 1st IF is fed to the mixer module via a 60 MHz high pass filter. The mixer module contains 3 low pass filters, a ringmixer and a diplexer. Due to the modular construction of the unit (MIXER MODULE) it suppresses intermodulation products in the IF output of the 2nd mixer caused by spurious emissions. If these emissions were to penetrate the mixer module they could cause mixing products with VCO's harmonics in the vicinity of the 5 MHz IF signal. The filters in the signal path to the ring mixer M 1 strongly attenuate signals above 200 MHz; the cut off frequency for the LO and RF signals is around 66 MHz. An attenuation of < 40 dB from 160 MHz to 1.6 GHz is achieved by the screened construction and the use of air core coils and SMD capacitors. The passband attenuation is in contrast, only 0.3 dB. The mixer output always sees a 50 ohm termination made up of the filter network consisting of L 7, L 8, C 54 and C 55. This minimizes intermodulation from the ring mixer. The sum frequency is separated from the output filter by a parallel tuned resonant circuit, and terminated to 50 ohm by a series tuned resonant circuit. The difference frequency (5 MHz) passes via the Chebyshev filter (0.4 dB passband attenuation; 40 dB stopband attenuation from 27 MHz to 1.6 GHz) to the output of the mixer module. The signal then passes to the two filter branches T 1, D 10, F 8, D 3 and T 2, D 11, F 7, D 4. The DATA and STROBE control signals from the processor are stored in IC-A, which control the comparators IC-B and thus the diodes of the respective quartz filter.

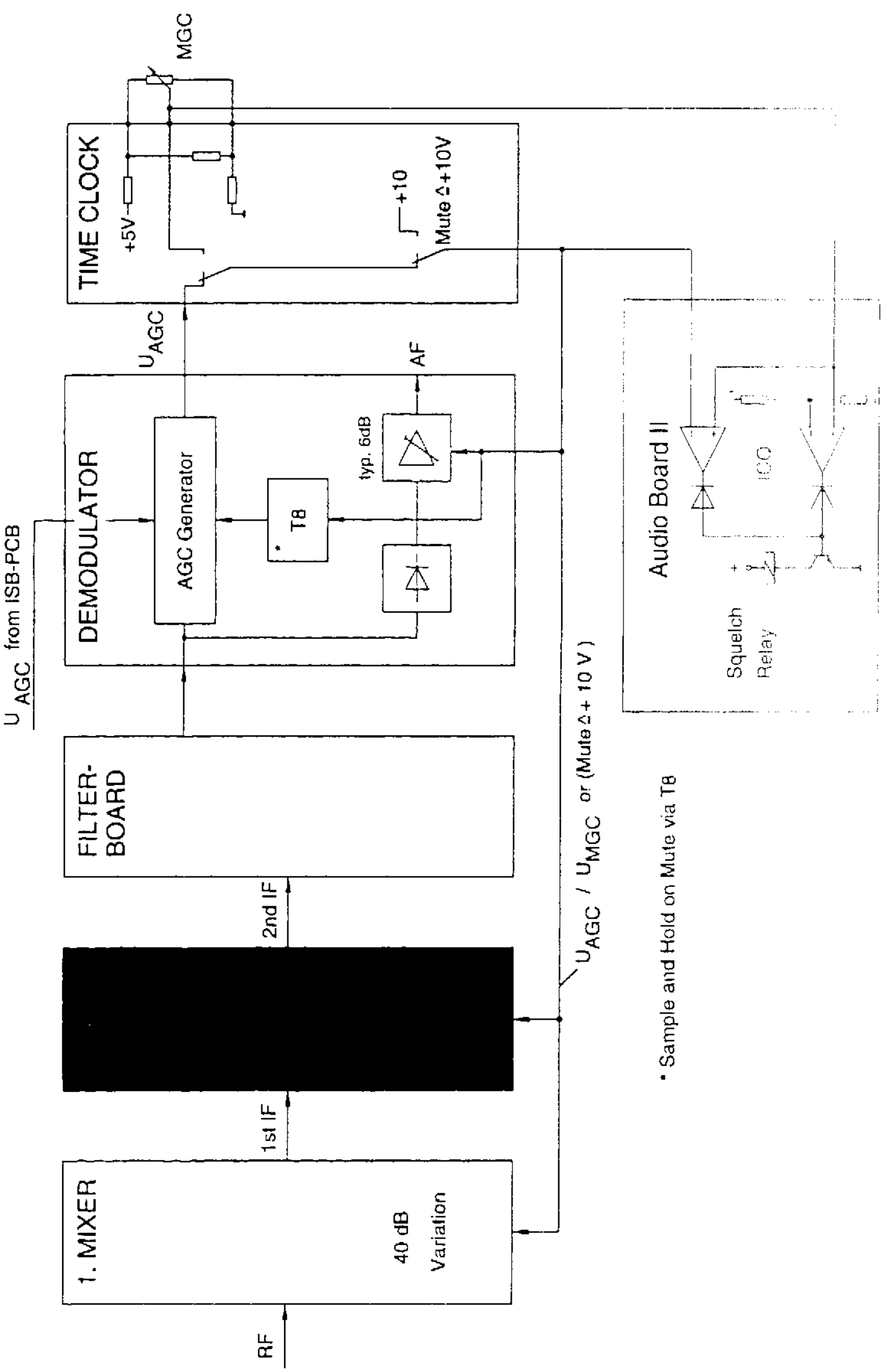
A DATA H signal switches the 6 kHz path (± 3 kHz) on the negative edge of the STROBE signal. A voltage of 15 V is then present on MP 2. D 10 thus conducts; MP 3 is at the same time about 2.5 V, so that D 3 also conducts and the filter F 8 becomes operational. Filter F 7 is at the same time blocked. A DATA L signal is required for the opening the 3 kHz path.

-2.Mixer-

The following two-stage amplifier (T 3 and T 4) has dual-gate MOSFETS, each stage having a dynamic range of 40 dB. The IF signal is fed to gate 1. The amount of amplification is controlled by the DC voltage on G 2. The voltage on gate 2 causes the drain current to change and therefore the gain of the transistor to change; high current-high gain; low current-low gain. Low gain is achieved by making the gate 2 voltage with reference to source negative which causes low current to flow. Due to the fact that the bias of the transistor also depends on the value of the gate 1- source voltage, a source resistor would therefore cause an unwanted change in the bias. This problem is minimized by using the zener diode D 6. This holds the source voltage at a temperature compensated level between 5.6 min. to 6.2 V max.. The AGC range for gate 2 is between 5.2 to 7.0 V. IC-F is used to increase the U_{AGC} from 2.0 - 3.2 to 5.2 - 7.0 V.
The difference voltage U_{AGC} min - U_{AGC} max is controlled by R 25, R 24, and the voltage range by R 20, R 21 and R 22. Potentiometer R 22 is used to compensate for transistor differences.

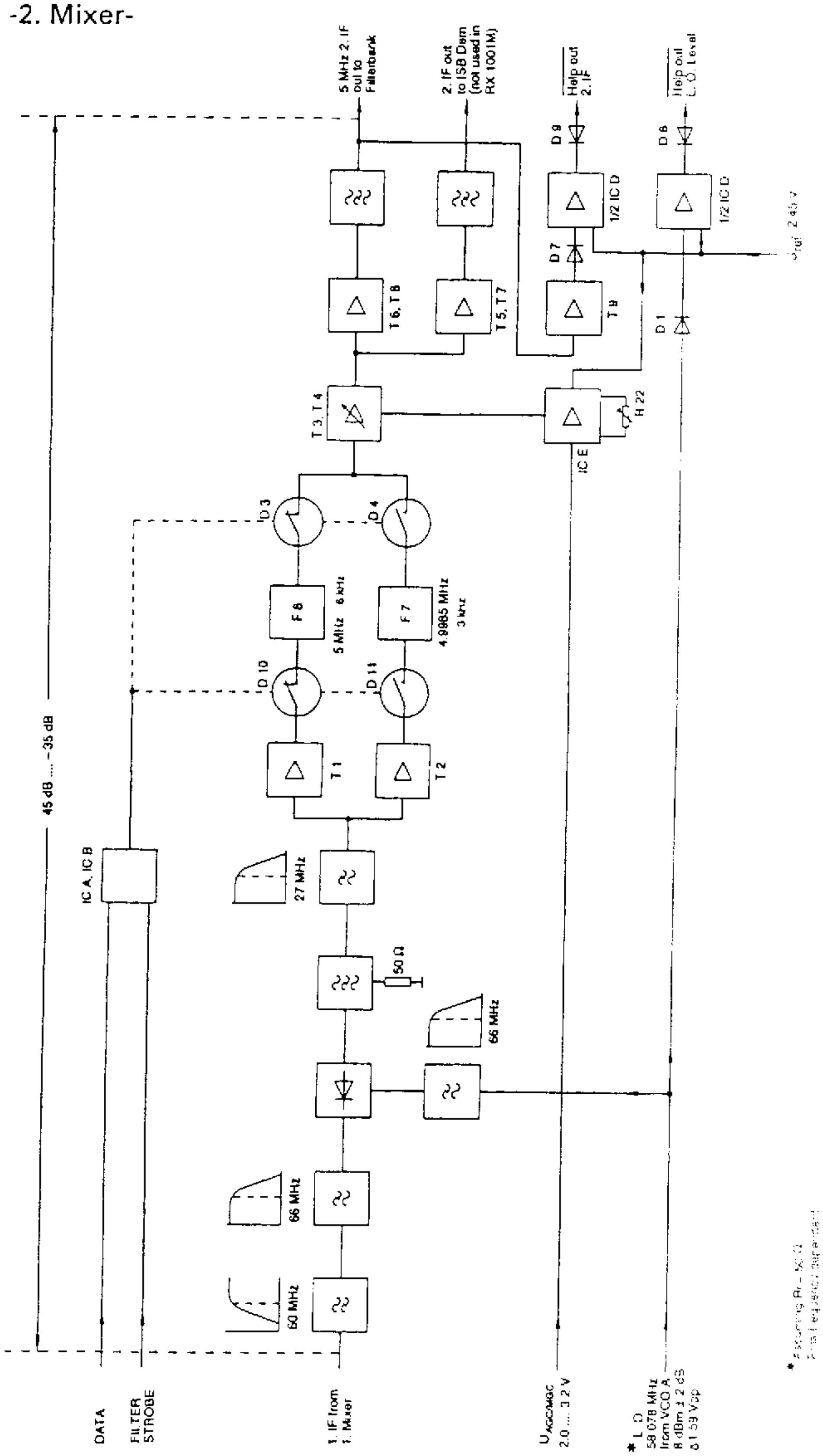
The voltage regulator IC-C and the four diodes D 14-17 regulate the voltage. The diodes are used for temperature compensation.
The output signal is split between 2 buffer stages. Each buffer stage is followed by a transistor amplifier (T 7, T 8). A transformer bandpass filter is connected to the outputs of the transistor amplifiers to attenute harmonics and provide the required 50 ohm termination. The signal level 5 MHz IF OUT TO FILTERBANK output is monitored by the 5 MHz IF level sensor. The signal is amplified by T 9 rectified by D 7 and compared by IC-D with the reference voltage from R 6, R 60 and D 2. The level sensor is required only during BITE TEST. Using the LO LEVEL sensor the incoming signal from VCO A f = 58.078 MHz (+7 dBm) using rectifier D 1 and comparator IC-D is monitored. If the input signal level is too low then the LO LEVEL output is low. If the level is correct then the LO output is HIGH.

-2. Mixer-



Gain control principle

-2. Mixer-



Blockdiagram 2. Mixer

-2. Mixer-

Test and alignment instructions

Required: Circuit diagram - 2[nd] MIXER - Hagenuk Drawing No. 97 Sa BX 2.155.90
spectrum analyser, signal generator

Test configuration: The 2[nd] mixer module is removed and the cassette is opened. Then reconnect all cables to the receiver.

Testing of basic gain

Unplug St (plug) 2 (63.078 MHz FROM 1[st] IF) and connect the tracking generator into place (f = 63.078 MHz P_{OUT} -46 dBm).
Connect the spectrum analyser to ST 3 (5 MHz IF OUT TO ISB DEMODULATOR) with the following settings:

Centre frequency	5	MHz
Span	20	kHz
Reference level	0	dBm

Switch on receiver and check output level at:
1[st] bandwidth 3.00 kHz code 87
2[nd] bandwidth 6.00 kHz code 88
Test values:
Reconnect the filter with the lower output level. Disconnect the AGC voltage (ST 1 pin 4) and feed in an external AGC voltage U_{AGC} of 2.00 V ± 5 mV.
Test values:
Output level at plug ST 3 should be: -1 dBm ± 0.5 dB (can be adjusted with R 22).

Testing the IF and LO level monitoring circuit

Disconnect ST 2 and terminate connection ST 2 on the circuit board with 50 ohm. Connect DVM to ST 1 pin 8.
Test values:
Reduce signal level from signal generator; at -40 to -44 dBm, LOW level should be on ST 1 pin 8.
Connect socket Bu 2 to receiver, disconnecting at socket Bu 3 and connecting the signal generator to socket Bu 3, 58.078 MHz from VCO.
Connect DVM to ST 1 pin 9. Set signal generator to f = 58.078 MHz P_{OUT} +7 dBm.
Test values:
Reduce signal from signal generator; at +3 dBm to -1 dBm, LOW level should be on ST 1 pin 9.

-2. Mixer-

Testing the dynamic characteristic
Preparations as in item 1 above.

NOTE
Fit case cover.

Test values:

Signal generator 63.078 MHz	U_{AGC}	P_{OUT} on plug ST 2
-46 dBm	2.00 V	-1 dBm ± 0.5 dB
-46 dBm	2.20 V	-11 dBm ± 3 dB
-46 dBm	2.40 V	-22 dBm ± 3 dB
-46 dBm	2.60 V	-33 dBm ± 4 dB
-46 dBm	2.80 V	-46 dBm ± 5 dB
-46 dBm	3.00 V	-61 dBm ± 5 dB
-26 dBm	3.20 V	-61 dBm ± 5 dB

If the maximum attenuation is exceeded, R 76 (if not enough, R 66) must be fitted in parallel with R 25; then start again with item 1.

Testing the crystal filters
Select 3.00 kHz bandwidth on receiver.
Test values:
Measure the output level on plug ST 2 with a spectrum analyser. Vary the frequency of the signal generator in accordance with the following table and measure the level.

Signal generator frequency	Output level
63.078 MHz ± 3 kHz	U/out -12 dBm
63.078 MHz ± 5.0 kHz	U/out -40 dBm
63.078 MHz ± 7.8 kHz	U/out -70 dBm
63.078 MHz ± 100... 200 kHz	U/out -70 dBm

Select 6.00 kHz bandwidth on receiver.
Test values:
Measure the output level on plug St 2 with a spectrum analyser. Vary the frequency of the signal generator in accordance with the following table and measure the level:

Signal generator frequency	Output level
63.078 MHz ± 6 kHz	U/out -12 dBm
63.078 MHz ± 10 kHz	U/out -40 dBm
63.078 MHz ± 15.6 kHz	U/out -70 dBm
63.078 MHz ± 100...200 kHz	U/out -70 dBm

-2.Mixer-

Test and alignment instructions (mixer module)

Required: Circuit diagram - 2nd MIXER Hagenuk Drawing No. 97 Sa Bx 2.155.90
spectrum analyser, RF generators, VSWR bridge

Test configuration: The 2nd MIXER module is removed and the cassette is opened; all subsequent operations are illustrated in the diagrams given below.

Testing the LO filter

Disconnect the module inputs and outputs from the circuit board. Solder a coax cable to the left-hand filter in the central section and connect to the input of the spectrum analyser. Connect the RF generator to the input (see fig. 4-1).

Spectrum analyser settings:

Centre frequency	100	MHz
Span	200	MHz
Tracking generator-level	-10	dBm

Test values:
The filter curves should reach the levels stated at the frequencies given.

Frequency	Level
60 MHz	-10 dBm ± 0.5 dB
105 MHz	-30 dBm ± 0.7 dB
200 MHz	<60 dBm

Testing the RF filter

Solder a coax cable to the right-hand filter in the central section and connect to the input of the spectrum analyser. Connect the RF generator to the input (see fig. 4-2).

Spectrum analyser settings:

Centre frequency	100	MHz
Span	200	MHz
Tracking generator-level	-10	dBm

Test values:
The filter curves should reach the levels stated at the frequencies given.

Frequency	Level
60 MHz	-10 dBm
105 MHz	-30 dBm ± 0.7 dB
200 MHz	<60 dBm

-2. Mixer-

Testing the IF filter
Solder a coax cable to the filter board in the central section and connect to the spectrum analyser input. Connect the RF generator as illustrated in fig. 4-3.
Spectrum analyser settings: same as in item 2.
Test values:

Frequency	Level
5 MHz	-10 dBm ± 0.4 dB
30 MHz	< -50 dBm
50 MHz	< -70 dBm

Testing the input matching of the filter board
Terminate the IF filter with 50 Ohm (fig. 4-3). Connect the spectrum analyser and tracking generator to a VSWR bridge (impedance bridge). The bridge input to the circuit being measured is open.

Spectrum analyser settings:	Centre frequency	5 MHz/ 121.2 MHz
	Span	2 MHz
	Tracking generator-level	0 dBm

bring the measuring curve on to the 0 dBm reference line. Measure the return loss.

Test values:

Frequency	Return loss	VSWR
5 MHz	>19 dB	<1.25
121.2 MHz	>16 dB	<1.35

NOTE
If the return loss is less than the specified limit for 121.2 MHz, it may be improved by compressing or expanding L 7.

-2. Mixer-

Overall testing of module
Resolder the ring mixer M 1 (IE 500) to the filter sections already measured and then fit cover on to module: Connect measuring instruments as shown in fig. 4-4.

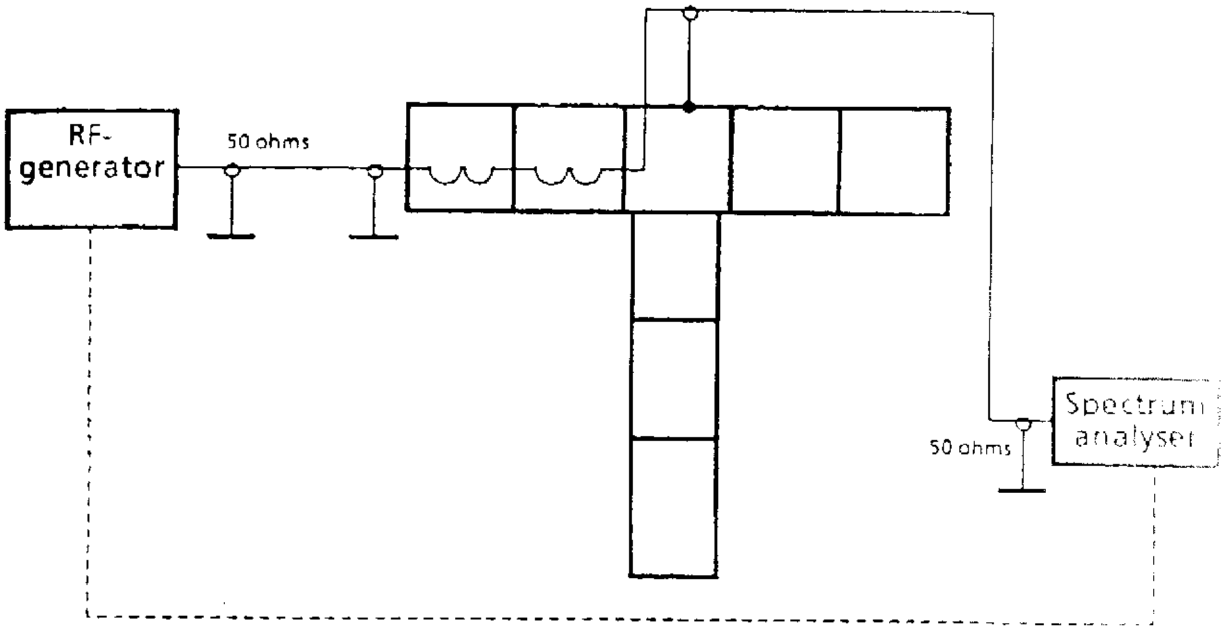
RF generator f = 63.078 MHz; -20 dBm
RF generator f = 58.078 MHz; +7 dBm

Spectrum analyser settings:	Centre frequency	5 MHz
		58.078 MHz
		63.078 MHz
		121.156 MHz
	Span	100 kHz
	Reference level	10 dBm

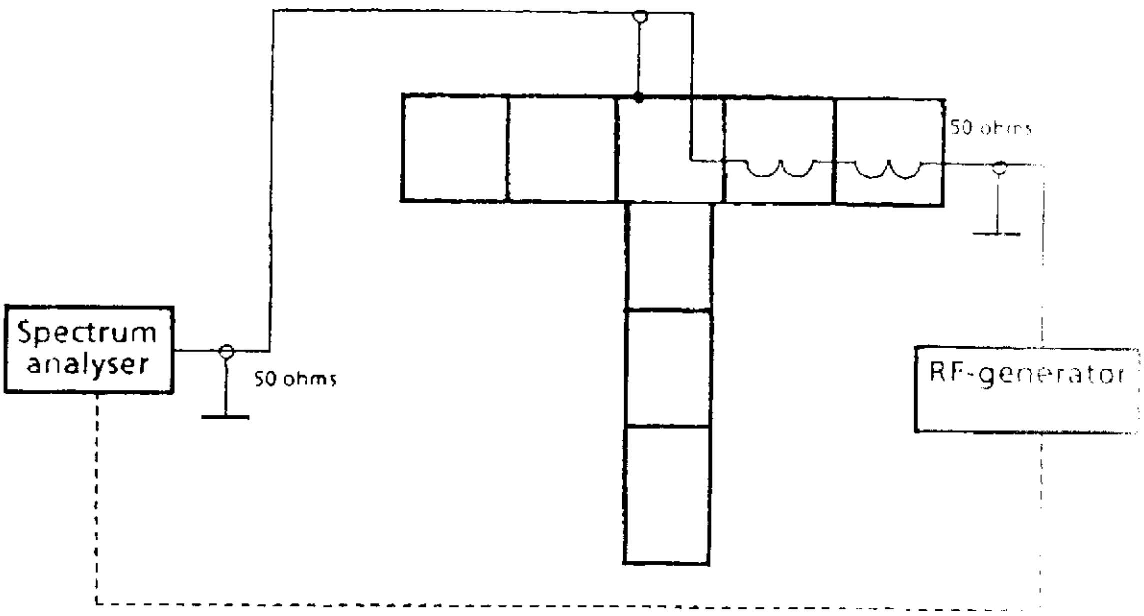
Test values:

Frequency	Output level
5 MHz	> -28.5 dBm
58.078 MHz	< -70 dBm
63.078 MHz	< -90 dBm
121.156 MHz	< -90 dBm

-2. Mixer-

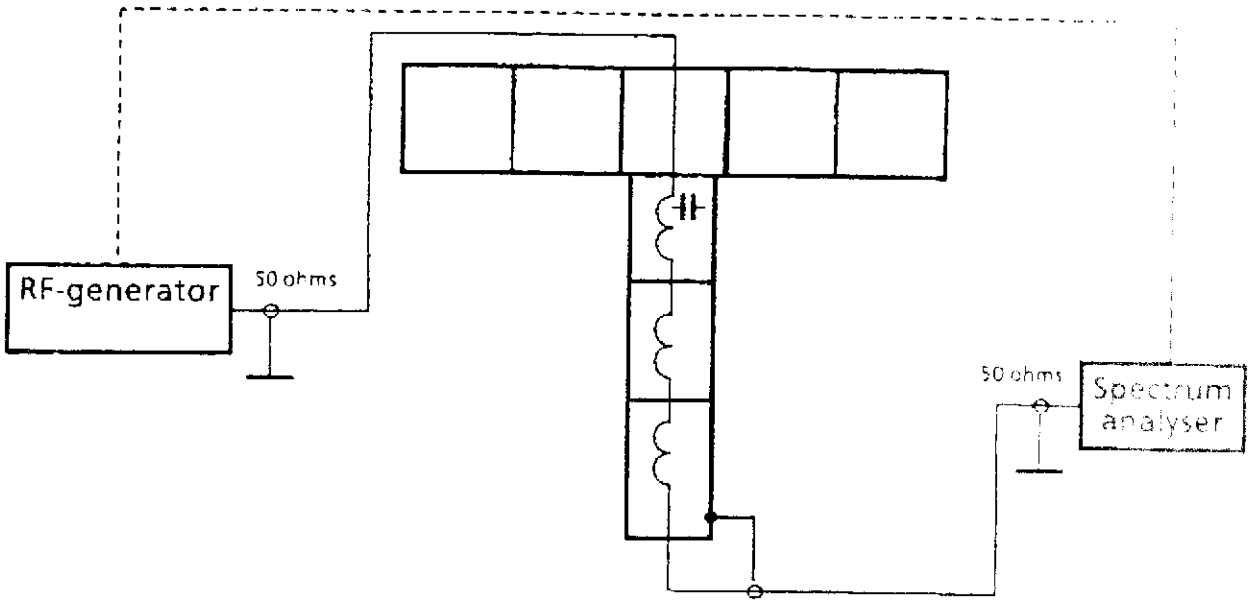


Testing LO-FILTER

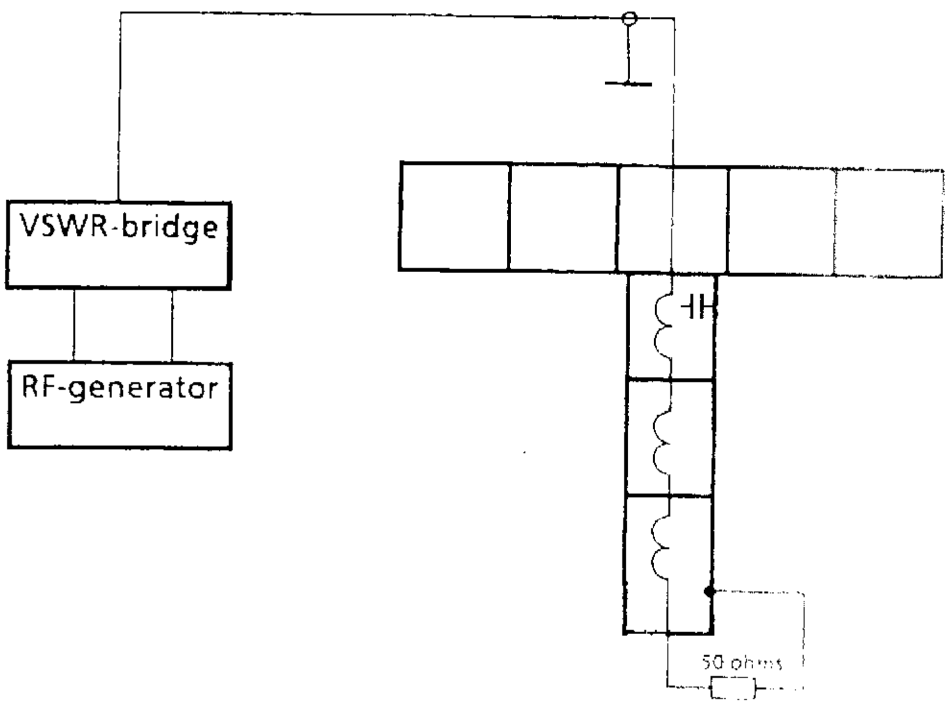


RF-FILTER

-2. Mixer-

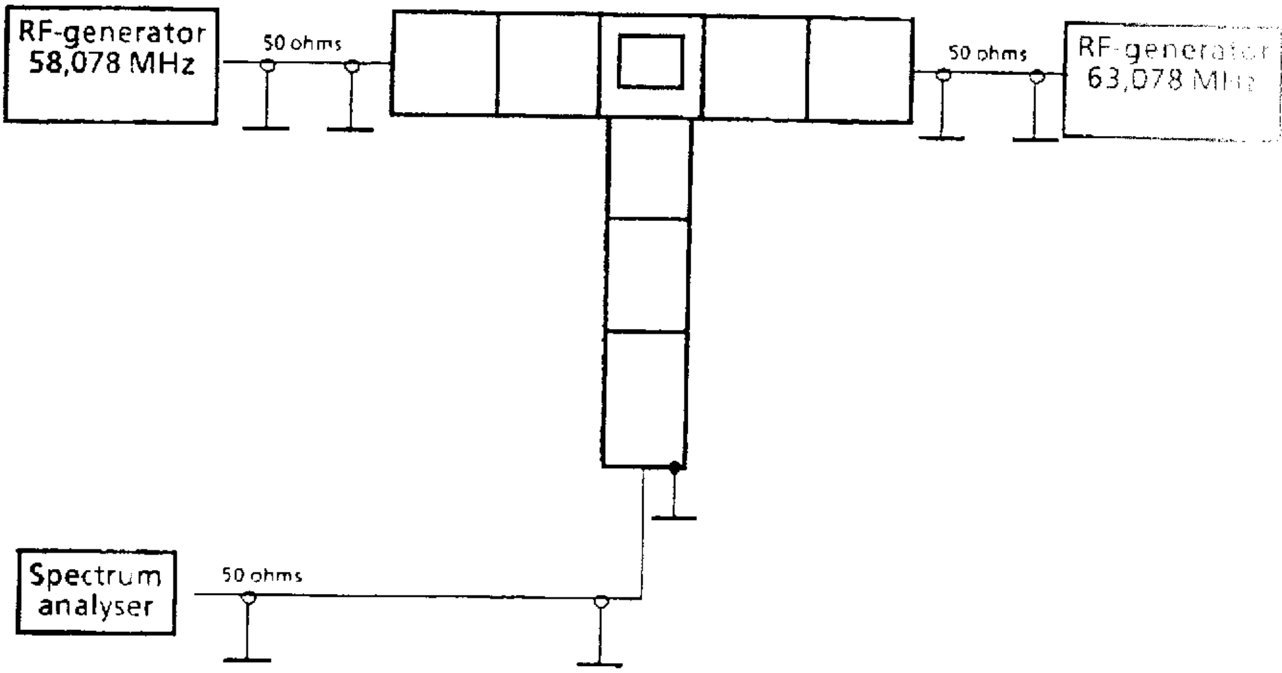


Testing IF-FILTER and input matching



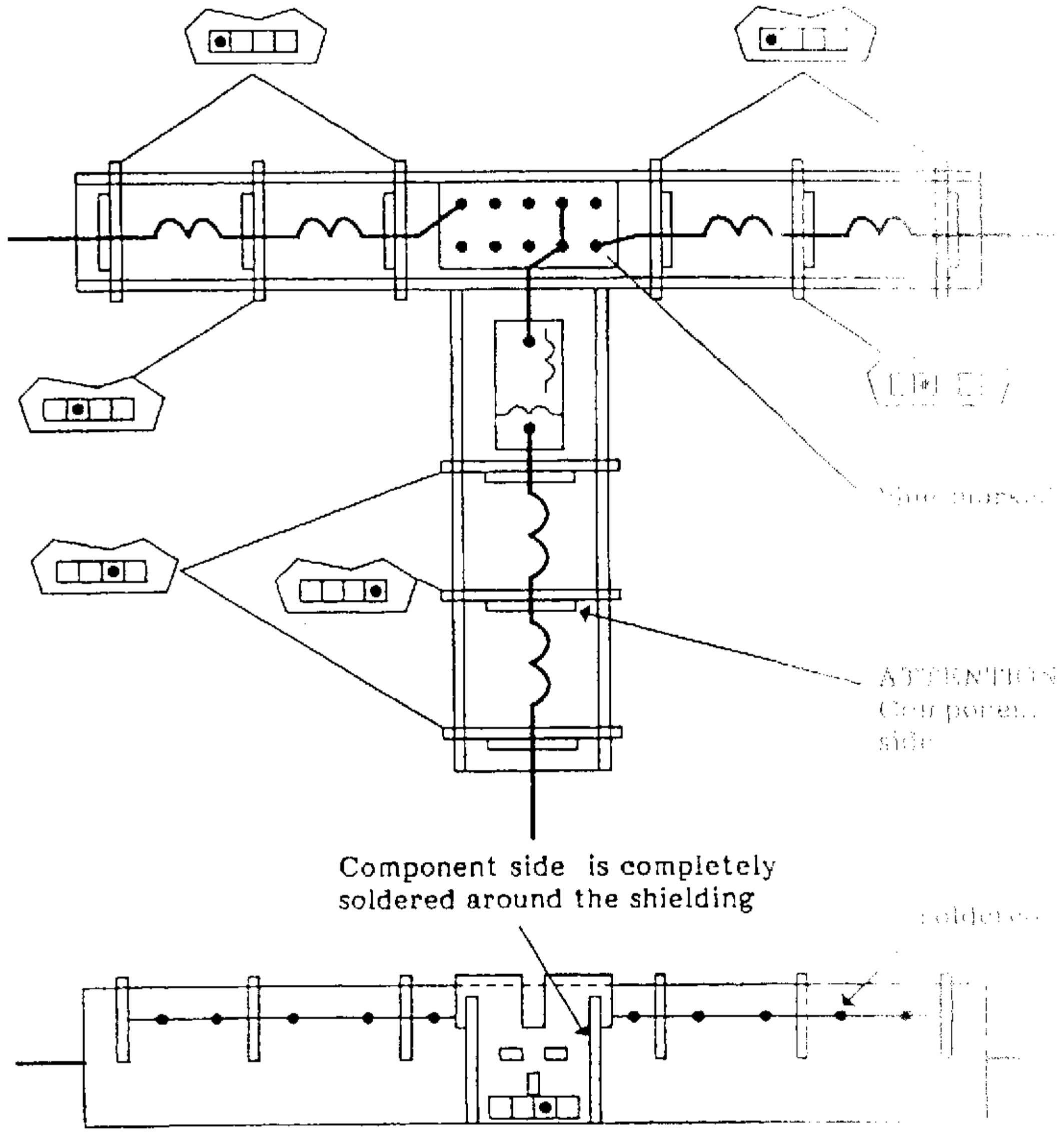
Testing the impedance of the input matching

-2. Mixer-



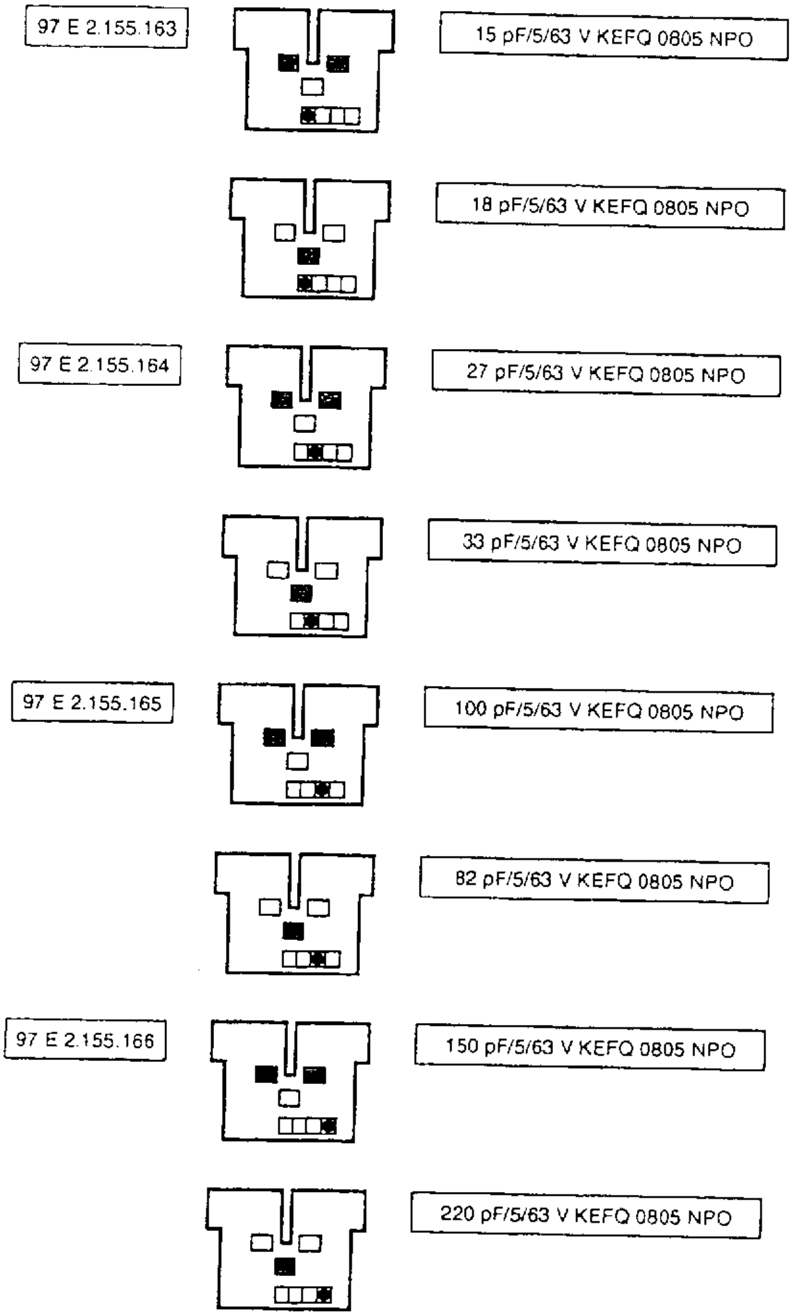
Overall testing of the module

-2. Mixer-



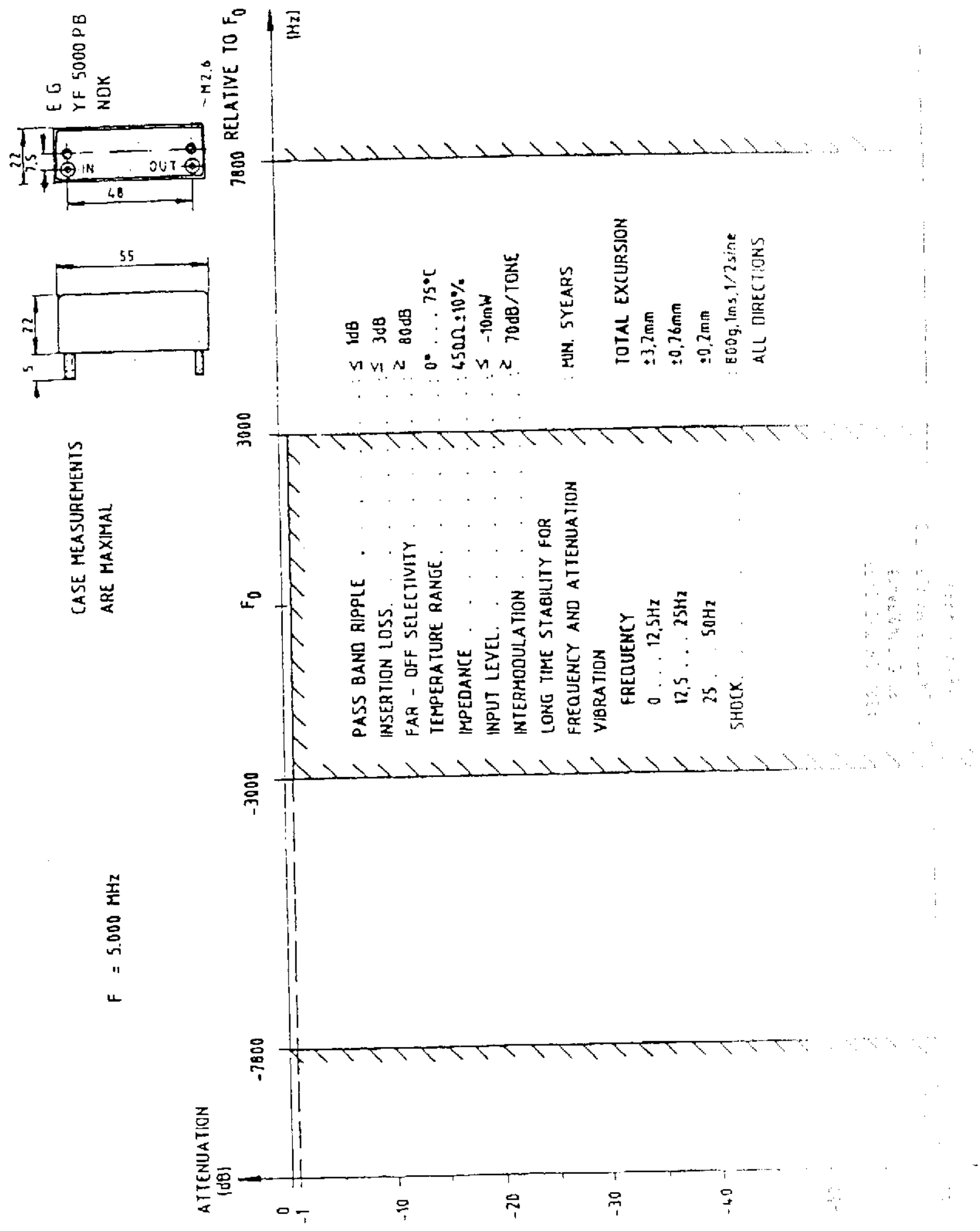
Arrangement of 2. Mixer LP-Filters

-2. Mixer-



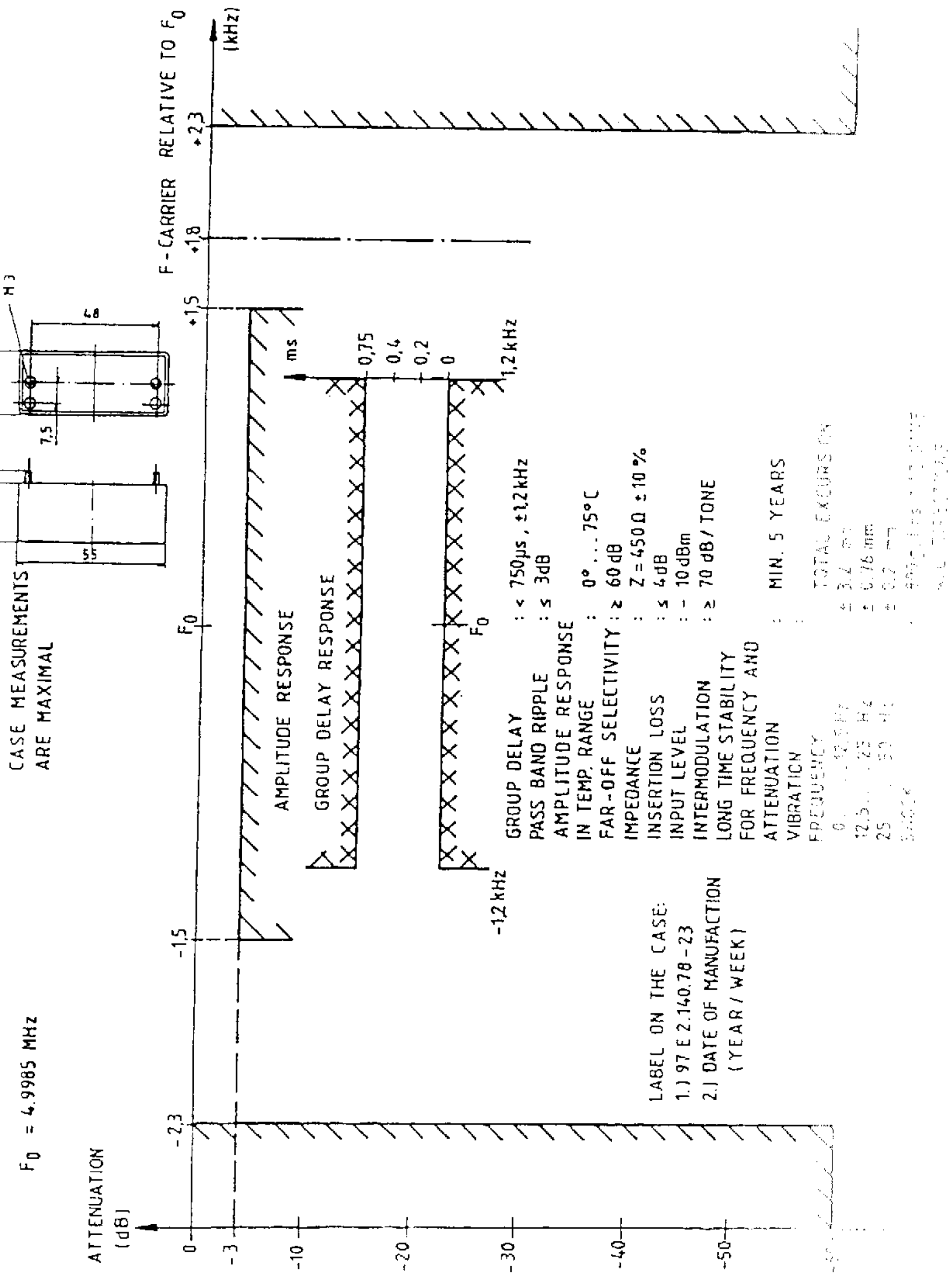
2. Mixer Capacitor PCBs

-2. Mixer-



Quartz Filter 2. Mixer drawing No. 97 E 2.140.78-18

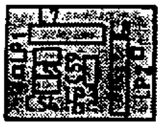
-2. Mixer-



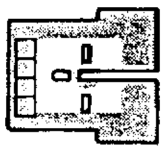
Quartz Filter B=3kHz drawing No. 97 E 2.140.78-23

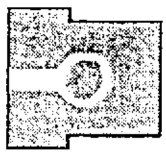
-2. Mixer-

see circuit diagram - 2. MIXER 97 Sa BX 2.155.90

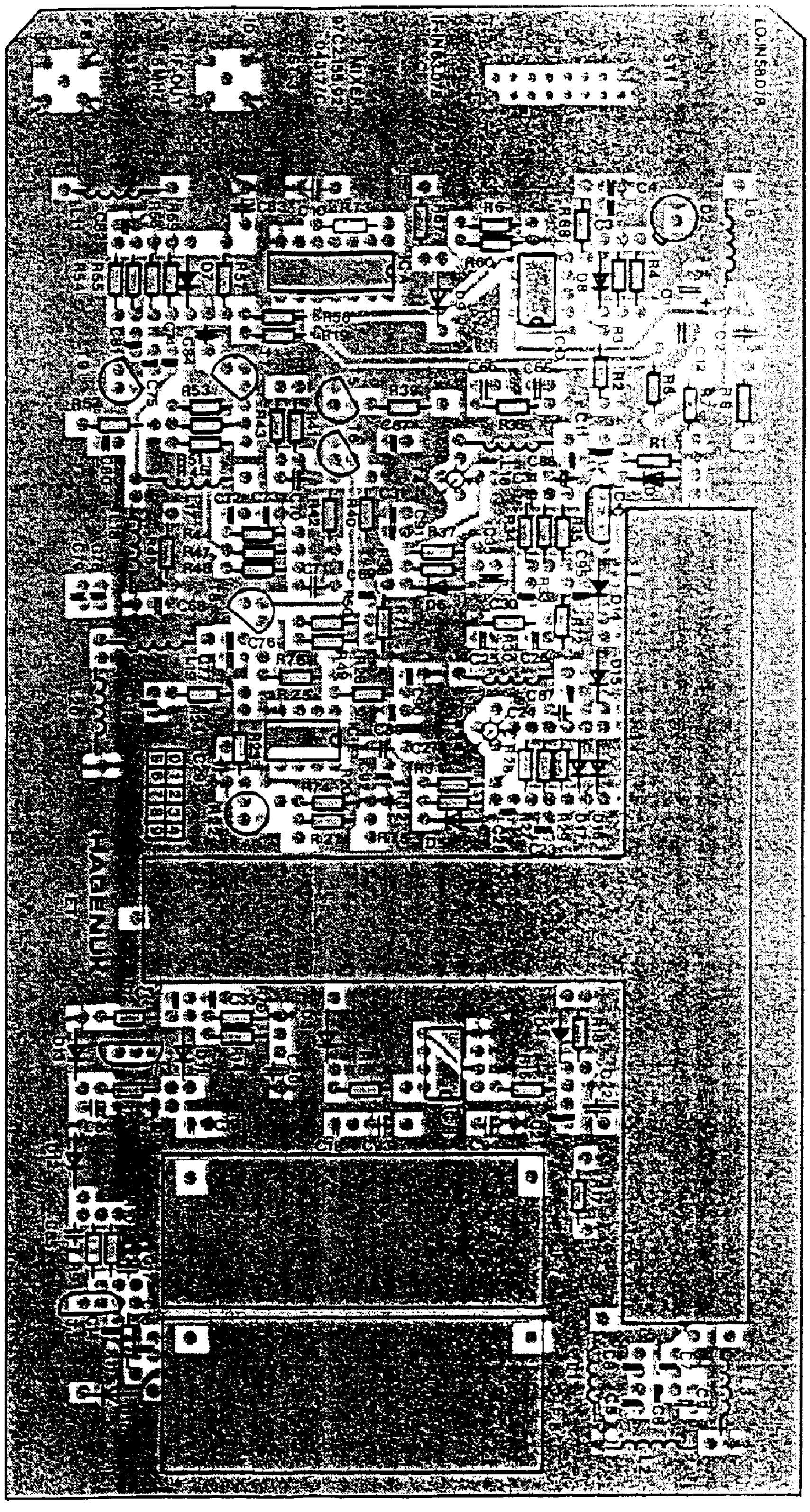


Diplexer PCB - 97 E 2.155.170

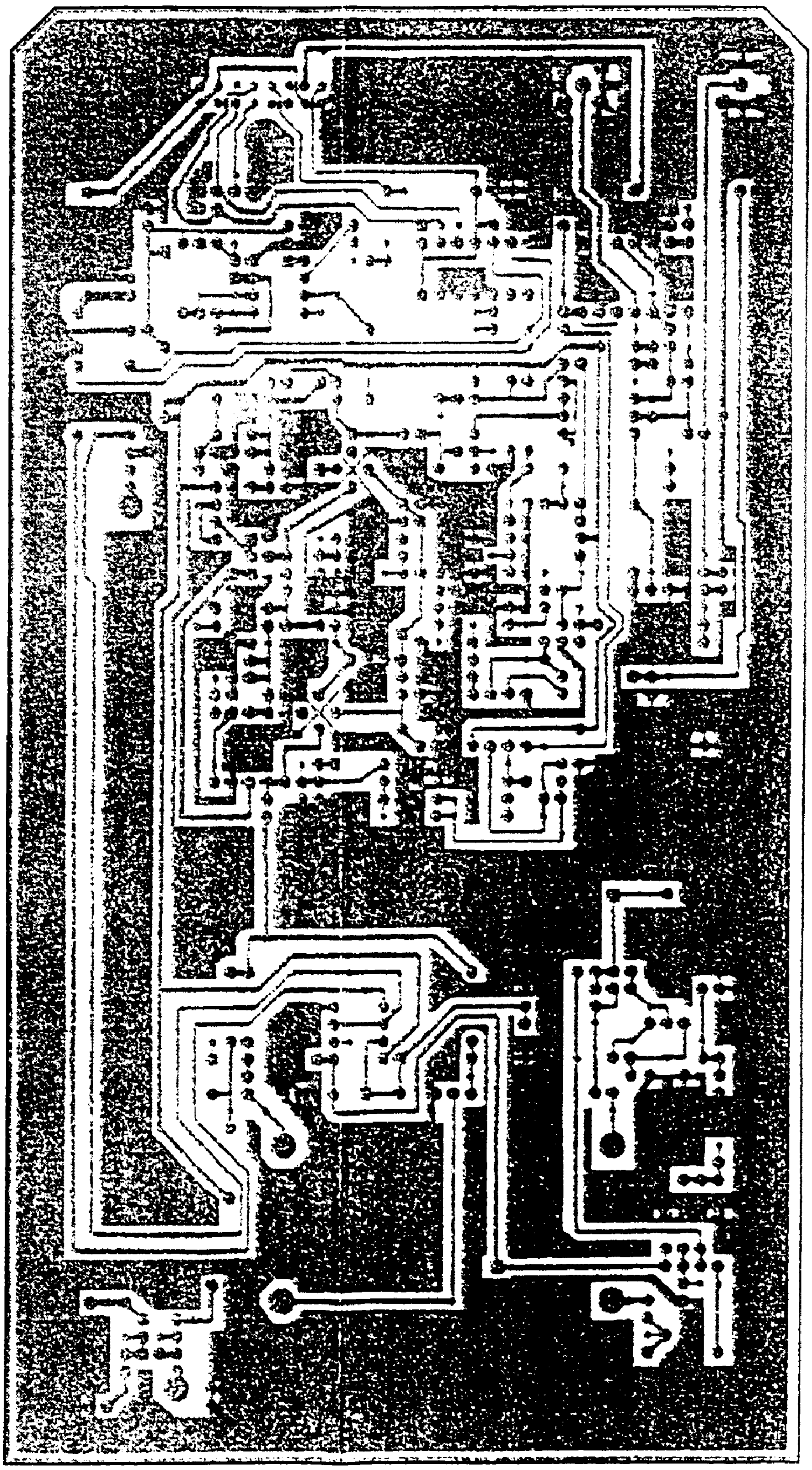




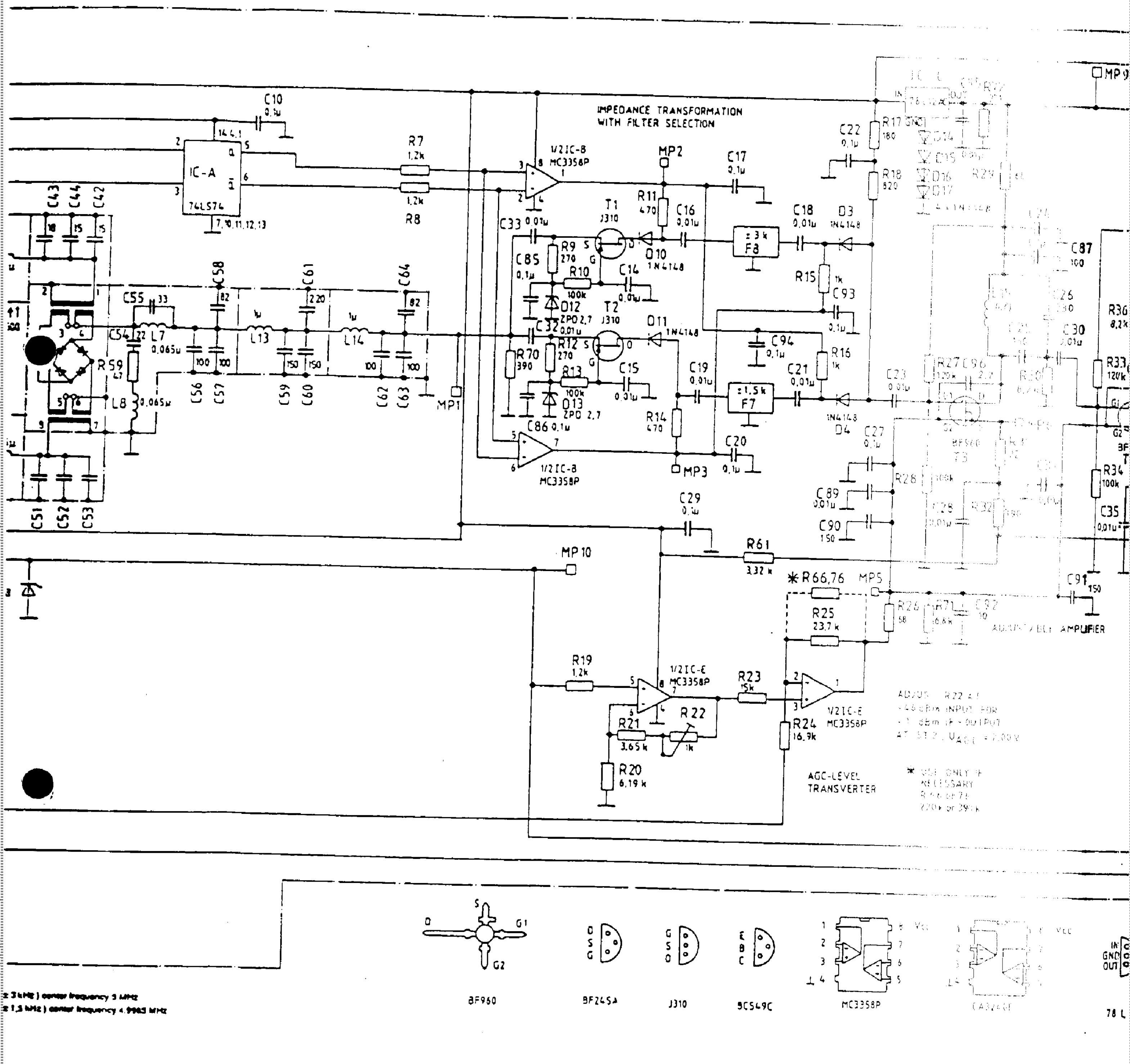
Capacitor PCB - 97 E 2.155.163-166



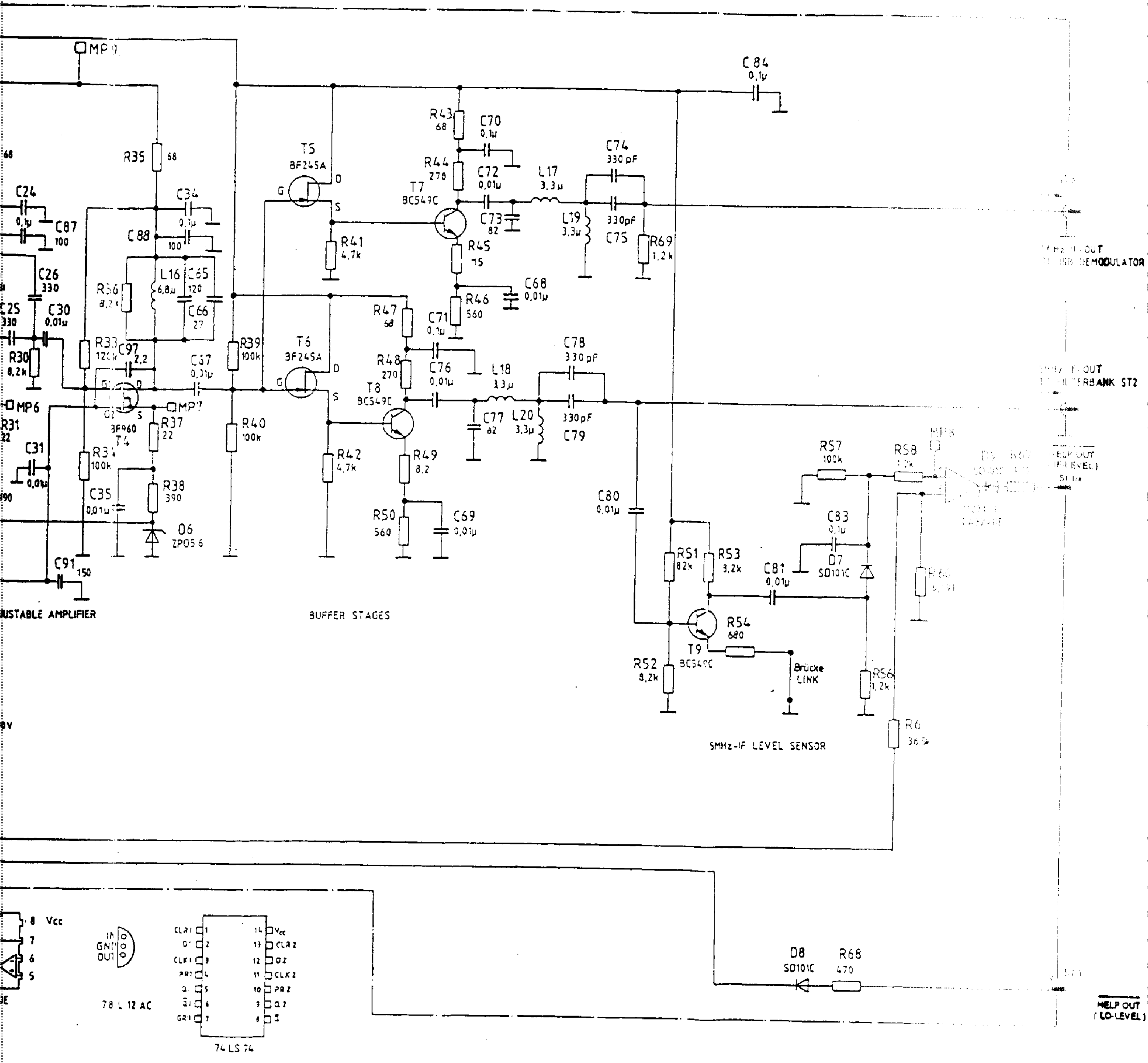
see circuit diagram - 2. MIXER 97 Sa BX 2.155.90



Printed Circuit Board
2. Mixer
97 C 2.155.92



IMPEDANCE TRANSFORMATION WITH FILTER SELECTION
IC-A
74LS74
1/2 IC-B MC3358P
1/2 IC-E MC3358P
T1 J310
T2 J310
D3 1N4148
D4 1N4148
D10 1N4148
D11 1N4148
D12 ZPD 2,7
D13 ZPD 2,7
F8
F7
MP1
MP2
MP3
MP5
MP10
R61 3,32 k
✱ R66,76
R25 23,7 k
R19 1,2k
R23 15k
R24 16,9k
R20 6,19 k
R21 3,65 k
R22 1k
AGC-LEVEL TRANSVERTER
ADJUSTABLE AMPLIFIER
BF960
BF245A
J310
BC549C
MC3358P
CA3240
± 3 kHz) center frequency 5 MHz
± 1,5 kHz) center frequency 4.9985 MHz



2. MIXER
Circuit Diagram
97 Sa BX 2.155.90

Parts lists No.
97 Sa 2.155.9[illegible]

-2. Mixer-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Capacitors:				
1643.819	C1	47/20/35 V	RSP RM 2,5	VALVO
1423.037	C2	0,1/20/63 V	MKS 2	WIMA
1739.840	C3	1000pF/10/100 V	EGRU RM 2,5	VALVO
1739.840	G4	1000pF/10/100 V	EGRU RM 2,5	VALVO
1732.633	C5	82pF/2/100 V	EGRU RM 2,5 NPO	VALVO
1732.617	C6	47pF/2/100 V	EGRU RM 2,5 NPO	VALVO
1115.774	C7	56pF/2/63 V	DIN 41923 NPO	
1478.389	C8	150pF/2/63 V	N150 EDPU 0,6	VALVO
0945.048	C9	100pF/2/63V	NPO 1B DIN 41923	
1423.037	C10	0,1/20/63 V	MKS 2	WIMA
1739.859	C11	0,01/+80/-20/40 V	EGRU RM 2,5	VALVO
1739.859	C12	0,01/+80/-20/40 V	EGRU RM 2,5	VALVO
1739.859	C13	0,01/+80/-20/40 V	EGRU RM 2,5	VALVO
1739.859	C14	0,01/+80/-20/40 V	EGRU RM 2,5	VALVO
1739.859	C15	0,01/+80/-20/40 V	EGRU RM 2,5	VALVO
1739.859	C16	0,01/+80/-20/40 V	EGRU RM 2,5	VALVO
1423.037	C17	0,1/20/63 V	MKS 2	WIMA
1739.859	C18	0,01/+80/-20/40 V	EGRU RM 2,5	VALVO
1739.859	C19	0,01/+80/-20/40 V	EGRU RM 2,5	VALVO
1423.037	C20	0,1/20/63 V	MKS 2	WIMA
1739.859	C21	0,01/+80/-20/40 V	EGRU RM 2,5	VALVO
1423.037	C22	0,1/20/63 V	MKS 2	WIMA
1739.859	C23	0,01/+80/-20/40 V	EGRU RM 2,5	VALVO
1423.037	C24	0,1/20/63 V	MKS 2	WIMA
1420.844	C25	330pF/2/2/63 V	DIN 41923	
1420.844	C26	330pF/2/2/63 V	DIN 41923	
1423.037	C27	0,1/20/63 V	MKS 2	WIMA
1739.859	C28	0,01/+80/-20/40 V	EGRU RM 2,5	VALVO
1423.037	C29	0,1/20/63 V	MKS 2	WIMA
1739.859	C30	0,01/+80/-20/40 V	EGRU RM 2,5	VALVO
1739.859	C31	0,01/+80/-20/40 V	EGRU RM 2,5	VALVO
1739.859	C32	0,01/+80/-20/40 V	EGRU RM 2,5	VALVO
1739.859	C33	0,01/+80/-20/40 V	EGRU RM 2,5	VALVO
1423.037	C34	0,1/20/63 V	MKS 2	WIMA
1739.859	C35	0,01/+80/-20/40 V	EGRU RM 2,5	VALVO
1647.032	C36	15pF/5/63 V	KEFQ 0805	VALVO
1647.032	C37	15pF/5/63 V	KEFQ 0805	VALVO
1650.157	C38	18pF/5/63 V	KEFQ 0805	VALVO
1646.966	C39	27pF/5/63 V	KEFQ 0805	VALVO
1646.966	C40	27pF/5/63 V	KEFQ 0805	VALVO
1650.181	C41	33pF/5/63 V	KEFQ 0805	VALVO
1647.032	C42	15pF/5/63 V	KEFQ 0805	VALVO
1647.032	C43	15PF/5/63 V	KEFQ 0805	VALVO

-2. Mixer-

Parts lists No.
97 Sa 2.155.90

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1650.157	C44	18pF/5/63 V	KEFQ 0805	VALVO
1647.032	C45	15pF/5/63 V	KEFQ 0805	VALVO
1647.032	C46	15pF/5/63 V	KEFQ 0805	VALVO
1650.157	C47	18pF/5/63 V	KEFQ 0805	VALVO
1646.966	C48	27pF/5/62 V	KEFQ 0805	VALVO
1646.966	C49	27pF/5/62 V	KEFQ 0805	VALVO
1650.181	C50	33pF/5/63 V	KEFQ 0805	VALVO
1647.032	C51	15pF/5/63 V	KEFQ 0805	VALVO
1647.032	C52	15pF/5/63 V	KEFQ 0805	VALVO
1650.157	C53	18pF/5/63 V	KEFQ 0805	VALVO
1647.172	C54	22pF/5/63 V	KEFQ 0805	VALVO
1650.181	C55	33pF/5/63 V	KEFQ 0805	VALVO
1646.958	C56	100pF/5/63 V	KEFQ 0805	VALVO
1646.958	C57	100pF/5/63 V	KEFQ 0805	VALVO
1646.915	C58	82pF/5/63 V	KEFQ 0805	VALVO
1646.842	C59	150pF/5/63 V	KEFQ 0805	VALVO
1646.842	C60	150pF75/63 V	KEFQ 0805	VALVO
1647.008	C61	220pF/5/63 V	KEFQ 0805	VALVO
1646.958	C62	100pf/5/63 V	KEFQ 0805	VALVO
1646.958	C63	100pf/5/63 V	KEFQ 0805	VALVO
1646.915	C64	82pF/5/63 V	KEFQ 0805	VALVO
1304.291	C65	120pF/2/2/63 V	DIN 41923	
1186.078	C66	27pF/2/63 V	DIN 41923	
1739.859	C67	0,01/+80/-20/40 V	EGRU RM 2,5	VALVO
1739.859	C68	0,01/+80/-20/40 V	EGRU RM 2,5	VALVO
1739.859	C69	0,01/+80/-20/40 V	EGRU RM 2,5	VALVO
1423.037	C70	0,1/20/63 V	MKS 2	WIMA
1423.037	C71	0,1/20/63 V	MKS 2	WIMA
1739.859	C72	0,01/+80/-20/40 V	EGRU RM 2,5	VALVO
1116.231	C73	82pF/2/63 V	DIN 41923	
1420.844	C74	330pF/2/63 V	DIN 41923	
1420.844	C75	330pF/2/63 V	DIN 41923	
1739.859	C76	0,01/+80/-20/40 V	EGRU RM 2,5	VALVO
1116.231	C77	82pF/2/63 V	DIN 41923	
1420.844	C78	330pF/2/63 V	DIN 41923	
1420.844	C79	330pF/2/63 V	DIN 41923	
1739.859	C80	0,01/+80/-20/40 V	EGRU RM 2,5	VALVO
1739.859	C81	0,01/+80/-20/40 V	EGRU RM 2,5	VALVO
1423.037	C83	0,1/20/63 V	MKS 2	WIMA
1423.037	C84	0,1/20/63 V	MKS 2	WIMA
1423.037	C85	0,1/20/63 V	MKS 2	WIMA
1423.037	C86	0,1/20/63 V	MKS 2	WIMA
0945.048	C87	100pF/2/63 V	DIN 41923	
0945,048	C88	100pF/2/63 V	DIN 41923	
1739.859	C89	0,01/+80/-20/40 V	EGRU RM 2,5	VALVO

Parts lists No.
97 Sa 2.155.90

-2. Mixer-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1478.389	C90	150pF/2/63 V	N150 EDPU 0,6	VALVO
1478.389	C91	150pF/2/63 V	N150 EDPU 0,6	VALVO
0945.145	C92	10pF/2/63 V	DIN 41923	
1423.037	C93	0,1/20/63 V	MKS 2	WIMA
1423.037	C94	0,1/20/63 V	MKS 2	WIMA
1739.859	C95	0,01/+80/-20/40 V	EGRU RM 2,5	VALVO
0945.102	C96	2,2pF/0,25/63 V	NPO/IB DIN 41923	
0945.102	C97	2,2pF/0,25/63 V	NPO/IB DIN 41923	

Diodes:

1464.740	D1		SD 101 C	ITT
1865.668	D2		ZN 458	FERRANTI
0745.677	D3		1 N 4148	
0745.677	D4		1 N 4148	
1562.592	D6		ZPD 5,6 SB 14327	ITT
1464.740	D7		SD 101 C	ITT
1464.740	D8		SD 101 C	ITT
1464.740	D9		SD 101 C	ITT
0745.677	D10		1 N 4148	
0745.677	D11		1 N 4148	
0694.959	D12		ZPD 2,7	ITT
0694.959	D13		ZPD 2,7	ITT
0745.677	D14		1 N 4148	
0745.677	D15		1 N 4148	
0745.677	D16		1 N 4148	
0745.677	D17		1 N 4148	

Resistores:

0767.190	R1	100k-5-0,6-0207	DIN 44052-G	
0744.794	R2	1,2k-5-0,6-0207	DIN 44052-G	
1285.602	R3	6,19k-1-50-0207	DIN 44061-G	
1296.000	R4	90,9k-1-50-0207	DIN 44061-G	
0530.352	R5	3,3k-5-0,6-0207	DIN 44052-G	
1405.381	R6	36,5k-1-50-0,6-0207	DIN 44061-G	
0744.794	R7	1,2k-5-0,6-0207	DIN 44052-G	
0744.794	R8	1,2k-5-0,6-0207	DIN 44052-G	
0179.663	R9	270-5-0,6-0207	DIN 44052-G	
0767.190	R10	100k-5-0,6-0207	DIN 44052-G	
0554.898	R11	470-5-0,6-0207	DIN 44052-G	
0179.663	R12	270-5-0,6-0207	DIN 44052-G	
0767.190	R13	100k-5-0,6-0207	DIN 44052-G	

Parts lists No.
97 Sa 2.155.90

-2. Mixer-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
0554.898	R14	470-5-0,6-0207	DIN 44052-G	
0179.698	R15	lk-5-0,6-0207	DIN 44052-G	
0179.698	R16	lk-5-0,6-0207	DIN 44052-G	
0744.883	R17	180-5-0,6-0207	DIN 44052-G	
0744.921	R18	820-5-0,6-0207	DIN 44052-G	
0744.794	R19	1,2k-5-0,6-0207	DIN 44052-G	
1285.602	R20	6,19k-1-50-0207	DIN 44061-G	
1414.909	R21	3,65k-1-50-0207	DIN 44061-G	
1930.893	R22	lk/20 Trimmpotiom.	170/6 MOL.	SIEMENS
0791.733	R23	15k-5-0,6-0207	DIN 44052-G	
1293.028	R24	16,9k-1-50-0207	DIN 44061-G	
1286.935	R25	23,7k-1-50-0,6-0207	DIN 44061-G	
0653.853	R26	68-5-0,6-0207	DIN 4405-G	
0921.580	R27	120k-5-0,6-0207	DIN 44052-G	
0767.190	R28	100k-5-0,6-0207	DIN 44052-G	
0653.853	R29	68-5-0,6-0207	DIN 44052-G	
0542.814	R30	8,2k-5-0,6-0207	DIN 44052-G	
0744.735	R31	22-5-0,6-0207	DIN 44052-G	
0744.751	R32	390-5-0,6-0207	DIN 44052-G	
0921.580	R33	120k-5-0,6-0207	DIN 44052-G	
0767.190	R34	100k-5-0,6-0207	DIN 44052-G	
0653.853	R35	68-5-0,6-0207	DIN 44052-G	
0542.814	E36	8,2k-5-0,6-0207	DIN 44052-G	
0744.735	R37	22-5-0,6-0207	DIN 44052-G	
0744.751	R38	390-5-0,6-0207	DIN 44052-G	
0767.190	R39	100k-5-0,6-0207	DIN 44052-G	
0767.190	R40	100k-5-0,6-0207	DIN 44052-G	
0767.212	R41	4,7-5-0,6-0207	DIN 44052-G	
0767.212	R42	4,7-5-0,6-0207	DIN 44052-G	
0653.853	R43	68-5-0,6-0207	DIN 44052-G	
0179.663	R44	270-5-0,6-0207	DIN 44052-G	
0626.716	R45	15-5-0,6-0207	DIN 44052-G	
0542.857	R46	560-5-0,6-0207	DIN 44052-G	
0653.853	R47	68-5-0,6-0207	DIN 44052-G	
0179.663	R48	270-5-0,6-0207	DIN 44052-G	
1004.719	R49	8,2-5-0,6-0207	DIN 44052-G	
0542.857	R50	560-5-0,6-0207	DIN 44052-G	
0744.875	R51	82k-5-0,6-0207	DIN 44052-G	
0542.814	R52	8,2k-5-0,6-0207	DIN 44052-G	
0542.814	R53	8,2k-5-0,6-0207	DIN 44052-G	
0698.172	R54	680-5-0,6-0207	DIN 44052-G	
0744.794	R56	1,2k-5-0,6-0207	DIN 44052-G	
0767.190	R57	100k-5-0,6-0207	DIN 44052-G	
0744.794	R58	1,2k-5-0,6-0207	DIN 44052-G	
1768.751	R59	47-5-0,06 W 2x1,25x0,5/0,7		

-2. Mixer-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1285.602	R60	6,19k-1-50-0207	DIN 44061-G	
1683.888	R61	3,32k-1-100-05-0204	DIN 44061-G	
0799.416	R66	220k-5-0,6-027	DIN 44052-G Abgleichwid.	
0554.898	R67	470-5-0,6-0207	DIN 44052-G	
0554.898	R68	470-5-0,6-0207	DIN 44052-G	
0744.794	R69	1,2k-5-0,6-0207	DIN 44052-G	
0744.751	R70	390-5-0,6-0207	DIN 44052-G	
0767.220	R71	6,8k-5-0,6-0207	DIN 44052-G	
0542.830	R72	27k-5-0,6-0207	DIN 44052-G	
0744.840	R73	5,6k-5-0,6-0207	DIN 44052-G	
0799.416	R76	390k-5-0,6-207	DIN 44052-G Abgleichwid.	

Coils:

1068.105	L1	0,15uH/10 PCT	Typ 72.00	JAHRE
1068.105	L2	0,15uH/10 PCT	Typ 72.00	JAHRE
1068.105	L3	0,15uH/10 PCT	Typ 72.00	JAHRE
1902.229	L4	0,165uH	97 E 2.155.160-5	
1902.229	L5	0,165uH	97 E 2.155.160-5	
1427.105	L6	82uH/10 PCT	Typ 72.00	JAHRE
1917.455	L7	0,065uH	97 E 2.155.170-2	
1917.455	L8	0,065uH	97 E 2.155.170-2	
1902.229	L9	0,165uH	97 E 2.155.160-5	
1902.229	L10	0,165uH	97 E 2.155.160-5	
1076.140	L11	10µH/10 PCZ	Typ 72.00	JAHRE
1902.350	L13	1uH B 78108-T1102-K		SIEMENS
1902.350	L14	1uH B 78108-T1102-K		SIEMENS
0845.213	L15	6,8uH/10	PCT/Typ 72.00	JAHRE
0845.213	L16	6,8uH/10	PCT/Typ 72.00	JAHRE
1865.684	L17	3,3uH B 78108-T1332-K		SIEMENS
1865.684	L18	3,3uH B 78108-T1332-K		SIEMENS
1865.684	L19	3,3uH B 78108-T1332-K		SIEMENS
1865.684	L20	3,3uH B 78108-T1332-K		SIEMENS

Integrated circuis:

1653.172	IC A		74 LS 74 N	
1422.715	IC B		MS 3358 P 1	MOTOROLA
1865.676	IC C	LM 78 L12	ACT/NAT.MC 78 L 12	MOTOROLA/ACP
			UA 78 L 12	AC/TEXAS
1427.156	IC D		CA 3240 E	OP.-Verst.
1422.715	IC E		MC 3358 P1	MOTOROLA

Parts lists No.
97 Sa 2.155.90

-2. Mixer-

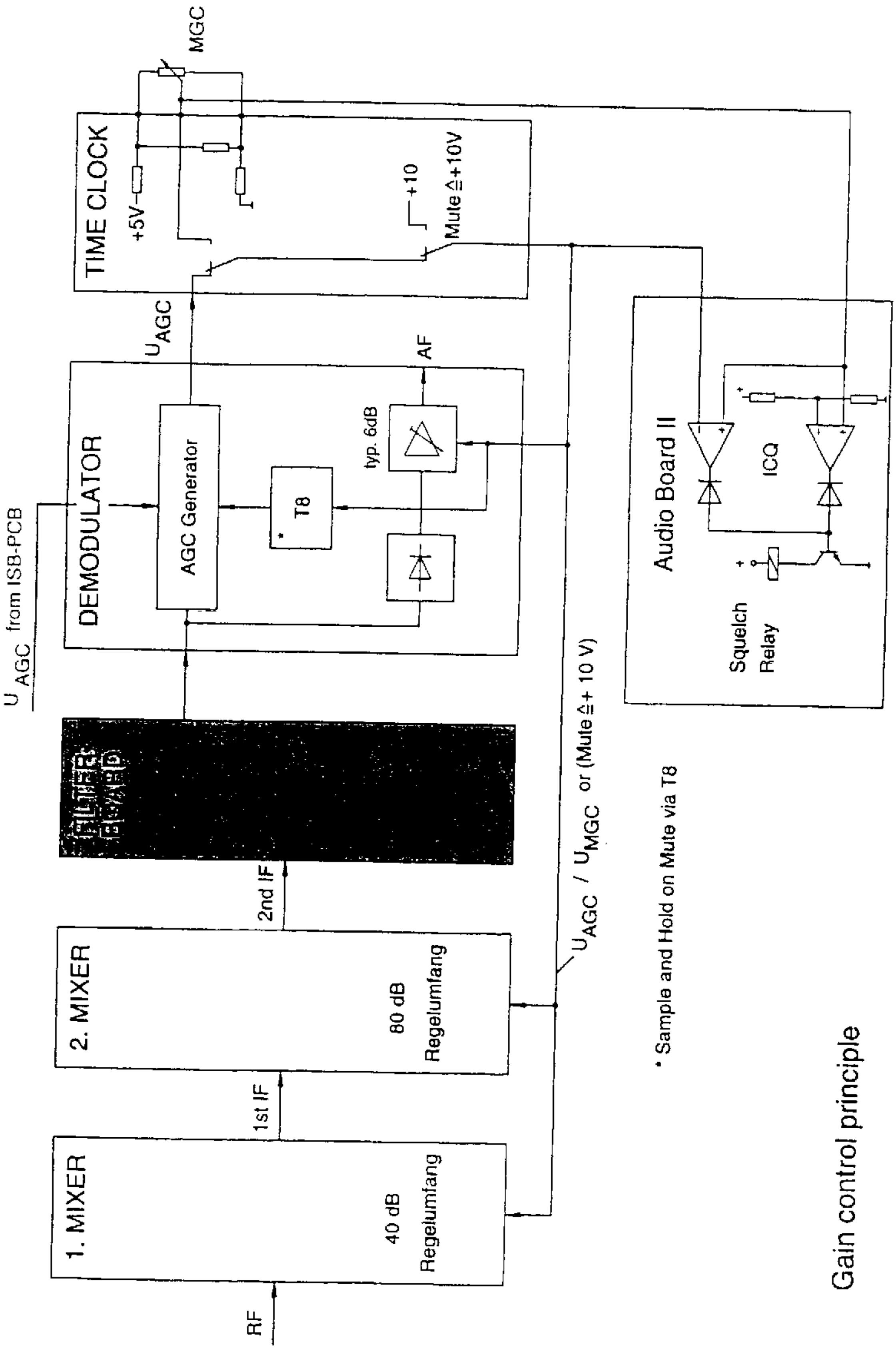
Ident-No.	Mark	Electr. value	Identity	Manufacturer
Transistors:				
1425.137	T1		J 310	NATIONAL
1425.137	T2		J 310	NATIONAL
1865.706	T3		BF 960	SIEMENS, VALVO TELEFUNKEN
1865.706	T4		BF 960	SIEMENS, VALVO TELEFUNKEN
1562.606	T5		BF 245 A	VALVO
1562.606	T6		BF 245 A	VALVO
1291.106	T7		BC 549 C	ROE, ITT
1291.106	T8		BC 549 C	ROE, ITT
1291.106	T9		BC 549 C	ROE, ITT
Connectors:				
1826.514	ST1	16-pins	609-1604E	T&B
1705.504	ST2		Nr. 11.1520.001	TELEGÄRTNER
1705.504	ST3		Nr. 11.1520.001	TELEGÄRTNER
Supplements:				
1078.577	M1	ring mixer IE 500		
1934.244	F7	quartz filter	97 E 2.140.78-23	
1865.633	F8	quartz filter	97 E 2.140.78-18	

-Filterboard-

Technical description
The filterboard contains six crystal filters of different bandwidths and an oscillator with mixing stage, which converts the 5 MHz IF to a 30 kHz IF. This is mixed and amplified in the IC C. The oscillation amplitude of the quartz oscillator with T1 and Q1 is monitored with the level sensor. The oscillator level is rectified by diode D15 and sent to the microprocessor via an operation amplifier IC D.
The input and output impedances of the crystal filters are 50 Ohm. The microprocessor determines which filter is activated (depending on bandwidth selected). The information is written into IC - A (LINE DECODER + LATCH), which then controls the switching diodes via IC - B DRIVER OPEN COLLECTOR (e.g., D 3, D 4 for filter F 1). To allow full utilization of the bandwidths of the crystal filters in the 2nd MIXER (B = 3 kHz, B = 6 kHz), there is a bypass circuit using diodes D 1, D 2.
Since one pair of diodes is always switched irrespective of the filter selected, a defined DC voltage is present on the diode buses. This voltage is monitored by IC - D, which signals any fault to the microprocessor via the HELP OUT output.

The crystal oscillator with T 1 has a frequency f = 5.0285 MHz, which together with the IF of f = 4.9985 MHz, gives a new IF of f = 30 kHz.

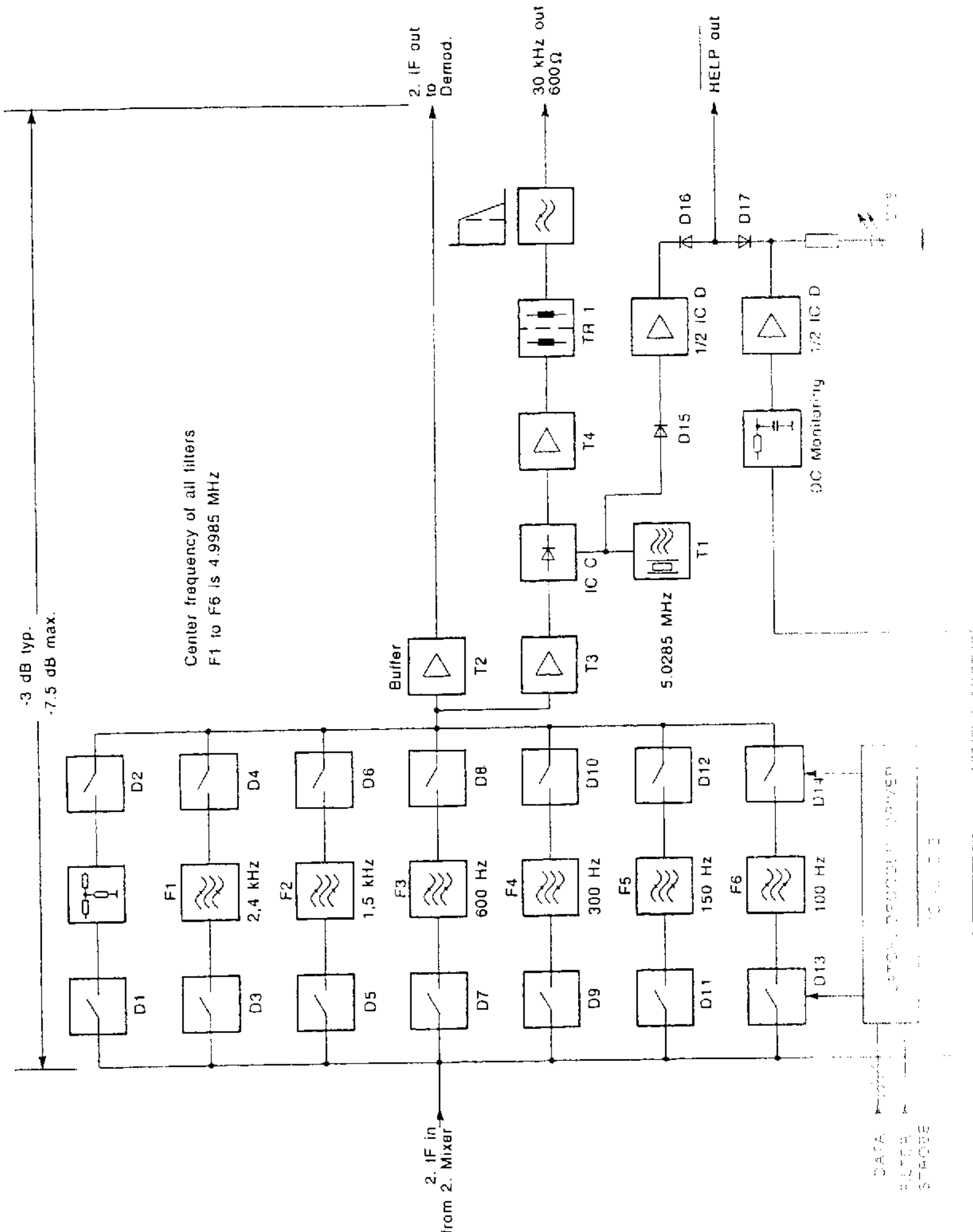
-Filterboard-



* Sample and Hold on Mute via T8

Gain control principle

-Filterboard-



-Filterboard-

Test and alignment instructions

Required: Circuit diagram FILTERBOARD - Hagenuk Drawing No 97 Sa C 2.155.76
tracking generator, spectrum analyser

Test configuration: The FILTERBOARD is removed and remains connected to the receicer only by the ribbon cable to plug St 1. Connect tracking generator to socket Bu 3. Connect spectrum analyser to socket Bu 2.

Measurement of current consumption
Connect an ammeter into the 5 V and 18 V power supplies. Select bandwidths 0.10 kHz to 3 kHz on the receiver in succession

Test values:
In all ranges I_5 V = 55 mA ± 10 mA
In all ranges I_{18} V = 30 mA +± 10 mA

Measurement of attenuation with no filter or bypass selected
The +18 V power supply must be disconnected for this purpose.
Tracking generator settings: P_{out} -20 dBm
Spectrum analyser settings: reference level -20 dBm
Test values:
attenuation > 60 dB in all bandwidths (see item 1).

Measurement of passband attenuation of bypass circuit
Reconnect +18 V power supply.
Select bandwidth 3.00 kHz.
Test values:
The passband attenuation should be 6 dB ± 3 dB.

Measurement of passband and stopband attenuation of crystal filters
Measurement of F 1 = 2.40 kHz
Select bandwidth 2.40 kHz on receiver.
Test values:
Passband attenuation < 4 dB; offband attenuation > 60 dB
(see filter curve 97 E a.140.78-2).

Measurement of F 2 = 1.50 kHz
Select bandwidth 1.50 kHz on receiver.
Test values:
Passband attenuation < 6 dB; offband attenuation > 60 dB
(see filter curve 97 E 2.140.78-16)

-Filterboard-

Measurement of F 3 = 0.60 kHz
Select bandwidth 0.60 kHz on receiver.
Test values:
Passband attenuation < 6 dB; offband attenuation > 60 dB
(see filter curve 97 E 2.140.78-15)

Measurement of F 4 = 0.30 kHz
Select bandwidth 0.30 kHz on receiver.
Test values:
Passband attenuation < 6 dB; offband attenuation > 60 dB
(see filter curve 97 E 2.140.78 14)

Measurement of F 5 = 0.15 kHz
Select bandwidth 0.15 kHz on receiver.
Test values:
Passband attenuation < 7 dB; offband attenuation > 60 dB
(see filter curve 97 E 2.140.78-13).

Measurement of F 6 = 0.10 kHz
Select bandwidth 0.10 kHz on receiver:
Test value:
Passband attenuation < 7 dB; offband attenuation > 60 dB.
(see filter curve 97 E 2.140.78-12)

Testing the 30 kHz IF
Connect a signal generator (f = 4.9985 MHz, level -30 dBm) to socket Bu 3; connect frequency counter to socket Bu 4.
Test values:
The output frequency should be 30.00 kHz ± 10 Hz.
The crystal oscillator can be accurately tuned with capacitor C 56.

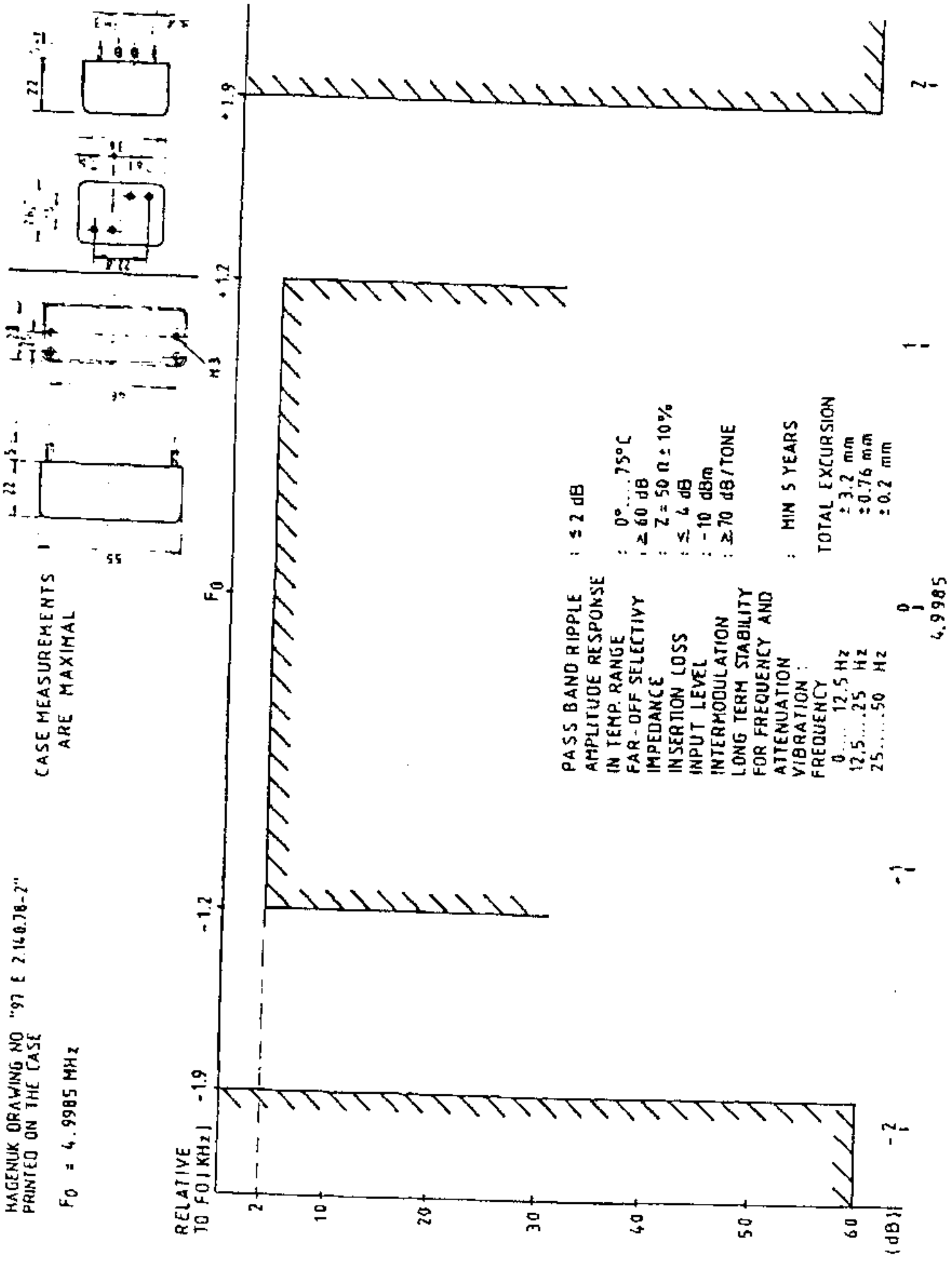
Connect spectrum analyser to socket Bu 2 and terminate socket Bu 3 with 50 Ohm.

Test values:
The oscillator level at f = 5.0285 MHz should be < -88 dBm.

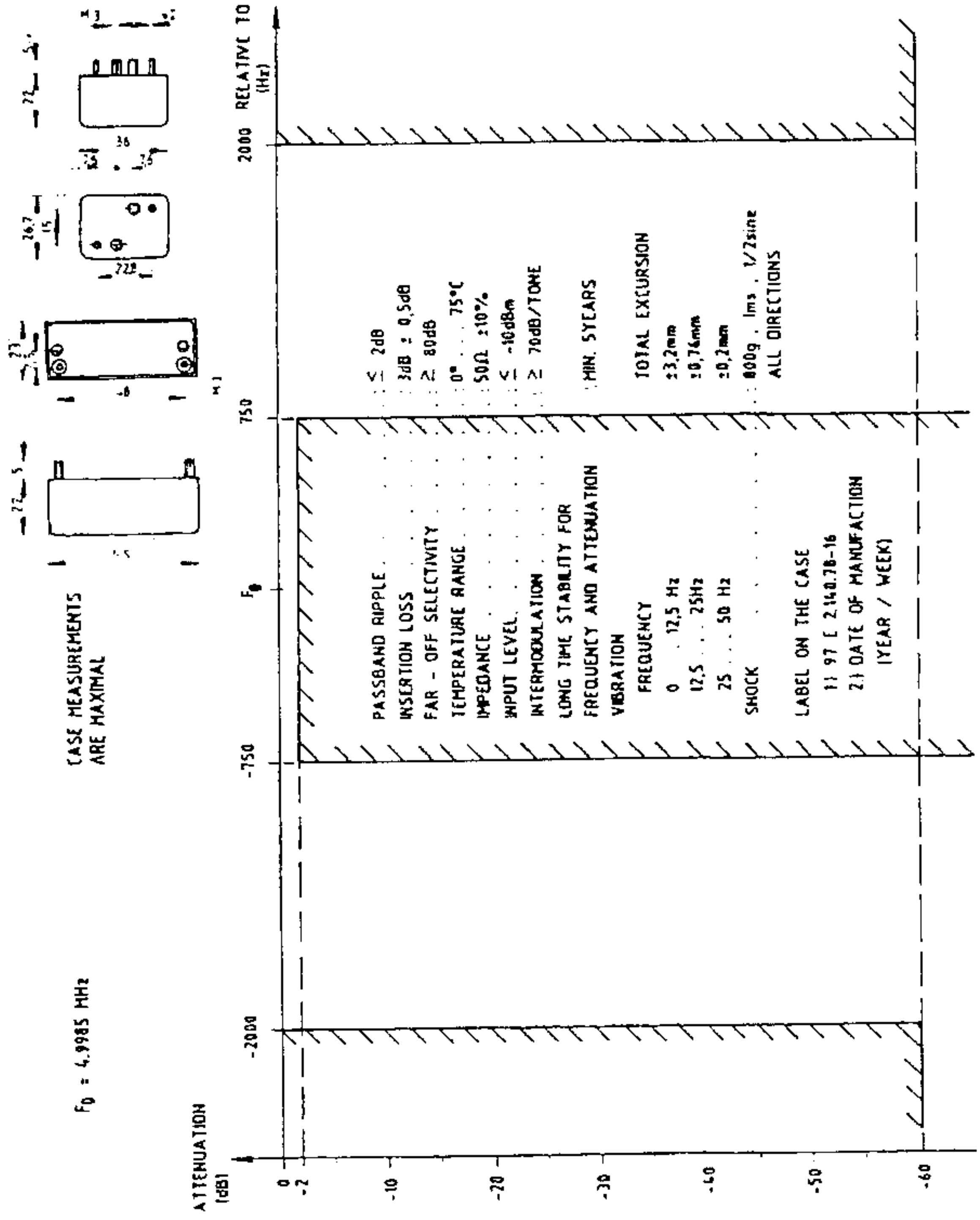
Connect a signal generator (f = 4.9985 MHz) to socket Bu 3 and terminate socket Bu 4 with 600 ohm.
Test values:

Level on socket Bu 3 (dBm)	Level on socket Bu 4 (dBm)	Voltage accross 600 ohm (V_{pp}) min.	nom.	max.
-50	-16 ± 6	0.062	0.123	0.692
-40	-7 ± 6	0.5	1.0	2.0
-30	-7 ± 6	0.5	1.0	2.0

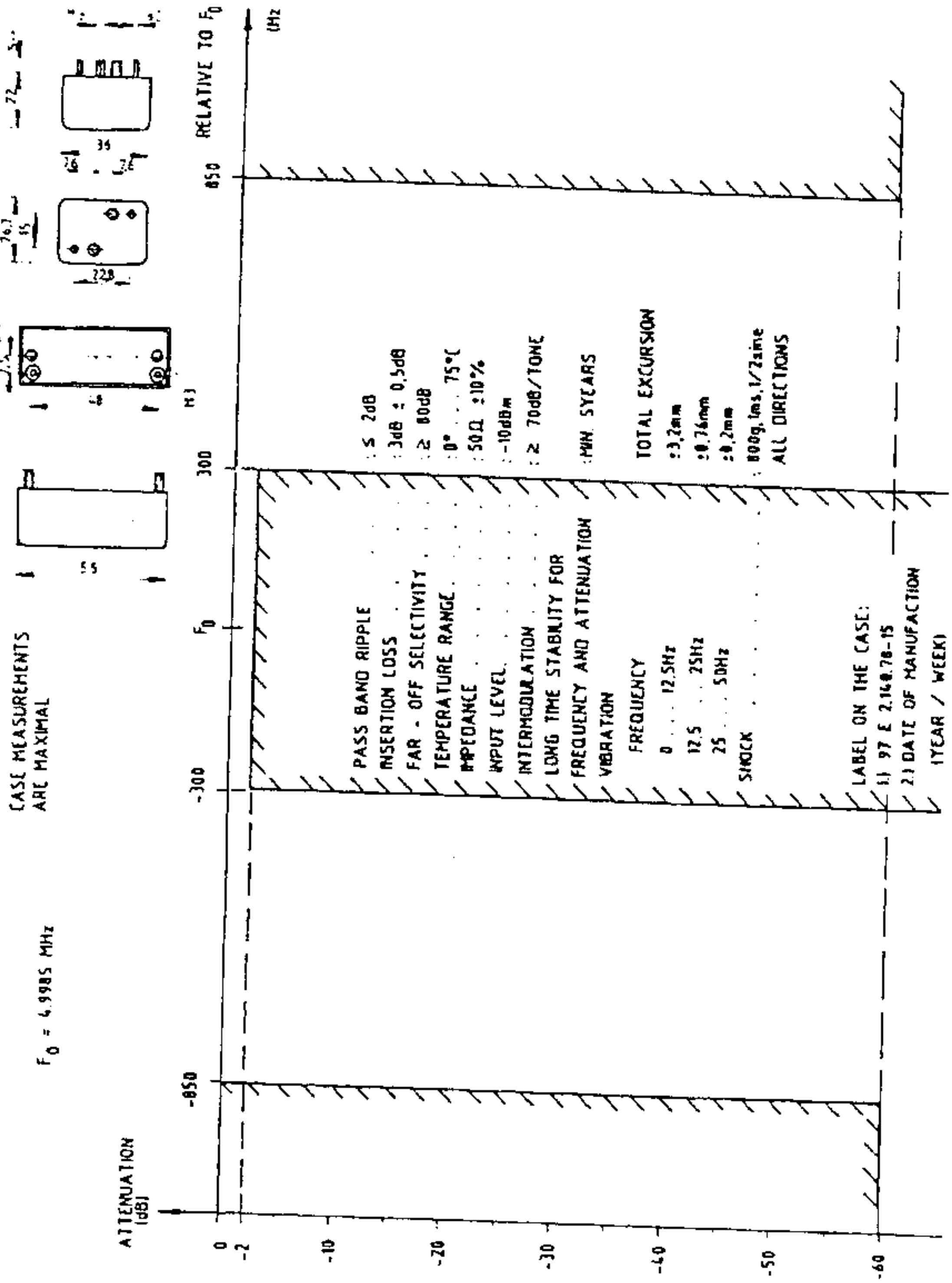
-Filterboard-



Quartz Filter drawing No. 97 E 2.140.78-2

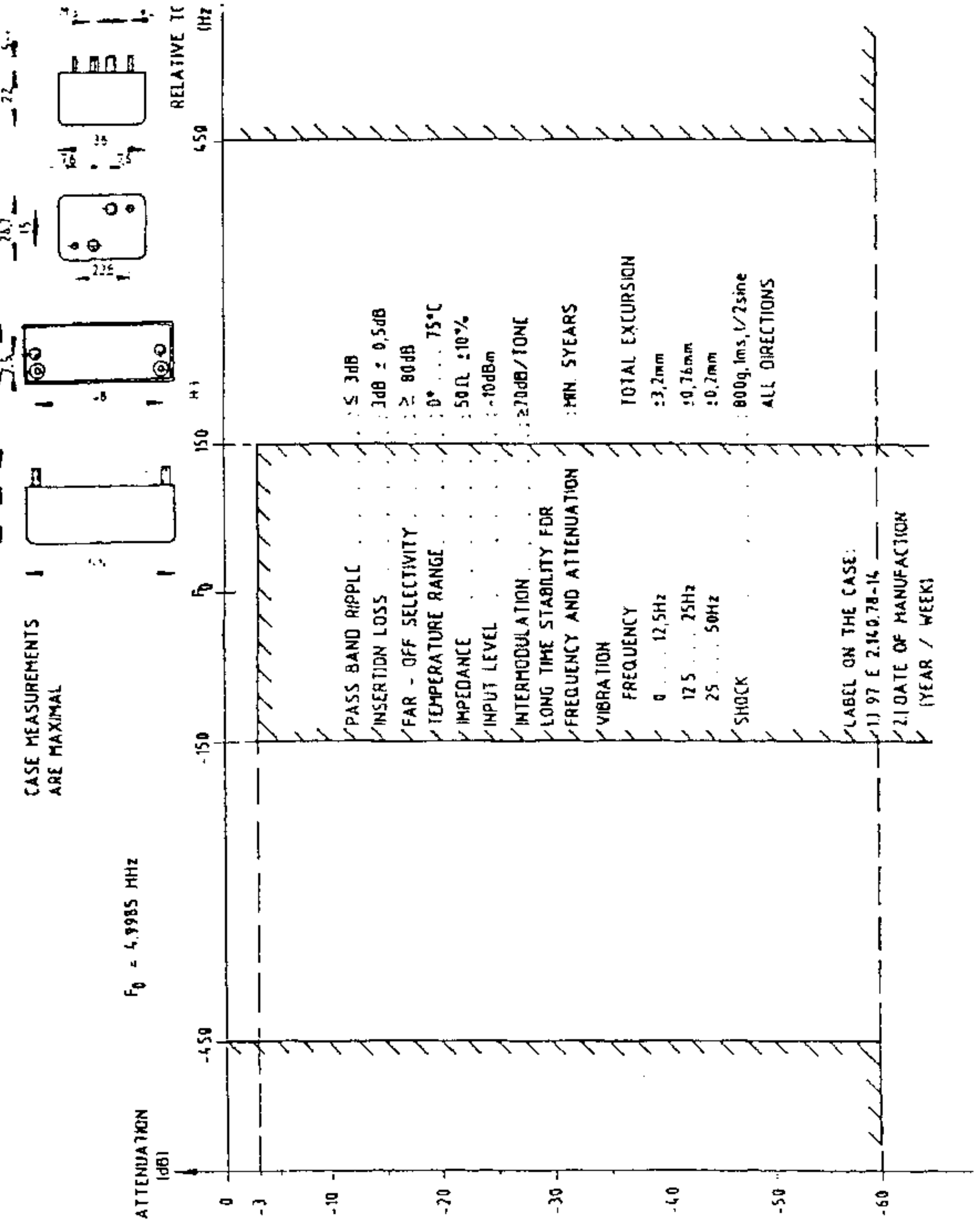


Quartz Filter drawing No. 97 E 2.140.78-16



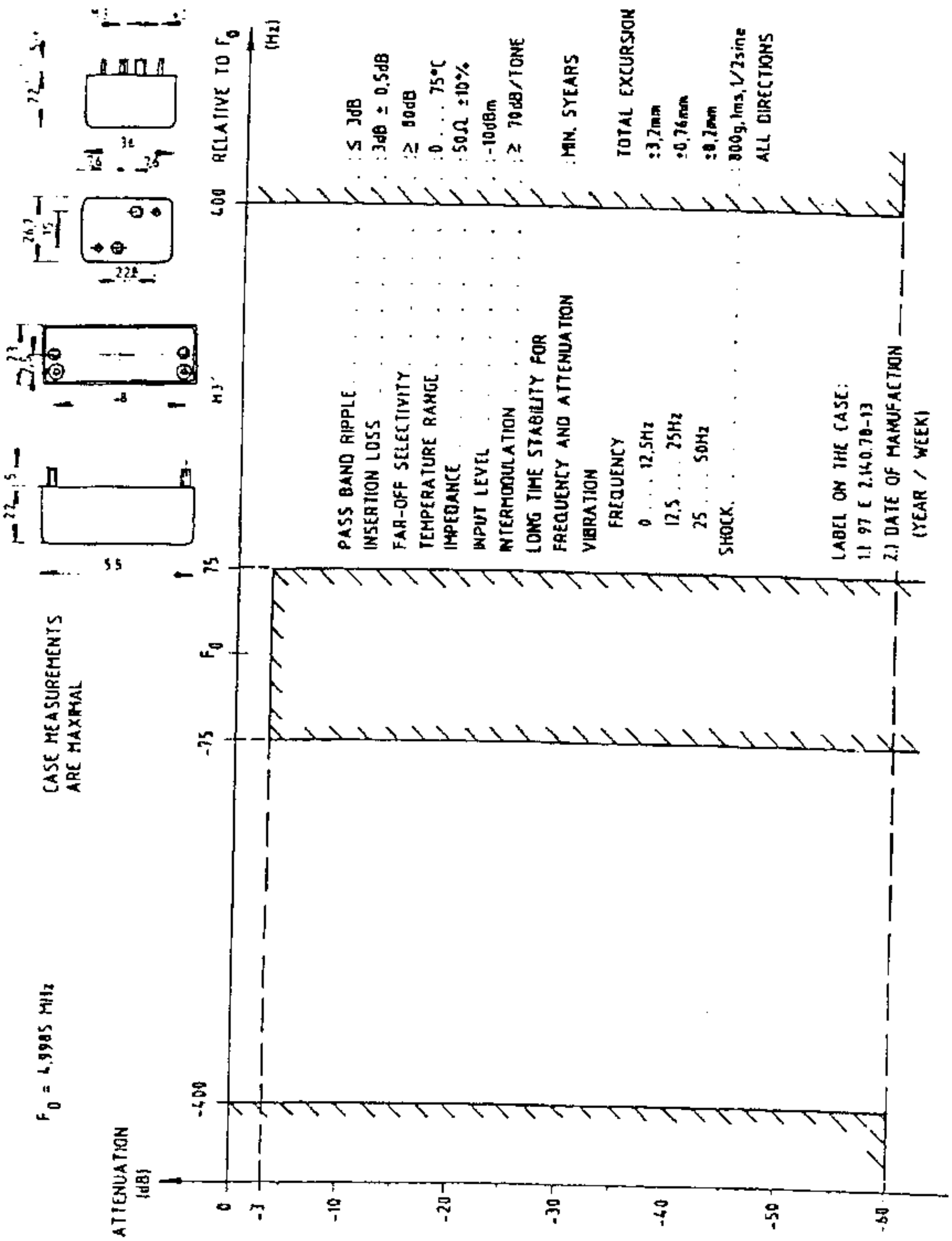
Quartz Filter drawing No. 97 E 2.140.78-15

-Filterboard-

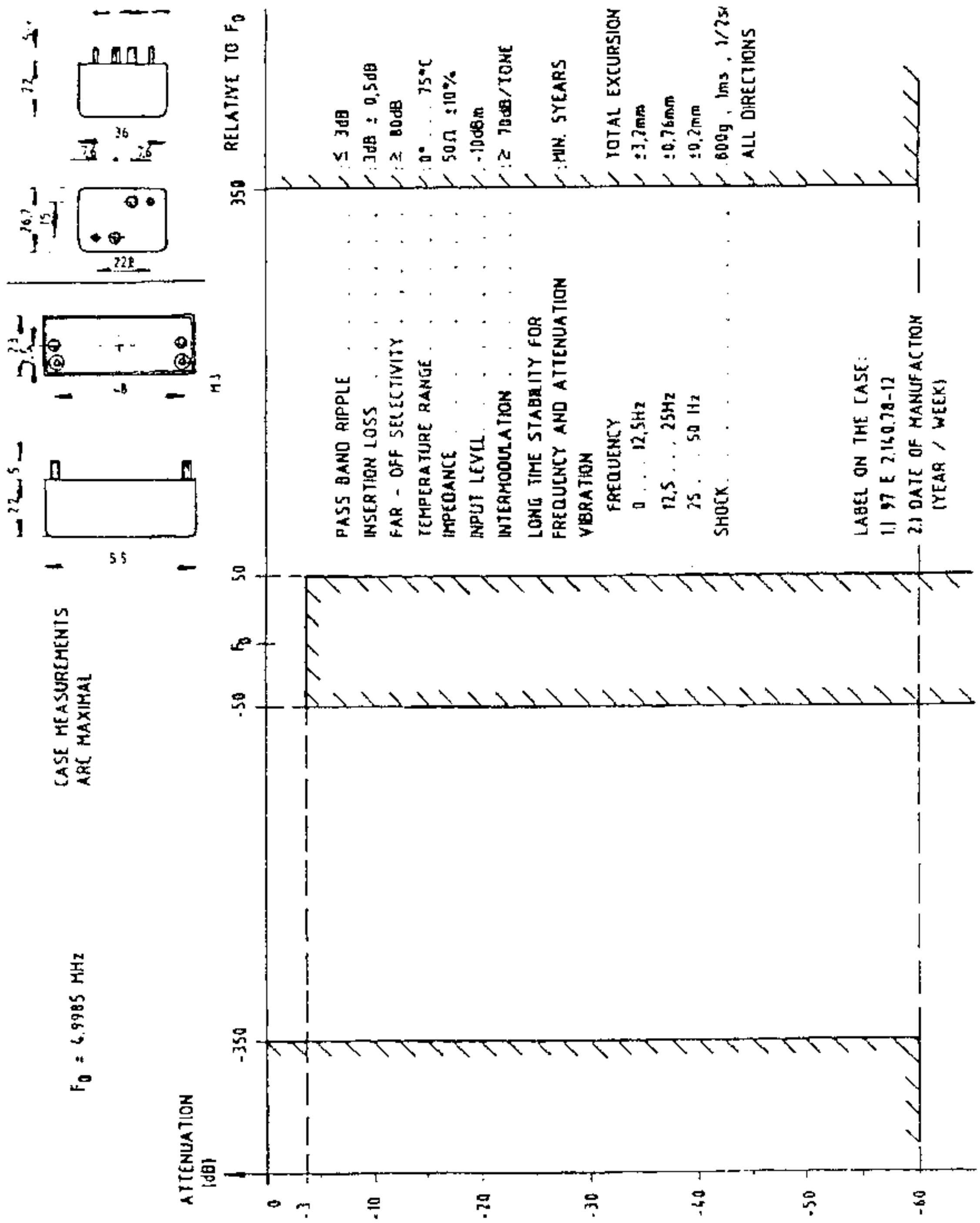


Quartz Filter drawing No. 97 E 2.140.78-14

-Filterboard-



Quartz Filter drawing No. 97 E 2.140.78-13



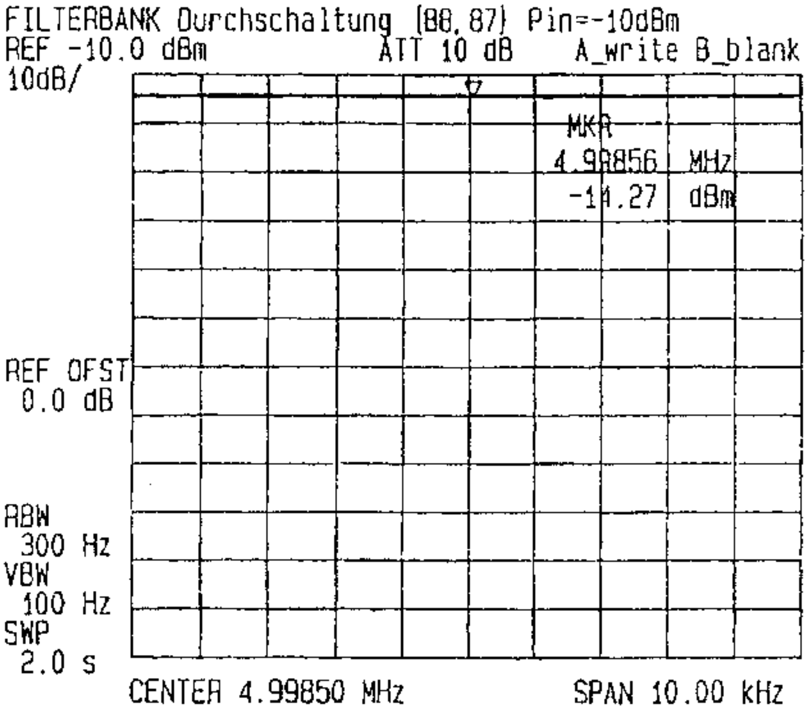
Quartz Filter drawing No. 97 E 2.140.78-12

Customer specified Quartz Filter drawing

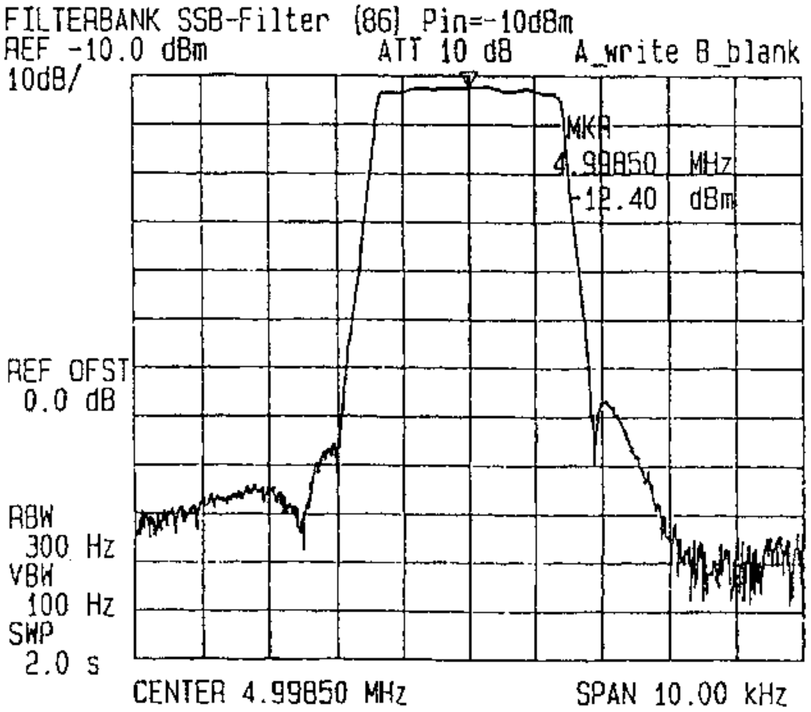
Customer specified Quartz Filter drawing

Customer specified Quartz Filter drawing

Filterboard -by passed- (88, 87)

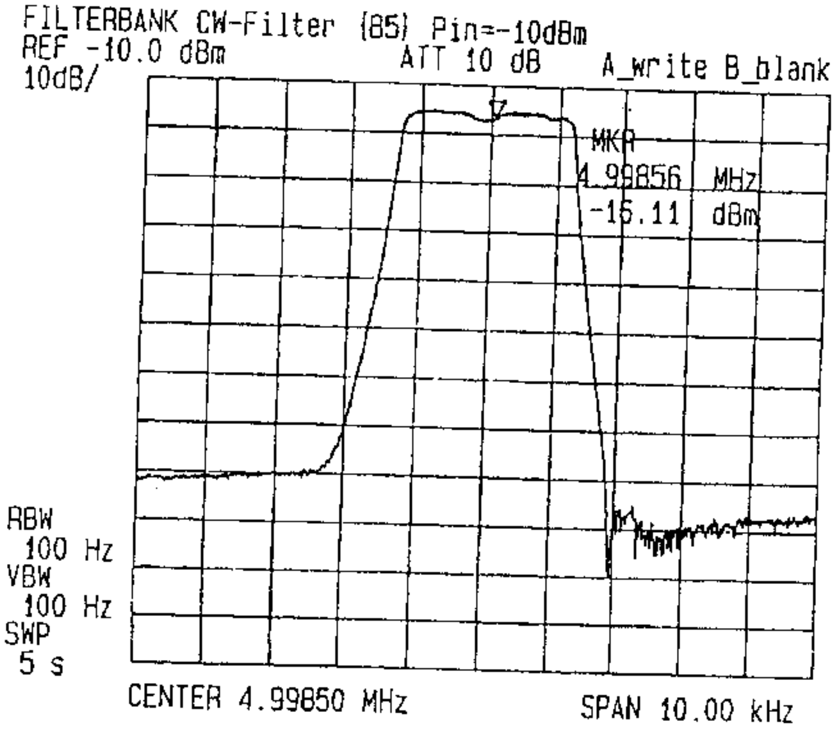


Filterboard -SSB-Filter- (86)

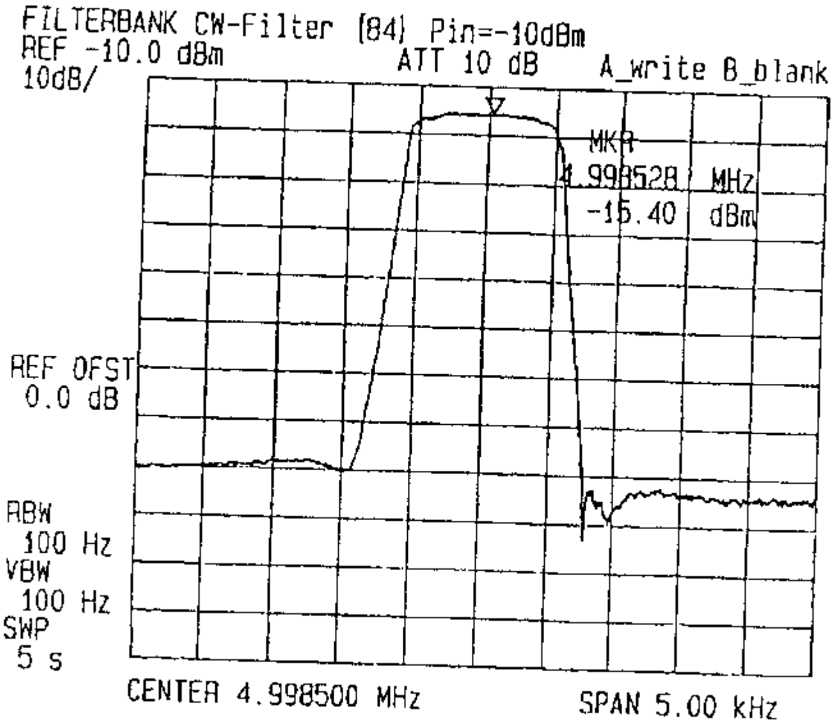


-Filterboard-

Filterboard -CW-filter- (85)

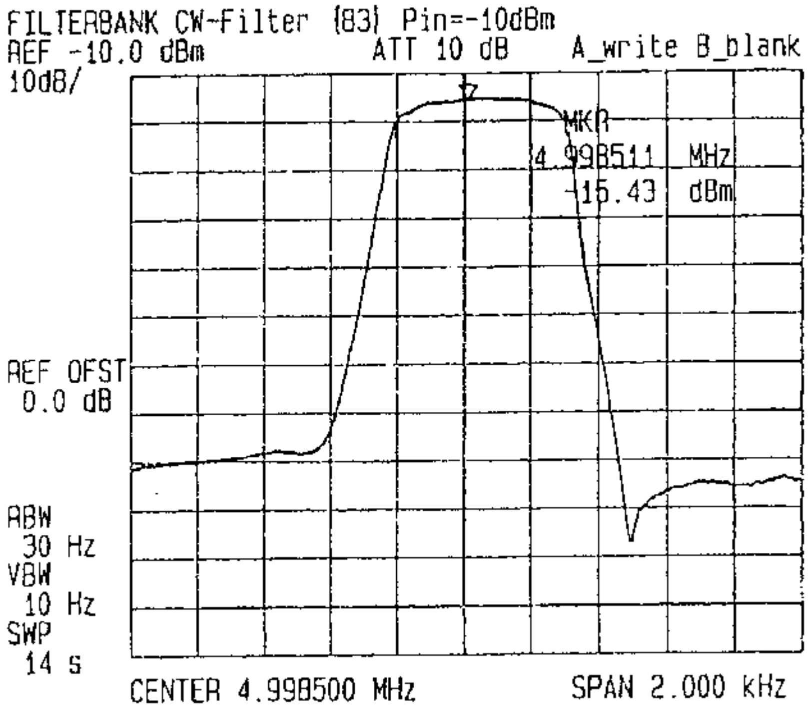


Filterboard -CW-filter- (84)

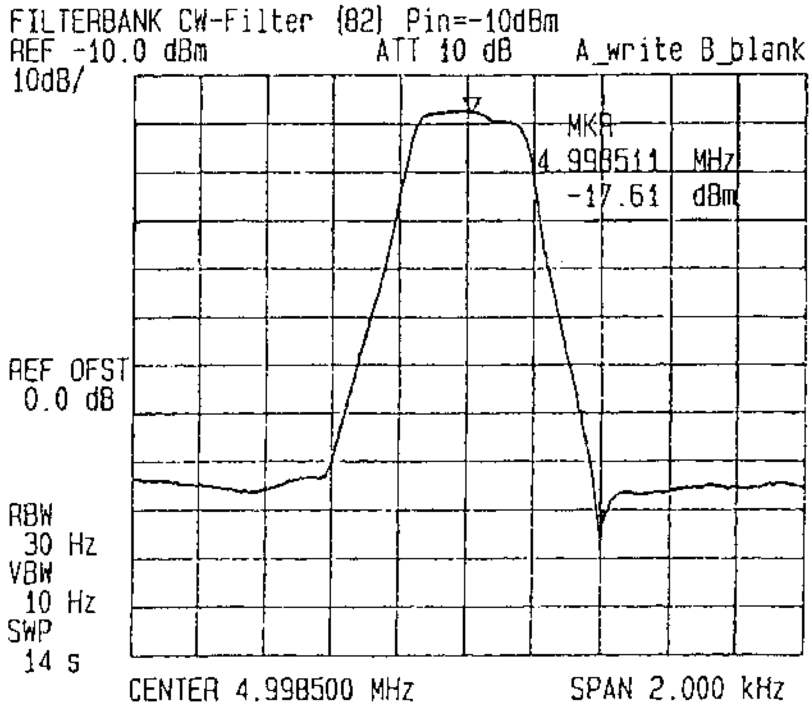


-Filterboard-

Filterboard -CW-filter- (83)

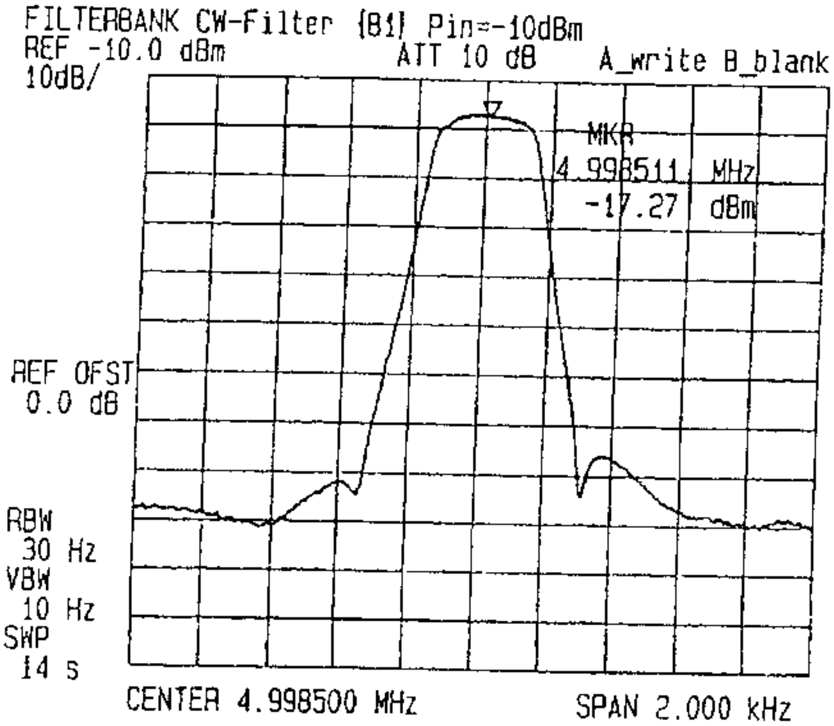


Filterboard -CW-filter- (82)

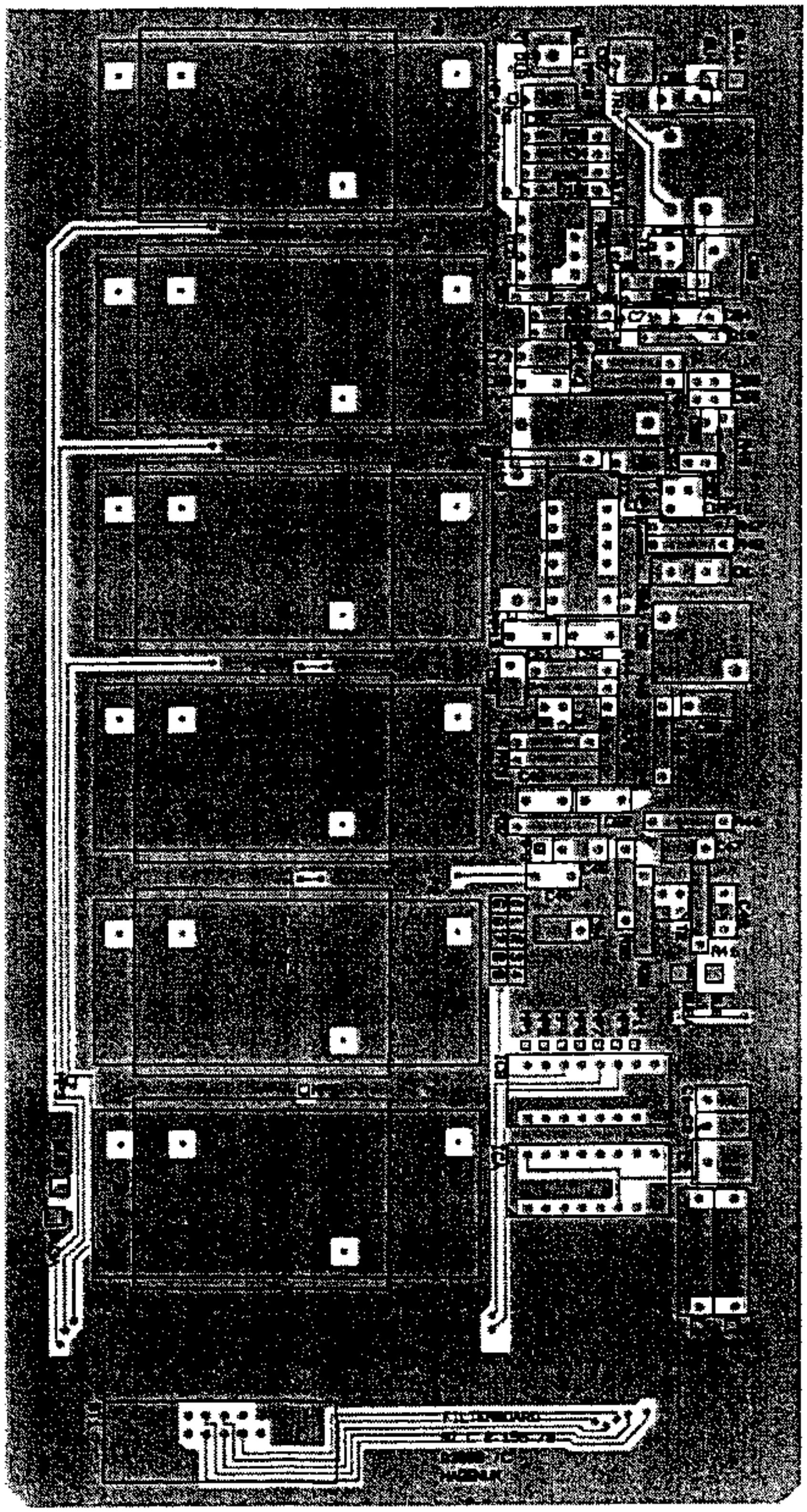


-Filterboard-

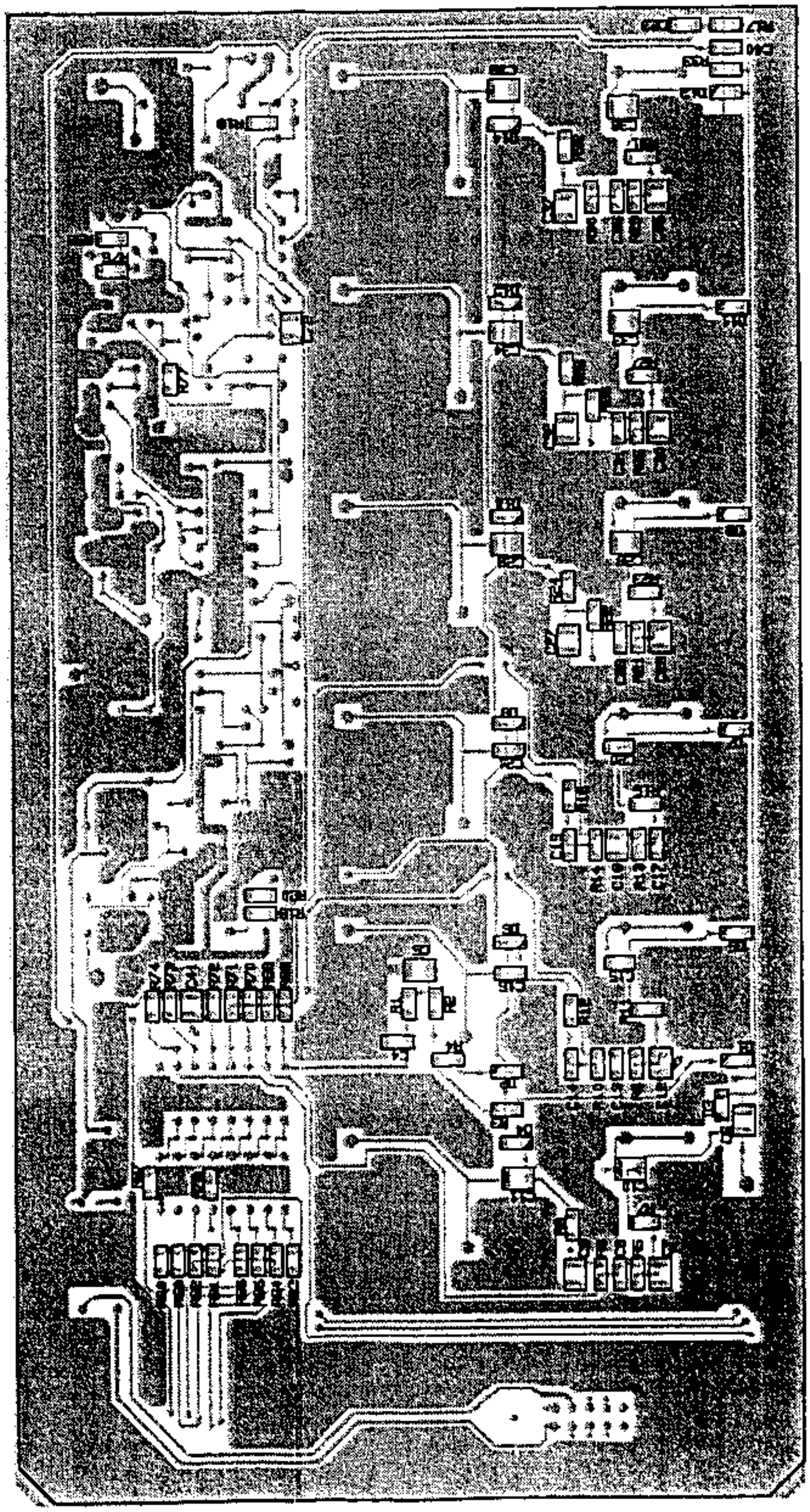
Filterboard -CW-filter- (81)



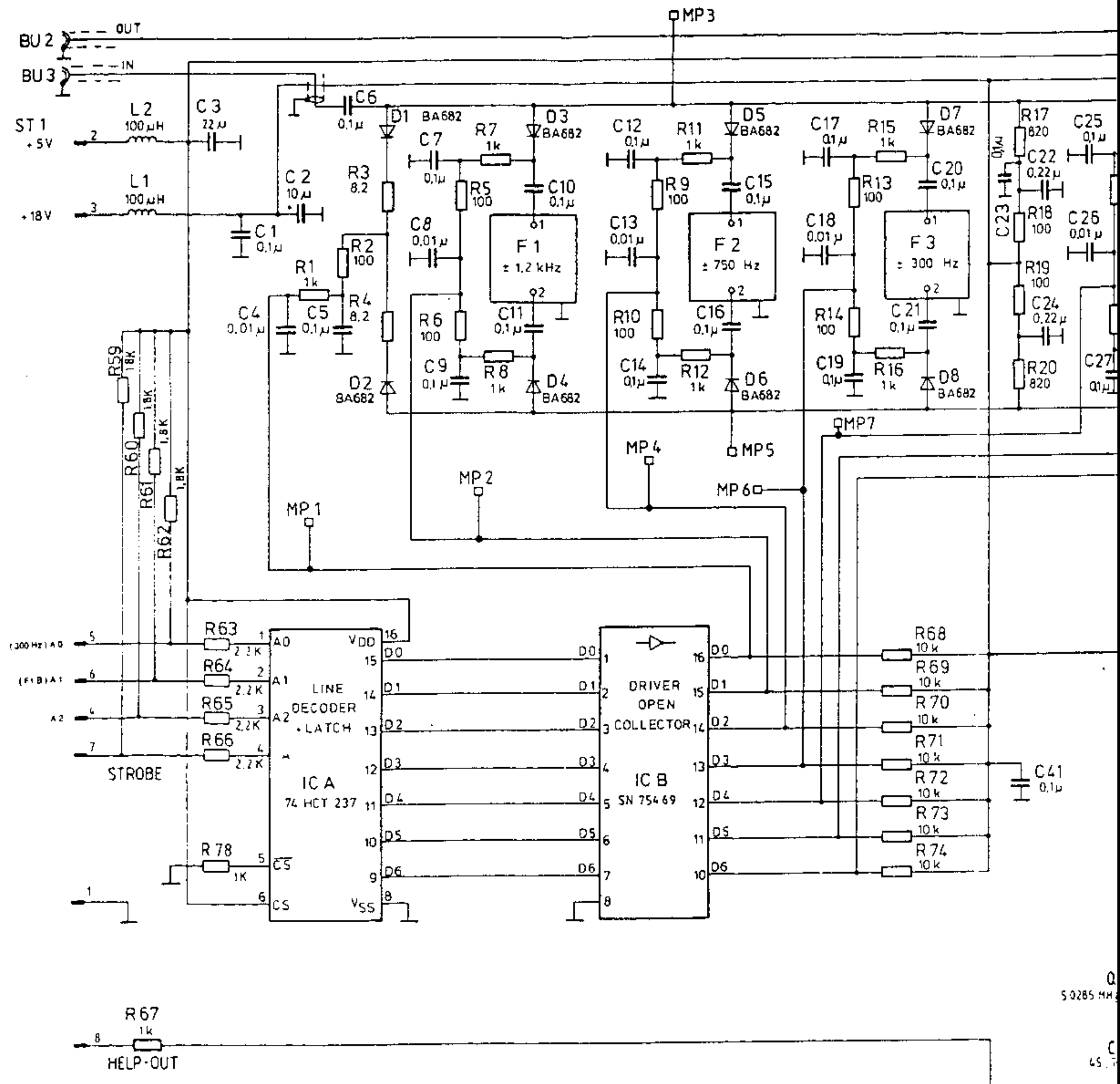
see circuit diagr



see circuit diagram - FILTERBOARD 97 Sa B 2.155.76



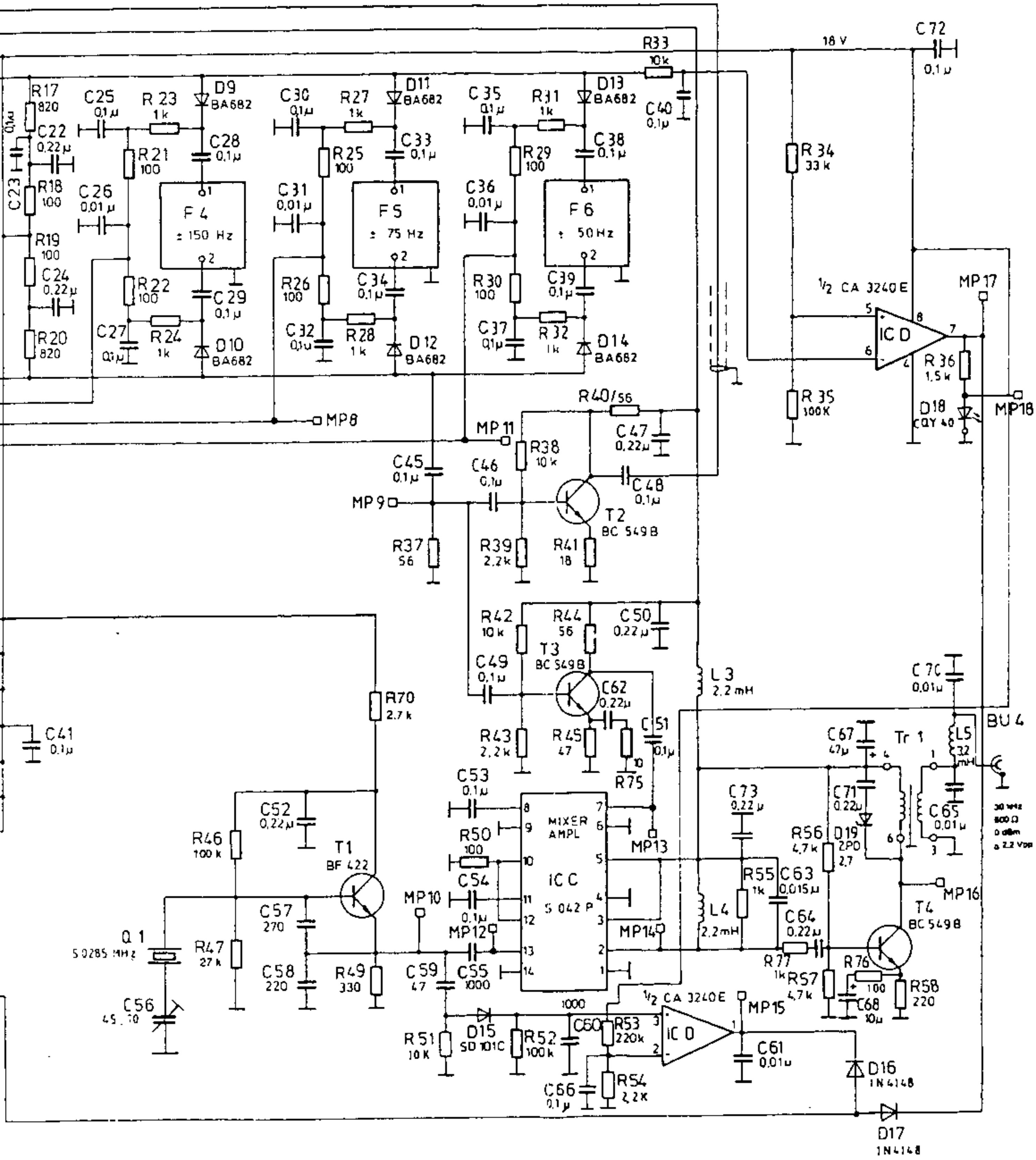
Printed Circuit Board
Filterboard
97 C 2.155.76



Filter	Zeichnungs - Nr.
F 1 ±1,2 kHz	97 E 2.140 78 - 2
F 2 ±750 Hz	97 E 2.140 78 - 16
F 3 ±300 Hz	97 E 2 140 78 - 15
F 4 ±150 Hz	97 E 2.140. 78 - 14
F 5 ± 75 Hz	97 E 2 140 78 - 13
F 6 ± 50 Hz	97 E 2 140 78 - 12

all filters center frequency 4.9985 MHz

L S 97 E 2 155.150



FILTERBOARD
Circuit Diagram
97 Sa C 2.155.76

Parts lists No.
97 Sa 2.155.76

-Filterboard-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Capacitors:				
1423.037	C1	0,1/20/63 V	MKS 2	WIMA
1423.304	C2	10/20/25 V	SAL 2222 122 90006	VALVO
1401.343	C3	22/20/10 V	MKS SAL RP	WIMA
1853.724	C4	0,01/10/63 V	KEFQ 1210	VALVO
1646.990	C5	0,1/10/63 V	KEFQ 1210	VALVO
1646.990	C6	0,1/10/63 V	KEFQ 1210	VALVO
1646.990	C7	0,1/10/63 V	KEFQ 1210	VALVO
1853.724	C8	0,01/10/63 V	KEFQ 1210	VALVO
1646.990	C9	0,1/10/63 V	KEFQ 1210	VALVO
1646.990	C10	0,1/10/63 V	KEFQ 1210	VALVO
1646.990	C11	0,1/10/63 V	KFFQ 1210	VALVO
1646.990	C12	0,1/10/63 V	KEFQ 1210	VALVO
1853.724	C13	0,01/10/63 V	KEFQ 1210	VALVO
1646.990	C14	0,1/10/63 V	KEFQ 1210	VALVO
1646.990	C15	0,1/10/63 V	KEFQ 1210	VALVO
1646.990	C16	0,1/10/63 V	KEFQ 1210	VALVO
1646.990	C17	0,1/10/63 V	KEFQ 1210	VALVO
1853.724	C18	0,01/10/63 V	KEFQ 1210	VALVO
1646.990	C19	0,1/10/63 V	KEFQ 1210	VALVO
1646.990	C20	0,1/10/63 V	KEFQ 1210	VALVO
1646.990	C21	0,1/10/63 V	KEFQ 1210	VALVO
1400.568	C22	0,22/10/63 V	MKS 2	WIMA
1853.724	C23	0,01/10/63 V	KEFQ 1210	VALVO
1400.568	C24	0,22/10/63 V	MKS 2	WIMA
1646.990	C25	0,1/10/63 V	KEFQ 1210	VALVO
1853.724	C26	0,01/10/63 V	KEFQ 1210	VALVO
1646.990	C27	0,1/10/63 V	KEFQ 1210	VALVO
1646.990	C28	0,1/10/63 V	KEFQ 1210	VALVO
1646.990	C29	0,1/10/63 V	KEFQ 1210	VALVO
1646.990	C30	0,1/10/63 V	KEFQ 1210	VALVO
1853.724	C31	0,01/10/63 V	KEFQ 1210	VALVO
1646.990	C32	0,1/10/63 V	KEFQ 1210	VALVO
1646.990	C33	0,1/10/63 V	KEFQ 1210	VALVO
1646.990	C34	0,1/10/63 V	KEFQ 1210	VALVO
1646.990	C35	0,1/10/63 V	KEFQ 1210	VALVO
1853.724	C36	0,01/10/63 V	KEFQ 1210	VALVO
1646.990	C37	0,1/10/63 V	KEFQ 1210	VALVO
1646.990	C38	0,1/10/63 V	KEFQ 1210	VALVO
1646.990	C39	0,1/10/63 V	KEFQ 1210	VALVO
1853.724	C40	0,01/10/63 V	KEFQ 1210	VALVO
1646.990	C41	0,1/10/63 V	KEFQ 1210	VALVO
1423.037	C45	0,1/20/63 V	MKS 2	WIMA

-Filterboard-

Parts lists No.
97 Sa 2.155.76

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1423.037	C46	0,1/20/63 V	MKS 2	WIMA
1400.568	C47	0,22/10/63 V	MKS 2	WIMA
1423.037	C48	0,1/20/63 V	MKS 2	WIMA
1423.037	C49	0,1/20/63 V	MKS 2	WIMA
1400.568	C50	0,22/10/63 V	MKS 2	WIMA
1423.037	C51	0,1/20/63 V	MKS 2	WIMA
1400.568	C52	0,22/10/63 V	MKS 2	WIMA
1423.037	C53	0,1/20/63 V	MKS 2	WIMA
1423.037	C54	0,1/20/63 V	MKS 2	WIMA
0944.971	C55	1000pF/10/63 V	K 2000 EDPU	VALVO
1068.229	C56	5-60 pF	2222 809 07011	VALVO
0945.056	C57	220 pF/2/63 V	N 750 1 B EDPU	DIN 41923
1420.844	C58	330 pF/2/63 V	N 750 1 B EDPU	VALVO
0945.811	C59	47 pF/2/63 V	NPO/1 B EDPU	DIN 41923
0944.971	C60	1000pF/10/63 V	K 2000 EDPU	VALVO
0904.988	C61	0,01/100/20/40 V	K 10000 EDPU	VALVO
1400.568	C62	0,22/10/63 V	MKS 2	WIMA
1405.136	C63	0,015/5/63 V	MKS 2	WIMA
1400.568	C64	0,22/10/63 V	MKS 2	WIMA
1647.288	C65	0,01/5/63 V	MKS 2	WIMA
1423.037	C66	0,1/20/63 V	MKS 2	WIMA
1815.377	C67	47/20/25 V	2222 035 56479	VALVO
1423.304	C68	10/20/25 V	SAL 2222 122 90006	VALVO
1647.288	C70	0,01/5/63 V	MKS 2	WIMA
1400.568	C71	0,22/10/63 V	MKS 2	WIMA
1646.990	C72	01/10/63 V	KEFQ 1210	VALVO
1400.568	C73	0,22/10/63 V	MKS 2	WIMA

Diodes:

1767.089	D1		BA 682	ITT
1767.089	D2		BA 682	ITT
1767.089	D3		BA 682	ITT
1767.089	D4		BA 682	ITT
1767.089	D5		BA 682	ITT
1767.089	D6		BA 682	ITT
1767.089	D7		BA 682	ITT
1767.089	D8		BA 682	ITT
1767.089	D9		BA 682	ITT
1767.089	D10		BA 682	ITT
1767.089	D11		BA 682	ITT
1767.089	D12		BA 682	ITT
1767.089	D13		BA 682	ITT
1767.089	D14		BA 682	ITT

Parts lists No.
97 Sa 2.155.76

-Filterboard-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1465.740	D15		SD 101 C	ITT
0745.677	D16		1 N 4148	ITT/FAIRCHILD/ SIEMENS/VALVO/ AEG-TELEFUNKEN
0745.677	D17		1 N 41448	ITT/FAIRCHILD/ SIEMENS/VALVO/ AEG-TELEFUNKEN
1427.121	D18		TLUR 5400	AEG-TELEFUNKEN
0694.959	D19		ZPD 2,7	ITT

Resistors:

1643.460	R1	SMD 1k-5-0,125 W	3,2x1,6x0,58	HN 329 T.4
1647.105	R2	SMD 100-5-0,125 W	3,2x1,6x0,58	HN 329 T.4
1853.740	R3	SMD 8,2-5-0,125 W	3,2x1,6x0,58	HN 329 T.4
1853.740	R4	SMD 8,2-5-0,125 W	3,2x1,6x0,58	HN 329 T.4
1647.105	R5	SMD 100-5-0,125 W	3,2x1,6x0,58	HN 329 T.4
1647.105	R6	SMD 100-5-0,125 W	3,2x1,6x0,58	HN 329 T.4
1643.460	R7	SMD 1k-5-0,125 W	3,2x1,6x0,58	HN 329 T.4
1643.460	R8	SMD 1k-5-0,125 W	3,2x1,6x0,58	HN 329 T.4
1647.105	R9	SMD 100-5-0,125 W	3,2x1,6x0,58	HN 329 T.4
1647.105	R10	SMD 100-5-0,125 W	3,2x1,6x0,58	HN 329 T.4
1643.460	R11	SMD 1k-5-0,125 W	3,2x1,6x0,58	HN 329 T.4
1643.460	R12	SMD 1k-.5-0,125 W	3,2x1,6x0,58	HN 329 T.4
1647.105	R16	SMD 100-5-0,125 W	3,2x1,6x0,58	HN 329 T.4
1647.105	R14	SMD 100-5-0,125 W	3,2x1,6x0,58	HN 329 T.4
1643.460	R15	SMD 1k-5-0,125 W	3,2x1,6x0,58	HN 329 T.4
1643.460	R16	SMD 1k-5-0,125 W	3,2x1,6x0,58	HN 329 T.4
1748.297	R17	SMD 820-5-0,125 W	2x1,25x0,5/0,7	HN 329 T.2
1647.105	R18	SMD 100-5-0,125 W	3,2x1,6x0,58	HN 329 T.4
1647.105	R19	SMD 100-5-0,125 W	3,2x1,6x0,58	HN 329 T.4
1748.297	R20	SMD 820-5-0,125 W	2x1,25x0,5/0,7	HN 329 T.2
1647.105	R21	SMD 100-5-0,125 W	3,2x1,6x0,58	HN 329 T.4
1647.105	R22	SMD 100-5-0,125 W	3,2x1,6x0,58	HN 329 T.4
1643.460	R23	SMD 1k-5-0,125 W	3,2x1,6x0,58	HN 329 T.4
1643.460	R24	SMD 1k-5-0,125 W	3,2x1,6x0,58	HN 329 T.4
1647.105	R25	SMD 100-5-0,125 W	3,2x1,6x0,58	HN 329 T.4
1647.105	R26	SMD 100-5-0,125 W	3,2x1,6x0,58	HN 329 T.4
1643.460	R27	SMD 1k-5-0,125 W	3,2x1,6x0,58	HN 329 T.4
1643.460	R28	SMD 1k-5-0,125 W	3,2x1,6x0,58	HN 329 T.4
1647.105	R29	SMD 100-5-0,125 W	3,2x1,6x0,58	HN 329 T.4
1647.105	R30	SMD 100-5-0,125 W	3,2x1,6x0,58	HN 329 T.4
1643.460	R31	SMD 1k-5-0,125 W	3,2x1,6x0,58	HN 329 T.4

-Filterboard-

Parts lists No.
97 Sa 2.155.76

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1643.460	R32	SMD 1k-5-0,125 W	3,2x1,6x0,58	HN 329 T.4
1710.478	R33	SMD 10k-5-0,06 W	2x1,25x0,5/0,7	HN 329 T.2
0627.895	R34	33k-5-0,6-0207	DIN 44052-G	
0767.190	R35	100k-5-0,6-0207	DIN 44052-G	
0480.444	R36	1,5k-5-0,6-0207	DIN 44052-G	
0530.360	R37	56-5-0,6-0207	DIN 44052-G	
0179.701	R38	10k-5-0,6-0207	DIN 44052-G	
0744.808	R39	2,2k-5-0,6-0207	DIN 44052-G	
0530.360	R40	56-5-0,6-0207	DIN 44052-G	
0779.776	R41	18-5-0,6-0207	DIN 44052-G	
0179.701	R42	10 k-5-0,6-0207	DIN 44052-G	
0744.808	R43	2,2 k-5-0,6-0207	DIN 44052-G	
0530.360	R44	56-5-0,6-0207	DIN 44052-G	
0626.694	R45	47-5-0,6-0207	DIN 44052-G	
0767.190	R46	100k-5-0,6-0207	DIN 44052-G	
0542.830	R47	27k-5-0.6-0207	DIN 44052-G	
0179.639	R48	100-5-0,6-0207	DIN 44052-G	
0744.859	R49	330-5-0,6-0207	DIN 44052-G	
0179.639	R50	100-5-0,6-0207	DIN 44052-G	
0179.701	R51	10 k-5-0,6-0207	DIN 44052-G	
0767.190	R52	100 k-5-0,6-0207	DIN 44052-G	
0799.416	R53	220 k-5-0,6-0207	DIN 44052-G	
0744.808	R54	2,2 k-5-0,6-0207	DIN 44052-G	
0179.698	R55	1 k-5-0,6-0207	DIN 44052-G	
0767.212	R56	4,7 k-5-0,6-0207	DIN 44052-G	
0767.212	R57	4,7 k-5-0,6-0207	DIN 44052-G	
1612.859	R58	220-5-0,125 W 3,2x1,6x0,58		HN 329 T.4
1643.487	R59	1,8 k-5-0,125 W 3,2x1,6x0,58		HN 329 T.4
1643.487	R60	1,8 k-5-0,125 W 3,2x1,6x0,58		HN 329 T.4
1643.487	R61	1,8 k-5-0,125 W 3,2x1,6x0,58		HN 329 T.4
1643.487	R62	1,8 k-5-0,125 W 3,2x1,6x0,58		HN 329 T.4
1643.525	R63	2,2 k-5-0,125 W 3,2x1,6x0,58		HN 329 T.4
1643.525	R64	2,2 k-5-0,125 W 3,2x1,6x0,58		HN 329 T.4
1643.525	R65	2,2 k-5-0,125 W 3,2x1,6x0,58		HN 329 T.4
1643.525	R66	2,2 k-5-0,125 W 3,2x1,6x0,58		HN 329 T.4
1643.460	R67	1k-5-0,125 W 3,2x1,6x0,58		HN 329 T.4
1710.478	R68	10 k-5-0,06 W 2x1,25x0,5/0,7		HN 329 T.4
1710.478	R69	10 k-5-0,06 W 2x1,25x0,5/0,7		HN 329 T.4
1710.478	R70	10 k-5-0,06 W 2x1,25x0,5/0,7		HN 329 T.4
1710.478	R71	10 k-5-0,06 W 2x1,25x0,5/0,7		HN 329 T.4
1710.478	R72	10 k-5-0,06 W 2x1,25x0,5/0,7		HN 329 T.4
1710.478	R73	10 k-5-0,06 W 2x1,25x0,5/0,7		HN 329 T.4
1710.478	R74	10 k-5-0,06 W 2x1,25x0,5/0,7		HN 329 T.4
0626.708	R75	10-5-0,6-0207	DIN 44052-G	

-Filterboard-

Parts lists No.
97 Sa 2.155.76

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1647.105	R76	100-5-0,125 W3,2x1,6x0,58		HN 329 T.4
1643.460	R77	1k-5-0,125 W 3,2x1,6x0,58		HN 329 T.4
1643.460	R78	1k-5-0,125 W 3,2x1,6x0,58		HN 329 T.4
1411.225	R79	2,7k-5-0,5-0204	DIN 44052-G	

Coils:

0747.572	L1	100 µH/10 PCT	Typ 72.1	JAHRE
		or 100 µH	B 78108-S 1104-J	SIEMENS
0747.572	L2	100 µH/10 PCT	Typ 72.1	JAHRE
		or 100 µH	B 78108-S 1104-J	SIEMENS
0745.650	L3	2000 µH	Nr. 2500-42	AMPHENOL
0745.650	L4	2000 µH	Nr. 2500-42	AMPHENOL
1962.523	L5	3,2 mH	97 E 2.155.150	HAGENUK

Integrated circuits:

1767.097	IC-A		IC 74 HCT 237	TEXAS, ITT
1423.711	IC-B		IC 75469	
1739.816	IC-C		IC S 042 P	SIEMENS
1427.156	IC-D		IC CA 3240 E	

Transistors:

1297.783	T1		BF 422	
1291.033	T2		BC 549 B	
1291.033	T3		BC 549 B	
1291.033	T4		BC 549 B	

Connectors:

1765.396	Bu2	coax cabel		97 E 2.155.79
1765.418	Bu3	coax cabel		97 E 2.155.80
0746.096	Bu4	BNC-plog	UG 657/U 31102	
1826.549	St1	Connectorpanel 10-pins	609-1004 E	ANSLEY

-Filterboard-

Parts lists No.
97 Sa 2.155.76

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Supplement:				
1422.952	F1	filter SSB 1,2 kHz		97 E 2.140.78-2
1765.450	F2	filter 750 Hz		97 E 2.140.78-16
1765.442	F3	filter 300 Hz		97 E 2.140.78-15
1765 434	F4	filter 150 Hz		97 E 2 140 78-14
1765.469	F5	filter 75 Hz		97 E 2.140.78-13
1853.708	F6	filter 50 Hz		97 E 2.140.78-12
1739.794	Q1	quartz 5,0285 MHz		97 E 2.140.412-2
1739.433	Tr1	Transmitter		97 E 2.140.414

-Demodulator-

Technical Description

The 5 MHz signal coming from the filterboard is further amplified with the transistor T2. The gain is adjusted with the potentiometer R16. The output signal of this stage is divided into two paths.

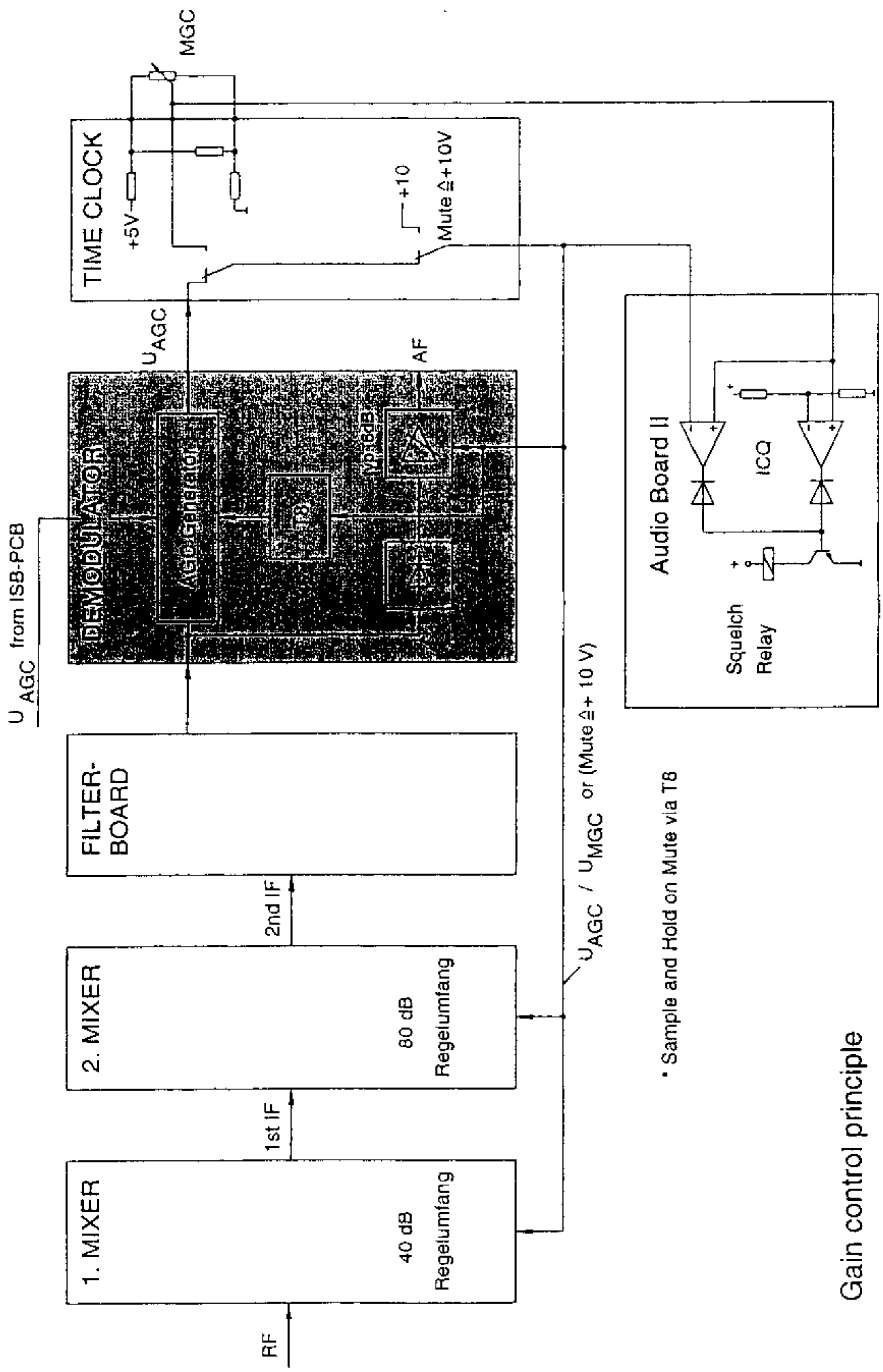
1) An amplifier with IC A and T9
   This signal is low pass filtered with L8 and C71 to C74 and fed out to the socket BU1 at the back of the demodulator with an output level of -10 dBm.
2) An amplifier with T3 and T4.
   Using these two stages, the signal is amplified to a level from where the control voltage can be directly generated when rectified. T 3 is connected to both demodulator ICs IC-H and IC-J (SSB/DSB).
   The output of T4 follow two rectifier circuits.
   Firstly the antenna diversity demodulator with D7, R46, C78 and IC B4 as a buffer. This signal with a short attack and decay time constant is used for evaluation in the TTY-Converter TG 1001 M which can be externally connected, in order to determine in antenna diversity mode, which antenna supplies the higher input voltage.
   Secondly the control voltage U_{AGC} is generated by rectifying the IF signal with D1. This voltage is stored in C15, the charge time constant is determined with R17/R119, whilst the discharge time constant (AGC SHORT) is determined by R18.
   When the receiver is disabled by an external MUTE signal, a high control voltage, which in this case is generated on the TIME CLOCK HELP board goes to the pin 11 St 2. T8 is thus disabled, C15 can not discharge. At input level jumps of 30 dB the capacitor C15 is charged up in around 10 ms, and discharged with a time constant of 200 ms determined by R18 when the signal disappears. The time constants relate to the closed control loop. The IC B1 is connected as a voltage follower and does not load the control voltage due to its high input impedance.
   In front of IC B2 the control voltage from the ISB demodulator is added to the control voltage of IC B1. The output of IC B2 charges up the capacitor C17 via R21; R22 and R23 discharge it by a very small amount so that C17 holds its charged voltage for a long time. IC B3 buffers the charging voltage of C17. The charging voltage of C17 is connected to IC C4 via an analogue switch in IC E in the case when AGC LONG is selected.

In order that short interference pulses do not disable the receiver in the AGC LONG mode, the AGC long and AGC short generator outputs are added (D5; D6). The higher voltage in each case sets the gain of the receiver. AGC LONG or AGC SHORT are set by the control part of the receiver. In the case of AGC LONG, when the input signal disappears the control voltage is held constant for four seconds. During this time, the AF amplified with IC L4 is held so low that the rectified voltage across C55 does not recharge via D9 and D10 but discharges via R92. This time constant was selected in conjunction with the switching point of the Schmitt Trigger IC M such that after four seconds the analogue switch in the IC E connects the resistance R24 to ground. Thus the voltage across C17 is discharged.
The monoflop IC F is triggered when the AGC-modes AGC LONG and AGC SHORT are changed and discharges the capacitors C14 and C17 via R76 and R25. This is necessary, since in the MGC mode (HF manual control) due to the now open control loop, the AGC voltage can be larger than the MGC voltage, which would lead to the receiver being disabled when there is a change from MGC to AGC. Special control times are required for LINK 11 operation. It is accomplished in the circuit AGC FOR LINK 11 OPERATION with the module around IC D.

SSB/CW - DSB demodulator
Selection of the demodulator is via the DSB -SSB SWITCH with the transistor T12. The SSB demodulator consists of the differential amplifier IC H, in which IF and BFO frequency are mixed. The BFO frequency reaches the IC via St 3 BFO IN, with the frequency being dependent on the position of the side band:

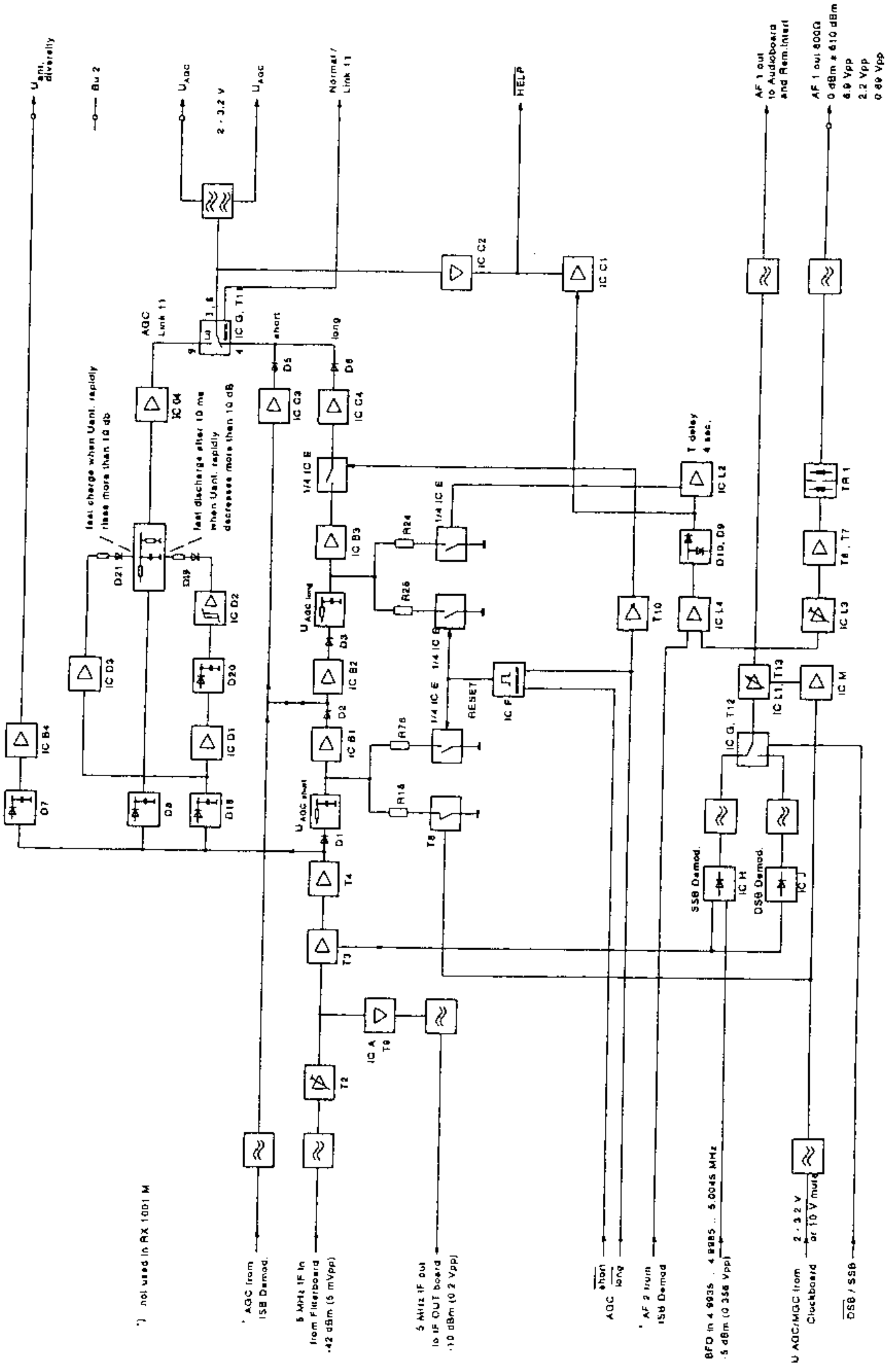
- in the upper side band USB 5.000 MHz
- in the lower side band LSB 4.997 MHz
- in telegraphy adjustable around f-center 4.9985 MHz

The low pass with C37; R58 and C42 rejects the difference frequency between IF and BFO frequency. The double side band modulated signal with full carrier (DSB) is demodulated in IC J and T5. IC J amplifies the IF, which is to be demodulated, T5 is biased so that the base emitter diode works as a rectifier in B mode. The low pass with C44, R71 and C45 filters out unwanted RF. The demodulated signal is then switched through analogue switch IC G and amplified with IC L1 and IC L3. The amplifier IC L1 delivers the AF to the receiver control part. The IC L3 with the subsequent complimentary emitter follower T6 and T7 passes the AF to the Tr1, which ensures a symmetrical output. With P1 the output level can be set to 0 dBm ± 10 dB. Due to a AGC controlled transistor T13 in the feedback branch of IC L1, reduction of AF-level difference between small and large antenna signals in achieved.



Gain control principle

-Demodulator-



Blockdiagram Demodulator

-Demodulator-

Test and alignment instructions

Required: Circuit diagram - DEMODULATOR - Hagenuk Drawing No. 97 Sa B 2.155.70
spectrum analyser, signal generator, harmonic distortion meter, oscilloscope, DVM, power supply

Test configuration: The DEMODULATOR module is removed and the cover taken off.
Connect spectrum analyser to socket Bu 15 MHz IF OUT.
Connect signal generator to plug ST 1 IF IN.
Connect DVM to plug ST 2 pin 8, linking pins 8,6 and 11.
Connect power supply +18V to plug ST 2 pin 3 and earth to pin 1.

Measurement of current consumption
Test values:
Specified: 130 mA ± 15% at U_{nom}. 18 V ± 50 mV

Measurement of AGC
Set the signal generator to f = 5.001 MHz, P_{out} = - 40 dBm. Connect oscilloscope and harmonic distortion meter to plug ST 1 pin 4. Connect signal generator (f = 5.00 MHz, P_{out}= -5 dBm) to plug ST BFO IN. Set U_{AGC} to maximum value with the slug Or L 14.
Test values:
Set the values U_{AGC} = 2.6 V with R 16.

Remove signal generator signal BFO IN.
Test values:
The signal on socket Bu 1 IF OUT should be f = 5 MHz P_{out} - 10 dBm ± 3 dB.
Reconnect signal generator and set level P_{out} = - 42 dBm. Then turn R 152 fully counterclockwise and set level AF 1 with R 144.

Test values:
AF 1 on oscilloscope 1.1 Vpp + 0.3 V pp/-0.2 Vpp.
Set signal generator level on P_{out} to -40 dBm and set AF 1 level with R 152.

Test values:
AF 1 on oscilloscope 1.1 Vpp + 0.3 Vpp/-0.2 Vpp Measure THD K < 3 %.
Set the signal generator connected to plug ST 1 IF IN to f = 5.0002 MHz and f = 5.003 MHz

Test values:
The levels of the AF signals may differ from the level of the 1 kHz signal by max. 10 %.

-Demodulator-

NOTE
f = 5.0002 MHz = AF 200 Hz
f = 5.003 MHz = AF 3 kHz

Remove signal generator signal BFO IN. Set signal generator IF IN to f = 5.000 MHz 30 % modulated with 1 kHz.
Test values:
AF 1 on oscilloscope 1 Vpp + 0.3 Vpp/-0.2 Vpp
THD K < 3 %.
Increase modulation percentage to 80 %.

Test values:
TDH K < 3 %.
Reset modulation to 30 %. On the rear of the cassette, terminate socket Bu 2 pins 1 and 2 with 600 Ohm and connect oscilloscope.

Test values:
The AF level can be varied from a minimum of 0.4 Vpp to a maximum of 6 Vpp by potentiometer P 1 on the back of the cassette.

NOTE
A special test instrument is required for further testing of AGC performance (time constants):
Hagenuk DEMODULATOR
Hagenuk DEMODULATOR TEST BOXES I and II

Measurement of AGC performance
Set switches "AGC/ISB" and "AF 2" to "ON" and switch DSB/SSB to SSB.

Switch off signal generator.
U_{AGC} is adjustable by the potentiometer (on the test instrument).
Specified value: U_{AGC} approx. 1.9 - 3.2 V.

Set the AGC voltage to 2.6 V with the potentiometer "U_{AGC}".
Set the AGC switch to "AGC long". Switch AF 2 off.
Turn potentiometer back fully counter clockwise.
Specified values: U_{AGC} should have fallen to about 1.9 V after about 4 s.

Set AGC switch to "AGC long". Set signal generator input level to -10 dBm. Connect 2-channel storage oscilloscope (see test configuration).
Set IF switch to "IF adj." by test instrument I (0 dB switch).
Reduce input level from -10 dBm to - 40 dBm.
Specified values: U_{AGC} should remain at about 2.3 V for 2-4 s and then fall to 2.0 V.
Response time: < 400 ms.

-Demodulator-

Set switch to "AGC short".
Reduce input level by test instrument I (30 dB switch) from -10 dBm to - 40 dBm
Specified values: AGC voltage should have settled at 1.9 - 2.0 V (voltmeter) within 400 s of switching over.

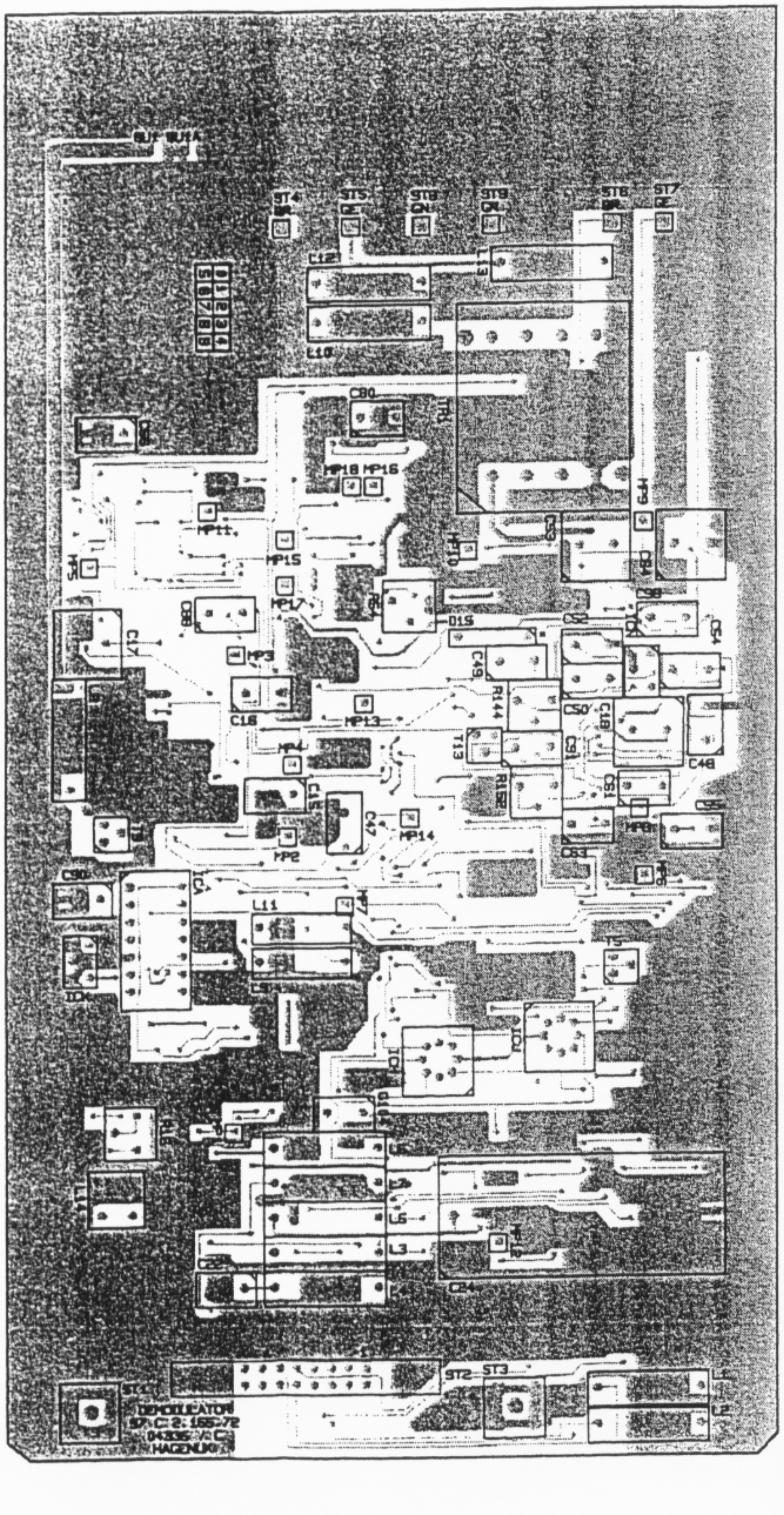
Increase level from - 40 to -10 dBm by test instrument 1 (30 dB switch).
Specified value: rise time of AGC voltage < 10 ms.

Adjustment of Link 11 timing:
Set Link 11 switch to "ON".
Set signal generator input level to -55 dBm.
Adjust R 54 so that the voltage at measuring point MP 16 just goes "LOW".
Test of high-speed charging.
Increase signal generator level to - 22 dBm.
The voltage on MP 18 must go "HIGH" at this input level (± 3 dB).

Testing the BITE operation

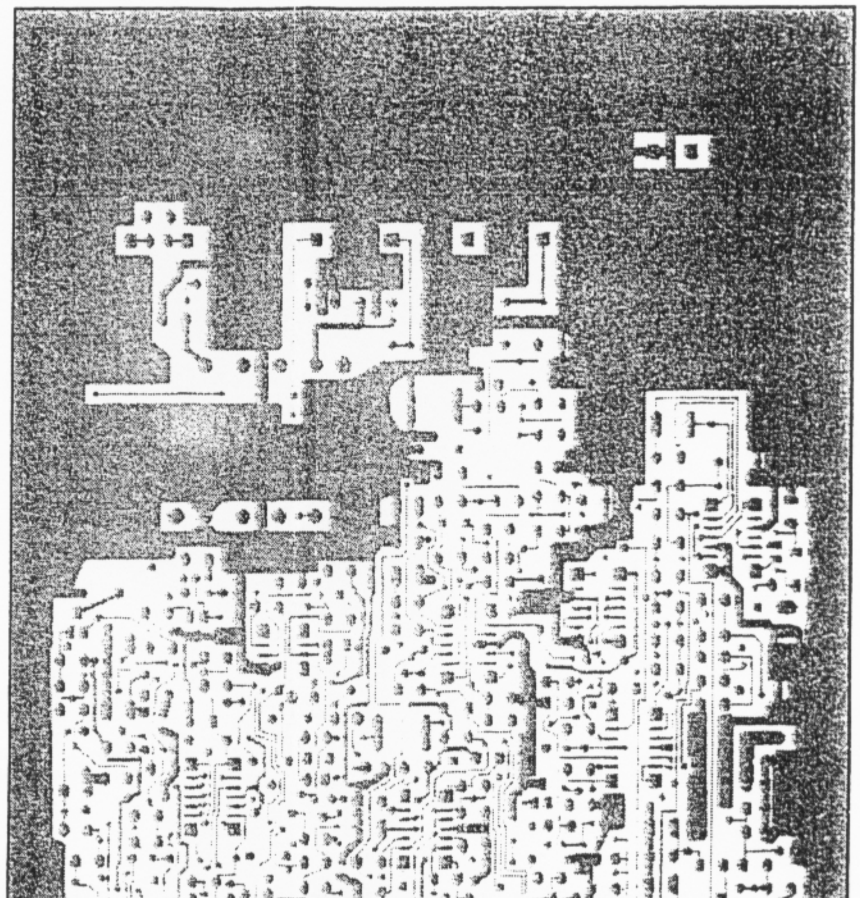
Set signal generator to f = 5.000 MHz P_{out} = - 40 dBm. The component to be tested is BITE comparator II IC - C 1. Connect an LED with 470 Ohm series resistor to plug ST 2 pin 12.
Connect signal generator BFO IN.
Test values:
Functional test: BFO IN signal present: LED should be off.
Without a BFO IN signal, the LED should go on after 2.5 s.

Reconnect signal generator BFO IN and connect plug ST 2 pin 14 to ground.
Test values:
Functional test: LED is off
Reduce signal generator level IF IN on plug ST 1; LED goes on at P_{IN} - 46 dBm ± 3 dB.

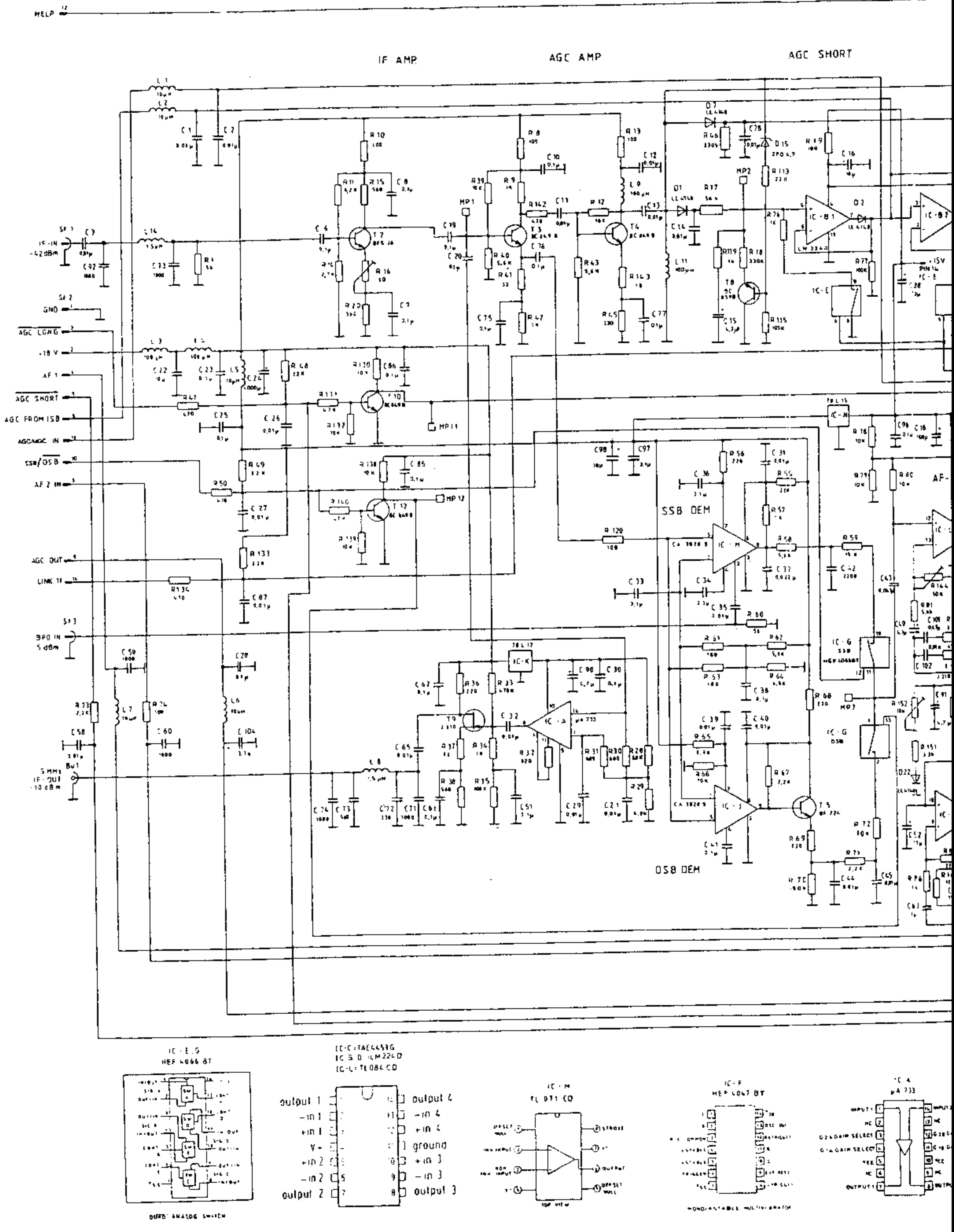


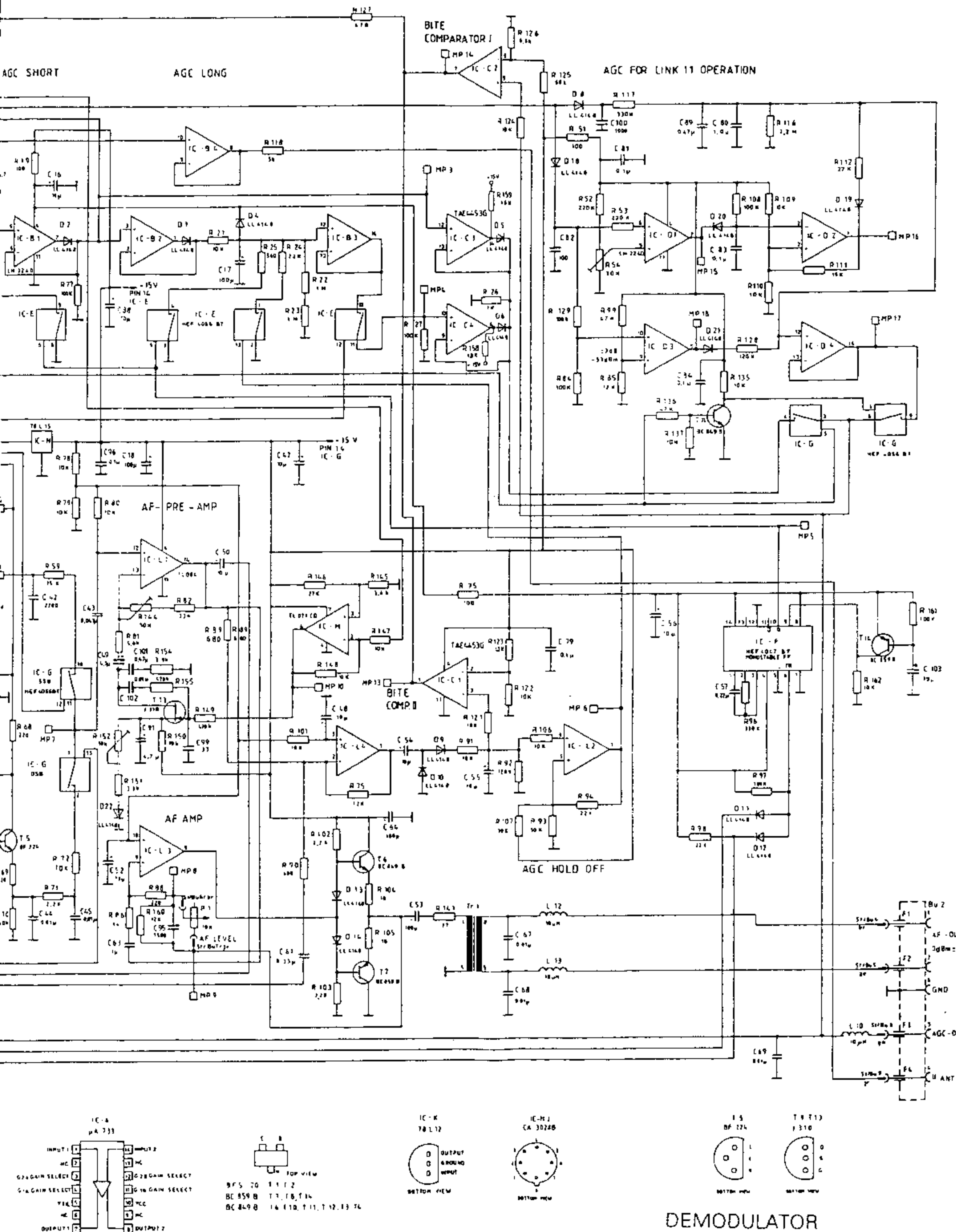
ST4
ST5
ST6
ST7
C12
L10
C80
MP18 MP16
MP11
MP15
MP17
MP3
C16
MP13
MP4
MP2
MP14
C47
L11
D15
C49
R144
T13
C50
C52
C54
C38
C48
C53
C24
L3
L6
ST2
ST3
DEMODULATOR
HAGENUK

see circuit diagram - DEMODULATOR 97 Sa B 2.155.70



Printed Circuit Board
Demodulator
97 B 2.155.72


HELP
IF AMP
AGC AMP
AGC SHORT
SSB DEM
DSB DEM
GND
AGC LONG
+18 V
AF 1
AGC SHORT
AGC FROM ISB
AGC/MGC IN
SSB/DSB
AF 2 IN
AGC OUT
LINK 11
BFO IN 5 dBm
IC-E,G HEF 4066 BT
QUAD ANALOG SWITCH
IC-C: TAE4453G
IC-B,D: LM224D
IC-L: TL084CD
output 1
-in 1
+in 1
V+
+in 2
-in 2
output 2
output 4
-in 4
+in 4
ground
+in 3
-in 3
output 3
IC-M TL 071 CD
TOP VIEW
IC-F HEF 4047 BT
MONOSTABLE MULTIVIBRATOR
IC-A µA 733



DEMODULATOR
Circuit Diagram
97 Sa B 2.155.70

Parts lists No.
97 Sa 2.155.70

-Demodulator-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Capacitors:				
1556.029	C1	Chip K. 0,01 µF/10/63 V		VALVO
1556.029	C2	Chip K. 0,01 µF/10/63 V		VALVO
1556.029	C3	Chip K. 0,01 µF/10/63 V		VALVO
1646.990	C6	Chip K. 0,1 µF/10/63 V		VALVO
1646.990	C8	Chip K. 0,1 µF/10/63 V		VALVO
1646.990	C9	Chip K. 0,1 µF/10/63 V		VALVO
1646.990	C10	Chip K. 0,1 µF/10/63 V		VALVO
1556.029	C11	Chip K. 0,01 µF/10/63 V		VALVO
1556.029	C12	Chip K. 0,01 µF/10/63 V		VALVO
1556.029	C13	Chip K. 0,01 µF/10/63 V		VALVO
1556.029	C14	Chip K. 0,01 µF/10/63 V		VALVO
1430.955	C15	4,7 µF/35 V	ETQ 4	ROE
1423.304	C16	10 µF/25 V		VALVO
1913.913	C17	100 µF/25 V	Typ 036 KO T7	VALVO
1913.913	C18	100 µF/25 V	Typ 036 KO T7	VALVO
1646.990	C19	Chip K. 0,1 µF/10/63 V		VALVO
1646.990	C20	Chip K. 0,1 µF/10/63 V		VALVO
1556.029	C21	Chip K. 0,01 µF/10/63 V		VALVO
1423.304	C22	Sal-Elko 10 µF/25 V		VALVO
1646.990	C23	Chip K. 0,1 µF/10/63 V		VALVO
0988.308	C24	1000 µF/40 V	B41010-C7108T	SIEMENS
1646.990	C25	Chip K. 0,1 µF/10/63 V		VALVO
1556.029	C26	Chip K. 0,01 µF/10/63 V		VALVO
1556.029	C27	0,01 µF/10/63 V		VALVO
1646.990	C28	0,1 µF/10/63 V		VALVO
1556.029	C29	0,01 µF/10/63 V		VALVO
1556.029	C30	0,1 µF/10/63 V		VALVO
1556.029	C31	0,01 µF/10/63 V		VALVO
1556.029	C32	0,01 µF/10/63 V		VALVO
1646.990	C33	0,1 µF/10/63 V		VALVO
1646.990	C34	0,1 µF/10/63 V		VALVO
1556.029	C35	0,01 µF/10/63 V		VALVO
1646.990	C36	0,1 µF/10/63 V		VALVO
1646.931	C37	0,022 µF/10/63 V		VALVO
1646.990	C38	0,1 µF/10/63 V		VALVO
1556.029	C39	0,01 µF/10/63 V		VALVO
1556.029	C40	0,01 µF/10/63 V		VALVO
1646.990	C41	0,1 µF/10/63 V		VALVO
1674.889	C42	2200/10/63 V		SIEMENS
1647.830	C43	0,047 µF/10/63 V		WIMA
1556.029	C44	0,01 µF/10/63 V	Best.-No. 222285212472	VALVO
1556.029	C45	0,01 µF/10/63 V	Best.-No. 222285212472	VALVO

Parts lists No.
97 Sa 2.155.70

-Demodulator-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1423.304	C47	10 µF/25 V		VALVO
1423.304	C48	10 µF/25 V		VALVO
1430.955	C49	4,7 µF/35 V	ETQ 4	ROE
1204.521	C50	10 µF/35 V	ETQ 4	ROE
1646.990	C51	0,1 µF/10/63 V		VALVO
1423.304	C52	10 µF/25 V		VALVO
1913.913	C53	100 µF/25 V	Typ 036 KO T 7	VALVO
1423.304	C54	10 µF/25 V		VALVO
1423.304	C55	10 µF/25 V		VALVO
1423.304	C56	10 µF/25 V		VALVO
1647.016	C57	0,22 µF/10/63 V		VALVO
1556.029	C58	0,01 µF/10/63 V		VALVO
1646.885	C59	1000/5/63 V		VALVO
1646.885	C60	1000/5/63 V		VALVO
1469.088	C61	0,33 µF/10/63 V	MKS 2	WIMA
1646.990	C62	0,1 µF/10/63 V		VALVO
1469.053	C63	1 µF/63 V	MKS 2	WIMA
1913.913	C64	100 µF/25 V	Typ 036 KO T 7	VALVO
1556.029	C65	0,01µF/10/63 V		VALVO
1646.990	C66	0,1 µF/10/63 V		VALVO
1556.029	C67	0,01 µF/10/63 V		VALVO
1556.029	C68	0,01 µF/10/63 V		VALVO
1556.029	C69	0,01 µF/10/63 V		VALVO
1646.885	C71	1000/5/63 V		VALVO
1647.784	C72	330/5/63 V		VALVO
1643.983	C73	560/5/63 V		VALVO
1646.885	C74	1000/5/63 V		VALVO
1646.990	C75	0,1 µF/10/63 V		VALVO
1646.990	C76	0,1 µF/10/63 V		VALVO
1646.990	C77	0,1 µF/10/63 V		VALVO
1646.893	C78	0,01 µF/5/63 V		VALVO
1546.990	C79	0,1 µF/10/63 V		VALVO
1469.053	C80	1 µF/10/63 V	MKS 2	WIMA
1646.990	C81	0,1 µF/10/63 V		VALVO
1646.958	C82	100/5/63 V		VALVO
1646.990	C83	0,1 µF/10/63 V		VALVO
1646.990	C84	0,1 µF/10/63 V		VALVO
1646.990	C85	0,1 µF/10/63 V		VALVO
1646.990	C86	0,1 µF/10/63 V		VALVO
1556.029	C87	0,01 µF/10/63 V		VALVO
1423.304	C88	10 µF/25 V		VALVO
1683.357	C89	0,47 µF/10/63 V		VALVO
1430.955	C90	4,7 µF	ETQ 4	ROE
1430.955	C91	4,7 µF	ETQ 4	ROE

Parts lists No.
97 Sa 2.155.70

-Demodulator-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1646.885	C92	1000 pF/5/63 V		VALVO
1646.885	C93	1000 pF/5/63 V		VALVO
1760.092	C95	1500/10/63 V		VALVO
1646.990	C96	0,1 µF/10/63 V		VALVO
1646.990	C97	0,1µF/10/63 V		VALVO
1423.304	C98	10 µF/25 V		VALVO
1650.181	C99	33/5/63 V		VALVO
1646.885	C100	1000/5/63 V		VALVO
1683.357	C101	0,47 µF/10/63 V		VALVO
1556.029	C102	0,01 µF/10/50 V		VALVO
1887.580	C103	1,0 µF/10/35 V		
1302.744	C104	3,3 µF/20/25 V		

Diodes:

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1613.162	D1		LL 4148	ITT
1613.162	D2		LL 4148	ITT
1613.162	D3		LL 4148	ITT
1613.162	D4		LL 4148	ITT
1613.162	D5		LL 4148	ITT
1613.162	D6		LL 4148	ITT
1613.162	D7		LL 4148	ITT
1613.162	D8		LL 4148	ITT
1613.162	D9		LL 4148	ITT
1613.162	D10		LL 4148	ITT
1613.162	D11		LL 4148	ITT
1613.162	D12		LL 4148	ITT
1613.162	D13		LL 4148	ITT
1613.162	D14		LL 4148	ITT
1068.237	D15		ZPD 4,7	ITT
1613.162	D18		LL 4148	ITT
1613.162	D19		LL 4148	ITT
1613.162	D20		LL 4148	ITT
1613.162	D21		LL 4148	ITT
1613.162	D22		LL 4148	ITT

-Demodulator-

Parts lists No.
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Ident-No.	Mark	Electr. value	Identity	Manufacturer
Resistors:				
1878.050	R1	56 - 5 - 0,125 W		
1647.105	R8	100 - 5 - 0,125 W		
1643.460	R9	1 K - 5 - 0,125 W		
1647.105	R10	100 - 5 - 0,125 W		
1709.569	R11	8,2 - 5 - 0,125 W		
1612.948	R12	10 K - 5 - 0,125 W		
1647.105	R13	100 - 5 - 0,125 W		
1647.431	R14	2,7 K - 5 - 0,125 W		
1643.428	R15	560 - 5 - 0,125 W		
1895.370	R16		50 171/6 M 1 L	Simsen
1647.156	R17	33 K - 5 - 0,125 W		
1647.121	R18	330 K - 5 - 0,125 W		
1647.105	R19	100 - 5 - 0,125 W		
1643.428	R20	560 - 5 - 0,125 W		
1612.949	R21	10 K - 5 - 0,125 W		
1555.987	R22	1 M - 5 - 0,125 W		
1555.987	R23	1 M - 5 - 0,125 W		
1650.130	R24	22 K - 5 - 0,125 W		
1643.428	R25	560 - 5 - 0,125 W		
1643.460	R26	1 K - 5 - 0,125 W		
1612.980	R27	100 K - 5 - 0,125 W		
1647.091	R28	6,8 K - 5 - 0,125 W		
1647.091	R29	6,8 K - 5 - 0,125 W		
1647.075	R30	680 - 5 - 0,125 W		
1647.075	R31	680 - 5 - 0,125 W		
1649.086	R32	820 - 5 - 0,125 W		
1613.065	R33	470 K - 5 - 0,125 W		
1643.460	R34	1 K - 5 - 0,125 W		
1612.980	R35	100 K - 5 - 0,125 W		
1612.859	R36	220 - 5 - 0,125 W		
1643.304	R37	22 - 5 - 0,125 W		
1643.428	R38	560 - 5 - 0,125 W		
1612.948	R39	10 K - 5 - 0,125 W		
1647.083	R40	5,6 K - 5 - 0,125 W		
1643.320	R41	33 - 5 - 0,125 W		
1643.460	R42	1 K - 5 - 0,125 W		
1647.083	R43	5,6 K - 5 - 0,125 W		
1643.363	R45	330 - 5 - 0,125 W		
1647.121	R46	220 K - 5 - 0,125 W		
1704.621	R47	470 - 5 - 0,125 W		

Parts lists No.
97 Sa 2.155.70

-Demodulator-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1650.130	R48	22 K - 5 - 0,125 W		
1650.130	R49	22 K - 5 - 0,125 W		
1704.621	R50	470 - 5 - 0,125 W		
1647.105	R51	100 - 5 - 0,125 W		
1613.006	R52	220 K - 5 - 0,125 W		
1613.006	R53	220 K - 5 - 0,125 W		
1913 883	R54	20 K	171/6 M 1 L	Simsen
1612.859	R55	220 - 5 - 0,125 W		
1612.859	R56	220 - 5 - 0,125 W		
1643.460	R57	1 K - 5 - 0,125 W		
1647.083	R58	5,6 K - 5 - 0,125 W		
1647.164	R59	15 K - 5 - 0,125 W		
1878.050	R60	56 - 5 - 0,125 W		
1866.540	R61	180 - 5 - 0,125 W		
1647.083	R62	5,6 K - 5 - 0,125 W		
1866.540	R63	180 - 5 - 0,125 W		
1647.091	R64	6,8 K - 5 - 0,125 W		
1643.576	R65	3,9 K - 5 - 0,125 W		
1612.948	R66	10 K - 5 - 0,125 W		
1643.525	R67	2,2 K - 5 - 0,125 W		
1612.859	R68	220 - 5 - 0,125 W		
1612.859	R69	220 - 5 - 0,125 W		
1666.363	R70	150 K - 5 - 0,125 W		
1643.525	R71	2,2 K - 5 - 0,125 W		
1612.948	R72	10 K - 5 - 0,125 W		
1643.525	R73	2,2 K - 5 - 0,125 W		
1647.105	R74	100 - 5 - 0,125 W		
1647.202	R75	12 K - 5 - 0,125 W		
1643.460	R76	1 K - 5 - 0,125 W		
1612.980	R77	100 K - 5 - 0,125 W		
1612.948	R78	10 K - 5 - 0,125 W		
1612.948	R79	10 K - 5 - 0,125 W		
1612.948	R80	10 K - 5 - 0,125 W		
1647.083	R81	5,6 K - 5 - 0,125 W		
1643.630	R82	33 K - 5 - 0,125 W		
1612.980	R84	100 K - 5 - 0,125 W		
1647.202	R85	12 K - 5 - 0,125 W		
1643.460	R86	1 K - 5 - 0,125 W		
1612.859	R88	220 - 5 - 0,125 W		
1647.075	R89	680 - 5 - 0,125 W		
1647.075	R90	680 - 5 - 0,125 W		
1612.948	R91	10 K - 5 - 0,125 W		
1709.127	R92	120 K - 5 - 0,125 W		

-Demodulator-

Parts lists No.
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Ident-No.	Mark	Electr. value	Identity	Manufacturer
1612.948	R93	10 K - 5 - 0,125 W		
1650.130	R94	22 K - 5 - 0,125 W		
1647.105	R95	100 - 5 - 0,125 W		
1647.121	R96	330 K - 5 - 0,125 W		
1612.980	R97	100 K - 5 - 0,125 W		
1650.130	R98	22 K - 5 - 0,125 W		
1612.913	R99	4,7 k - 5 - 0,125 W		
1612.948	R101	10 K - 5 - 0,125 W		
1643.525	R102	2,2 K - 5 - 0,125 W		
1643.525	R103	2,2 K - 5 - 0,125 W		
1672.738	R104	10 - 5 - 0,125 W		
1672.738	R105	10 - 5 - 0,125 W		
1612.948	R106	10 K - 5 - 0,125 W		
1647.210	R107	39 K - 5 - 0,125 W		
1612.980	R108	100 K - 5 - 0,125 W		
1612.948	R109	10 K - 5 - 0,125 W		
1612.948	R110	10 K - 5 - 0,125 W		
1647.164	R111	15 K - 5 - 0,125 W		
1647.148	R112	27 K - 5 - 0,125 W		
1650.130	R113	22 K - 5 - 0,125 W		
1612.980	R115	100 K - 5 - 0,125 W		
1811.169	R116	2,2 M - 5 - 0,125 W		
1647.121	R117	330 K - 5 - 0,125 W		
1878.050	R118	56 - 5 - 0,125 W		
0179.698	R119	1 K - 5 - 0,6	0207 DIN 44052 G	
1647.105	R120	100 - 5 - 0,125 W		
1612.948	R121	10 K - 5 - 0,125 W		
1612.948	R122	10 K - 5 - 0,125 W		
1643.673	R123	47 K - 5 - 0,125 W		
1612.948	R124	10 K - 5 - 0,125 W		
1612.964	R125	68 - 5 - 0,125 W		
1647.091	R126	6,8 - 5 - 0,125 W		
1704.621	R127	470 - 5 - 0,125 W		
1709.127	R128	120 K - 5 - 0,125 W		
1612.980	R129	100 - 5 - 0,125 W		
1612.948	R130	10 K - 5 - 0,125 W		
1643.673	R131	47 K - 5 - 0,125 W		
1612.948	R132	10 K - 5 - 0,125 W		
1650.130	R133	22 K - 5 - 0,125 W		
1704.621	R134	470 - 5 - 0,125 W		
1612.948	R135	10 K - 5 - 0,125 W		
1643.673	R136	47 K - 5 - .0,125 W		

Parts lists No.
97 Sa 2.155.70

-Demodulator-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1612.948	R137	10 K - 5 - 0,125 W		
1612.948	R138	10 K - 5 - 0,125 W		
1612.948	R139	10 K - 5 - 0,125 W		
1643.673	R140	47 K - 5 - 0,125 W		
1709.054	R141	27 - 5 - 0,125 W		
1704.621	R142	470 - 5 - 0,125 W		
1913.905	R143	18 - 5 - 0,125 W		
1913.891	R144	50 K	171/6 M 1 L	Simsen
1647.083	R145	5,6 - 5 - 0,125 W		
1647.148	R146	27 K - 5 - 0,125 W		
1612.948	R147	10 K - 5 - 0,125 W		
1612.948	R148	10 K - 5 - 0,125 W		
1613.065	R149	470 K - 5 - 0,125 W		
1612.948	R150	10 K - 5 - 0,125 W		
1649.094	R151	3,3 K - 5 - 0,125 W		
1940.333	R152	10 K	171/6 M 1 L	Simsen
1643.576	R154	3,9 K - 5 - 0,125 W		
1613.065	R155	470 K - 5 - 0,125 W		
1643.487	R158	1,8 K - 5 - 0,125 W		
1643.487	R159	1,8 K - 5 - 0,125 W		
0745.804	R160	12 K - 5 - 0,125 W		
1612.980	R161	100 K - 5 - 0,125 W		
1612.948	R162	10 K - 5 - 0,125 W		

Coils:

1076.140	L1	10 µH/10 %	Typ 72.00	JAHRE
1076.140	L2	10 µH/10 %	Typ 72.00	JAHRE
1068.113	L3	100 µH/20 %	Typ 72.1	JAHRE
1068.113	L4	100 µH/20 %	Typ 72.1	JAHRE
1076.140	L5	10 µH/10 %	Typ 72.00	JAHRE
1076.140	L6	10 µH/10 %	Typ 72.00	JAHRE
1076.140	L7	10 µH/10 %	Typ 72.00	JAHRE
1068.164	L8	1,5 µH/10 %	Typ 72.00	JAHRE
1573.284	L9	100 µH/10 %	B.78108-T1104-K	Sie.
1076.140	L10	10 µH/10 %	Typ 72.00	JAHRE
1573.284	L11	100 µH/10 %	B78108-T1104-K	Sie.
1076.140	L12	10 µH/10 %	Typ 72.00	JAHRE
1076.140	L13	10 µH/10 %	Typ 72.00	JAHRE
1763.431	L14		74 E 88.15 N 1	

-Demodulator-

Parts lists No.
97 Sa 2.155.70

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Integrated circuits:				
1815.105	IC A		UA 733 N	
1913.948	IC B		LM 224 D	
1963.538	IC C		TAE 4453 G	
1913.948	IC D		LM 224 D	
1649.795	IC E		HEF 4066 BT/SO-14	
1913.972	IC F		HEF 4047 BT	
1649.795	IC G		HEF 4066 BT/SO-14	
1469.045	IC H		CA 3028 B	
1469.045	IC J		CA 3028 B	
1865.676	IC K		78 L 12	
1953.060	IC L		TL 084 CD	MOTOROLA/ TEXAS
1913.980	IC M		TL 071 ID	TEXAS
1422.200	IC N		78 L 15	TEXAS
Transistors:				
1913.956	T2		BFS 20	VALVO
1710.575	T3		BC 849 B	VALVO
1710.575	T4		BC 849 B	VALVO
0922.714	T5		BF 224	VALVO
1710.575	T6		BC 849 B	VALVO
1740.520	T7		BC 859 B	VALVO
1740.520	T8		BC 859 B	VALVO
1425.137	T9		J310	VALVO
1710.575	T10		BC 849 B	VALVO
1710.575	T11		BC 849 B	VALVO
1710.575	T12		BC 849 B	VALVO
1425.137	T13		J310	VALVO
1740.520	T14		BC 859 B	VALVO
Connectors:				
1422.693	St1		R 114665	RADIALL
1826.514	St2	16-pins		
1422.693	St3		R 114665	RADIALL

Parts lists No.
97 Sa 2.155.70

-Demodulator-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1478.397	1		RTM 12 H 630	
1478.397	2		RTM 12 H 630	
1478.397	3		RTM 12 H 630	
1478.397	4		RTM 12 H 630	
1478.397	5		RTM 12 H 630	
1478.397	6		RTM 12 H 630	
1478.397	7		RTM 12 H 630	
1478.397	8		RTM 12 H 630	

Supplements:

1434.438	P1	10 K/20/Lin

-ISB-Demodulator-

Technical description

If the RX 1001 M / RX 5001 is operated with the additional ISB DEMODULATOR module, the 2. signal output of the 2nd mixer is used to supply IF to the ISB demodulator.

To provide a better understanding of which sideband is processed in the respective demodulator, refer to the section - frequency conversion - on page 4-5.

The crystal filter of the filter bank has a centre frequency of 4.9985 MHz which is why the DEMODULATOR processes the **upper sideband** (USB).

The crystal filter of the ISB DEMODULATOR has a centre frequency of 5.0015 MHz which is why the ISB DEMODULATOR processes the lower **side band** (LSB).

Crystal filter and IF amplifier

The crystal filter in the ISB DEMODULATOR has the same pass-band characteristic as the SSB filter in the filter bank but the centre frequency in this case is 5.0015 MHz.

The IF amplifier with IC A has an input impedance of about 2.4 kOhms, the source impedance is appr. 700 Ohms for low-noise amplification and stable operation. Tr 3 transforms the crystal filter impedance to 1 kOhm. R 8 in parallel reduces possible reactions which could be caused by fluctuations in the input impedance of IC A so that filter QF 1 is always terminated to 50 Ohms.

The filtered IF signal after being amplified by IC A is split and fed to the AGC generator and the LSB demodulator.

AGC generation

The filtered IF signal is amplified by the IF amplifier (IC A) and by transistors T 2 and T 3 so that it can be rectified with D 1.

R 24 charges capacitor C 25 with the rectified IF in appr. 10 ms and R 25 discharges it in appr. 200 ms. Both time constants relate to the closed control loop of the whole receiver with a change in level of 30 dB. If the receiver is muted, T 4 is cut off, the capacitor retains its stored charge so that after muting the receiver continues with its previous gain setting.

The operational amplifier IC B which is connected as a voltage follower and has little loading effects on the AGC voltage stored in C 25 since it has a very high input impedance buffers the AGC before it is fed to the DEMODULATOR via an analog switch in IC C. In the DEMODULATOR, the AGC voltage generated by the ISB demodulator (LSB) and the AGC voltage generated in the demodulator (USB) are compared with each other and the respective higher voltage is used for controlling the overall gain of the receiver.

If the receiver is operated in MGC mode, the AGC generated can be greater than the MGC voltage. In this case the amplifier would have low gain for a time after AGC modes are switched on.
For this reason, the monostable IC D is triggered via the AGC LONG or AGC SHORT lines and with ISB. For the duration of the monostable pulse R 26 is connected to GND via another analog switch in IC C controlled by the monostable, and C 25 is discharged. This makes it impossible for the receiver to start AGC with low gain.
Potentiometer R 33 is used to adjust IC A to produce 2.6 V AGC voltage at the output ST 1/6 for an IF input level of -40 dBm.

-ISB-Demodulator-

Demodulator

The demodulator consists of the differential amplifier IC E in which the IF and BFO frequencies are mixed. In ISB mode the BFO supplies a frequency of 5.000 MHz which is fed to IC E via the BFO buffer stage with T 6. In order to reduce any reaction of the BFO voltage present at the input (pin 5) of IC E back to the AGC amplifier, resistance R 12 has been inserted into the connection between the IF amplifier and the demodulator.

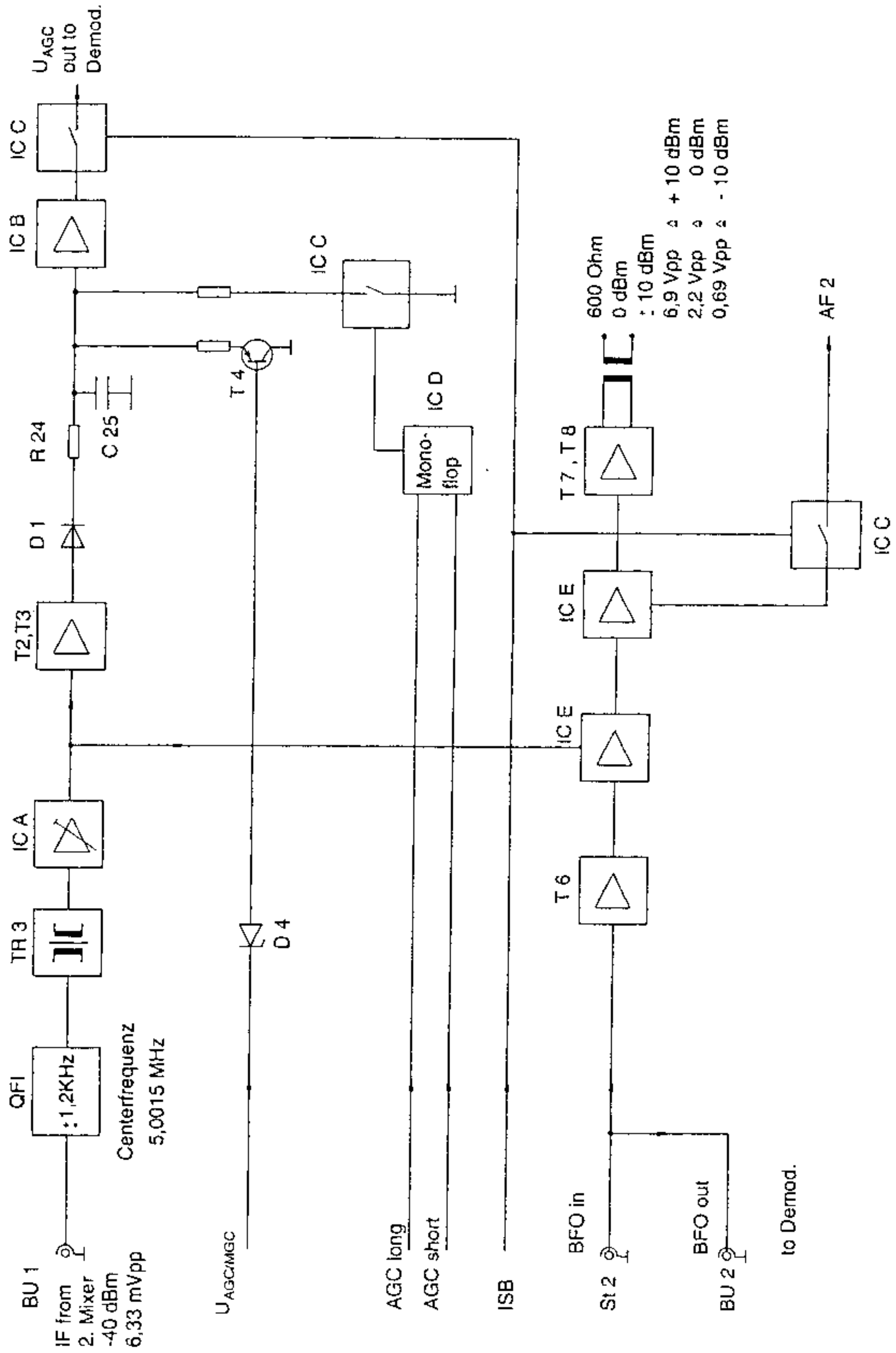
The BFO signal ST 2 is not only used inside the ISB demodulator, but it is also sent to Bu 2 to be fed to the demodulator module as well.

At the output of IC E, a RC low-pass filter filters out the demodulated AF.

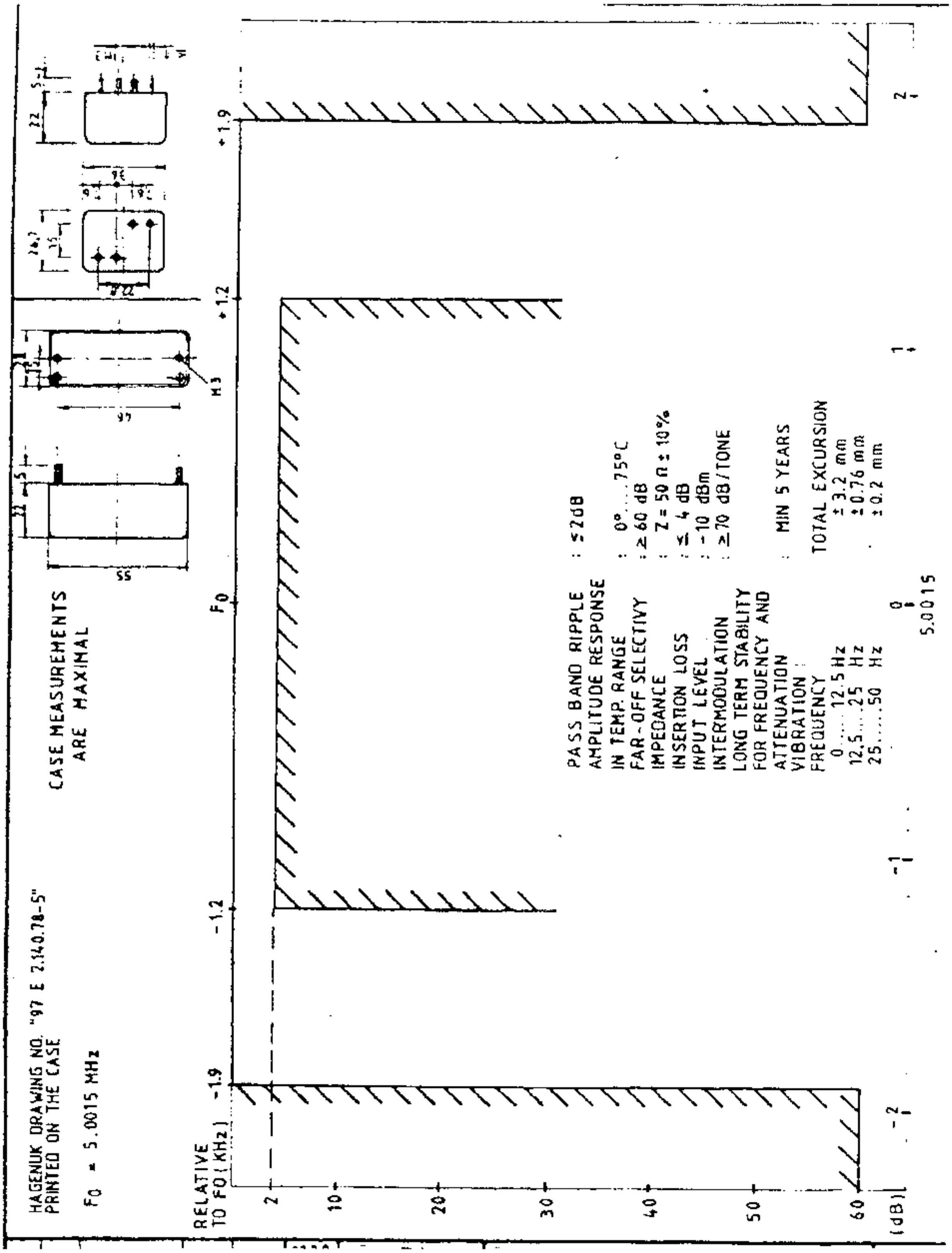
In IC F1, the AF is amplified to a level of appr. 1.1 Vpp and is fed in ISB mode only via two parallel analog switches in IC C to ST 1/9 (AF 2).

The AF is further amplified in IC F2 and the complementary emitter follower with T 7 and T 8 following it. Electrically insulated by transformer Tr 2, it is fed to a jack at the back of the ISB demodulator module. The potentiometer P 1 located there can be used to after the level of 0 dBm ± 10 dB.

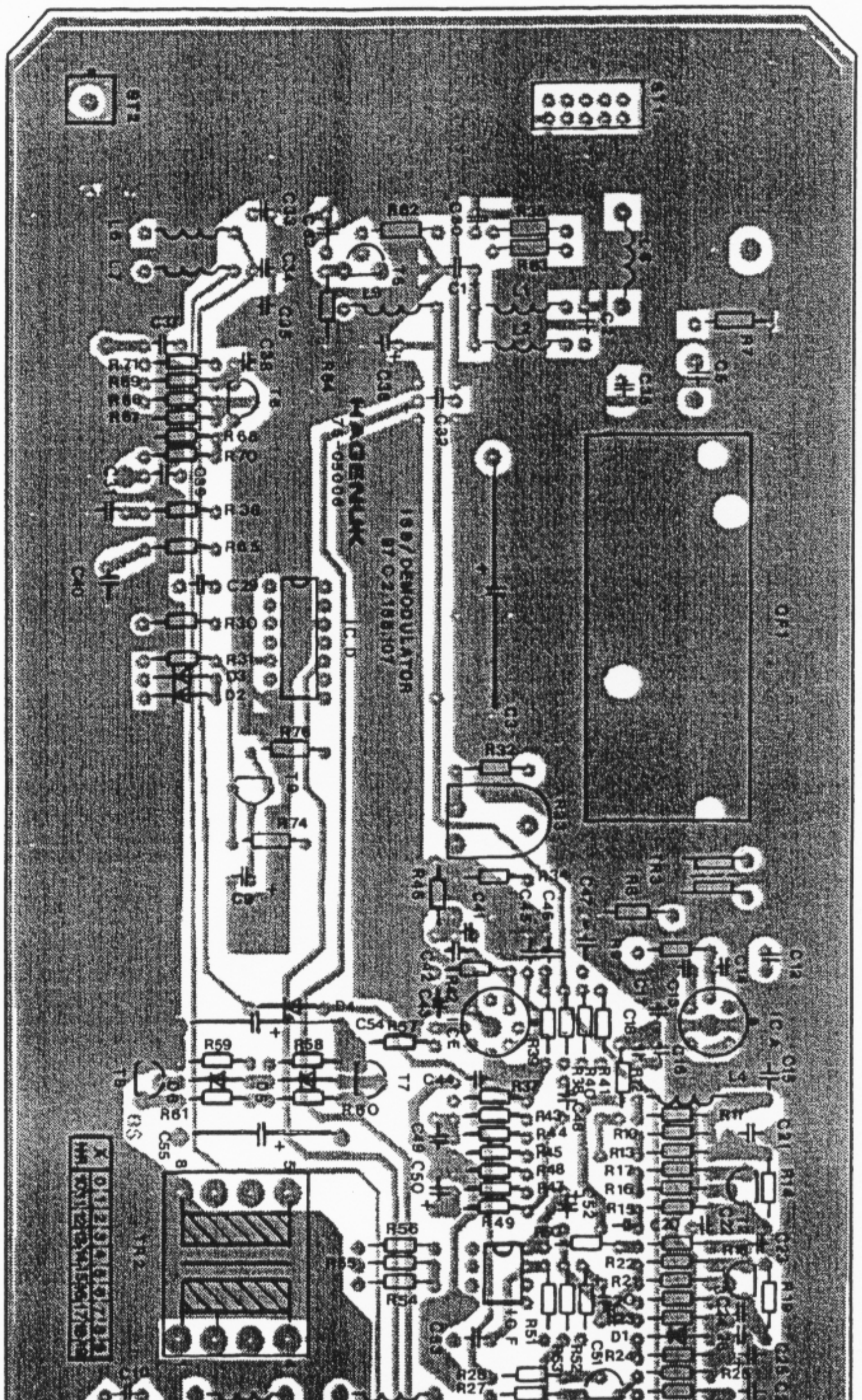
-ISB-Demodulator-



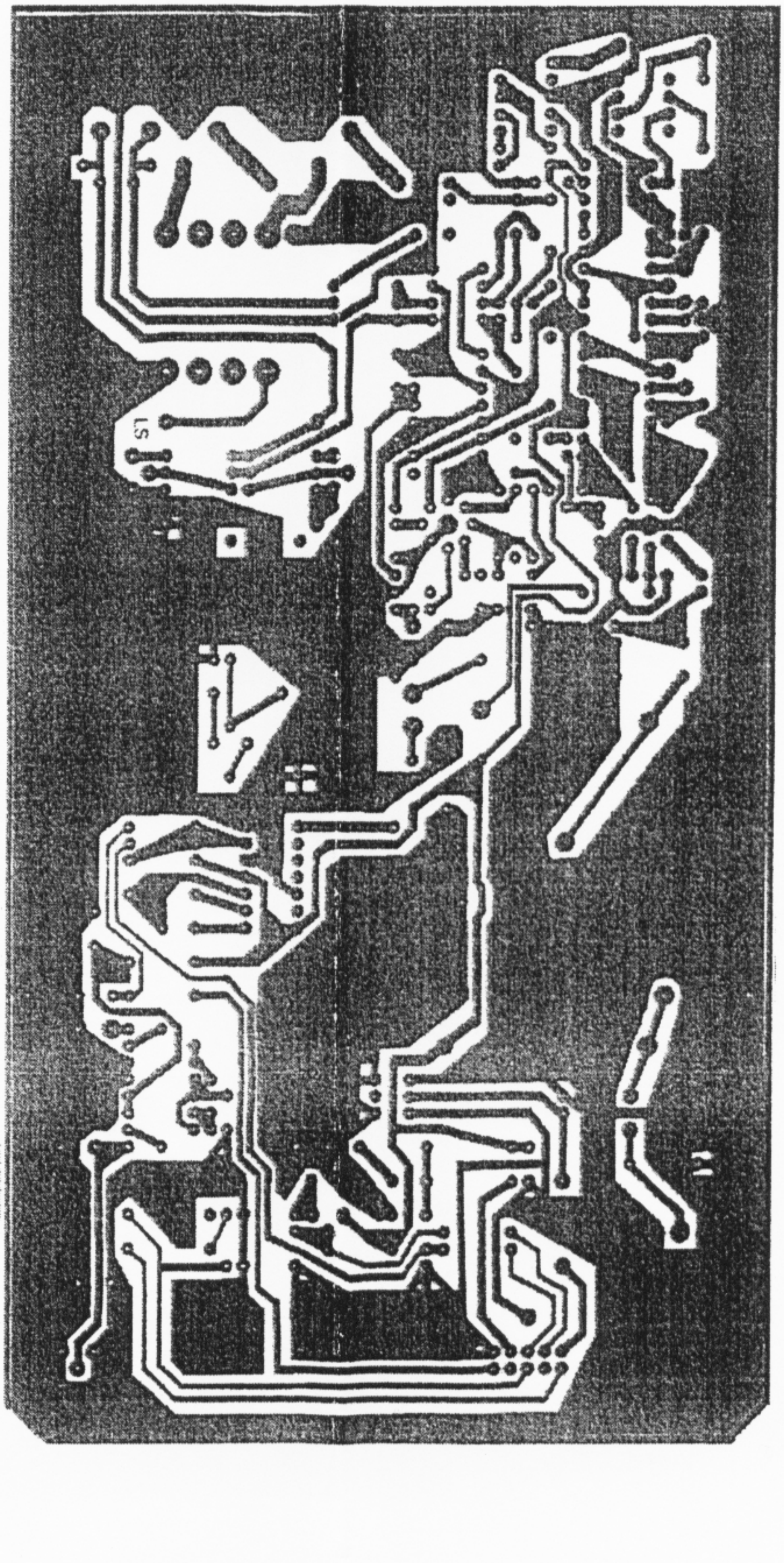
Blockdiagram ISB-Demodulator



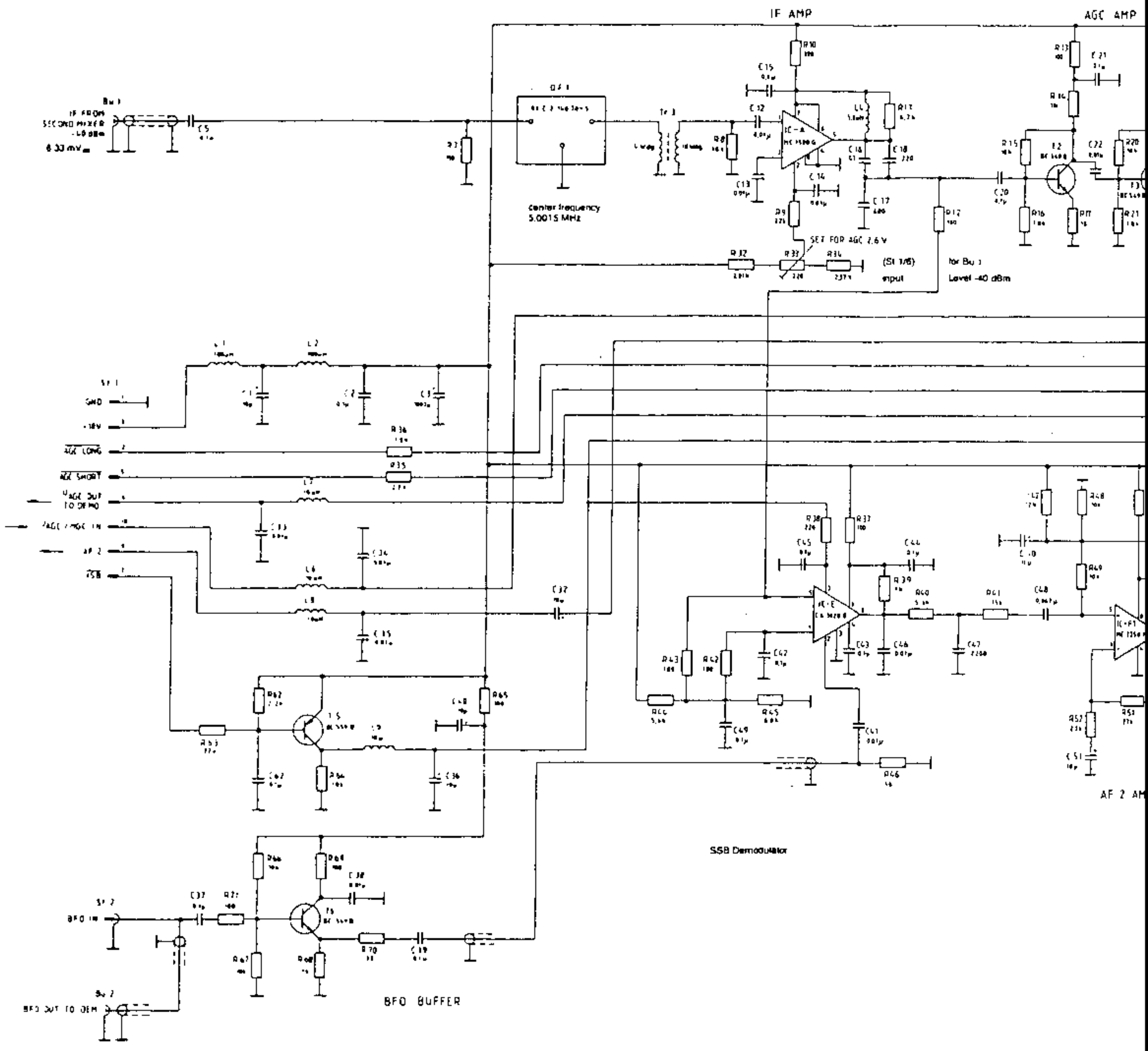
ISB Filter - 97 E 2.140.78-5

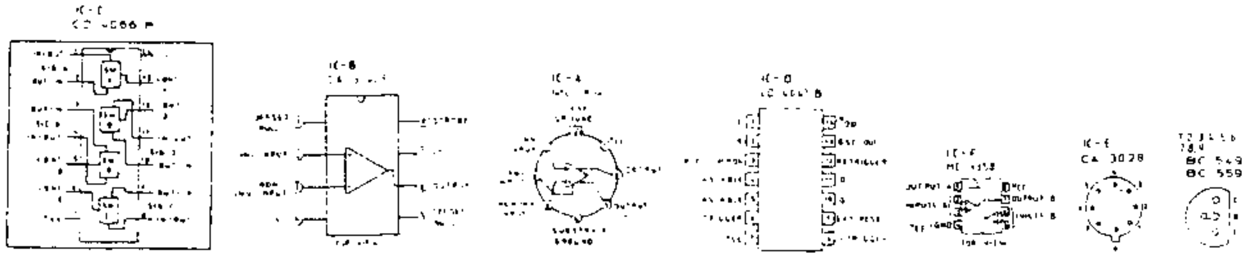


see circuit diagram - ISB-DEMODULATOR 97 Sa B 2.155.105



Printed Circuit Board
ISB-Demodulator
97 C 2.155.107





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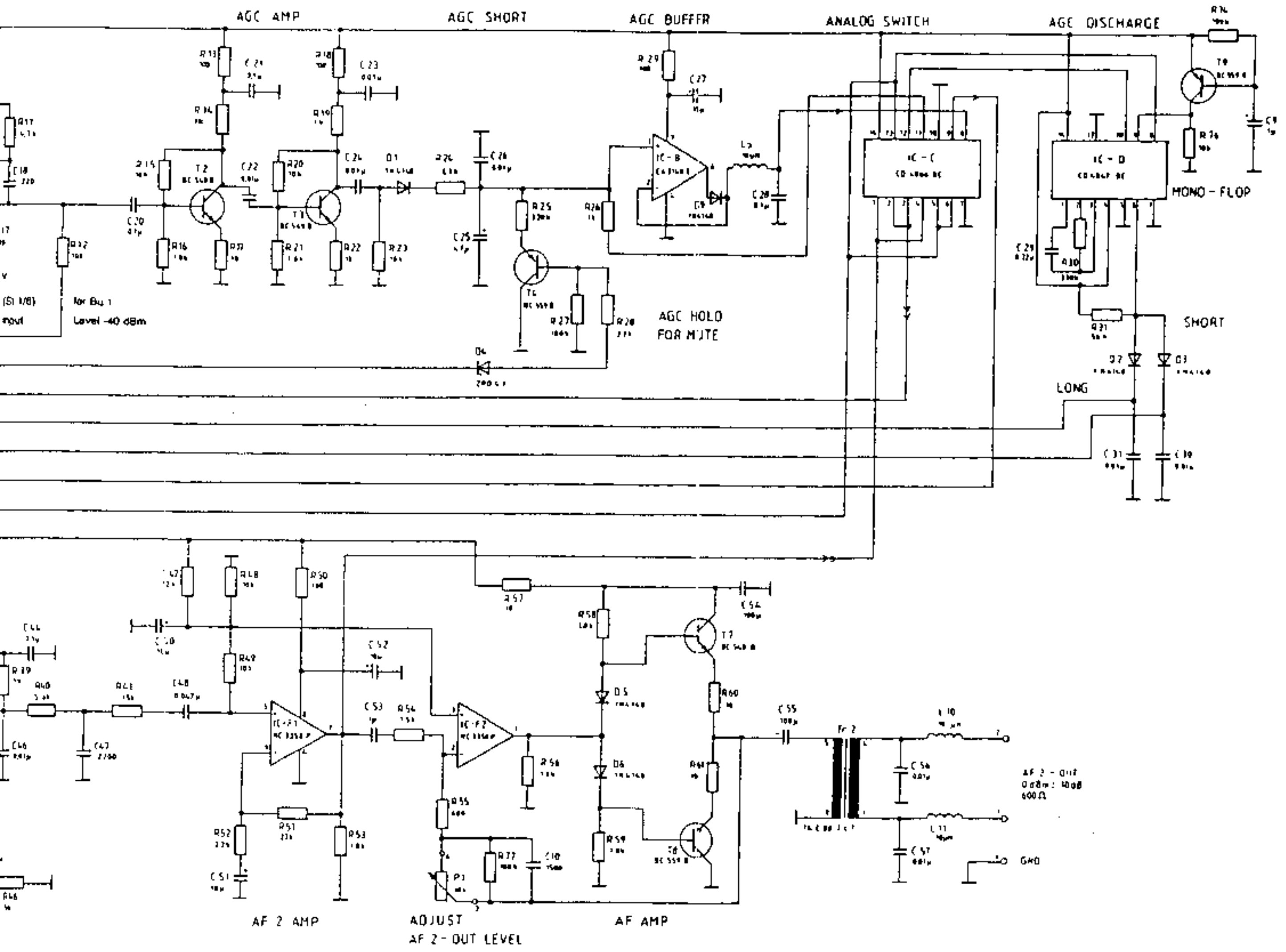


ISB-DEMODULATOR
Circuit Diagram
97 Sa B 2.155.105

Parts lists No.
97 Sa 2.155.105

-ISB-Demodulator-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Capacitors:				
1423.304	C1	10 µF/25 V		VALVO
1423.037	C2	0,1 µF/63 V	MKS 2	WIMA
1026.909	C3	1000 µF/25 V		SIEMENS
1423.037	C5	0,1 µF/63 V	MKS 2	WIMA
1469.967	C9	1/20/35 V	ETPW-1A	ROE., STC
1538.047	C10	1500pf/10/100 V	CK 05 BX 152 K	ROE.
0904.988	C12	0,01 µF/40 V	EDPU 0,6 K 10000	VALVO
0904.988	C13	0,01 µF/40 V	EDPU 0,6 K 10000	VALVO
0904.988	G14	0,01 µF/40 V	EDPU 0,6 K 10000	VALVO
1423.037	C15	0,1 µF/63 V	MKS 2	WIMA
0945.811	C16	47 pF/63 V	EDPU 0,6 NPO	VALVO
1449.669	C17	680 pF/100 V	8131A-100-C06-681	JERIE
0945.056	C18	220 pF/63 V	EDPU 0,6 N 750	VALVO
1423.037	C20	0,1 µF/63 V	MKS 2	WIMA
1423.037	C21	0,1 µF/6 V	MKS 2	WIMA
0904.988	C22	0,01 µF/40 V	EDPU 0,6 K 10000	VALVO
0904.988	C23	0,01 µF/40 V	EDPU 0,6 K 10000	VALVO
0904.988	C24	0,01 µF/40 V	EDPU 0,6 K 10000	VALVO
1430.955	C25	4,7 µF/35 V	ETQ 4	ROE
0904.988	C26	0,01 µF/40 V	EDPU 0,6 K 10000	VALVO
1423.304	C27	10 µF/25 V		VALVO
1423.037	C28	0,1 µF/63 V	MKS 2	WIMA
1190.172	C29	0,22 µF/63 V	MKS 2	WIMA
0425.196	C30	0,01 µF/63 V	MKS 2	WIMA
0425.196	C31	0,01 µF/63 V	MKS 2	WIMA
1423.304	C32	10 µF/25 V		VALVO
0904.988	C33	0,01 µF/40 V	EDPU 0,6 K 10000	VALVO
0904.988	C34	0,01 µF/40 V	EDPU 0,6 K 10000	VALVO
0904.988	C35	0,01 µF/40 V	EDPU 0,6 K 10000	VALVO
1423.304	C36	10 µF/25 V		VALVO
1423.037	C37	0,1 µF/63 V	MKS 2	WIMA
0904.988	C38	0,01 µF/40 V	EDPU 0,6 K 10000	VALVO
1423.037	C39	0,1 µF/63 V	MKS 2	WIMA
1423.304	C40	10 µF/25 V		VALVO
0904.988	C41	0,01 µF/40 V	EDPU 0,6 K 10000	VALVO
1423.037	C42	0,1 µF/63 V	MKS 2	WIMA
1423.037	C43	0,1 µF/63 V	MKS 2	WIMA
1423.037	C44	0,1 µF/63 V	MKS 2	WIMA

Parts lists No.
97 Sa 2.155.105

-ISB-Demodulator-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1423.037	C45	0,1 µF/63 V	MKS 2	WIMA
1425.196	C46	0,01 µF/63 V	MKS 2	WIMA
1556.762	C47	2200/100 V	FKS 2	WIMA
1469.061	C48	0,047 µF/63 V	MKS 2	WIMA
1423.037	C49	0,1 µF/63 V	MKS 2	WIMA

Capacitors:

1423.304	C50	10 µF/25 V		VALVO
1423.304	C51	10 µF/25 V		VALVO
1423.304	C52	10 µF/25 V		VALVO
1469.053	C53	1 µF/50 V	MKS 2	WIMA
0857.912	C54	100 µF/25 V		VALVO
0857.912	C55	100 µF/25 V		VALVO
1425.196	C56	0,01 µF/63 V	MKS 2	WIMA
1425.196	C57	0,01 µF/63 V	MKS 2	WIMA

Coils:

0747.572	L1	100 µH/10 %	PCT/Typ 72.1	JAHRE
0747.572	L2	100 µH/10 %	PCT/Typ 72.1	JAHRE
1427.199	L4	5,6 µH/5 %	PCT/Typ 72.00	JAHRE
1076.140	L5	10 µH/10 %	PCT/Typ 72.00	JAHRE
1076.140	L6	10 µH/10 %	PCT/Typ 72.00	JAHRE
1076.140	L7	10 µH/10 %	PCT/Typ 72.00	JAHRE
1076.140	L8	10 µH/10 %	PCT/Typ 72.00	JAHRE
1076.140	L9	10 µH/10 %	PCT/Typ 72.00	JAHRE
1076.140	L10	10 µH/10 %	PCT/Typ 72.00	JAHRE
1076.140	L11	10 µH/10 %	PCT/Typ 72.00	JAHRE

Diodes:

0745.677	D1		1 N 4148	
0745.677	D2		1 N 4148	
0745.677	D3		1 N 4148	
1068.237	D4		ZPD 4,7	
0745.677	D5		1 N 4148	
0745.677	D6		1 N 4148	
0745.677	D9		1 N 4148	

Parts lists No.
97 Sa 2.155.105

-ISB-Demodulator-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Integrated Circuits:				
1695.975	IC A	MC 1590 G	97 E 2.140.72-6	
1300.326	IC B	CA 3140 E		RCA
1410.245	IC C	CD 4066 BE		RCA
1430.882	IC D	CD 4047 BE		RCA
1469.045	IC E	CA 3028 B		RCA
1422.715	IC F	MC 3358 p		MOTOROLA
Supplements:				
1434.48	P1	10 K/20/	1W D13C61CK/P9	DRALORIC
1556.711	QF1		97E 2.140.78-5	HAGENUK
Resistors:				
0744.743	R7	150 5 % 1/8 W	DIN 44052	
0745.782	R8	1,8 k 5% 1/8 W	DIN 44052	
0767.204	R9	22 k 5 % 1/8 W	DIN 44052	
0744.751	R10	390 5 % 1/8 W	DIN 44052	
0767.212	R11	4,7 k 5 % 1/8 W	DIN 44052	
0179.639	R12	100 5 % 1/8 W	DIN 44052	
0179.639	R13	100 5 % 1/8 W	DIN 44052	
0179.698	R14	1 k 5 % 1/8 W	DIN 44052	
0179.701	R15	10 k 5 % 1/8 W	DIN 44052	
0745.782	R16	1,8 k 5 % 1/8 W	DIN 44052	
0779.776	R17	18 5 % 1/8 W	DIN 44052	
0179.639	R18	100 5 % 1/8 W	DIN 44052	
0179.698	R19	1 k 5 % 1/8 W	DIN 44052	
0179.701	R20	10 k 5 % 1/8 W	DIN 44052	
0745.782	R21	1,8 k 5 % 1/8 W	DIN 44052	
0779.776	R22	18 5 % 1/8 W	DIN 44052	
0179.701	R23	10 k 5% 1/8 W	DIN 44052	
0530.352	R24	3,3 k 5% 1/8 W	DIN 44052	
0744.778	R25	330 k 5 % 1/8 W	DIN 44052	
0179.689	R26	1 k 5 % 1/8 W	DIN 44052	
0767.190	R27	100 k 5 % 1/8 W	DIN 44052	
0542.830	R28	27 k 5 % 1/8 W	DIN 44052	
0179.639	R29	100 5 % 1/8 W	DIN 44052	
0744.778	R30	330 k 5 % 1/8 W	DIN 44052	
0179.744	R31	56 k 5 % 1/8 W	DIN 44052	
1491.385	R32	5 % 1/8 W	DIN 44052	

Parts lists No.
97 Sa 2.155.105

-ISB-Demodulator-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
0922.846	R33	220 VA 05 H VC 10	OHMIC	
1481.320	R34	2.37 K/1/0207	DBL 61200	
0744.808	R35	2,2 k 5 % 1/8 W	DIN 44052	
0745.782	R36	1,8 k 5 % 1/8 W	DIN 44052	
0179.639	R37	100 5 % 1/8 W	DIN 44052	
0542.938	R38	220 5 % 1/8 W	DIN 44052	
0179.698	R39	1 k 5 % 1/8 W	DIN 44052	
0744.840	R40	5,6 k 5% 1/8 W	DIN 44052	
0791.733	R41	15 k 5 % 1/8 W	DIN 44052	
0744.883	R42	180 5 % 1/8 W	DIN 44052	
0744.883	R43	180 5 % 1/8 W	DIN 44052	
0744.840	R44	5,6 k 5% 1/8 W	DIN 44052	
0767.220	R45	6,8 k 5% 1/8 W	DIN 44052	
0530.360	R41	56 5 % 1/8 W	DIN 44052	
0745.804	R47	12 k 5 % 1/8 W	DIN 44052	
0179.701	R48	10 k 5 % 1/8 W	DIN 44052	
0179.701	R49	10 k 5 % 1/8 W	DIN 44052	
0179.639	R50	100 5 % 1/8 W	DIN 44052	
0542.830	R51	27 k 5 % 1/8 W	DIN 44052	
0744.808	R52	2,2 k 5 % 1/8 W	DIN 44052	
0745.782	R53	1,8 k 5 % 1/8 W	DIN 44052	
0480.444	R54	1,5 k 5 % 1/8 W	DIN 44052	
0698.172	R55	680 5 % 1/8 W	DIN 44052	
0745.782	R56	1,8 5 % 1/8 W	DIN 44052	
0626.708	R57	10 5 % 1/8 W	DIN 44052	
0745.782	R58	1,8 k 5 % 1/8 W	DIN 44052	
0745.782	R59	1,8 k 5 % 1/8 W	DIN 44052	
0626.708	R60	10 5 % 1/8 W	DIN 44052	
0626.708	R61	10 5 % 1/8 W	DIN 44052	
0744.808	R62	2,2 k 5 % 1/8 W	DIN 44052	
0767.204	R63	22 k 5 % 1/8 W	DIN 44052	
0179.701	R64	10 k 5 % 1/8 W	DIN 44052	
0179.639	R65	100 5 % 1/8 W	DIN 44052	
0179.701	R66	10 k 5 % 1/8 W	DIN 44052	
0179.701	R67	10 k 5 % 1/8 W	DIN 44052	
0179.698	R68	1 k 5 % 1/8 W	DIN 44052	
0179.639	R69	100 5 % 1/8 W	DIN 44052	
0542.822	R70	33 5 % 1/8 W	DIN 44052	
0179.639	R71	100 5 % 1/8 W	DIN 44052	
0767.190	R74	100 K 1% 1/8 W	DIN 44061	
0179.701	R76	10 K 5 % 1/8 W	DIN 44052	
0767.190	R77	100 K 5 % 1/8 W	DIN 44052	

Parts lists No.
97 Sa 2.155.105

-ISB-Demodulator-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Transistors:				
1291.033	T2		BC 549 B	
1291.033	T3		BC 549 B	
1291.181	T4		BC 559 B	
1291.181	T5		BC 559 B	
1291.033	T6		BC 549 B	
1291.033	T7		BC 549 B	
1291.181	T8		BC 559 B	
1291.181	T9		BC 559 B	
Transformer:				
0693.332	Tr2		74 E 88.7 C 1	HAGENUK
1549.154	Tr3		97 E 2.140.111	HAGENUK
1826.549	St 01	10 pins	609-1004 E	ANSLEY

-IF Output-

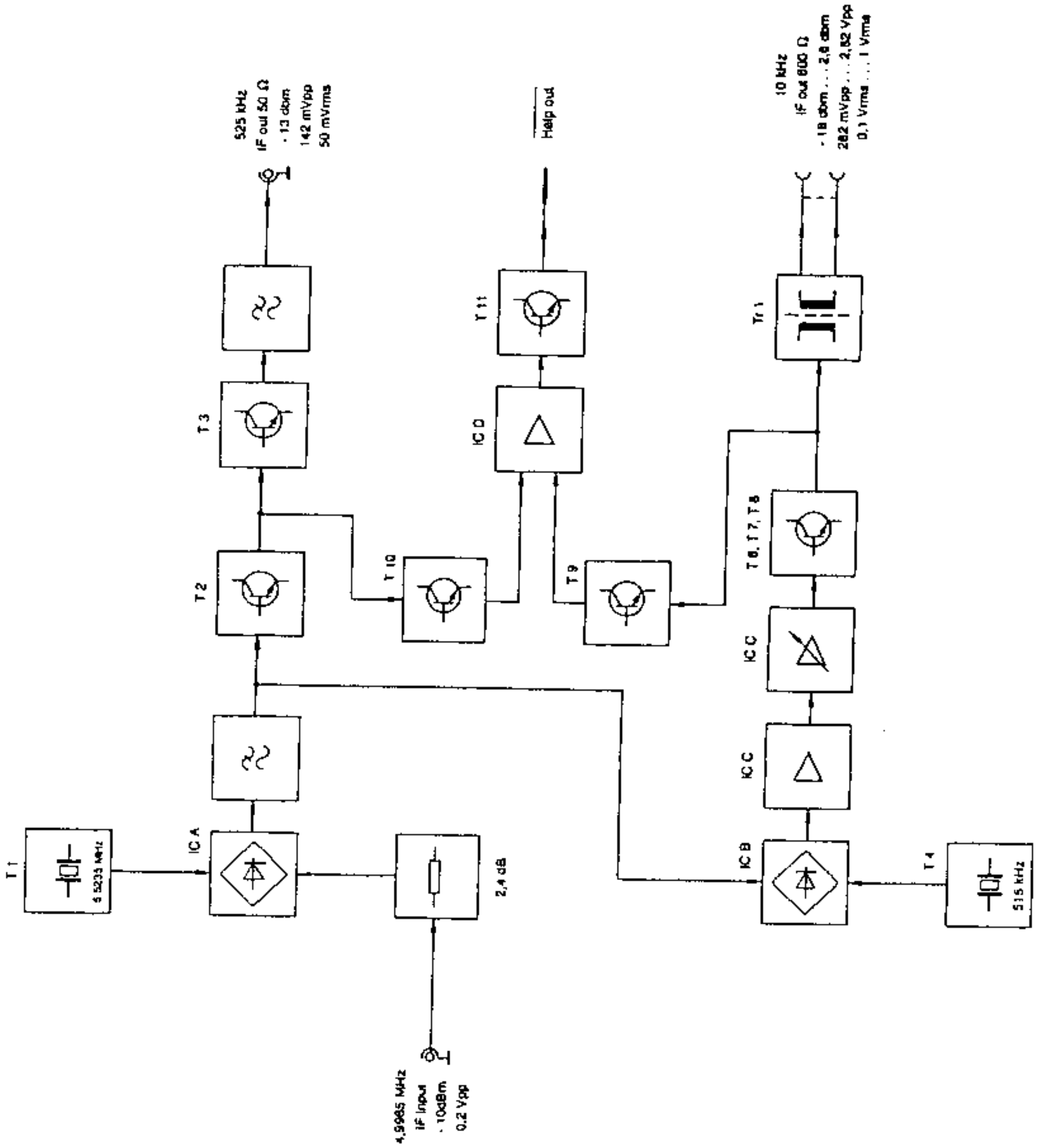
Technical description
The standard 5 MHz IF is remixed to other intermediate frequencies in the IF OUT 525/10 kHz module.

The new IF f=525 KHz is obtained from the normal IF f=4.9985 MHz by means of crysal oscillator T 1 f=5,5235 MHz and the mixer circuit IC - A; the new IF is present on socket Bu 2 525 kHz IF OUTPUT.

An IF of 10 kHz is convenient for recording communications as it allows standard tape recorders to be used. For this purpose the 525 kHz IF is remixed to the new IF of 10 kHz by further mixing with the crystal oscillator frequency of f=515 kHz. The quartz oscillator f=515 kHz with T 4 is followed by the mixer circuit IC - B. The output is fed through an active low-pass filter IC - C, so that the frequencies 515 kHz and 525 kHz do not appear at the output. The 10 kHz output on socket Bu 3 is adjustable in the range 0.1 ... 1V across 600 Ohm by means of a screwdriver-operated potentiometer at the rear.

The demodulator cassette IF output is connected to the IF OUT cassette IF input by a rigid BNC connection on the rear of the cassettes.
Both IF outputs are tested by the BITE facility. Level monitoring is performed by transistors T 9, T 10 and IC - D. If the level falls below the reference value, T 11 is driven and the output HELP OUT plug ST 6 pin 8 goes to 0 V.

-IF-Output-



Blockdiagram - IF-Output

-IF-Output-

Test and alignment instructions

Required: Circuit diagram IF OUT 525/10 kHz - HAGENUK Drawing No. 97 Sa C 2.155.100
signal generator, frequency counter, spectrum analyser

Test configuration: Remove IF OUT 525/10 kHz module, take off cover and restore ribbon cable connection to receiver (service adaptor). Connect signal generator f=4.9985 MHz P_{out}=-10 dBm to socket Bu 1 IF INPUT. Connect frequency counter (50 Ohm) to socket Bu 2 525 kHz IF OUTPUT.

Measurement of current consumption
Disconnect + 18 V power supply and measure current consumption.
Test values:
Specified: 150 ... 180 mA

Alignment of 525 kHz
Test values:
The frequency IF OUT should be 525 kHz ± 10 kHz. Can be fine-adjusted with capacitor C 1.
Connect spectrum analyser to socket Bu 2.

Spectrum analyser settings:	Centre frequency	525 kHz
	Span	5 kHz

Test values:
P_{out} should be -13 dBm ± 1 dB.

If output level exceeds specified value, bypass resistor R 19 with an SMD resistor (typically 1 kOhm) refer to circuit diagram R 90 SOT.

Change signal generator frequency to 4.9915 MHz and 5.0055 MHz.

Test values:
P_{out} should be -13 dBm ± 1 dB at both frequencies.
Spectrum analyser settings for measuring harmonics:

Centre frequency	3 MHz
Span	6 MHz
Reference level	0 dBm

Test values:
Attenuation of harmonics > 40 dB
Settings for measurement of noise level on 525 kHz signal
Set signal generator to f=4.9985 MHz P_{out} =-10 dBm.
Test values:
Interfering 4.9985 MHz frequency: should be > 50 dB down
Interfering 5.5235 MHz frequency: should be > 50 dB down

-IF-Output-

Alignment of 10 kHz
Terminate output socket Bu 3 with 600 Ohm and connect frequency counter and oscilloscope:

Test values:
The output frequency should be 10 kHz ± 10 Hz. It can be fine-adjusted with capacitor C 29.
Set out signal level with R 50.

Test values:
Potentiometer fully ccw. $U_{out} < 0.3\ V_{pp}$
Potentiometer fully cw. $U_{out} > 3\ V_{pp}$
Replace oscilloscope connected to socket Bu 3 by the spectrum analyser.

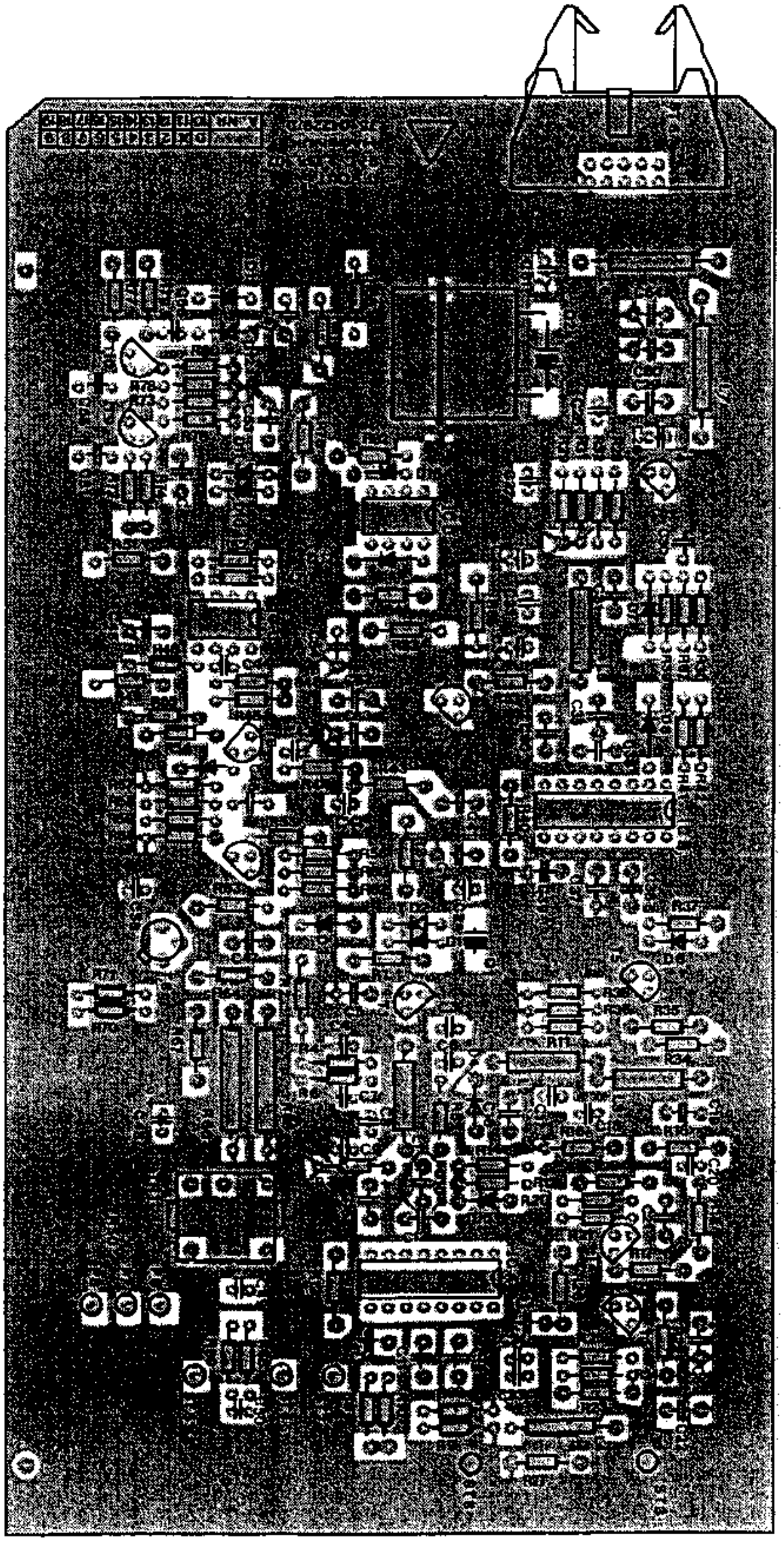
Spectrum analyser settings:	Centre frequency	50 kHz
	Span	100 kHz
Signal generator setting:		0 dBm

Test values:
Harmonics should be > 40 dB down at max. level (potentiometer at right-hand limit).

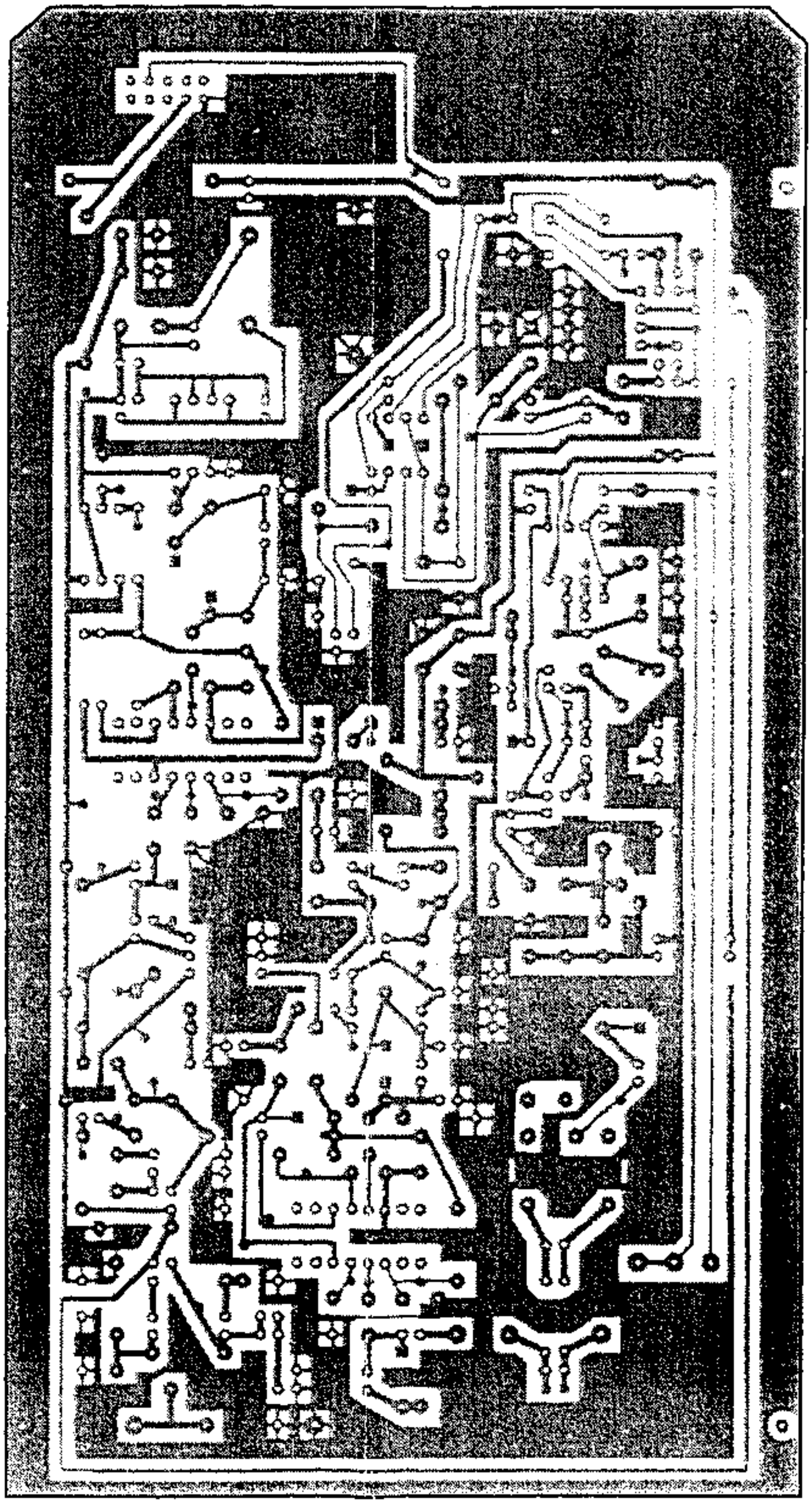
Measurement of spurious component levels
Test values:

max. 10 kHz output level	f = 4.9985 MHz	
	f = 5.5235 MHz	> 70 dB down
	f = 515 kHz	
	f = 525 kHz	
min. 10 kHz output level	f = 4.9985 MHz	
	f = 5.5235 MHz	> 60 dB down
	f = 515 kHz	
	f = 525 kHz	

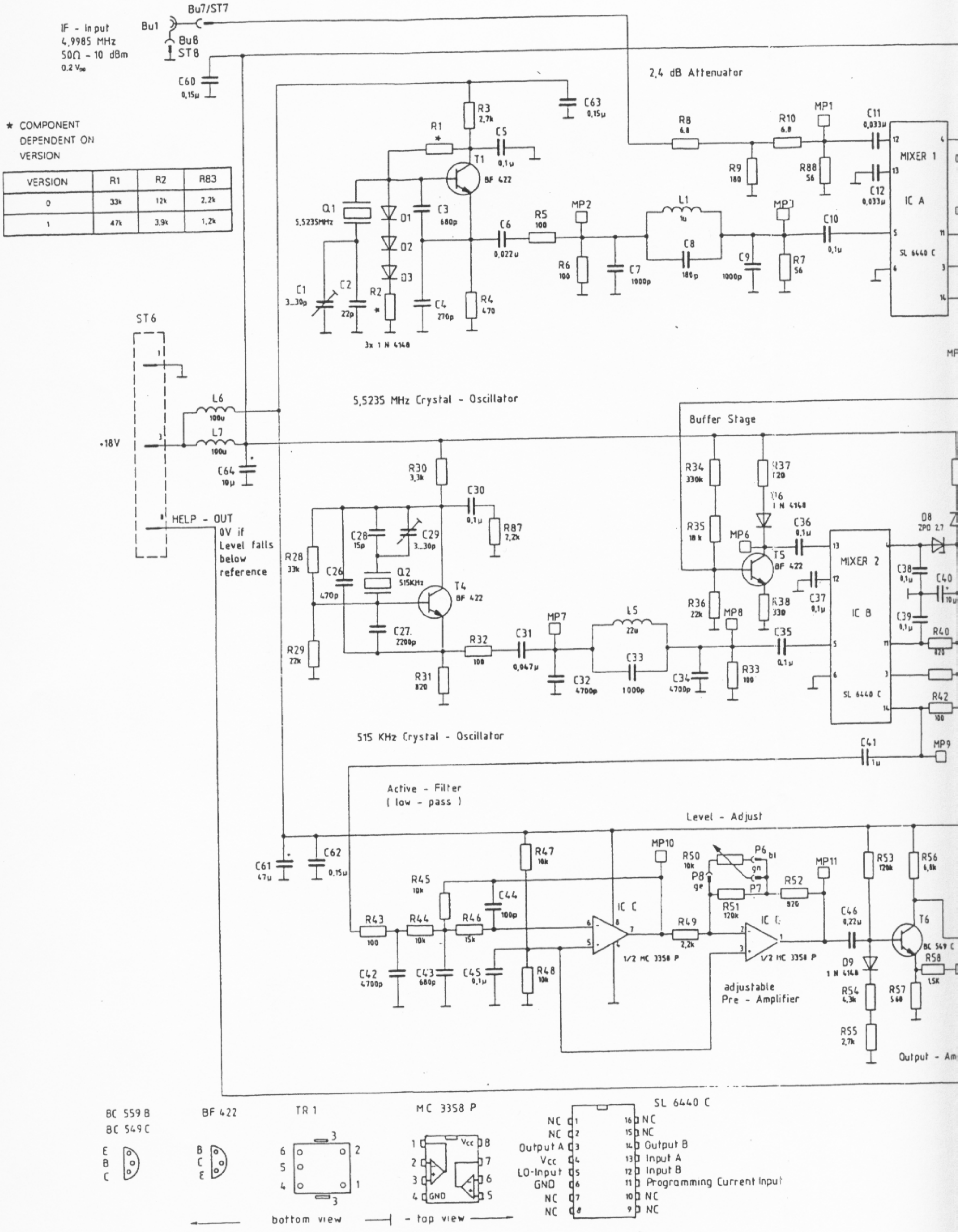
Final measurement
Screw cover back on. Connect signal generator f = 4.9985 MHz P_{out} =-10 dBm to socket Bu 1 IF INPUT.
Terminate output socket Bu 2 525 kHz IF OUTPUT with 50 Ohm and connect oscilloscope.
Test values:
Specified: 150 mVpp ≙ -13 dBm
Terminate output socket Bu 3 10 kHz IF OUTPUT with 600 Ohm and connect oscilloscope.
Test values:
Specified: variable < 0.3 Vpp to > 2 Vpp



see circuit diagram - IF-OUT 525 kHz 97 Sa C 2.155.100



Printed Circuit Board
IF-OUT 525 kHz
97 D 2.155.102



VERSION	R1	R2	R83
0	33k	12k	2,2k
1	47k	3,9k	1,2k

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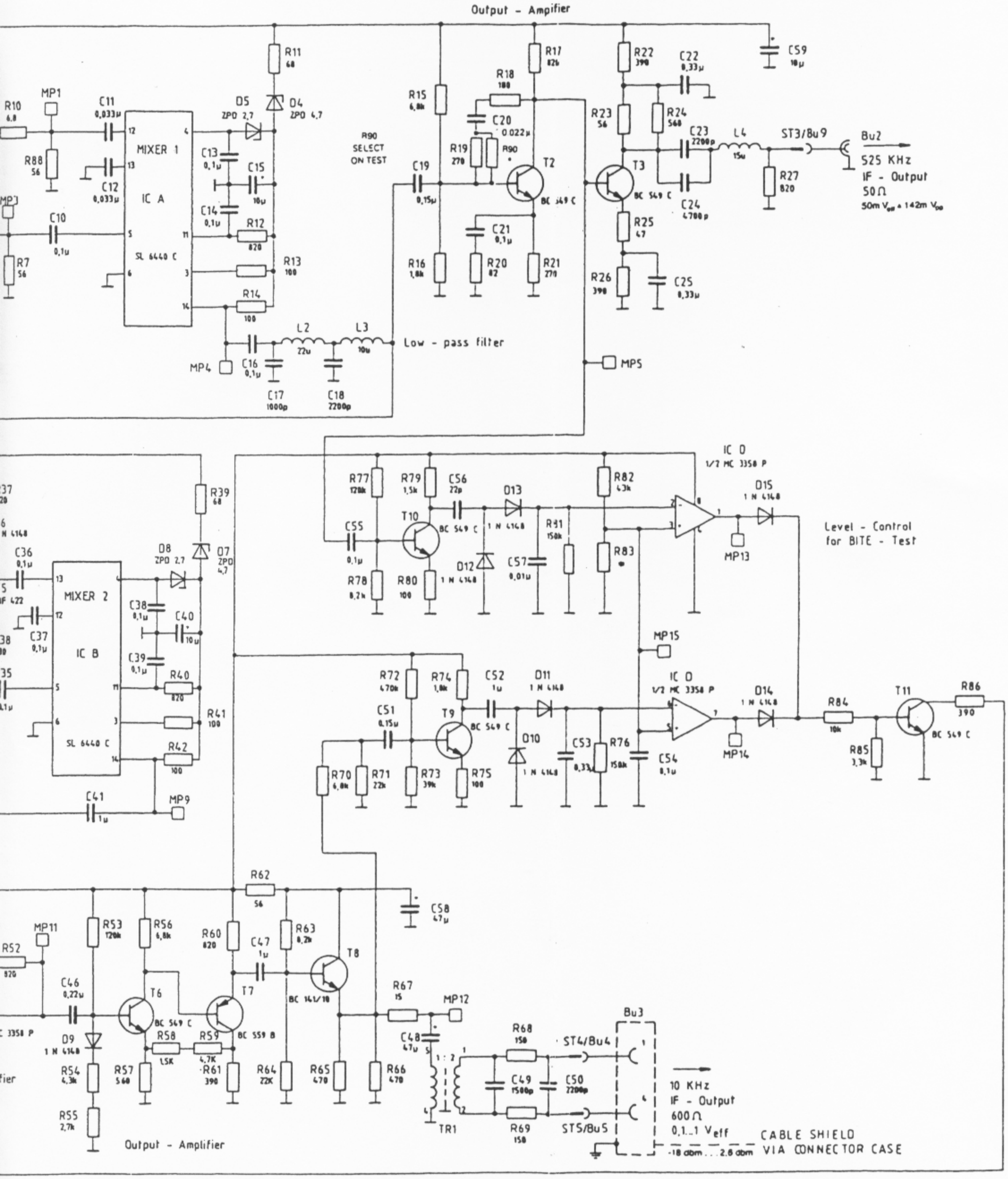


IF-OUT
Circuit Diagram
97 Sa C 2.155.100

Parts lists No.
97 Sa 2.155.100

-IF-Output-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Capacitors:				
1785.095	C1	4/30		VALVO
1732.579	C2	22/2 %/100 V	NPO EGRU	VALVO
1067.729	C3	680/10 %/63 V	EDPU	VALVO
1157.108	C4	270/2 %/63 V	N 750	VALVO
1423.037	C5	0,1 µF/20 %/63 V	MKS 2	WIMA
1078.585	C6	0,022 µF	EDPU	VALVO
1587.854	C7	1000/10 %/100 V	DEPUA	VALVO
1078.623	C8	180/2 %/63 V	N 750 EDPU	VALVO
1587.854	C9	1000/10 %/100 V	EDPU	VALVO
1423.037	C10	0,1 µF/20 %/63 V	MKS 2	WIMA
1647.296	C11	0,033 µF/5 %	MKS 2	WIMA
1647.296	C12	0,033 µF/5 %	MKS 2	WIMA
1404.822	C13	0,1 µF/10 %	MKS 2	WIMA
1404.822	C14	0,1 µF/10 %	MKS 2	WIMA
1423.304	C15	10 µF/25 V	Sal-Elko	VALVO
1404.822	C16	0,01 µF/10 %	MKS 2	WIMA
1587.854	C17	1000/10 %/100 V	EDPU	VALVO
0927.694	C18	2200/10 %/63 V	EDPU	VALVO
1405.160	C19	0,15 µF/10 %	MKS	WIMA
1078.585	C20	0,022 µF	EDPU	VALVO
1404.822	C21	0,1 µF/10 %	MKS 2	WIMA
1469.088	C22	0,33 µF/10 %	MKS 2	WIMA
0927.694	C23	2200/10 % 63 V	EDPU	VALVO
0945.072	C24	4700 10 % 63 V	EDPU	VALVO
1469.088	C25	0,33 µF/10 %	MKS 2	WIMA
1193.708	C26	470/2 %/63 V	EDPU	VALVO
0927.694	C27	2200/10 %/63 V	EDPUA	VALVO
0921.939	C28	15/2 % NPO	EDPU	VALVO
1785.095	C29	4/30		VALVO
1404.822	C30	0,1 µF/10 %	MKS 2	WIMA
1469.061	C31	0,047 µF/10 %	MKS 2	WIMA
0945.072	C32	4700/10 %/63 V	EDPU	VALVO
1587.854	C33	1000/10 %/100 V	EDPU	VALVO
0945.072	C34	4700/10 %/63 V	EDPU	VALVO
1404.822	C35	0,1 µF/10 %	MKS 2	WIMA
1404.822	C36	0,1 µF/10 %	MKS 2	WIMA
1404.822	C37	0,1 µF/10 %	MKS 2	WIMA
1404.822	C38	0,1 µF/10 %	MKS 2	WIMA
1404.822	C39	0,1 µF/10 %	MKS 2	WIMA
1423.304	C40	10 µF/25 V	Sal-Elko	VALVO
1469.053	C41	1 µF/10 %	MKS 2	WIMA
0945.072	C42	4700/10 %/63 V	EDPU	VALVO

-IF-Output-

Parts lists No.
97 Sa 2.155.100

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1067.729	C43	680/10 %/63 V	EDPU	VALVO
1067.885	C44	100/2 %	NPO EDPU	VALVO
1404.822	C45	0,1 µF/10 %	MKS 2	WIMA
1400.568	C46	0,22 µF/10 %	MKS 2	WIMA
1469.053	C47	1 µF/10 %	MKS 2	WIMA
1643.819	C48	47 µF/35 V		VALVO
0945.005	C49	1500/10 %/63 V	EDPU	VALVO
0927.694	C50	2200/10 %/63 V	EDPU	VALVO
1405.160	C51	0,15 µF/10 %	MKS 2	WIMA
1469.053	C52	1 µF/10 %	MKS 2	WIMA
1469.088	C53	0,33 µF/10 %	MKS 2	WIMA
1423.037	C54	0,1 µF/20 %	MKS 2	WIMA
1423.037	C55	0,1 µF/20 %	MKS 2	WIMA
0945.803	C56	22/2 %	EDPU	VALVO
1647.288	C57	0,01 µF/5 %	MKS 2	WIMA
1643.819	C58	47 µF/35 V		VALVO
1423.304	C59	10 µF/25 V		VALVO
1405.160	C60	0,15 µF/10 %	MKS 2	WIMA
1643.819	C61	47 µF/35 V		VALVO
1405.160	C62	0,15 µF/10 %	MKS 2	WIMA
1405.160	C63	0,15 µF/10 %	MKS 2	WIMA
1423.304	C64	10 µF/25 V		VALVO

Diodes:

0745.677	D1		1 N 4148	DIV
0745.677	D2		1 N 4148	DIV
0745.677	D3		1 N 4148	DIV
1068.237	D4	4,7 V	Z-Diode	ITT
0694.959	D5	2,7 V	Z-Diode	ITT
0745.677	D6		1 N 4148	DIV
1068.237	D7	4,7 V	Z-Diode	ITT
0694.959	D8	2,7 V	Z-Diode	ITT
0745.677	D9		1 N 4148	DIV
0745.677	D10		1 N 4148	DIV
0745.677	D11		1 N 4148	DIV
0745.677	D12		1 N 4148	DIV
0745.677	D13		1 N 4148	DIV
0745.677	D14		1 N 4148	DIV
0745.677	D15		1 N 4148	DIV

Parts lists No.
97 Sa 2.155.100

-IF-Output-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Resistors:				
0627.895	R1 *	33 k/5 %	DIN 44052-G 207	
0745.804	R2 *	12 k/5 %	DIN 44052-G 207	
0745.820	R3	2,7 k/5 %	DIN 44052-G 207	
0554.898	R4	470/5 %	DIN 44052-G 207	
0179.639	R5	100/5 %	DIN 44052-G 207	
0179.639	R6	100/5 %	DIN 44052-G 207	
0530.360	R7	56/5 %	DIN 44052-G 207	
0831.395	R8	6,8/5 %	DIN 44052-G 207	
0744.883	R9	180/5 %	DIN 44052-G 207	
0831.395	R10	6,8/5 %	DIN 44052-G 207	
0653.853	R11	68/5 %	DIN 44052-G 207	
0744.921	R12	820/5 %	DIN 44052-G 207	
0179.639	R13	100/5 %	DIN 44052-G 207	
0179.639	R14	100/5 %	DIN 44052-G 207	
0767.220	R15	6,8 k/5 %	DIN 44052-G 207	
0745.782	R16	1,8 k/5 %	DIN 44052-G 207	
0744.921	R17	820/5 %	DIN 44052-G 207	
0744.883	R18	180/5 %	DIN 44052-G 207	
0179.663	R19	270/5 %	DIN 44052-G 207	
0744.913	R20	82/5 %	DIN 44052-G 207	
0179.663	R21	270/5 %	DIN 44052-G 207	
0744.751	R22	390/5 %	DIN 44052-G 207	
0530.360	R23	56/5 %	DIN 44052-G 207	
0542.857	R24	560/5 %	DIN 44052-G 207	
0626.694	R25	47/5 %	DIN 44052-G 207	
0744.751	R26	390/5 %	DIN 44052-G 207	
0744.921	R27	820/5 %	DIN 44052-G 207	
0627.895	R28	33 k/5 %	DIN 44052-G 207	
0767.204	R29	22 k/5 %	DIN 44052-G 207	
0530.352	R30	3,3 k/5 %	DIN 44052-G 207	
0744.921	R31	820/5 %	DIN 44052-G 207	
0179.639	R32	100/5 %	DIN 44052-G 207	
0179.639	R33	100/5 %	DIN 44052-G 207	
0744.778	R34	330 k/5 %	DIN 44052-G 207	
0744.786	R35	18 k/5 %	DIN 44052-G 207	
0767.204	R36	22 k/5 %	DIN 44052-G 207	
0744.921	R37	820/5 %	DIN 44052-G 207	
0744.859	R38	330/5 %	DIN 44052-G 207	
0653.853	R39	68/5 %	DIN 44052-G 207	
0744.921	R40	820/5 %	DIN 44052-G 207	
0179.639	R41	100/5 %	DIN 44052-G 207	
0179.639	R42	100/5 %	DIN 44052-G 207	

* refer to version and circuit diagram

-IF-Output-

Parts lists No.
97 Sa 2.155.100

Ident-No.	Mark	Electr. value	Identity	Manufacturer
0179.639	R43	100/5 %	DIN 44052-G 207	
0179.701	R44	10 k/5 %	DIN 44052-G 207	
0179.701	R45	10 k/5 %	DIN 44052-G 207	
0791.733	R46	15 k/5 %	DIN 44052-G 207	
0179.701	R47	10 k/5 %	DIN 44052-G 207	
0179.701	R48	10 k/5 %	DIN 44052-G 207	
0744.808	R49	2,2 k/5 %	DIN 44052-G 207	
1434.438	R50	10 k/20 %	DI3C 61CK/P9	Draloric
0921.580	R51	120 k/5 %	DIN 44052-G 207	
0744.921	R52	820/5 %	DIN 44052-G 207	
0721.580	R53	120 k/5 %	DIN 44052-G 207	
0992.542	R54	4,3 k/5 %	DIN 44052-G 207	
0745.820	R55	2,7k/5 %	DIN 44052-G 207	
0767.220	R56	6,8 k/5 %	DIN 44052-G 207	
0542.857	R57	560/5 %	DIN 44052-G 207	
0480.444	R58	1,5 k/5 %	DIN 44052-G 207	
0767.212	R59	4,7 k/5 %	DIN 44052-G 207	
0744.921	R60	820/5 %	DIN 44052-G 207	
0744.751	R61	390/5 %	DIN 44052-G 207	
0530.360	R62	56/5 %	DIN 44052-G 207	
0542.814	R63	8,2 k/5 %	DIN 44052-G 207	
0767.204	R64	22 k/5 %	DIN 44052-G 207	
0753.270	R65	470/5 %	DIN 44052-G 414	
0753.270	R66	470/5 %	DIN 44052-G 414	
0626.716	R67	15/5 %	DIN 44052-G 207	
0744.743	R68	150/5 %	DIN 44052-G 207	
0744.743	R69	150/5 %	DIN 44052-G 207	
0767.220	R70	6,8 k/5 %	DIN 44052-G 207	
0767.204	R71	22 k/5 %	DIN 44052-G 207	
0837.075	R72	470 k/5 %	DIN 44052-G 207	
0799.300	R73	39 k/5 %	DIN 44052-G 207	
0745.782	R74	1,8 k/5 %	DIN 44052-G 207	
0179.639	R75	100/5 %	DIN 44052-G 207	
0830.089	R76	150 k/5 %	DIN 44052-G 207	
0921.580	R77	120 k/5 %	DIN 44052-G 207	
0542.814	R78	8,2 k/5 %	DIN 44052-G 207	
0480.444	R79	1,5 k/5 %	DIN 44052-G 207	
0179.639	R80	100/5 %	DIN 44052-G 207	
0830.089	R81	150 k/5 %	DIN 44052-G 207	
1059.505	R82	43 k/5 %	DIN 44052-G 207	
0744.808	R83 *	2,2 k/5 %	DIN 44052-G 207	
0179.701	R84	10 k/5 %	DIN 44052-G 207	
0530.352	R85	3,3 k/5 %	DIN 44052-G 207	
0744.751	R86	390/5 %	DIN 44052-G 207	

* refer to version and circuit diagram

Parts lists No.
97 Sa 2.155.100

-IF-Output-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
0744.808	R87	2,2 k/5 %	DIN 44052-G 207	
0530.360	R88	56/5 %	DIN 44052-G 207	
	R90	S.O.T		

Coils:

1078.569	L1	1 µH/10 %		JAHRE
1168.096	L2	22 µH/10 %		JAHRE
1076.140	L3	10 µH/10 %		JAHRE
1078.550	L4	15 µH/10 %		JAHRE
1168.096	L5	22 µH/10 %		JAHRE
1068.113	L6	100 µH/20 %		JAHRE

Integrated circuits:

	IC A	SL 6440 C		Plessey
	IC B	SL 6440 C		Plessey
1422.715	IC C	MC 3558 P 1		MOTOROLA
1422.715	IC D	MC 3558 P 1		MOTOROLA

Transistors:

1297.783	T1		BF 422	DIV
1291.106	T2		BC 549 C	DIV
1291.106	T3		BC 549 C	DIV
1297.783	T4		BF 422	DIV
1297.783	T5		BF 422	DIV
1291.106	T6		BC 549 C	DIV
1291.181	T7		BC 559 C	DIV
1496.816	T8		BC 141/10	DIV
1291.106	T9		BC 549 C	DIV
1291.106	T10		BC 549 C	DIV
1291.106	T11		BC 549 C	DIV

-IF-Output-

Parts lists No.
97 Sa 2.155.100

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Supplements:				
1297783	Tr1		BF 422	DIV
0746.096	Bu1		UG 657/U	
0746.096	Bu2		UG 657/U	
1786.296	Bu3	4-pins	T 3303 500	TUCHEL
	Bu 4	10-pins	609-1004 E	ANSLY
	Q1	5.5235 MHz	97 E 2.155.102-5	
	Q2	515 kHz	97 E 2.155.102-6	

-VCO-A-

Technical description

The local oscillator frequencies for the 1st and 2nd mixer are generated in the VCOs A and B. The frequency for the 1st mixer should be able to be set in 10 Hz steps from 63.078 to 93.06799 MHz. If this setting was required to be carried out only by means of one phase locked loop (PLL), the setting time in the event of a frequency change would be too long. Therefore a total of three PLLs are used, two in the VCO A and one in the VCO B.
The operation will now be explained using the block diagram (VCO A - B):
In the VCO B the 10 MHz, 1 MHz and 100 kHz steps are generated by means of a PLL. The initial frequency is generated by one of the three oscillators in VCO B1. This frequency is now mixed with the output frequency of the VCO A (58.678 ... 58.778 MHz), the differential frequency 4,4 ... 34,3 MHz is then the input frequency for the PLL in the VCO B.

In the VCO A the initial frequency 58.678 ... 58.778 MHz is generated with the VCO A2. Its frequency is stabilized by means of a PLL. The frequency of the VCO A2 is mixed with the frequency of the 58.078 MHz crystal oscillator, the differential frequency (600 - 700 kHz) is divided by the factor 10 (=60 ... 70 kHz) and fed to the phase detector.
The second input of the phase detector is linked with the frequency of the VCO A1 divided by 1000. The VCO A1 is therefore part of the second PLL. Its frequency 60 ... 70 MHz can be set in 10 kHz steps (reference frequency = 10 kHz!), the exact frequency is determined by the 10 Hz, 100 Hz, 1 kHz and 10 kHz position of the selected reception frequency. Due to the high reference frequency the response time is short when there is a change of frequency. Due to the fact that the frequency of the VCO A1 is divided by 1000, the interval of the steps is now 10 Hz, at a frequency of 60 - 70 kHz instead of 10 kHz.
By including the crystal frequency 58.078 MHz into the phase locked loop of the 1st mixer and the 2nd mixer a temperature and ageing dependent deviation of the crystal oscillator over the entire receiver train is compensated in the 2nd mixer. The phase locked loop of the VCO A will be described in greater detail below.

a) Phase lock loop 60 - 70 MHz
   It consists of the VCO A1 with the Clapp circuit designed oscillator with T8 and the two buffer stages T10 and T11. The supply voltage for the oscillator is stabilized with the voltage regulator IC-G.
   The output of the buffer stage with T10 is linked with the /10 divider: IC-F, which is designed using ECL technology due to the high frequencies which have to be processed.
   The divided signal is amplified to CMOS level, divided by 100 in IC-D and fed to the phase detector IC-C with the two level converters T9 and T6.
   The phase locked loop 60 - 70 MHz consists of the universal frequency divider IC-L, and a dual modulus prescaler 10/:11 and the phase detector IC-K. The division factor of IC-J is controlled by IC L.

-VCO-A-

The universal frequency divider contains a chain of counters which can be programmed. Up to three series connected, dual modulus pre-scalers can be connected via the outputs inverted OFB3; OFB3, OFB2 and OFB1.
The chain of counters consists of 5 decimal counting stages, a binary stage (division factor 1 ... 16) (stage M) and a divider (stage H) with which a frequency in the half channel offset can be set. The information P for the decimal counter stage is obtained by subtracting the two registers A, B and an external borrow in (bin).

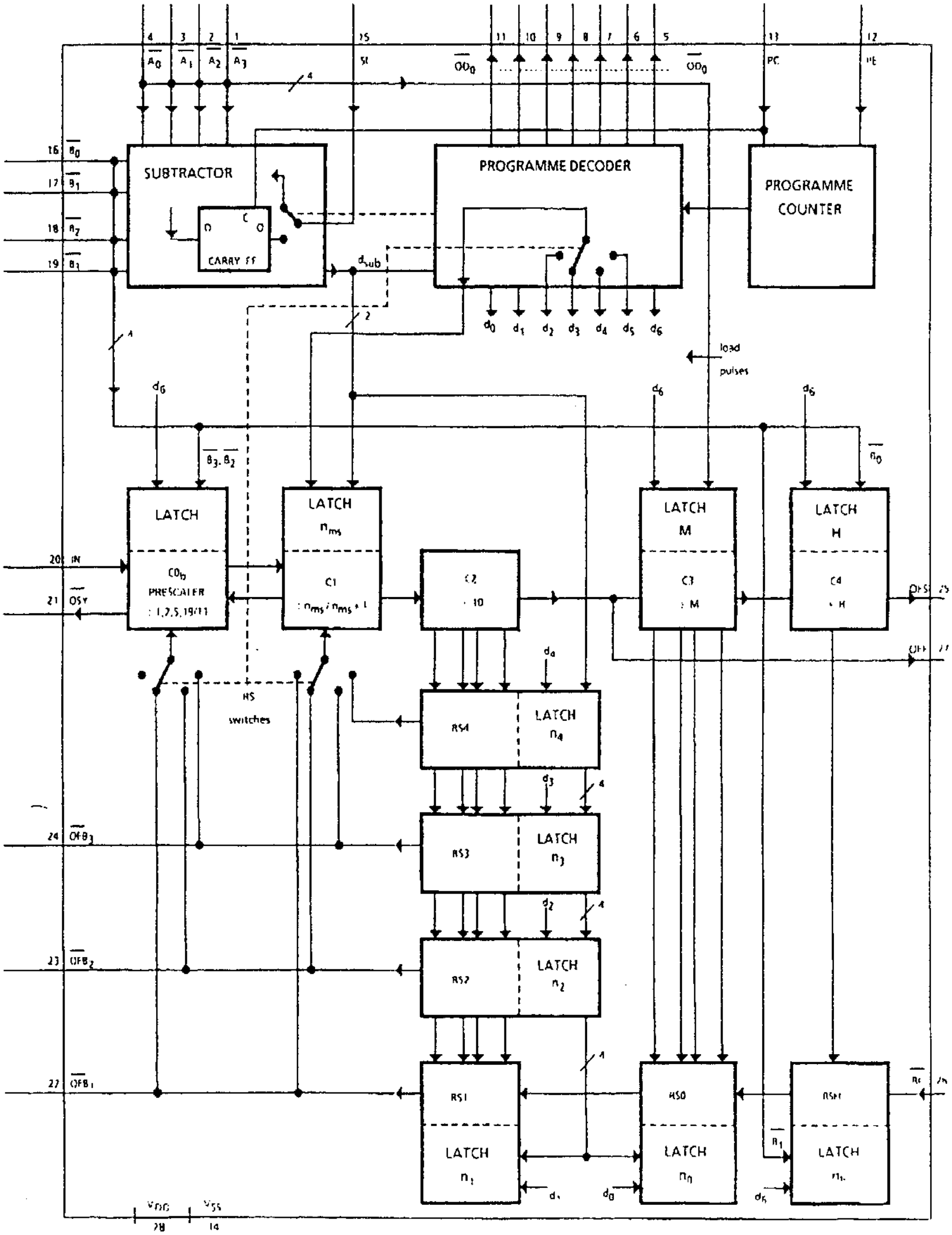
$$P = A - B - bin$$

If the result is negative

$$P = A - B - bin + M * 10^5$$

The registers A and B are loaded digit wise (4 Bits each).

-VCO-A-



IC - Blockdiagram

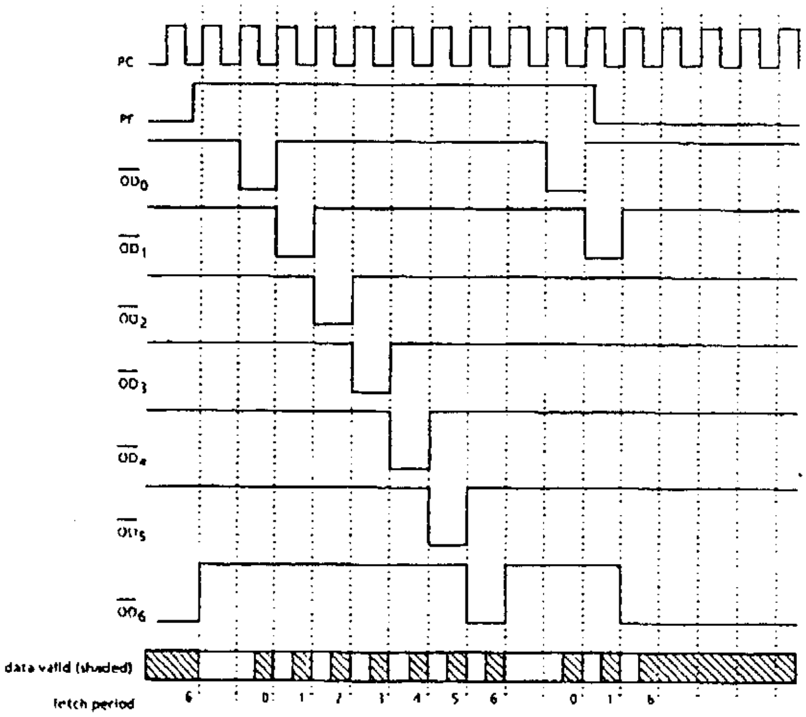
-VCO-A-

With a reference frequency of 10 kHz and a frequency range in the VCO A1 of 60 - 69.999 MHz the division ratio to be loaded into the universal frequency divider becomes P = 6000.0 ... 6999.9. There, 6000.0 corresponds to a set receive frequency range in which the 10 Hz, 100 Hz, 1 kHz and 10 kHz positions contain the figure 0, at 6999.9 all positions have the figure 9. Since the universal divider has five decimal counter stages, but only four are required, the fifth stage is permanently programmed with "6". All figures reach the A register. The B register is not required here and is filled with zeros.

The BCD data must be loaded into the universal divider in inverted form. Loading requires an external timing signal at the input PC and the program enable (PE) input to "HIGH". The BCD data are serially loaded beginning with the lowest value position (n_0). When PC = LOW a charging pulses is generated in the IC which loads the data into the relevant register. The data must be stable during the time PC = LOW.

M is set to 10 (A1, A3 = LOW) via the diodes D16 and D17. The output FF of IC-L is linked with the input of the phase detector IC-K. The 10 kHz reference frequency from the BFO is fed to the other input of the phase detector IC-K. The passive loop filter consists of the components R91, 53, 51 and C50, C52.

The fifth position is permanently programmed to "6" via the diodes D12/D12. In the sixth position it is determined via the data in the B register whether semi channel offset (B1, B0) is required, (B1, B0 via D14, D15 to LOW $\hat{=}$ H = 1, no half channel offset, see Table) through B3, B4 = HIGH C0b is set to 10/11 dual modulus.



Timing diagram showing program data inputs

Allocation of data input

fetch period	inputs $\bar{A}_3$ $\bar{A}_2$ $\bar{A}_1$ $\bar{A}_0$	$\bar{B}_3$ $\bar{B}_2$ $\bar{B}_1$ $\bar{B}_0$		SI
0	n0A	n0B		b_{in}
1	n1A	n1B		X
2	n2A	n2B		X
3	n3A	n3B		X
4	n4A	n4B		X
5	n5A	n5B		X
6	M	CO_b control	1/2 channel control	X

-VCO-A-

Allocation of data input $\bar{B}_3$ to $\bar{B}_0$ during fetch period 6

$\bar{B}_3$	$\bar{B}_2$	CO_b division ration
L	L	1
L	H	2
H	L	5
H	H	10/11

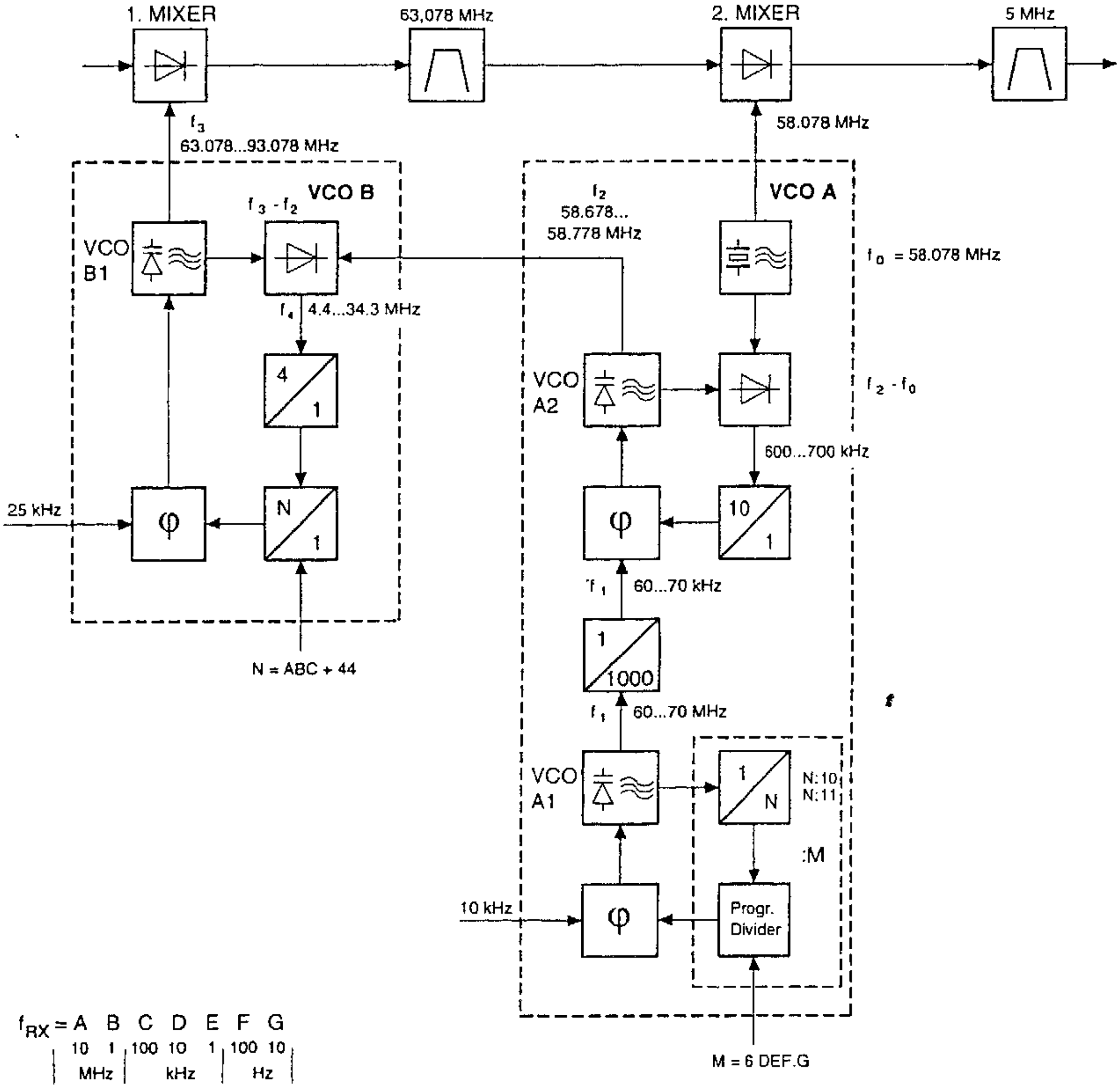
$\bar{B}_1$	$\bar{B}_0$	1/2 channel configuration
L	L	H = 1
L	H	H = 2; nh = 0
H	H	H = 2; nh = 1
H	L	test state

H = HIGH state (the more positive voltage)
L = LOW state (the less positive voltage)
X = state is immaterial

b) 58.078 MHz Crystal oscillator
In addition to the oscillator T13 this module contains two buffer stages with T14 and T15. The output signal from T14 is fed to the mixer M1 on the VCO board, the signal from T15 is fed to the 2nd mixer. The supply voltage of this module is stabilized with IC-M.

c) Phase locked loop 58.678 ... 58.778 MHz
It consists of the VCO A2, the mixer M1, the divide by 10 counter IC-E and the phase detector IC-C. The VCO A2 is constructed in the similar fashion to the VCO A1, due to the narrow tuning range a varicap is sufficient for tuning. The VCO signal reaches the double balanced Schottky diode ring mixer M1 via the buffer stages T3 and T4. The differential frequency of the VCO A2 and crystal oscillator (58.678 ... 58.778) MHz - 58.078 MHz = 600 to 700 kHz is amplified with T5 and T7 to CMOS level and fed to the :10 divider IC-E. Due to the use of transistors which are specified for the "low frequency" range, the sum frequency output of the mixer is not amplified. In the phase detector IC-C the frequency of the VCO A1 divided by 1000 (dividers are IC-F and IC-D) is compared with the differential frequency VCO A2 - crystal oscillator divided by 10. The passive loop filter is linked to the varicap D1 in the VCO A2.
Should the PLLs be out of lock, the "Lock detect" outputs of the phase comparators IC-K, IC-C are not generating pulses any more. These pulses are integrated by means of R2/C5/R7 or R3/C6/R8 and fed to the operational amplifiers in IC-A which are connected as comparators. An OR connection of the outputs is produced via D2, D3 and this causes the LED (D23) located on the backof the VCO cassette turn off when one of the PLLs is in a non-locked state. The microprocessor of the receiver is advised of the locked in status of the VCO A via the optocoupler IC-H.

-VCO-A-



Blockdiagram VCO A and VCO B

VCO A/B Frequencysynthesis calcualting schedule

	A	B	C	D	E	F	G
f_{RX}							
	10 MHz	1 MHz	100 kHz	10 kHz	1 kHz	100 Hz	10 Hz

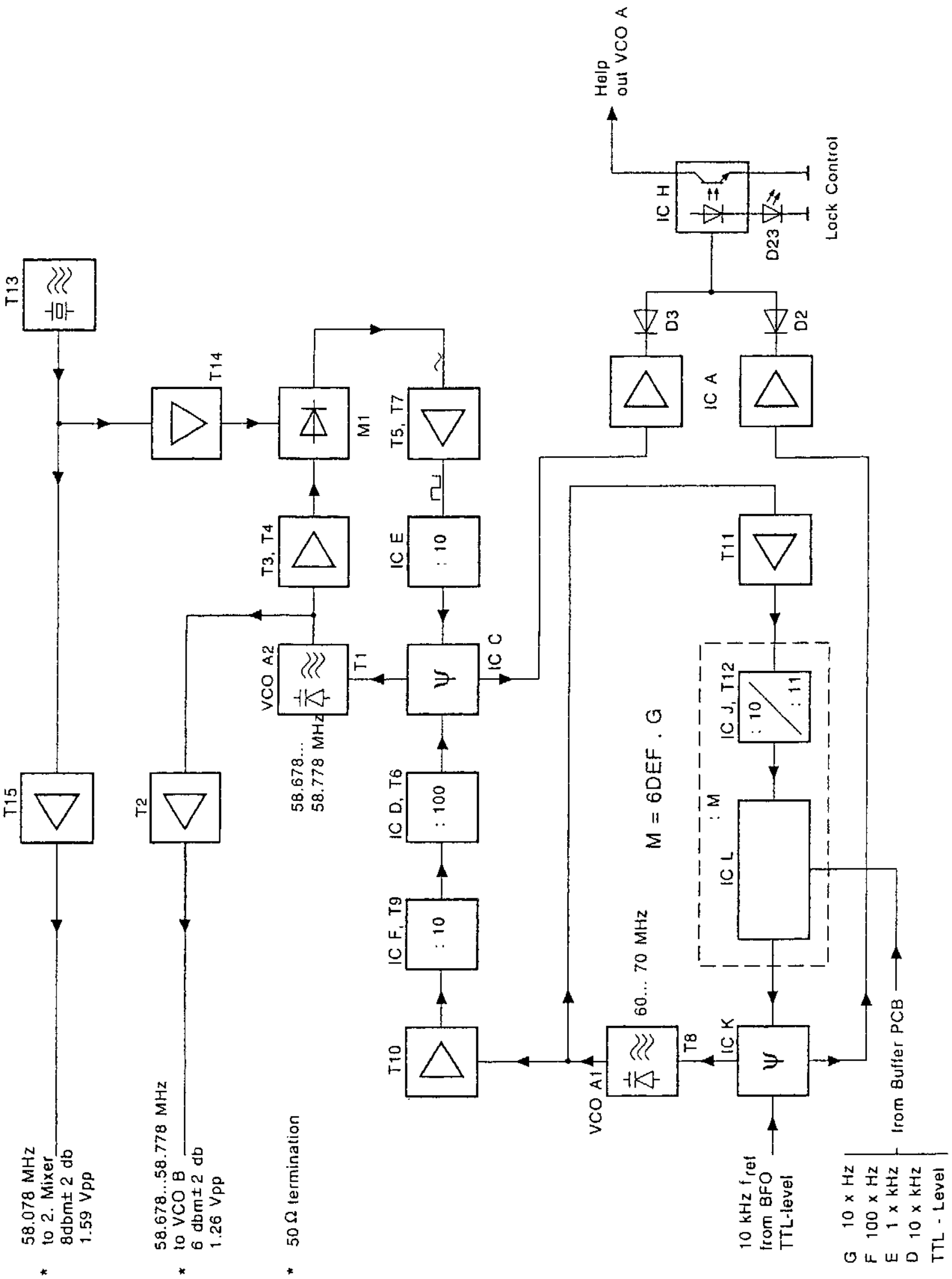
M = 6000.0 + DEF.G [6 | | | . |]

N = ABC + 44 [| |]

	MHz 10	MHz 1	kHz 100	kHz 10	kHz 1	Hz 100	Hz 10	Hz 1
f_1 (VCO A_1) = 10 kHz x M								
$'f_1 = f_1 : 1000$								
f_2 (VCO A_2) = $'f_1$ x 10 + 58.078 MHz								
f_4 = 25 kHz x N x 4								
f_3 (VCO B) = $f_2 + f_4$								
1. IF = $f_3 - f_{RX}$								
2. IF = 1. IF - 58.078 MHz								

Above example only valid in USB mode (Filters 0.1 ... 2.4 kHz)
or DSB mode (Filter 6 kHz)

-VCO-A-



VCO-A Block Diagram

-VCO-A-

Test and alignment instructions (VCO - A 2)
Required: Dircuit diagram VGO-A - Hagenuk Drawing No. 97 Sa B 2.155.55
spectrum analyser, frequency counter, power supply

Testing the oscillator
Connect VCO-A2 board
Bu 3 Pins 2 - 6, 8, 10 to ground
Bu 3 pin 11 to +18 V
Bu 3 pin 7 to spectrum analyser (50 Ohm termination)
Bu 3 pin 9 to frequency counter (50 Ohm termination)

Testing the power supply
Voltage to be measured at MP 5
Test values:
The voltage at IC - B should be +15 V ± 0.75 V.

Testing the tuning range
Tuning voltage UD on socket Bu 3 pin 1 (feed in, UD 5.0 V ± 0.1 V)
Test values:
The oscillator frequency should be 58.72 MHz ± 20 kHz, level 6 dBm ± 2 dB (frequency adjustment with L 1 possible).
Tuning voltage UD 3.5 V ± 0.1 V
Test values:
The oscillator frequency should be 58.6 MHz and the level 6 dBm ± 2 dB.
Tuning voltage UD 6.5 V ± 0.1 V
Test values:
The oscillator frequency should be < 58.8 MHz; the level 6 dBm ± 2 dB.

-VCO-A-

Test and alignment instructions (VCO-A 1)

Required:	Circuit diagram VCO-A - Hagenuk Drawing No. 97 Sa B 2.155.55 spectrum analyser, frequency counter, power supply
Test configuration:	Module VCO A is removed, the cassette is opened and submodules VCO-A 1 and VCO-A 2 are also removed.

Testing the oscillator
Conncet VCO-A 1 board as follows:
Socket Bu 4 pins 2 - 6, 8, 10 to ground
Bu 4 pin 11 to +18 V
Bu 4 pin 7 to spectrum analyser (50 Ohm termination)
Bu 4 pin 9 to frequency counter (50 Ohm termination)

Testing the power supply
Voltage to be measured at MP 1
Test values:
The voltage at IC - G should be +15 V ± 0.75 V.

Testing the tuning range
For tuning voltage UD to socket Bu 4 pin 1: UD 7.0 V)
Test values:
The oscillator frequency should be 65 MHz ± 0.5 MHz and the level 6 dBm ± 2 dB (the frequency can be trimmed with L 2).
Tuning voltage UD 3.5 V ± 0.1 V
Test values:
The oscillator frequency should be < 58 MHz and the level 6 dBm ± 2 dB.
Tuning voltage UD 12.5 V ± 0.1 V
Test values:
The oscillator frequency should be > 71 MHz and the level 6 dBm ± 2 dB.

-VCO-A-

Test and alignment instructions (VCO A)

Required: Circuit diagram VCO-A - Hagenuk Drawing No. 97 Sa B 2.155.55
spectrum analyser

Test configuration: Module VCO - is removed and then connected to the receiver using a service adapter.

Testing the voltage stabiliziers
Test values:
Specified value on IC - M: 15 V ± 750 mV
Specified value on IC - O: 15 V ± 750 mV
Specified value on IC - N: 10 V ± 700 mV

Testing the crystal oscillator
Connect a spectrum analyser to plug ST 2 58.078 MHz
Test values:
Specified value: output frequency (50 Ohm termination) 58.078 MHz ± 100 Hz P_{out} 8 dBm ± 2 dB.

NOTE
The output frequency can be adjusted with L 3. The output level can be adjusted by compressing or expanding L 4.

Measurement of harmonics
Test values:
1st harmonic should be ≤ -35 dB
2nd harmonic should be ≤ -40 dB
3rd harmonic should be ≤ -50 dB

Fine Adjustment of the VCO-A1 and VCO-A2 oscillators

a) VCO A1

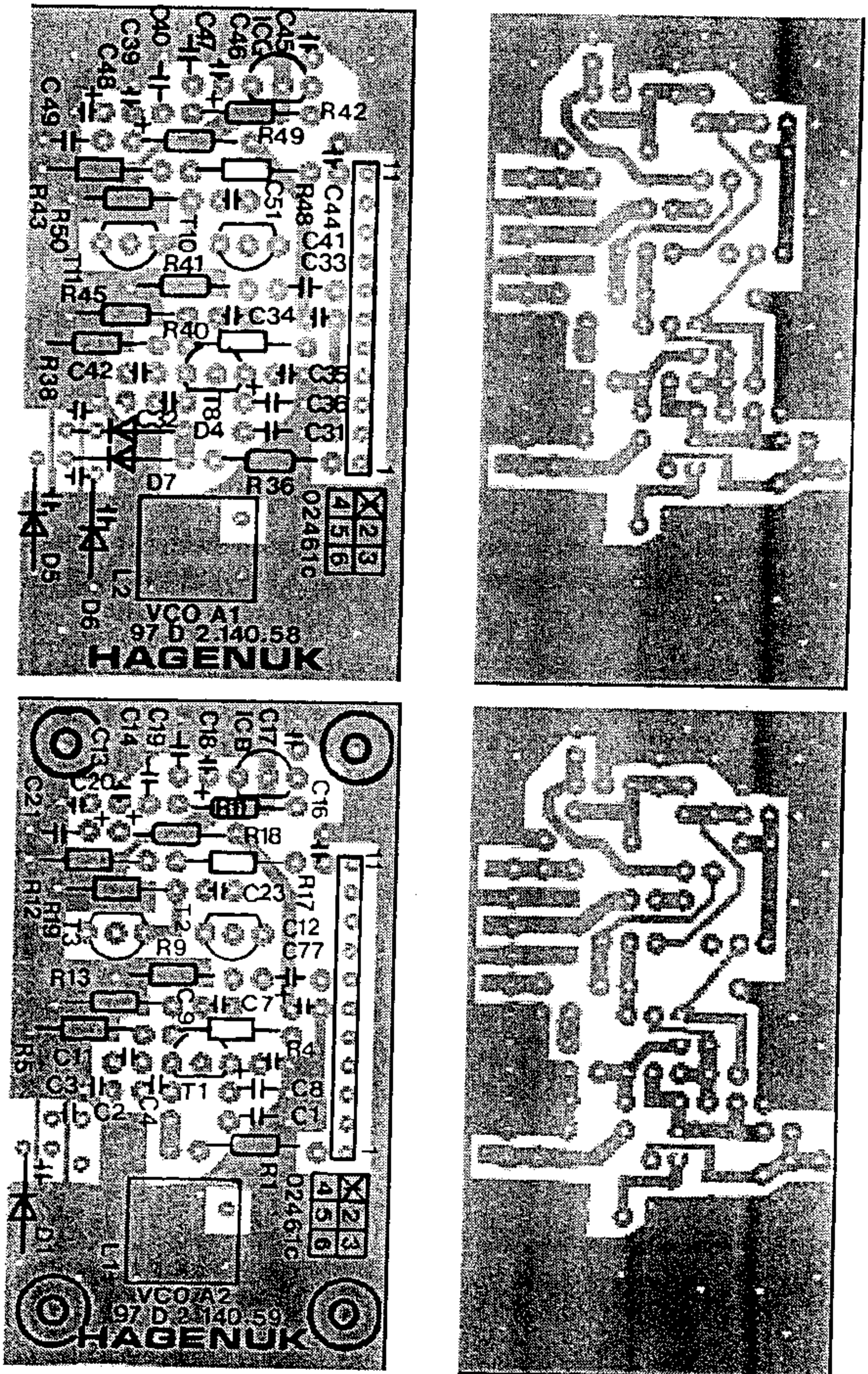
Screw VCO A1, A2 to the VCO board, connect the VCO A with the receiver via an adapter ribbon cable.
Input 1.05555 MHz measure at MP 2 with a high impedance volt meter (Ri = 10 Mohm) and by rotating the brass core in L2 adjust the voltage to 7 V ± 0.2 V.
Input 1.00000 MHz, measure the voltage at MP 2.
Required: U MP 2 > 4V.
Input 1.09999 MHz, measure the voltage at MP 2.
Required: U MP2 < 12 V

b) VCO A2

Input 1.05555 MHz, measure the voltage at MP 6 and adjust it by rotating the core from L1 to 5.0 V ± 0.2 V.
Input 1.00000 MHz, check the voltage at MP 6.
Required: U MP6 > 4V.
Input 1.09999 MHz, check the voltage at MP 6.
Required: U MP6 < 6V.

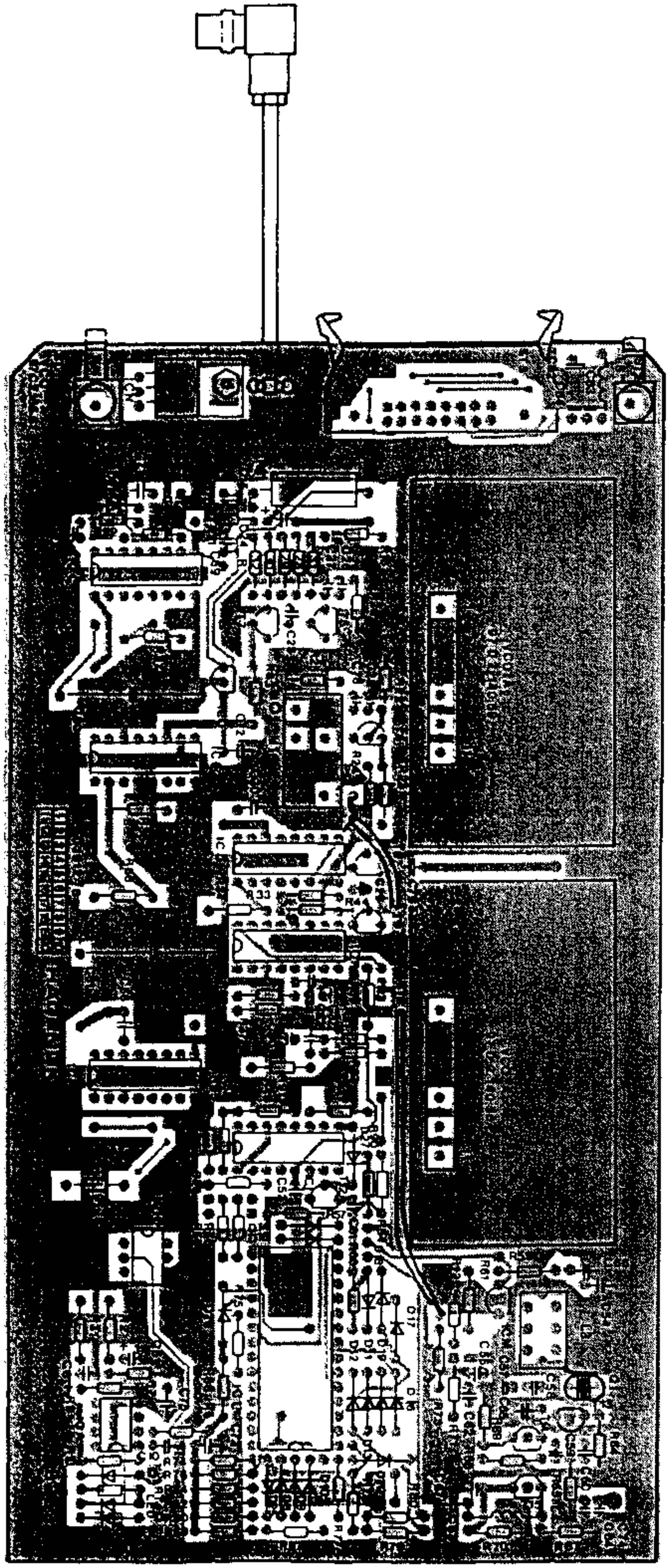
-VCO-A-

See circuit diagram: 97 Sa B 2.155.55



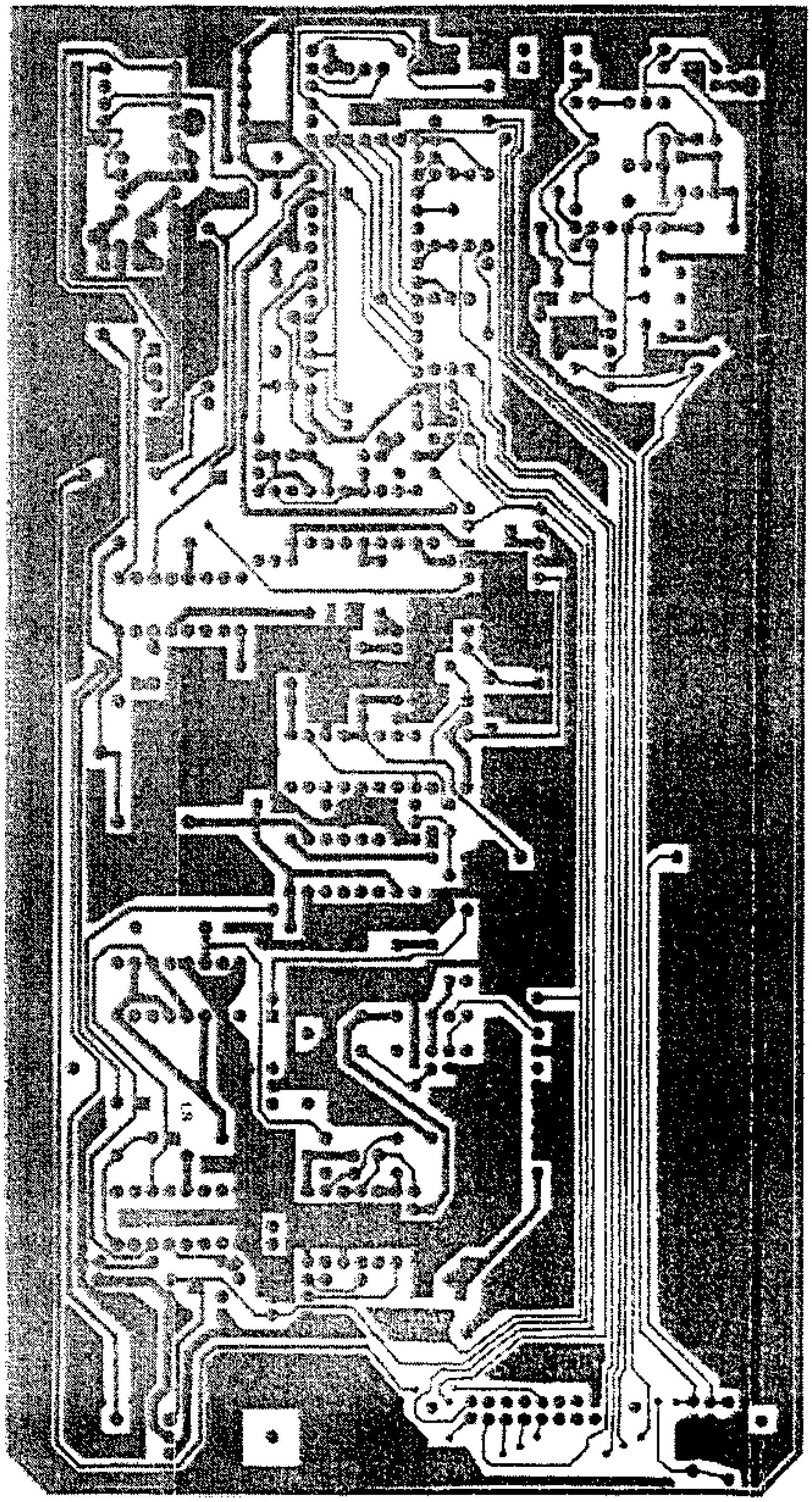
Printed Circuit Boards VCO-A1- 97 D 2.140.58 / VCO A2 - 97 D 2.140.59

HAG/ROD 016-04 93

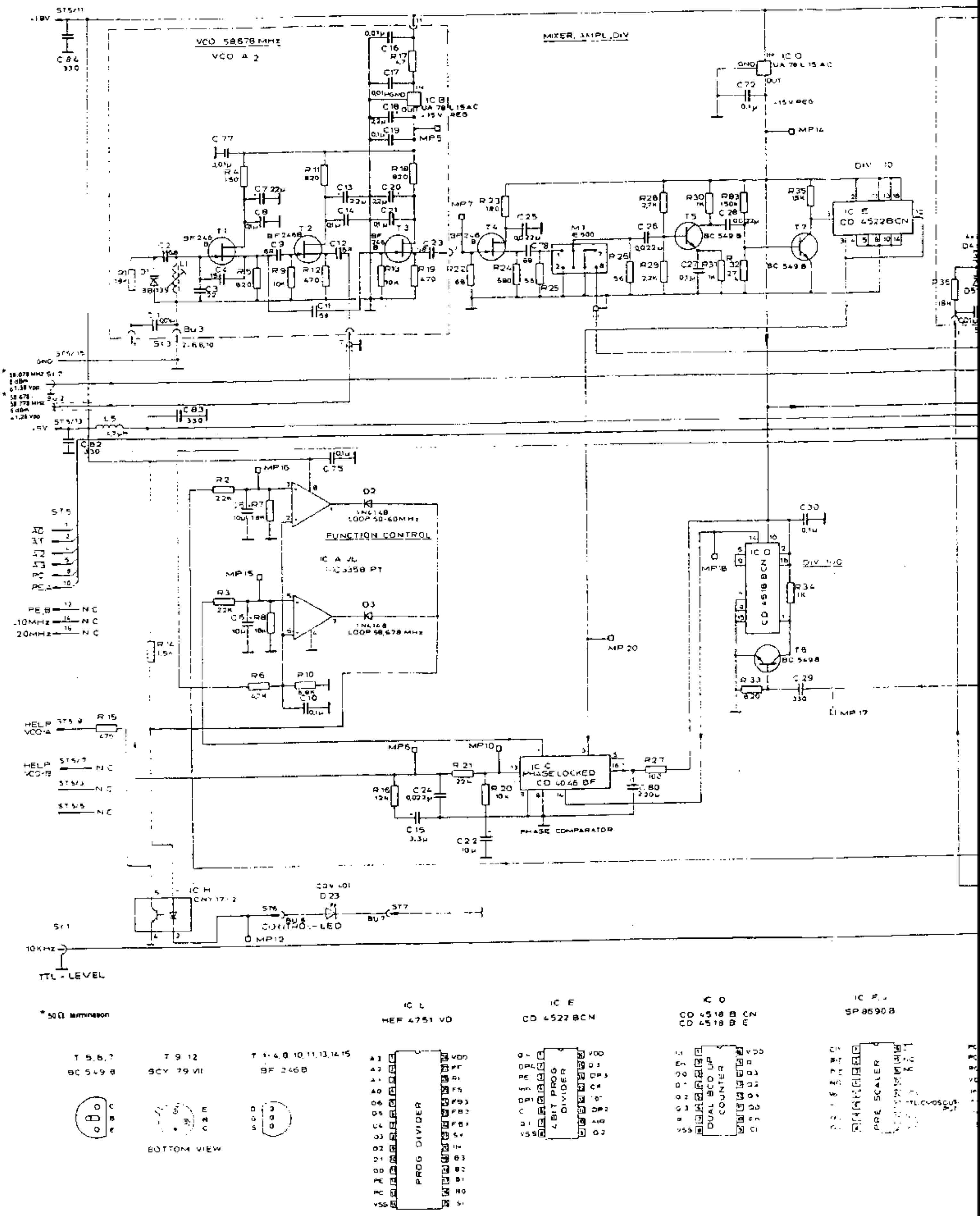


HAG/ROD 016-08.92

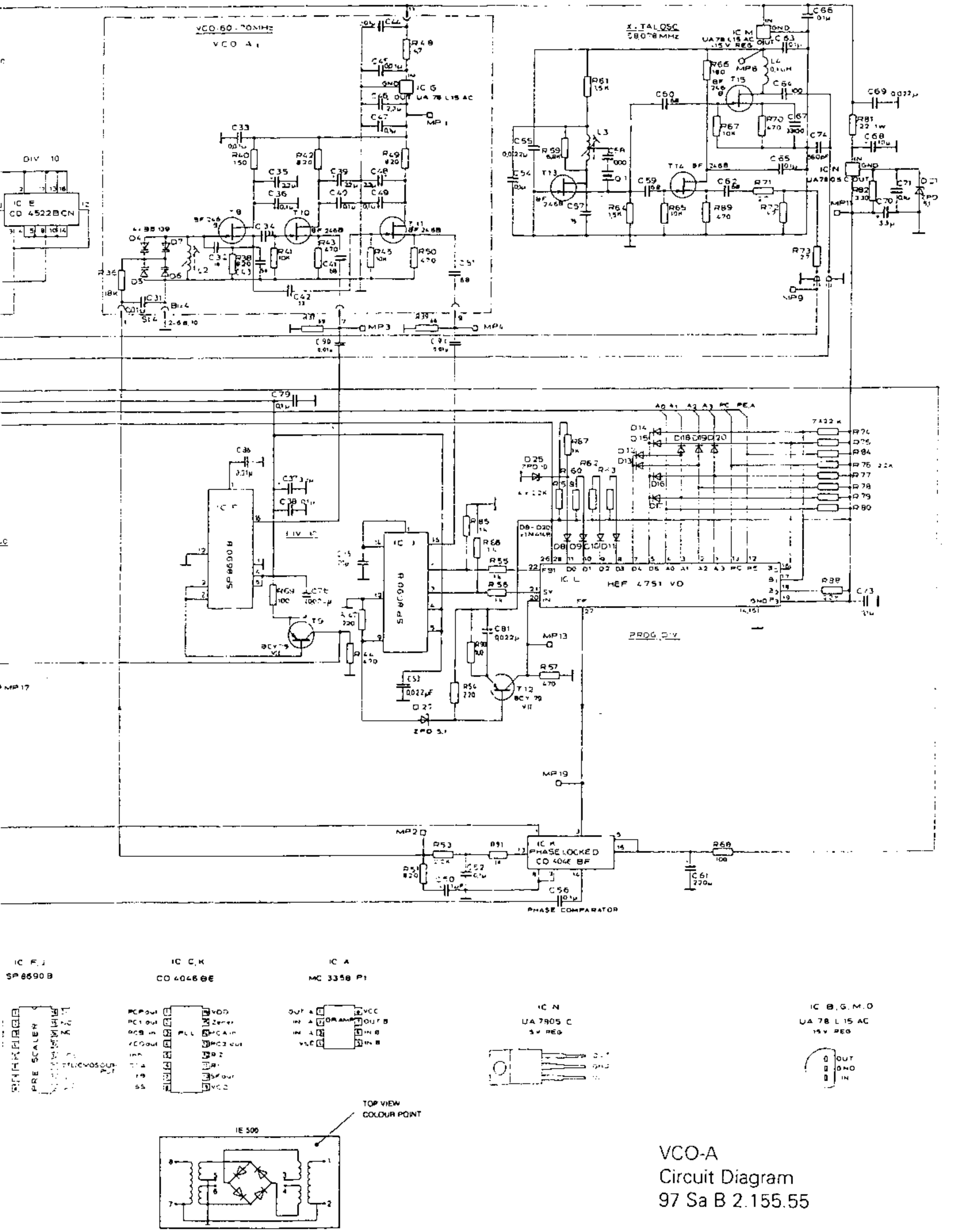
see circuit diagram - 97 Sa B 2.155.55



Printed Circuit Board
VCO-A
97 C 2.155.57



HAG/ROD 016-08 92



VCO-A
Circuit Diagram
97 Sa B 2.155.55

-VCO-A-

Parts lists No.
97 Sa 2.155.55

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Capacitors:				
1078.607	C1	0,01 µF/100 V	CK 05 BX 103 K	SEC
0945.137	C2	6,8 pF/± 0,25 pF/63 V	NPO/1B EDPU/0,6	VALVO
0945.161	C3	22 pF/63 V 2 %	NPO/1B EDPU/0,6	VALVO
0945.188	C4	15 pF/63 V 2 %	NPO/1B EDPU/0,6	VALVO
1204.521	C5	10 µF/35 V	ETQ 4 10/35	ERO
1204.521	C6	10 µF/35 V	ETQ 4 10/35	ERO
1194.550	C7	2,2 µF/35 V	ETQ 3 2,2/35	ERO
1307.053	C8	0,1 µF/50 V	CK 05 BX 104 K	SEC
0944.998	C9	68 pF/63 V 2 %	NPO/1B EDPU/0,6	VALVO
1307.053	C10	0,1 µF/50 V	CK 05 BX 104 K	SEC
0944.998	C11	68 pF/63 V 2 %	NPO/1B EDPU/0,6	VALVO
0944.998	C12	68 pF/63 V 2 %	NPO/1B EDPU/0,6	VALVO
1194.550	C13	2,2 µF/35 V	ETQ 3 2,2/35 V	ERO
1307.053	C14	0,1 µF/50 V	CK 05 BX 104 K	SEC
0973.602	C15	3,3 pF/35 V	TAP-F	ITT
0904.988	C16	0,01 µF/40 V	EDPU/0,6 K 10000	VALVO
0904.988	C17	0,01 µF/40 V	EDPU/0,6 K 10000	VALVO
1194.550	C18	2,2 µF/35 V	ETQ 3 2 ,2/35	ERO
1307.053	C19	0,1 µF/50 V	CK 05 BX 104 K	SEC
1194.550	C20	2,2 µF/35 V	ETQ 3 2,2/35 V	ERO
1307.053	C21	0,1 µF/50 V	CK 05 BX 104 K	SEC
1204 521	C22	10 µF/35 V	ETQ 4 10/35	ERO
0944.998	C23	68 pF/63 V 2 %	NPO/1B EDPU/0,6	VALVO
1309.447	C24	0,022 µF/100 V	CK 06 BX 223 K	SEC
1116.207	C25	0,022 µF/40 V	EDPU/0,6 K 10000	VALVO
1116.207	C26	0,022 µF/40 V	EDPU/0,6 K 10000	VALVO
1307 053	C27	0,1 µF/50 V	CK 05 BX 104 K	SEC
1116.207	C28	0,022 µF/40 V	EDPU/0,6 K 10000	VALVO
1420 844	C29	330 pF/63 V 2 %	N 750/1 B EDPU/0,6	VALVO
1307.053	C30	0,1 µF/50 V	CK 05 BX 104 K	SEC
0904.988	C31	0,01 µF/100/20/40 V	EDPU/0,6 K 10000	VALVO
0945.013	C32	10 pF/63 V 2 %	NPO/1B EDPU/0,6	VALVO
0904.988	C33	0,01 µF/40 V	EDPU/0,6 K 10000	VALVO
0945.021	C34	33 pF/63 V 2 %	NPO/1B EDPU/0,6	VALVO
1194.550	C35	2,2 µF/35 V	ETQ 3 2,2/35 V	ERO
1307.053	C36	0,1 µF/50 V	CK 05 BX 104 K	SEC
0973.602	C37	3,3 µF/35 V	TAP-F	ITT
1307.053	C38	0,1 µF/50 V	CK 05 BX 104 K	SEC
1194.550	C39	2,2 µF/35 V	ETQ 3 2,2/35	ERO
1307.053	C40	0,1 µF/50 V	CK 05 BX 104 K	SEC
0944.998	C41	68 pF/63 V 2 %	NPO/1B EDPU/0,6	VALVO
0945.021	C42	33 pF/63 V 2 %	NPO/1B EDPU/0,6	VALVO

Parts lists No.
97 Sa 2.155.55

-VCO-A-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1075.713	C43	56 pF/63 V 2 %	NPO/1B EDPU	
0904.988	C44	0,01 µF/40 V	EDPU/0,6 K 10000	VALVO
0904.988	C45	0,01 µF/40 V	EDPU/0,6 K 10000	VALVO
1194.550	C46	2.2 µF/35 V	ETQ 3 2,2/35	ERO
1307.053	C47	0,1 µF/50 V	CK 05 BX 104 K	SEC
1194.550	C48	2,2 µF/35 V	ETQ 3 2,2/35	ERO
1307.053	C49	0,1 µF/50 V	CK 05 BX 104 K	SEC
1118.013	C50	1 µF/35 V	ETQ 2 1/20/35	ERO
0944.998	C51	68 pF/63 V 2 %	NPO/1B EDPU/0,6	VALVO
1307.053	C52	0,1 µF/50 V	CK 05 BX 104 K	SEC
1116.207	C53	0,022 µF/40 V	EDPU/0,6 K 10000	VALVO
1307.053	C54	0,1 µF/50 V	CK 05 BX 104 K	SEC
1116.207	C55	0,022 µF/40 V	EDPU/0,6 K 10000	VALVO
1307.053	C56	0,1 µF/50 V	CK 05 BX 104 K	SEC
0945.188	C57	15 pF/63 V 2 %	NPO/1B EDPU/0,6	VALVO
0944.971	C58	1000 pF/63 V ± 10 %	K 2000/1000/10	VALVO
0944.998	C59	68 pF/63 V 2 %	NPO/1B EDPU/0,6	VALVO
0944.998	C60	68 pF/63 V 2 %	NPO/1B EDPU/0,6	VALVO
1067.923	C61	220 µF/25 V	B41283-B5227-T	SIEMENS
0944.988	C62	68 pF/63 V 2 %	NPO/1B EDPU/0,6	VALVO
1307.053	C63	0,1 µF/50 V	CK 05 BX 104 K	SEC
0945.048	C64	100 pF/63 V 2 %	NPO/1B EDPU/0,6	VALVO
1307.053	C65	0,1 µF/50 V	CK 05 BX 104 K	SEC
1307.053	C66	0,1 µF/50 V	CK 05 BX 104 K	SEC
0945.765	C67	3300 pF/63 V	EDPU/0,6 K 2000	VALVO
1204.521	C68	10 µF/35 V	ETQ 4 10/35	ERO
1116.207	C69	0,022 µF/40 V	EDPU/0,6 K 10000	VALVO
0973.602	C70	3,3 µF/35 V	TAP-F	ITT
1307.053	C71	0,1 µF/50 V	CK 05 BX 104 K	SEC
1307.053	C72	0,1 µF/50 V	CK 05 BX 104 K	SEC
1307.053	C73	0,1 µF/50 V	CK 05 BX 104 K	SEC
1422.103	C74	560 pF/63 V 2 %	EDPU/0,6 K 2000	VALVO
1307.053	C75	0,1 µF/50 V	CK 05 BX 104 K	SEC
1116.207	C76	0,022 µF/100/20/40 V	EDPU/0,6 K 10000	VALVO
1078.607	C77	0,01 µF/100 V	CK 05 BX 103 K	SEC
0944.998	C78	68 pF/63 V 2 %	NPO/1B EDPU/0,6	VALVO
1307.053	C79	0,1 µF/50 V	CK 05 BX 104 K	SEC
1067.923	C80	220 µF/25 V	B 41283-5227-T	SIEMENS
1116.207	C81	0,022 µF/100/20/40 V	EDPU/0,6 K 10000	VALVO
1420.844	C82	330 pF/63 V 2 %	N 750/1B EDPU/0,6	VALVO
1420.844	C83	330 pF/63 V 2 %	N 750/1B EDPU/0,6	VALVO
1420.844	C84	330 pF/63 V 2 %	N 750/1B EDPU/0,6	VALVO
1408.550	C85	0,01 µ/10/50 V	B 37981-F5103-K	SIEMENS
1408.550	C86	0,01 µ/10/50 V	B 37981-F5103-K	SIEMENS

Parts lists No.
97 Sa 2.155.55

-VCO-A-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1646 893	C90	0,01/10/63 V	KEFQ 0805 X7R	VALVO
1646.893	C91	0,01/10/63 V	KEFQ 0805 X7R	VALVO

Diodes:

1062.131	D1		BB 139	
0745.677	D2		1 N 4148	ITT
0745.677	D3		1 N 4148	ITT
1062.131	D4		BB 139	
1062.131	D5		BB 139	
1062.131	D6		BB 139	
1062.131	D7		BB 139	
0745.677	D8		1 N 4148	ITT
0745.677	D9		1 N 4148	ITT
0745.677	D10		1 N 4148	ITT
0745.677	D11		1 N 4148	ITT
0745.677	D12		1 N 4148	ITT
0745.677	D13		1 N 4148	ITT
0745.677	D14		1 N 4148	ITT
0745.677	D15		1 N4148	ITT
0745.677	D16		1 N 4148	ITT
0745.677	D17		1 N 4148	ITT
0745 677	D18		1 N 4148	ITT
0745.677	D19		1 N 4148	ITT
0745.677	D20		1 N 4148	ITT
0758.353	D21		ZPD 5,1	ITT
0936.480	D22		ZPD 10	ITT
0758.353	D27		ZPD 5,1	ITT

Resistors:

0744.786	R1	18 K 5 % 1/8 W	DIN 44052	
0767.204	R2	22 K 5 % 1/8 W	DIN 44052	
0767.204	R3	22 K 5 % 1/8 W	DIN 44052	
0744.743	R4	150 5 % 1/8 W	DIN 44052	
0744.921	R5	820 5 % 1/8 W	DIN 44052	
0767.212	R6	4,7 K 5 % 1/8 W	DIN 44052	
0744.786	R7	18 K 5 % 1/8 W	DIN 44052	
0744.786	R8	18 K 5 % 1/8 W	DIN 44052	
0179.701	R9	10 K 5 % 1/8 W	DIN 44052	
0767.220	R10	6,8 K 5 % 1/8 W	DIN 44052	
0744.921	R11	820 5 % 1/8 W	DIN 44052	

Parts lists No.
97 Sa 2.155.55

-VCO-A-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
0554.898	R12	470 5 % 1/8 W	DIN 44052	
0179.701	R13	10 K 5 % 1/8 W	DIN 44052	
0480.444	R14	1,5 K 5 % 1/8 W	DIN 44052	
0745 804	R16	12 K 5 % 1/8 W	DIN 44052	
0781.959	R17	4,7 5 % 1/8 W	DIN 44052	
0744.921	R18	820 5 % 1/8 W	DIN 44052	
0554.898	R19	470 5 % 1/8 W	DIN 44052	
0179.701	R20	10 K 5 % 1/8 W	DIN 44052	
0767.204	R21	22 K 5 % 1/8 W	DIN 44052	
0653.853	R22	68 5 % 1/8 W	DIN 44052	
0744 883	R23	180 5 % 1/8 W	DIN 44052	
0698.172	R24	680 5 % 1/8 W	DIN 44052	
0530.360	R25	56 5 % 1/8 W	DIN 44052	
0530.360	R26	56 5 % 1/8 W	DIN 44052	
0179.639	R27	100 5 % 1/8 W	DIN 44052	
0745.820	R28	2,7 K 5 % 1/8 W	DIN 44052	
0744.808	R29	2,2 K 5 % 1/8 W	DIN 44052	
0179.698	R30	1 K 5 % 1/8 W	DIN 44052	
0179.698	R31	1 K 5 % 1/8 W	DIN 44052	
0542 830	R32	27 K 5 % 1/8 W	DIN 44052	
0744.921	R33	820 5 % 1/8 W	DIN 44052	
0179.698	R34	1 K 5 % 1/8 W	DIN 44052	
0480.444	R35	1,5 K 5 % 1/8 W	DIN 44052	
1650.238	R37	68 5 % 1/8 W	DIN 44052	
0530.352	R38	3,3 K 5 % 1/8 W	DIN 44052	
0744.921	R38	820 5 % 1/8 W	DIN 44052	
1650.238	R39	68 5 % 1/8 W	DIN 44052	
0744.743	R40	150 5 % 1/8 W	DIN 44052	
0179.701	R41	10 K 5 % 1/8 W	DIN 44052	
0744.921	R42	820 5 % 1/8 W	DIN 44052	
0554.898	R43	470 5 % 1/8 W	DIN 44052	
0554.898	R44	470 5 % 1/8 W	DIN 44052	
0179.701	R45	10 K 5 % 1/8 W	DIN 44052	
0530.352	R46	3,3 K 5 % 1/8 W	DIN 44052	
0542.938	R47	220 5 % 1/8 W	DIN 44052	
0781.959	R48	4,7 5 % 1/8 W	DIN 44052	
0744.921	R49	820 5 % 1/8 W	DIN 44052	
0554.898	R50	470 5 % 1/8 W	DIN 44052	
0744.921	R51	820 5 % 1/8 W	DIN 44052	
0542.857	R52	560 5 % 1/8 W	DIN 44052	
0744.808	R53	2,2 K 5 % 1/8 W	DIN 44052	
0542.938	R54	220 5 % 1/8 W	DIN 44052	
0179.698	R55	1 K 5 % 1/8 W	DIN 44052	

-VCO-A-

Parts lists No.
97 Sa 2.155.55

Ident-No.	Mark	Electr. value	Identity	Manufacturer
0179.698	R56	1 K 5 % 1/8 W	DIN 44052	
0554.898	R57	470 5 % 1/8 W	DIN 44052	
0767.204	R58	22 K 5 % 1/8 W	DIN 44052	
0767.220	R59	6,8 K 5 % 1/8 W	DIN 44052	
0767.204	R60	22 K 5 % 1/8 W	DIN 44052	
0480.444	R61	1,5 K 5 % 1/8 W	DIN 44052	
0767.204	R62	22 K 5 % 1/8 W	DIN 44052	
0767.204	R63	22 K 5 % 1/8 W	DIN 44052	
0480.444	R64	1,5 K 5 % 1/8 W	DIN 44052	
0179.701	R65	10 K 5 % 1/8 W	DIN 44052	
0744.883	R66	180 5 % 1/8 W	DIN 44052	
0179.701	R67	10 K 5% 1/8 W	DIN 44052	
0179.639	R68	100 5 % 1/8 W	DIN 44052	
0179.639	R69	100 5 % 1/8 W	DIN 44052	
0554.898	R70	470 5 % 1/8 W	DIN 44052	
0830.119	R71	27 5 % 1/8 W	DIN 44052	
0626.694	R72	47 5 % 1/8 W	DIN 44052	
0830.119	R73	27 5 % 1/8 W	DIN 44052	
0767.204	R74	22 K 5 % 1/8 W	DIN 44052	
0767.204	R75	22 K 5 % 1/8 W	DIN 44052	
0744.808	R76	2,2 K 5 % 1/8 W	DIN 44052	
0767.204	R77	22 K 5 % 1/8 W	DIN 44052	
0767.204	R78	22 K 5 % 1/8 W	DIN 44052	
0767.204	R79	22 K 5 % 1/8 W	DIN 44052	
0767.204	R80	22 K 5 % 1/8 W	DIN 44052	
0728.586	R81	22 5 % 1/8 W	DIN 44052	
0744.859	R82	330 5 % 1/8 W	DIN 44052	
0830.089	R83	150 K 5 % 1/8 W	DIN 44052	
0767.204	R84	22 K 5 % 1/8 W	DIN 44052	
0179.698	R85	1 K 5 % 1/8 W	DIN 44052	
0179.698	R86	1 K 5 % 1/8 W	DIN 44052	
0179.698	R87	1 K 5 % 1/8 W	DIN 44052	
0767.204	R88	22 K 5 % 1/8 W	DIN 44052	
0554.898	R89	470 5 % 1/8 W	DIN 44052	
0179.639	R90	100 5 % 1/8 W	DIN 44052	
0179.698	R91	1 K 5 % 1/8 W	DIN 44052	

Coils:

1422.057	L1		97 E 2.140.62	HAGENUK
1422.057	L2		97 E 2.140.62	HAGENUK
1644.300	L3		97 E 2.140.61 B	HAGENUK
1536.222	L4		97 E 2.140.57-4	HAGENUK
0955.752	L5	4,7 µH/10 %	72.00	JAHRE

-VCO-A-

Parts lists No.
97 Sa 2.155.55

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Integrated circuits:				
1422.715	IC A		MC3358 P 1	MOTOROLA
1422.200	IC B		UA 78 L 15 AC	TEXAS
1417.622	IC C		CD 4046 BE	RCA
1422.138	IC D		CD 4518 BCN	NAT.
1470.606			CD 4518 BE	RCA
1422.154	IC E		CD 4522 BCN	RCA
1422.162	IC F		U6B95H9059X	
1422 200	IC G		UA 78 L 15 AC	TEXAS
1226.169	IC H		CNY 17/II	SIEMENS
1422.162	IC J		95 H 90	
1417.622	IC K		CD 4046 BE	RCA
1422.111	IC L		HEF 4751 VD	
1422.200	IC M		UA 78 L 15 AC	TEXAS
1384.325	IC N		UA 7805 C	
1422.200	IC O		UA 78 L 15 AC	TEXAS
Transistors:				
1238.949	T1		BF 246 B	VALVO
1238.949	T2		BF 246 B	VALVO
1238 949	T3		BF 246 B	VALVO
1238.949	T4		BF 246 B	VALVO
1291.033	T5		BC 549 B	
1291.033	T6		BC 549 B	
1291.033	T7		BC 549 B	
1238.949	T8		BF 246 B	VALVO
0722.529	T9		BCY 79 VII	
1238.949	T10		BF 246 B	VALVO
1238.949	T11		BF 246 B	VALVO
0722.529	T12		BCY 79 VII	
1238 949	T13		BF 246 B	VALVO
1238 949	T14		BF 246 B	VALVO
1238.949	T15		BF 246 B	VALVO
Connectors:				
1290.517	Bu3	11 pins	5.17.020.008.011.00	ODU
1290.517	Bu4	11 pins	5.17.020.008.011.00	ODU
1422.081	Bu5	28 pins	528-AG 11	AUGAT

Parts lists No.
97 Sa 2.155.55

-VCO-A-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1422.693	St1		R 114665	RADIALL
1422.693	St2		R 114665	RADIAILL
1288.814	St 3	11 pins	5.11.021.007.011.00	ODU
1288.814	St4	11 pins	5.11.021.007.011.00	ODU
1826.514	St5	16 pins	609 1604 E	ANSLEY
1478.397	St6		RTM 12 H 629	BÜRKLIN
1478.397	St7		RTM 12 H 629	BÜRKLIN

Supplements:

1078.577	M1		IE 500	IE
1450.808	Q1	58.078 MHz ± 7-10-6	XS 2816	KVG

-VCO-B-

Technical description

The VCO B consists of the following modules:

a) Three VCOs with buffer stages (VCO B1)
b) A mixer stage with low pass, amplifier stage, pulse shaper stage and divider:4
c) A programmable divider
d) A phase comparison stage

VCOs with buffer stages (VCO B1)

The VCO B1 is designed on its own PCB, which is encapsulated in a steel panel housing to protect it from magnetic interferences. It is linked with the PCB VCO B via an 11 pole connector.
Each of the three oscillators covers a frequency range of 10 MHz for the receive range 0 - 9.999 MHz (VCO - frequency 63 - 73 MHz) the oscillator T1 is switched on, for the range 10 - 19.999 MHz, the oscillator T4 is switched on and for the range 20 - 29.999 MHz, the oscillator T7 is switched on.
Selection is made by the microprocessor via the two lines -10 MHz, -20 MHz and the decoding logic, comprising of IC A. The respective oscillator is switched on with transistors T3, T8, T5. Each oscillator has its own buffer stage (with T2, T6, T9) whose outputs are connected together with coupling capacitors. The signal is decoupled with buffers T10/T12, amplified with T11, low pass filtered and fed on to the 1st mixer.

Mixer stage

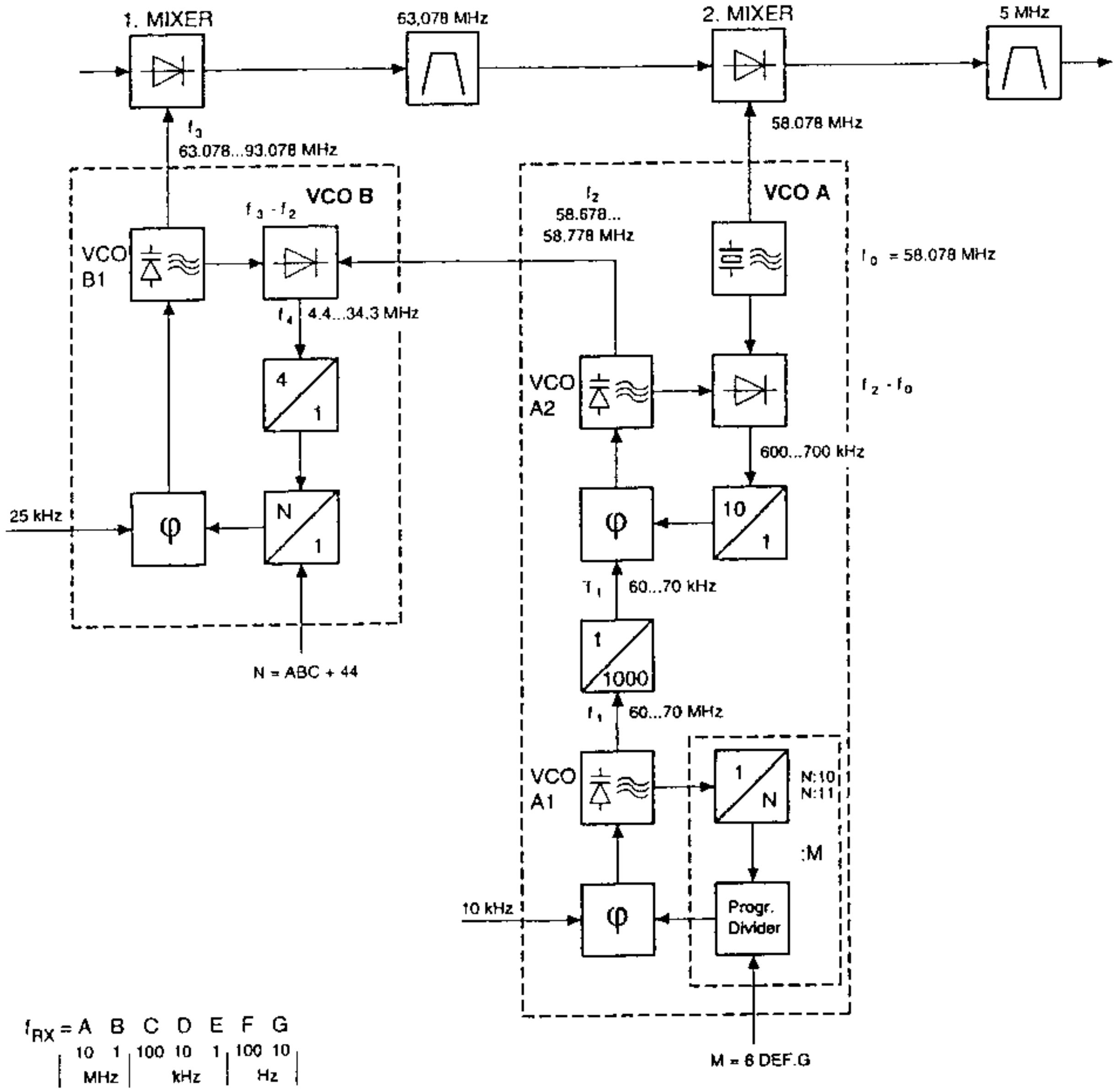
In mixer M1, the signal of the VCO A1 cassette is mixed with the output signal of the VCO A.
The differential frequency 4.4 ... 34.4 MHz at the output (pin 34) of the mixer is filtered out by a low pass filter and amplified with T15/T16. IC E is buffering the signal to TTL level.
Since the programmable frequency divider cannot safely process 34.4 MHz, the frequency 4.4 ... 34.4 MHz in IC F is divided by 4.
Since in VCO B 100 kHz is the smallest tuning step, the reference frequency would also have to be 100 kHz. The reference freqency is also reduced by the same division factor 4, (in other words U_{ref} = 25 kHz).

-VCO-B-

Programmable divider
The data lines for the VCO A and B are designed as a common bus, they are therefore loaded digit-wise into the three registers IC G, I, J. The address counter IC O selects the respective register. The data are inverted with the gates of IC K, since the programmable divider consisting of IC P, Q, R, T and S in contrast to VCO A, must be loaded with non-inverted data. Inversion of the data for the VCO B would be possible from the microprocessor but for reasons of simplification, the hardware solution was selected.

Phase detector
The output signal of the programmable divider is fed via the transistor T14 (level conversion TTL - CMOS) to the phase comparator IC C, the 25 kHz reference frequency comes from the BFO cassette. The passive loop filter consists of R75/C79, R74/C 46/R 73. The lock detect signal of the phase comparator is evaluated with the components R52/R 55/C 58/D 7/T 17. When the PLL is locked, the LED D6 on the back of the cassette lights up. The microprocessor of the receiver is advised of the locked status of the VCO B via D13.
The voltage controller IC B supplies the VCO B1 module and phase detector with a well-filtered supply voltage.

-VCO-B-



Blockdiagram - VCO A and VCO B

VCO A/B Frequencysynthesis calcualting schedule

	A	B	C	D	E	F	G
f_{RX}							
	10 MHz	1 MHz	100 kHz	10 kHz	1 kHz	100 Hz	10 Hz

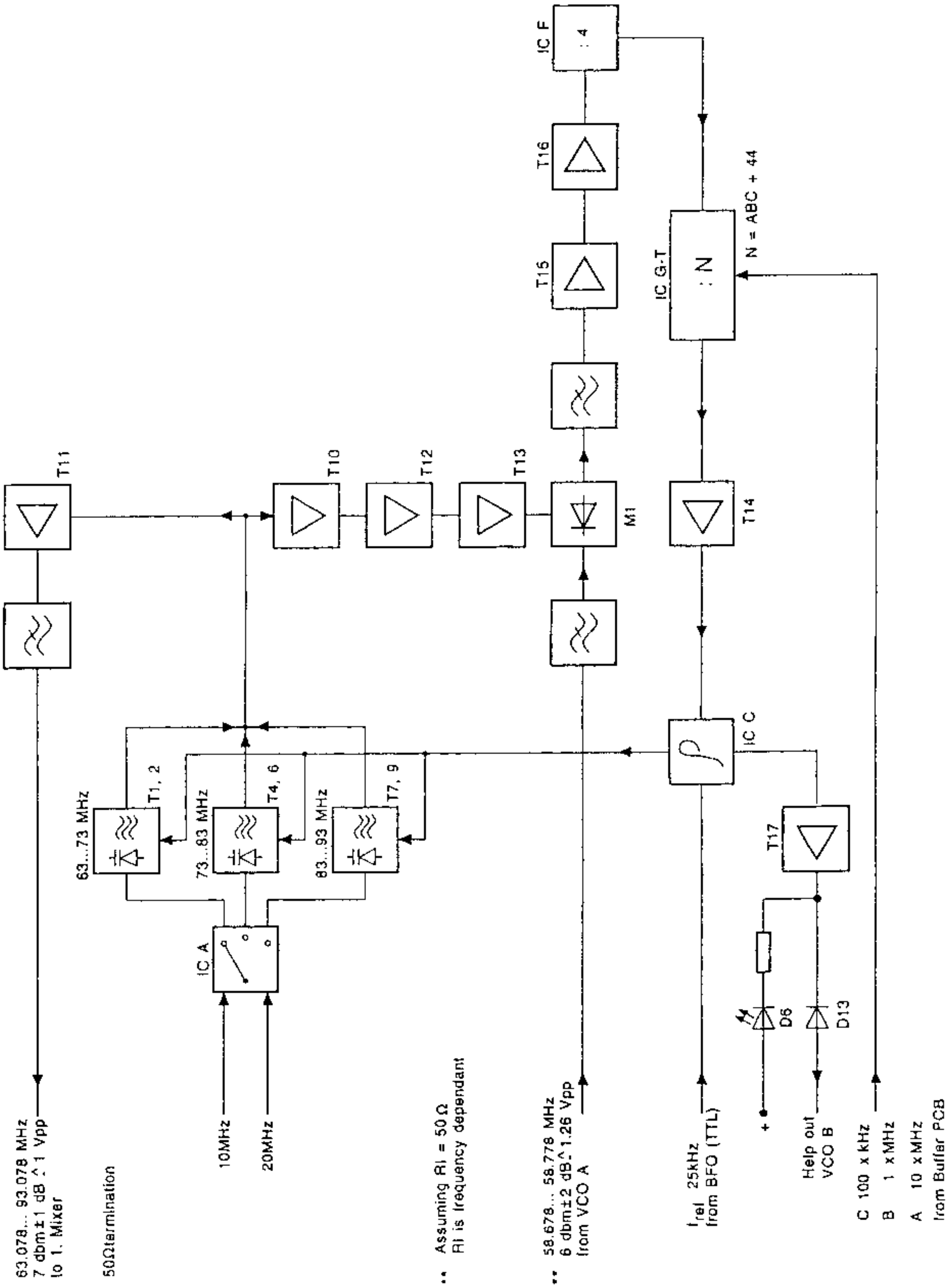
M = 6000.0 + DEF.G | 6 | | | . | |

N = ABC + 44 | | | |

	MHz 10	MHz 1	kHz 100	kHz 10	kHz 1	Hz 100	Hz 10	Hz 1
f_1 (VCO A_1) = 10 kHz x M								
$'f_1 = f_1 : 1000$								
f_2 (VCO A_2) = $'f_1$ x 10 + 58.078 MHz								
f_4 = 25 kHz x N x 4								
f_3 (VCO B) = $f_2 + f_4$								
1. IF = $f_3 - f_{RX}$								
2. IF = 1. IF - 58.078 MHz								

Above example only valid in USB mode (Filters 0.1 ... 2.4 kHz)
or DSB mode (Filter 6 kHz)

-VCO-B-



Blockdiagram VCO-B

-VCO-B-

Test and alignment instructions

Required: Circuit diagram VCO-B - Hagenuk Drawing No. 97 Sa B2.155.63
digital multimeter, frequency counter, spectrum analyser

Measurement procedure: The VCO-B is removed and the cassette is opened. The module is reconnected to the receiver.

Switch on the receiver, any setting is OK.

Checking the voltage controller
Measure the voltage on MP 1 IC - B with the digital multimeter.
Test values:
Voltage should be: 15 V ± 0.75 V.
Measure the voltage at MP 6 IC - H with the multimeter.
Test values:
Voltage should be: 10 V ± 0.5 V.

NOTE
A special test device is used for testing the PLL of the oscillators VCO B 1.
The tuning voltage is around 12.5 V with oscillator frequency f_{max} and around 3.5 V with oscillator frequency f_{min}. (applies for all three ranges).

Checking the 100 kHz Steps
Connect frequency counter to Bu 3 VCO OUT.
Modify the frequency in 100 kHz steps at the receiver.
Functional test:
The frequency should change from 63.078 to 63.178 to 63.278 (MHz) .. etc.

Checking the 1 MHz Steps
Alter the frequency at the receiver in 1 MHz steps.
Functional test:
The frequency should change from 63.078 to 64.078 to 65.078 (MHz) ... etc.

-VCO-B-

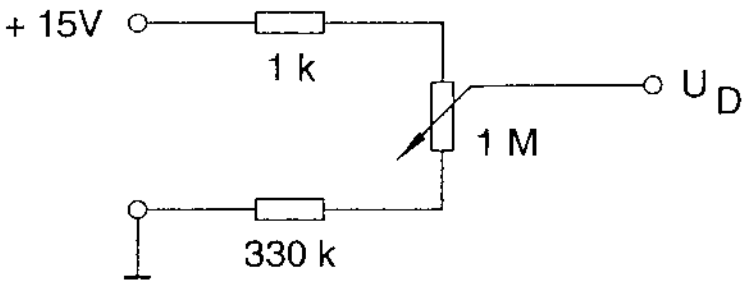
Test and alignment instructions (VCO B 1)

Required:	Circuit diagram - VCO-B - Hagenuk drawing No. 97 Sa B 2.155.63 frequency counter, spectrum analyser, termination resistor, power supply
Measurement procedure:	The VCO B module is withdrawn the cassette is opened, so that the VCO B 1 can be removed from the VCOB base board. Power supply +15 V ± 750 mV at Bu 1 pin 7 ground/0 V at Bu 1 pin 2,8,10

NOTE
The voltage at Bu 1 pin 7 must be free of spurious signals.

Testing the oscillators
Connect frequency counter to Bu 1 pin 1 and terminate Bu 1 pin 11 with 50 Ohm.
Test values:
Measure the power consumption;
should be: 10 mA ± 5 mA.

Setting the oscillator tuning range
Switch on the VCO with the 63/73 MHz tuning range by connecting Bu 1 pin 5 to 0 V. Set tuning voltage UD at Bu 1 pin 9 to +12.5 V ± 0.1 V



Test values:
The oscillator frequency should be 73 MHz ± 100 kHz; tuning is possible with the core in the coil L 1.
Set tuning voltage UD at Bu 1 pin 9 to 3.5 V ± 0.1 V.
Test values:
The oscillator frequency should be < 63 MHz.
Switch on the VCO with the tuning range 83/93 MHz by leaving Bu 1 pins 4 and 5 open.
Set tuning voltage UD at Bu 1 pin 9 to 12.5 V ± 0.1 V.

-VCO-B-

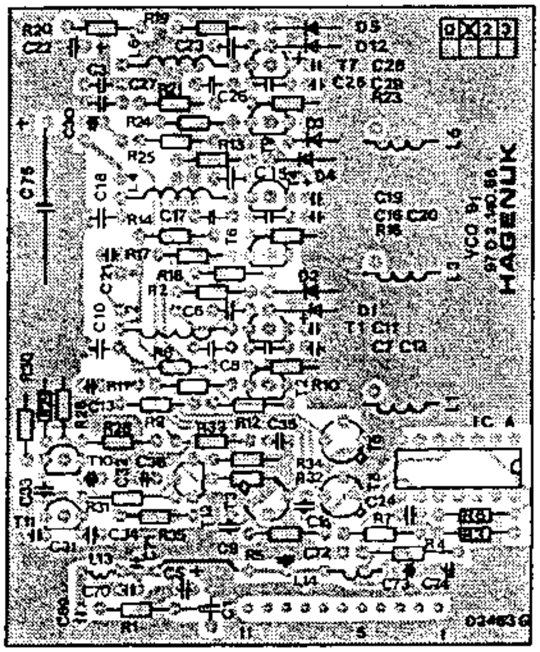
Test values:
The oscillator frequency should be 93 MHz ± 100 kHz, adjustment is possible with the core in coil L 5.
Set tuning voltage UD at Bu 1 pin 9 to 3.5 V ± 0.1 V.
Test values:
The oscillator frequency should be 83 MHz.
Switch on the VCO with tuning range 73/83 MHz by connecting Bu 1 pin 4 to 0 V. Set tuning voltage UD at Bu 1 pin 9 to 12.5 V ± 0.1 V.
Test values:
The oscillator frequency should be 83 MHz ± 100 kHz, adjustment is possible with the core in coil L 3.
Set tuning voltage UD at Bu 1 pin 9 to 3.5 V ± 0.1 V.
Test values:
The oscillator frequency should be 73 MHz.

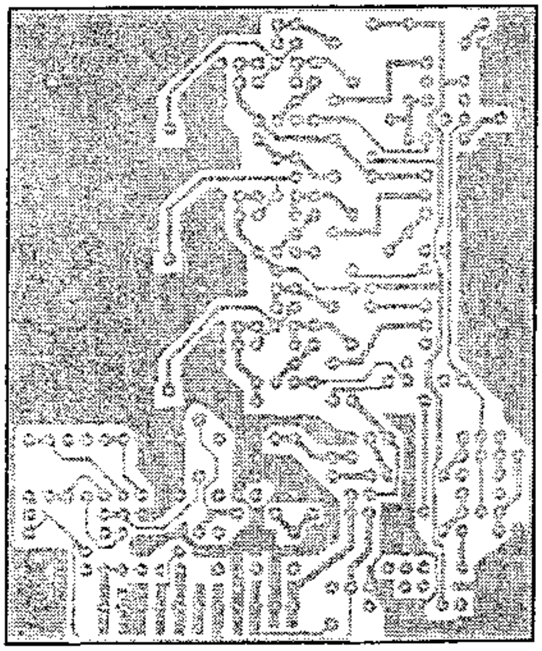
Check output level of the oscillators
Connect the spectrum analyser to Bu 1 pin 1 and terminate Bu 1 pin 11 with 50 Ohm.
Switch on the VCO for 63/73 MHz.
Test values:
The output level should be > 4.5 dBm (full tuning range).
Set the VCO 73/83.
Test values:
The output level should be > 4.5 dBm (full tuning range).
Set the VCO 83/93 MHz.
Test values:
The output level should be > 4.5 dBm (full tuning range).
Connect the spectrum analyser to Bu 1 pin 11 and terminate Bu 1 pin 1 with 50 ohm. Repeat test.
Test values:
Output level in all ranges > 4dBm.

NOTE
All the test values can differ from the one measured in the receiver. For flawless functioning with VCO B 1 installed, the output level on at Bu 1 pin 1 must be 7 dBm ± 1 dB. (Termination in receiver is not 50 Ohm)

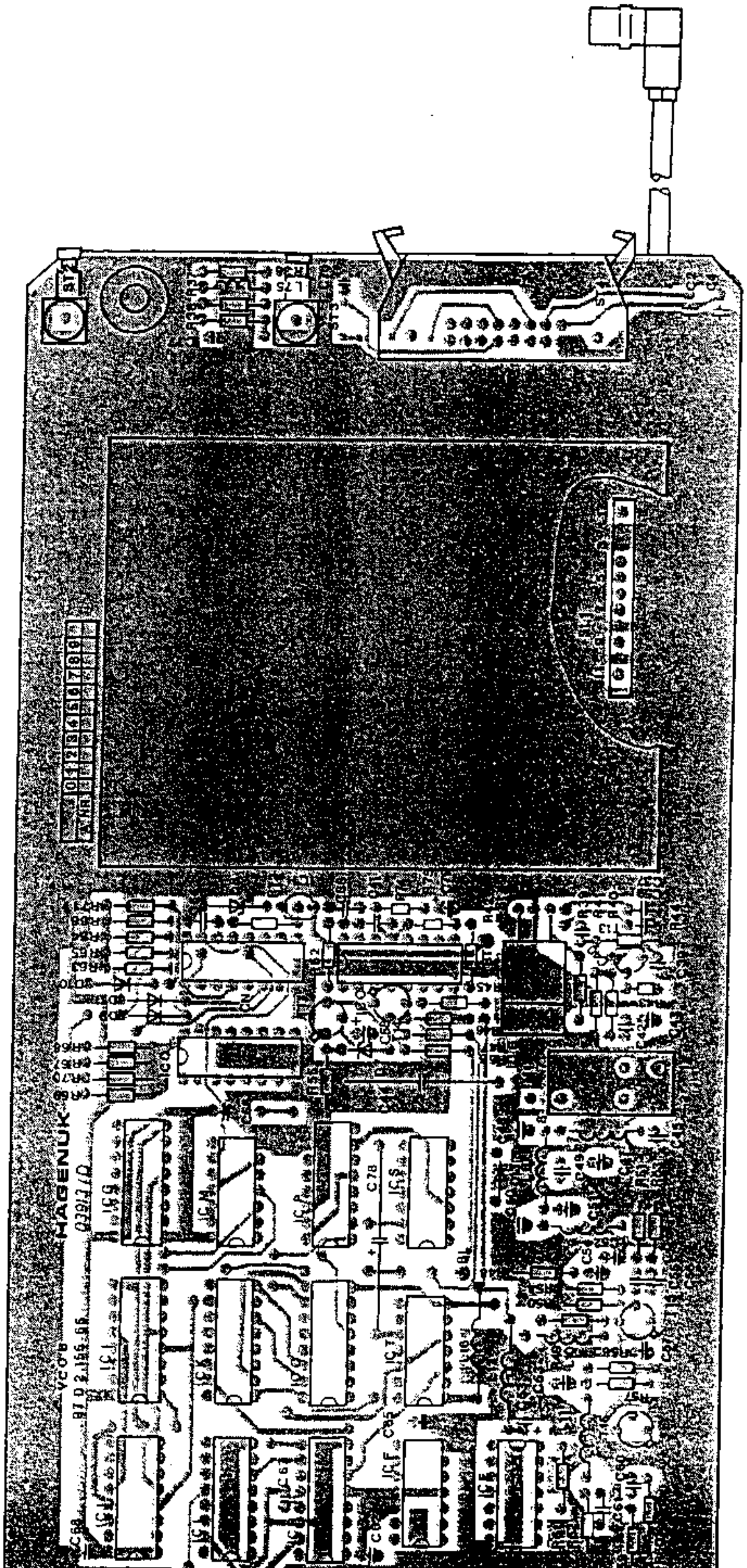
-VCO-B-

see circuit diagram - VCO-B 97 Sa B 2.155.63

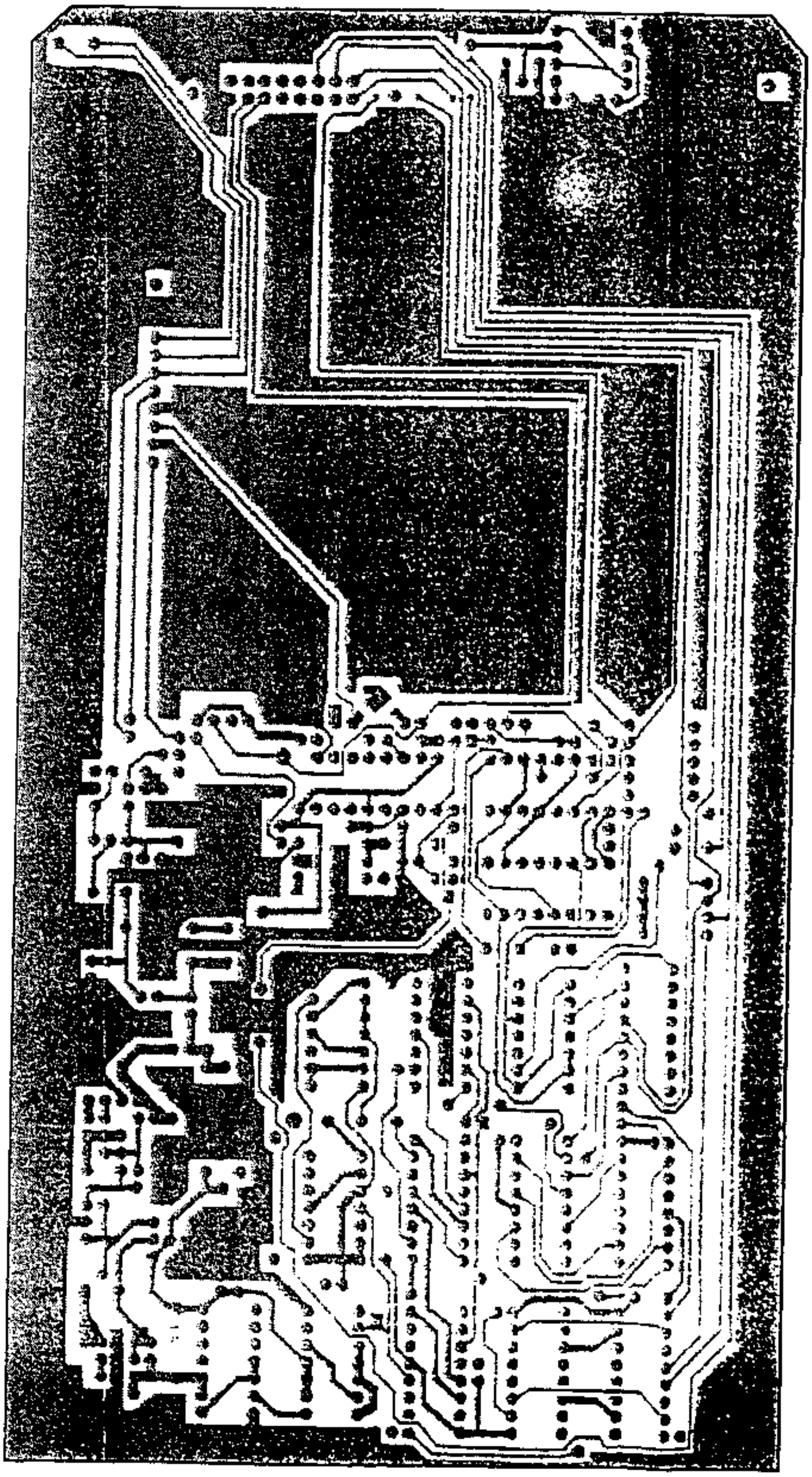




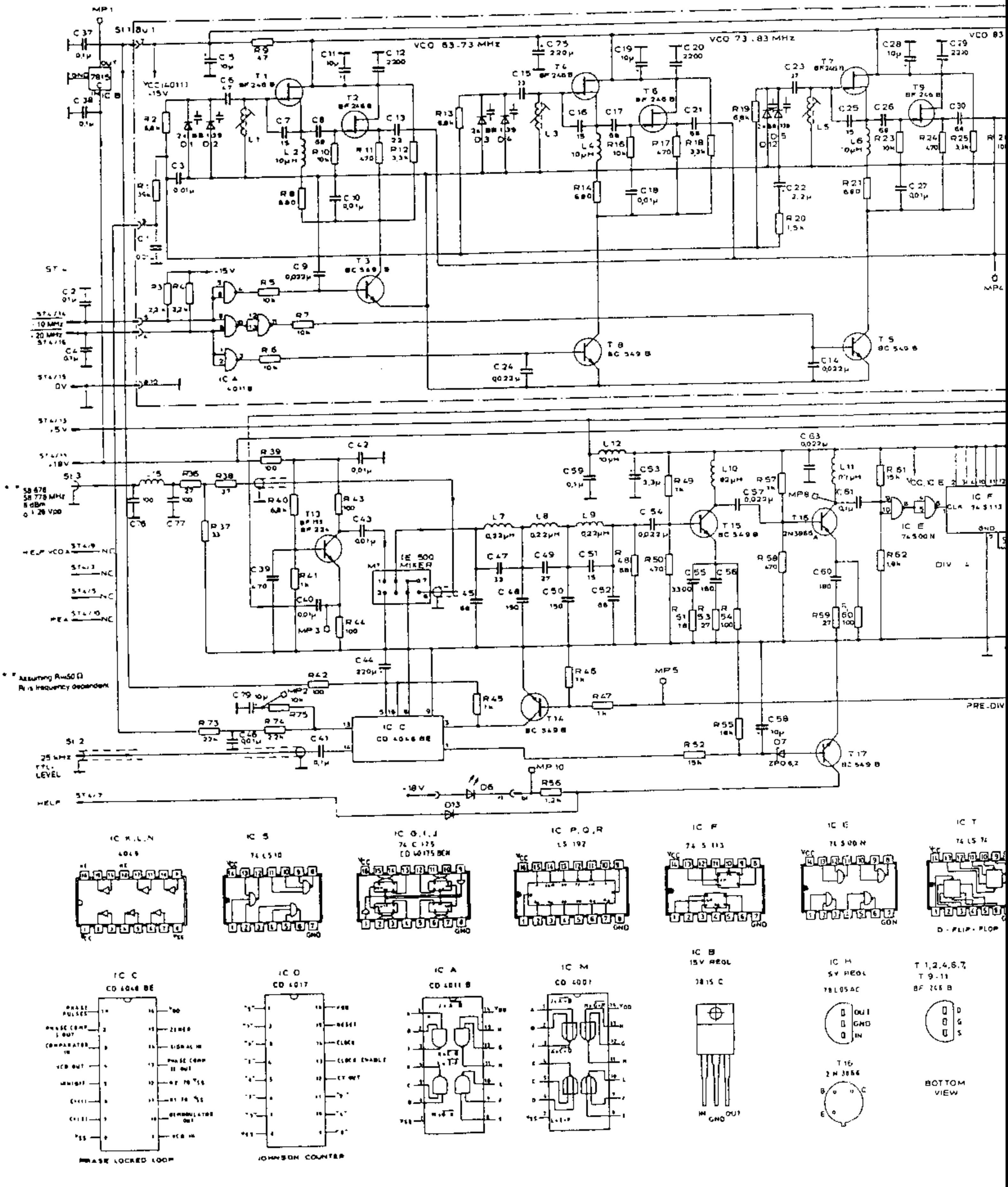
VCO-B1 - 97 D 2.140.66


HAGENUK

see circuit diagram - VCO B 97 Sa B 2.155.63



Printed Circuit Board
VCO-B
97 C 2.155.65



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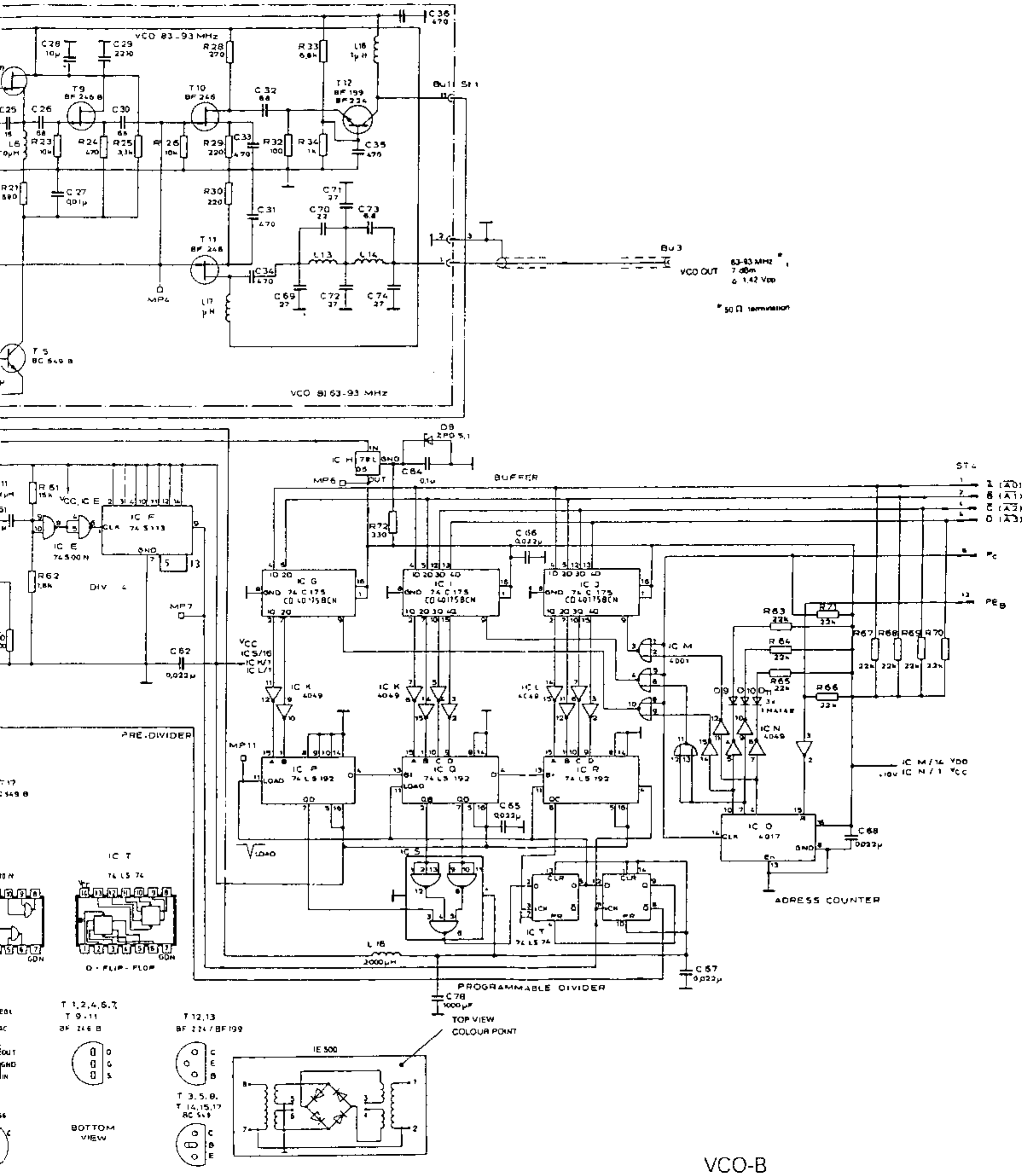


VCO-B
Circuit Diagram
97 Sa B 2.155.63

Parts lists No.
97 Sa 2.155.63

-VCO-B-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Capacitors:				
1078.607	C1	0,01 µF/100 V	CK 05 BX 103 K	SEC
1307.053	C2	0,1 µF/50 V	CK 05 BX 104 K	SEC
1078.607	C3	0,01 µF/100 V	CK 05 BX 103 K	SEC
1307.053	C4	0,1 µF/50 V	CK 05 BX 104 K	SEC
1204.521	C5	10 µF/35 V	ETQ 4	ROE
1430.920	C6	47 pF/200 V	CK 05 BX 470 K	SEC
1430.890	C7	15 pF/200 V	CK 05 BX 150 K	SEC
1430.939	C8	68 pF/200 V	CK 05 BX 680 K	SEC
1116.207	C9	0,022 µF/40 V	EDPU/0,6 K10000	VALVO
1078.607	C10	0,01 µF/100 V	CK 05 BX 103 K	SEC
1204.521	C11	10 µF/35 V	ETQ 4	ROE
0945.064	C12	2200 pF/63 V	EDPU/0,6 K2000	VALVO
0945.161	C13	22 pF/63 V	EDPU NPO	VALVO
1116.207	C14	0,022 µF/40 V	EDPU K10000	
1430.912	C15	33 pF/200 V	CK 05 BX 330 K	SEC
1430.890	C16	15 pF/200 V	CK 05 BX 150 K	SEC
1430.939	C17	68 pF/200 V	CK 05 BX 680 K	SEC
1078.607	C18	0,01 µF/100 V	CK 05 BX 103 K	SEC
1204.521	C19	10 µF/35 V	ETQ 4	ROE
0945.064	C20	2200 pF/63 V	EDPU K2000	VALVO
0944.998	C21	68 pF/63 V	EDPU NPO	VALVO
1199.528	C22	2,2 µF/35 V	ETP 1 A	ROE
1430.904	C23	27 pF/200 V	CK 05 BX 270 K	SEC
1116.207	C24	0,022 µF/40 V	EDPU K 10000	VALVO
1430.890	C25	15 pF/200 V	CK 05 BX 150 K	SEC
1430.939	C26	68 pF/200 V	CK 05 BX 680 K	SEC
1078 607	C27	0,01 µF/50 V	CK 05 BX 103 K	SEC
1204.521	C28	10 µF/35 V	ETQ 4	ROE
0945.064	C29	2200 pF/63 V	EDPU K 2000	VALVO
0944.998	C30	68 pF/63 V	EDPU NPO	VALVO
1067.877	C31	470 pF/63 V	EDPU N 1500	VALVO
0944 998	C32	68 pF/63 V	EDPU NPO	VALVO
1067.877	C33	470 pF/63 V	EDPU N 1500	VALVO
1067.877	C34	470 pF/63 V	EDPU N 1500	VALVO
1067.877	C35	470 pF/63 V	EDPU N 1500	VALVO
1067.877	C36	470 pF/63 V	EDPU N ISOO	VALVO
1307.053	C37	0,1 µF/50 V	CK 05 BX 104 K	SEC
1307.053	C38	0,1 µF/50 V	CK 05 BX 104 K	SEC
0945.757	C39	470 pF/63 V	N 1500-1B EDPU	
0904.988	C40	0,01 µF/40 V	EDPU NPO	VALVO
1307.053	C41	0,1 µF/50 V	CK 05 BX 104 K	SEC
0904.988	C42	0,01 µF/40 V	EDPU K 10000	VALVO

-VCO-B-

Parts lists No.
97 Sa 2.155.63

Ident-No.	Mark	Electr. value	Identity	Manufacturer
0904.988	C43	0,01 µF/40 V	EDPU NPO	VALVO
1067.923	C44	220 µF/25 V	B41283-B5227T	SIEMENS
0944.998	C45	68 pF/63 V	EDPU NPO	VALVO
1556.029	C46	0,01 µF/10 %/63 V	X7R 1206	
0945.021	C47	33 pF/63 V	EDPU NPO	VALVO
1083.147	C48	150 pF/63 V	EDPU N 750	VALVO
1186.078	C49	27 pF/63 V	EDPU NPO	VALVO
1083.147	C50	150 pF/63 V	EDPU N 750	VALVO
0945.188	C51	15pF/63 V	EDPU NPO	VALVO
0944.998	C52	68 pF/63 V	EDPU NPO	VALVO
0973.602	C53	3,3 µF/35 V	TAP-F	ITT
1116.207	C54	0,022 µF/40 V	EDPU K 10000	VALVO
0945.765	C55	3300 pF/63 V	EDPU K 2000	VALVO
1116.193	C56	180 pF/63 V	EDPU N 750	VALVO
1116.207	C57	0,022 µF/40 V	EDPU K 10000	VALVO
1204.521	C58	10 µF/35 V	ETQ 4	ROE
1307.053	C59	0,1 µF/50 V	CK 05 BX 104 K	SEC
1116.193	C60	180 pF/63 V	EDPU N 750	VALVO
1307.053	C61	0,1 µF/50 V	CK 05 BX 104 K	SEC
1116.207	C62	0,022 µF/40 V	EDPU K 10000	VALVO
1116.207	C63	0,022 µF/40 V	EDPU K 10000	VALVO
1307.053	C64	0,1 µF/50 V	CK 05 BX 104 K	SEC
1116.207	C65	0,022 µF/40 V	EDPU K 10000	VALVO
	C66	0,022 µF/40 V	EDPU K 10000	VALVO
	C67	0,022 µF/40 V	EDPU K 10000	VALVO
	C68	0,022 µF/40 V	EDPU K 10000	VALVO
1186.078	C69	27 pF/63 V	EDPU NPO	VALVO
0945.161	C70	22 pF/63 V	EDPU NPO	VALVO
1186.078	C71	27 pF/63 V	EDPU NPO	VALVO
1186.078	C72	27 pF/63 V	EDPU NPO	VALVO
0945.137	C73	6,8 pF/63 V	EDPU NPO	VALVO
1186.078	C74	27 pF/63 V	EDPU NPO	VALVO
1067.923	C75	220 µF/25 V	B41283-B5227 T	SIEMENS
0945.048	C76	100 µF/2 %/63 V	NPO/1 B EDPU 06	VALVO
0945.048	C77	100 µF/2 %/63 V	NPO/1 B EDPU 06	VALVO
1457.594	C78	1000 µF/6,3 V		
1204.521	C79	10 µF/35 V	ETQ 4	ROE

Diodes:

1062.131	D1		BB 139	ITT
1062.131	D2		BB 139	ITT
1062.131	D3		BB 139	ITT

Parts lists No.
97 Sa 2.155.63

-VCO-B-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1062.131	D4		BB 139	ITT
1062.131	D5		BB 139	ITT
0943.940	D7		ZPD 6,2	
0758.353	D8		ZPD 5,1	
0745.677	D9		1 N 4148	
0745.677	D10		1 N 4148	
0745.677	D11		1 N 4148	
1062.131	D12		BB 139	ITT
1465.740	D13		SD 1001 C	ITT

Resistors:

0799.300	R1	39 K 5 % 1/8 W	DIN 44052
0767.220	R2	6,8 K 5 % 1/8 W	DIN 44052
0744.808	R3	2,2 K 5 % 1/8 W	DIN 44052
0744.808	R4	2,2 K 5 % 1/8 W	DIN 44052
0179.701	R5	10 K 5 % 1/8 W	DIN 44052
0179.701	R6	10 K 5 % 1/8 W	DIN 44052
0179.701	R7	10 K 5% 1/8 W	DIN 44052
0698.172	R8	630 5 % 1/8 W	DIN 44052
0626.694	R9	47 5 % 1/8 W	DIN 44052
0179.701	R10	10 K 5 % 1/8 W	DIN 44052
0554.898	R11	470 5 % 1/8 W	DIN 44052
0530.352	R12	3,3 K 5 % 1/8 W	DIN 44052
0767.220	R13	6,8 K 5 % 1/8 W	DIN 44052
0698.172	R14	680 5 % 1/8 W	DIN 44052
0179.701	R16	10 K 5 % 1/8 W	DIN 44052
0554.898	R17	479 5 % 1/8 W	DIN 44052
0530.352	R18	3,3 K 5 % 1/8 W	DIN 44052
0767.220	R19	6,8 K 5 % 1/8 W	DIN 44052
0480.444	R20	1,5 K 5 % 1/8 W	DIN 44052
0689.172	R21	680 5 % 1/8 W	DIN 44052
0179.701	R23	10 K 5 % 1/8 W	DIN 44052
0554.898	R24	470 5 % 1/8 W	DIN 44052
0530.352	R25	3,3 K 5 % 1/8 W	DIN 44052
0179.701	R26	10 K 5 % 1/8 W	DIN 44052
0179.663	R28	270 5 % 1/8 W	DIN 44052
0542.938	R29	220 5 % 1/8 W	DIN 44052
0542.938	R30	220 5 % 1/8 W	DIN 44052
0179.639	R32	100 5 % 1/8 W	DIN 44052
0767.220	R33	6,8 K 5 % 1/8 W	DIN 44052
0179.698	R34	1 K 5 % 1/8 W	DIN 44052
0830.119	R36	27 5 % 1/8 W	DIN 44052

-VCO-B-

Parts lists No.
97 Sa 2.155.63

Ident-No.	Mark	Electr. value	Identity	Manufacturer
0542.822	R37	33 5 % 1/8 W	DIN 44052	
0830.119	R38	27 5 % 1/8 W	DIN 44052	
0179.639	R39	100 5 % 1/8 W	DIN 44052	
0767.220	R40	6,8 K 5 % 1/8 W	DIN 44052	
0179.698	R41	1 K 5 % 1/8 W	DIN 44052	
0179.639	R42	100 5 % 1/8 W	DIN 44052	
0179.639	R43	100 5 % 1/8 W	DIN 44052	
0179.639	R44	100 5% 1/8 W	DIN 44052	
0179.698	R45	1 K 5 % 1/8 W	DIN 44052	
0179.698	R46	1 K 5 % 1/8 W	DIN 44052	
0179.698	R47	1 K 5 % 1/8 W	DIN 44052	
0653.853	R48	68 5 % 1/8 W	DIN 44052	
0179.698	R49	1 K 5 % 1/8 W	DIN 44052	
0554.898	R50	470 5 % 1/8 W	DIN 44052	
0779.778	R51	18 5 % 1/8 W	DIN 44052	
0791.733	R52	15 K 5% 1/8 W	DIN44052	
0830.119	R53	27 5 % 1/8 W	DIN 44052	
0179.639	R54	100 5 % 1/8 W	DIN 44052	
0744.786	R55	18 K 5 % 1/8 W	DIN 44052	
0744.794	R56	1,2 K 5 % 1/8 W	DIN 44052	
0179.698	R57	1 K 5 % 1/8 W	DIN44052	
0554.898	R58	470 5 % 1/8 W	DIN 44052	
0830.119	R59	27 5 % 1/8 W	DIN 44052	
0179.639	R60	100 5 % 1/8 W	DIN 44052	
0791.733	R61	15 K 5 % 1/8 W	DIN 44052	
0745.782	R62	1,8 K 5 % 1/8 W	DIN 44052	
0767.204	R63	22 K 5 % 1/8 W	DIN 44052	
0767.204	R64	22 K 5 % 1/8 W	DIN 44052	
0767.204	R65	22 K 5 % 1/8 W	DIN 44052	
0767.204	R66	22 K 5 % 1/8 W	DIN 44052	
0767.204	R67	22 K 5 % 1/8 W	DIN 44052	
0767.204	R68	22 K 5 % 1/8 W	DIN 44052	
0767.204	R69	22 K 5 % 1/8 W	DIN 44052	
0767.204	R70	22 K 5 % 1/8 W	DIN 44052	
0767.204	R71	22 K 5 % 1/8 W	DIN 44052	
0744.859	R72	330 5 % 1/8 W	DIN 44052	
1650.130	R73	22 K 5 % 0,125	RC 01	VALVO
1650.130	R74	22 K 5 % 0,125	RC 01	VALVO
0179.701	R75	10 K 5 % 1/8 W	DIN 44052	

-VCO-B-

Parts lists No.
97 Sa 2.155.63

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Coils:				
	L1	7 Wdg.	97 Bv 2.140.122	HAGENUK
1076.140	L2	10 µH	10 µH 72.00	JAHRE
	L3	7 Wdg.	97 Bv 2.140.122	HAGENUK
1076.140	L4	10µH	10 µH 72.00	JAHRE
	L5	6 Wdg.	97 Bv 2.140.123	HAGENUK
1076.140	L6	10 µH	10 µH 72.00	JAHRE
0955.779	L7	0,22 µH	0,22 µH 72.00	JAHRE
0955.779	L8	0.22 µH	0,22 µH 72.00	JAHRE
0955.779	L9	0,22 µH	0,22 µH 72.00	JAHRE
1427.105	L10	82 µH	82 µH 72.00	JAHRE
1427.105	L11	82 µH	82 µH 72.00	JAHRE
1076.140	L12	10 µH 10 %	10 µH 72.00	JAHRE
1468.995	L13	5 Wdg.	97 E 2.140.66-3	HAGENUK
1469.002	L14	8 Wdg.	97 E 2.140.66-4	HAGENUK
1545.337	L15	9Wdg.	97 E 2.140.65-5	HAGENUK
0745.650	L16	2000 µH	2500-42	AMPHENOL
1078.569	L17	1 µH 10 %	1 µH MICC - 1 ROK	FASTRON
1078.569	L18	1 µH 10 %	1 µH MICC - 1 ROK	FASTRON
Integrated circuits:				
1303.422	IC A		4011 B	
1427.091	IC B		7815 C ro/220	
1417.622	IC C		4046 B	RCA
1427.075	IC E		SN 74 S 00	
or				
			SN 74 S 00 N	
1381.342	IC F		SN 74 S 113 N	
1427.067	IC G		74 C 175	
or				
1464.515			CD 40175 BCN	
1427.083	IC H		78 L 05 AC	
1427.067	IC I		74 C 175	
or				
1464.515			CD40175 BCN	
1427.067	IC J		74 C 175	
or				
1464.515			CD40175 BCN	
1410.237	IC K		4049 B	
1410.237	IC L		4049 B	
1303.414	IC M		4001 BE	

Parts lists No.
97 Sa 2.155.63

-VCO-B-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1410.237	IC N		4049 B	
0973.521	IC O		4017 AE	
1120.433	IC P		SN 74 LS 192	
1120.433	IC Q		SN 74 LS 192	
1120.433	IC R		SN 74 LS 192	
1120.441	IC S		SN 74 LS 10	
1186.787	IC T		SN 74 LS 74	

Transistors:

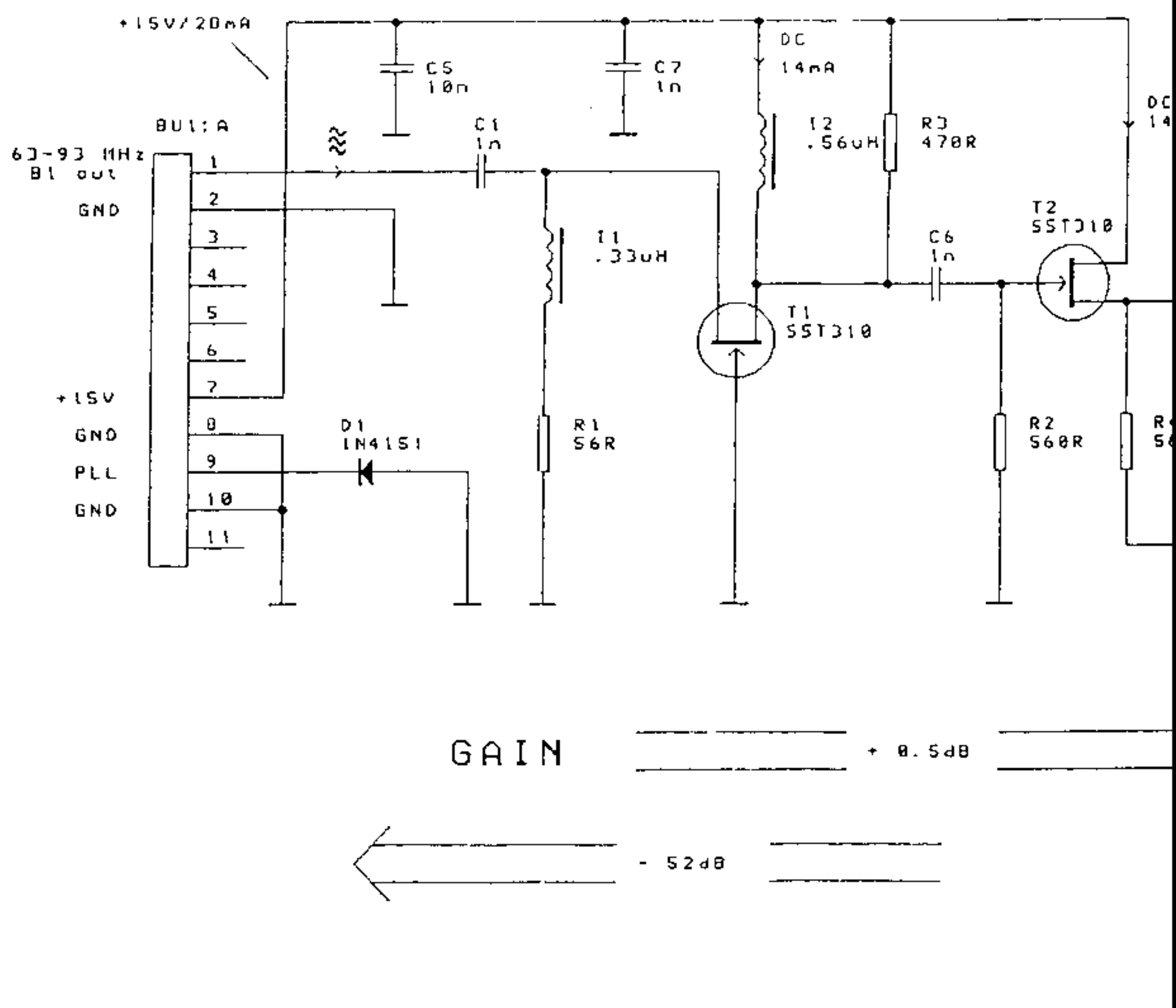
1238.949	T1		BF 246 B	
1233.949	T2		BF 246 B	
1291.033	T3		BC 549 B	
1238.949	T4		BF 246 B	
1291.033	T5		BC 549 B	
1238.949	T6		BF 246 B	
1238.949	T7		BF 246 B	
1291.033	T8		BC 549 B	
1238.949	T9		BF 246 B	
1717.499	T10		BF 246 B	
1717.499	T11		BF 246 B	
1025.015	T12		BF 199	
1025.015	T13		BF 199	
1291.033	T14		BC 549 B	
1291.033	T15		BC 549 B	
1168.207	T16		2 N 3866 A	MOTOROLA
1291.033	T17		BC 549 B	

Connectors:

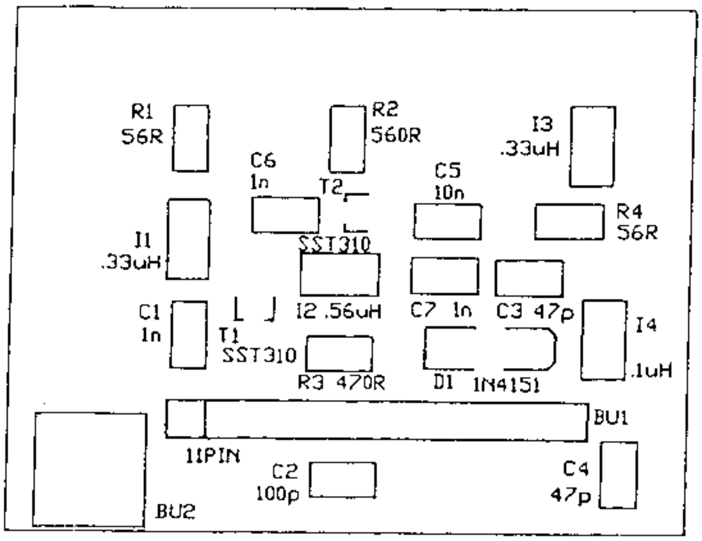
1288.814	St1	11 pins	5.11.021007.011.00	ODU
1422.693	St2		R 114665	RADIALL
1422.693	St3		R 114665	RADIALL
1478.397	St4		RTM 12 H 629	BURKLIN
1478.397	St5		RTM 12 H 629	BURKLIN
1290.513	Bu1	11 pins	5.17.020.008.011.00	ODU
1189.743	Bu2	16 pins	DIL B 16-P108	BURNDY

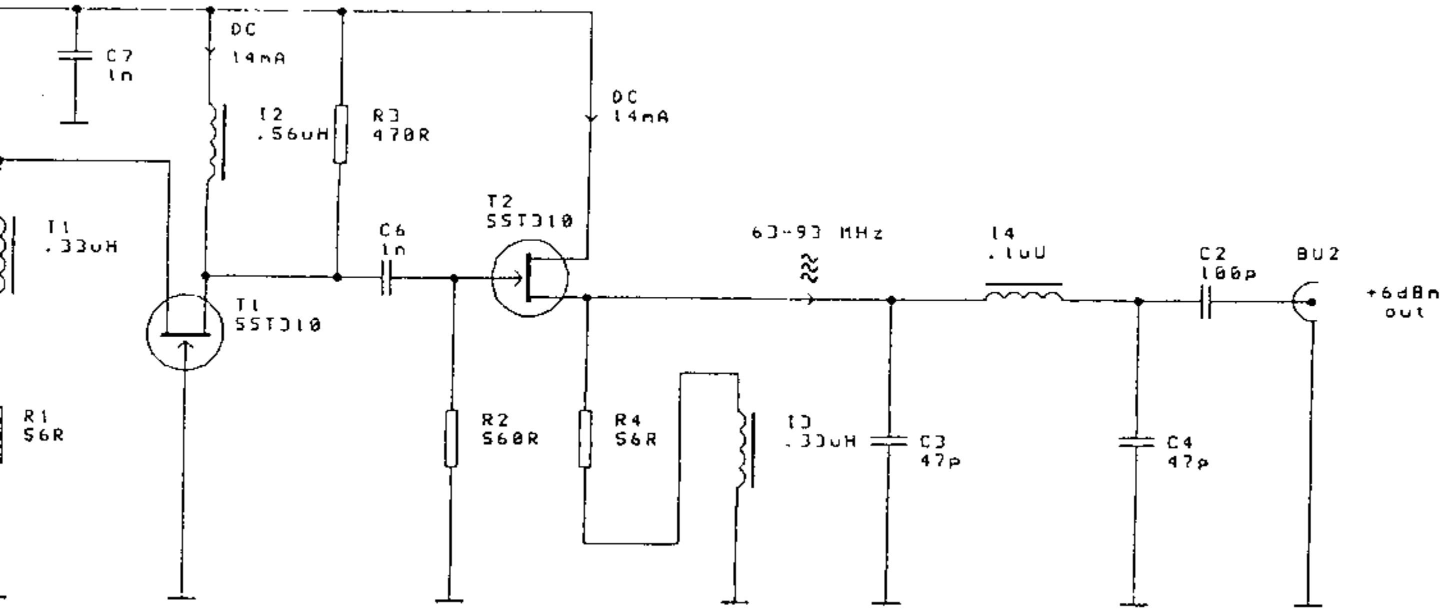
Supplements:

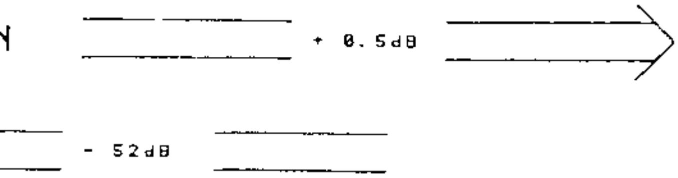
1078.577	M1	IE 500	IE	



+15V/20mA
BU1:A
63-93 MHz
B1 out
GND
+15V
GND
PLL
GND
1
2
3
4
5
6
7
8
9
10
11
C5
10n
C7
1n
C1
1n
DC
14mA
L2
.56uH
R3
470R
L1
.33uH
T1
SST310
C6
1n
T2
SST310
D1
1N4151
R1
56R
R2
560R
GAIN
+ 0.5dB
- 52dB







VCO-B2
Circuit Diagram
and Layout

-BFO-

Technical description

The principal function of this circuit is to mix the receiver IF into the AF range. For this purpose the beat frequency oscillator (BFO) is used as a variable mixing oscillator.

The heart of the circuit is the phase-locked loop (PLL), consisting of a voltage-controlled oscillator (VCO), a frequency divider (prescaler), a programmable frequency divider, a phase comparator and a loop filter. The VCO centre frequency is 49.985 MHz and is divided by divider IC - A down to a frequency which can be handled by the PLL-IC. Both this input signal and the reference frequency of 100 kHz are divided down by IC A and compared with each other. The reference frequency in this case is 100 Hz and this is therefore the step spacing of the VCO. The VCO output signal is fed to a 1:5 frequency divider which can be switched in and out of circuit and a fixed 1:2 frequency divider. The signal is amplified by a driver with adjustable output level and then passed through a low-pass filter. The software sets the address and data lines to high in modes in which the BFO is not required. Because all these lines are AND-connected by IC-K, the BFO is switched off by IC -C. The precise reference frequency required by the PLL is derived from a 10 MHz temperature-compensated crystal oscillator (TCXO) or an external 1 MHz frequency standard. The TCXO signal is designed to be blocked as soon as an exteral reference standard is present at the necessary level (IC D, E).

The two signal paths are connected together by an EXOR-circuit (IC E), the TCXO signal is divided by a factor of 10 and the external reference signal is used directly. The 100 kHz reference is obtained by dividing the 1 MHz signal by 10 (IC F). Further dividers then produce the reference frequencies of 10 kHz for VCO A (1:10 divider, IC H) and 25 kHz for VCO B (1:4 divider, IC H).

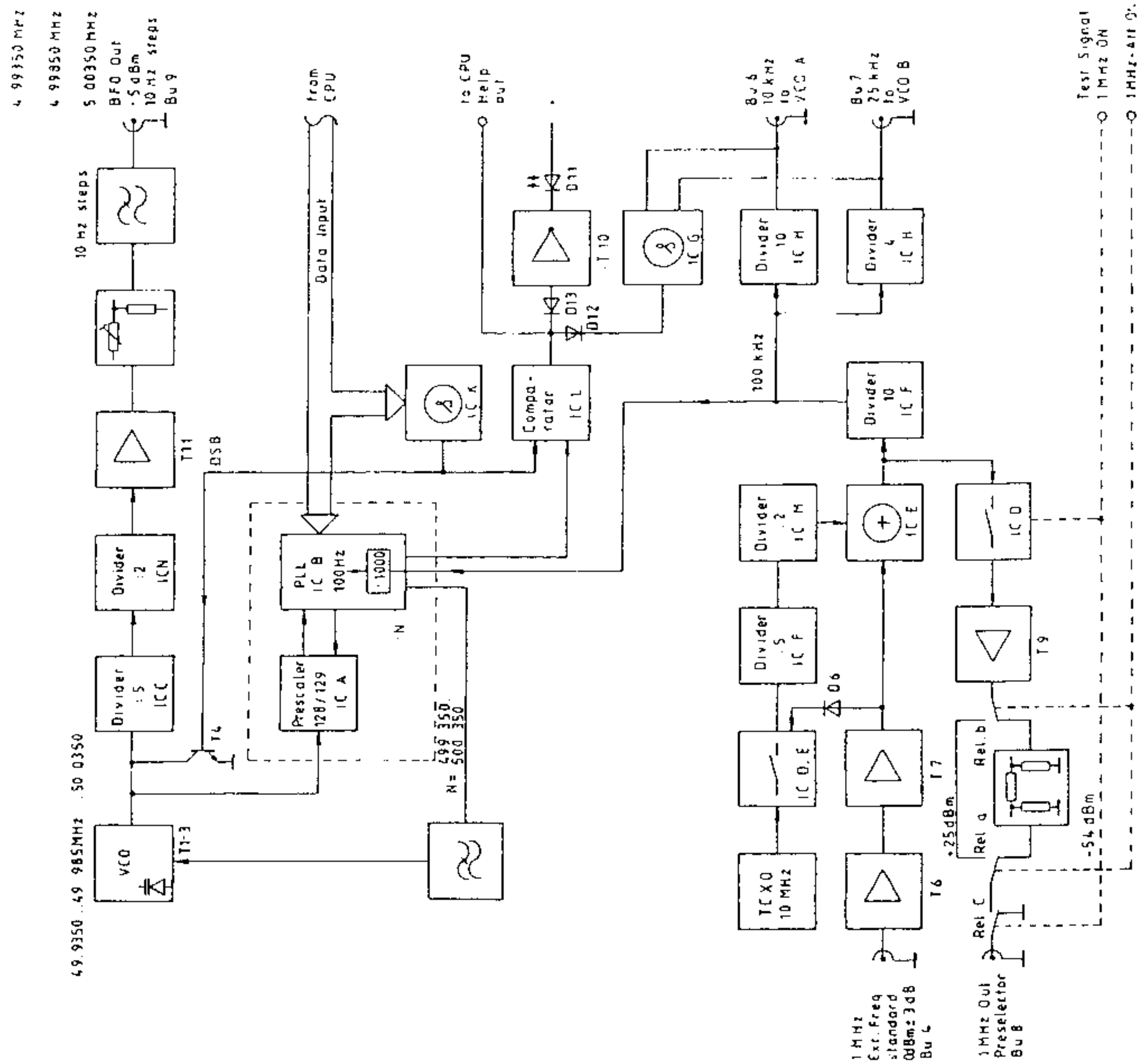
The BITE facility allows all important circuit components to be tested. It checks that the PLL is locked and that the reference frequencies for VCOs A and B are present. If these items are correct, an LED illuminates on the rear of the cassette and a signal is also given to the HELP-OUT line. If the BFO is malfunctioning, the HELP-OUT line is pulled to ground (St 4/1).

- Monitoring of reference frequencies for VCO A and B:
  The two signals are rectified and combined by an AND gate. If one of the two signals is absent, the gate output switches to LOW and pulls the HELP- OUT line to earth via D 12.

- Monitoring of locked condition of the VCO:
  IC TBB 146 (IC B) has a lock detector output (pin 13) whereby the locked condition can be recognized. In the out-of lock state, pulses appear at this output and are narrower the closer the output frequency matches the ref frequency or the closer the divided-down VCO frequency approaches the reference frequency (100 Hz). The mark/space ratio becomes larger and larger until eventually the voltage of the lock detector output goes completely to "high" in the locked condition. This signal is integrated for further evaluation - i. e., a DC voltage proportional to the mark/space ratio is obtained from the sampled signal. This is compared in the comparator (IC L) with an internal reference voltage and signalled via the HELP line and displayed visually by the LED (D11) on the rear of the cassette.

BITE test signal
This part of the circuit generates the 1 MHz test signal for the receiver. It consists of a switching transistor (T 9) and an attenuator which can be switched into circuit. The various functions are controlled via two lines: 1 MHz ON and 1 MHz ATT. ON. The signal is switched ON or OFF via the 1 MHZ ON line (IC D, relay C) and the attenuator is connected or by passed by the 1 MHz ATT. ON line (relays A and B).

-BFO-



Blockdiagram BFO

Test and alignment instructions (BFO - VCO)

Required: circuit diagram BFO - HAGENUK Drawing No. 97 Sa B 2.155.50
frequency counter, spectrum analyser, power supply

Test configuration: The BFO module is removed, the cassette is opened and the BFO - VCO is removed from the BFO board.

Testing the BFO-VCO

Connect the BFO-VCO board plug ST 5 pin 2 to earth
ST 5 pin 6 to +12 V
ST 5 pin 1 to frequency counter/spectrum analyser

Measuring the current consumption

Test values: specified < 50 mA

Tuning range of VCO

Connect a voltage of +2.5 V to plug ST 5 pin 11.

Test values:

The VCO frequency should be 50 MHz ± 10 kHz (it can be trimmed with C 3). Vary the voltage on plug St 5 pin 11 from +1 V to +4 V.

Test values:

The frequency change of the VCO should be > 100 Hz and the output level should be > 4 dBm.

-BFO-

Test and alignment instructions

Required: Circuit diagram BFO - HAGENUK Drawing No. 97 Sa B 2.155.50 spectrum analyser, frequency counter

Test configuration: The BFO module is removed and cassette cover is taken off. The module is reconnected to the receiver by means of the service adapter.

Test the TCXO
Connect the frequency counter to MP 15.
Test values:
The output frequency should be 10 MHz ± 3 Hz (the frequency can be trimmed by internal trimmer or external potentiometer if fitted.
Test values:

Frequency at	MP 9 should be	2 MHz
	MP 10 should be	1 MHz
	MP 11 should be	100 kHz

Disconnect plug ST 4 pins 2 and 3. Connect the spectrum analyser to socket Bu 8, 1 MHz OUT. Connect plug ST 4 pin 3 to HIGH level (1MHz ON).
Connect plug ST 4 pin 2 to HIGH (1 MHz ATT. ON)
Test values:
Output level on socket Bu 8 should be -54 dBm ± 1 dB
connect plug ST 4 pin 2 to LOW level (1 MHz ATT.OFF)
Test values;
Output level on socket Bu 8 should be +25 dBm ± 1 dB
Connect plug ST 4 pin 3 to LOW level.
Test values:
Functional test: no 1 MHz signal on socket Bu 8.

Testing the BFO frequency
Select module A1A on receiver; BFO offset 0.00 kHz.
Measure output signal on socket Bu 9 (50 Ohm termination).

Test values:
Specified: f_{out} 4.9985 MHz, P_{out} -5 dBm ± 1 dB.
Vary frequency offset from -5.00 kHz to +5.00 kHz on BFO knob.
Test values:
Functional test: the output frequency must track the frequency offset.

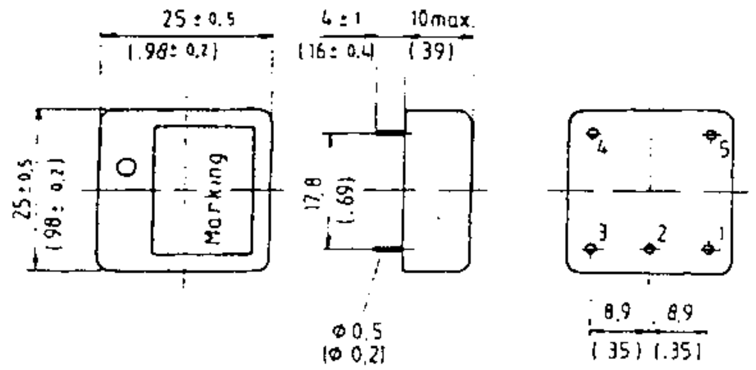
-BFO-

1.	Output frequency		f_0 = 10.000 MHz
2.	Frequency stability vs temperature	0^oC to + 70^oC	$\Delta f/f \leq \pm 0,5 \times 10^{-6}$
3.	Frequency stability vs temperature	- 15^oC to + 75^oC	$\Delta f/f \leq \pm 1 \times 10^{-6}$
4.	Frequency stability vs aging		$\Delta f/f \leq \pm 1 \times 10^{-6}$/year
4.2	Frequency stability vs supply voltage		$\Delta f/f \leq \pm$ 0,3 ppm/$\pm$ 5%
5.	Supply voltage		U_B = 18 V $\pm$ 5%
6.	Dissipation current		$I_B \leq$ 10 mA
7.	Output voltage		U_{out} ≙ TTL Low Power
8.	Open collector: Load		R_L = 470 Ω to+5V, parallel 74 LS 08
9.	Frequency adjustment with internal trimmer Or less: In case it is possible over a period of ten years to compensate the frequency drift because of aging and external, potentiometer 2,2 kΩ		$\Delta f/f \geq \pm 3 \times 10^{-6}$
10.	Suppression of spurious frequencies (except harmonics)		< 80 dB

11. Vibration

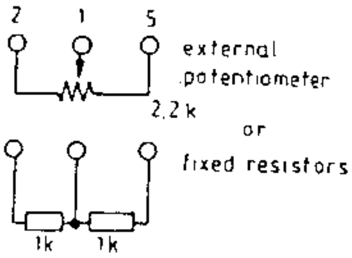
Frequency	Amplitude
0...12.5 Hz	3.2 mm
12.5...25 Hz	0,76 mm
25...50 Hz	0,2 mm

12.	Shock	800 g, 1 ms, 1/2sinus, all directions
13.	Storage temperature	-40 ....+ 85^oC
14.	Humidity	75% for 60 days
15.	Dimension and pin connections	



Pin connection

1-2-5 freq adj
3 +V
4 output
5 GND to case

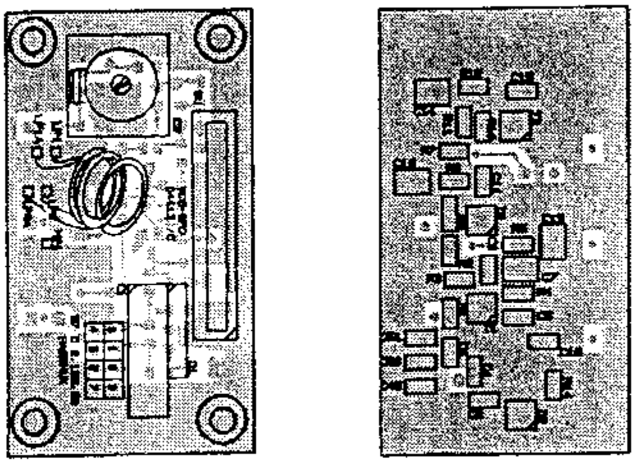


16. Label: 10 MHz, 97 E 2.155.52-3, 742 - week / year / production

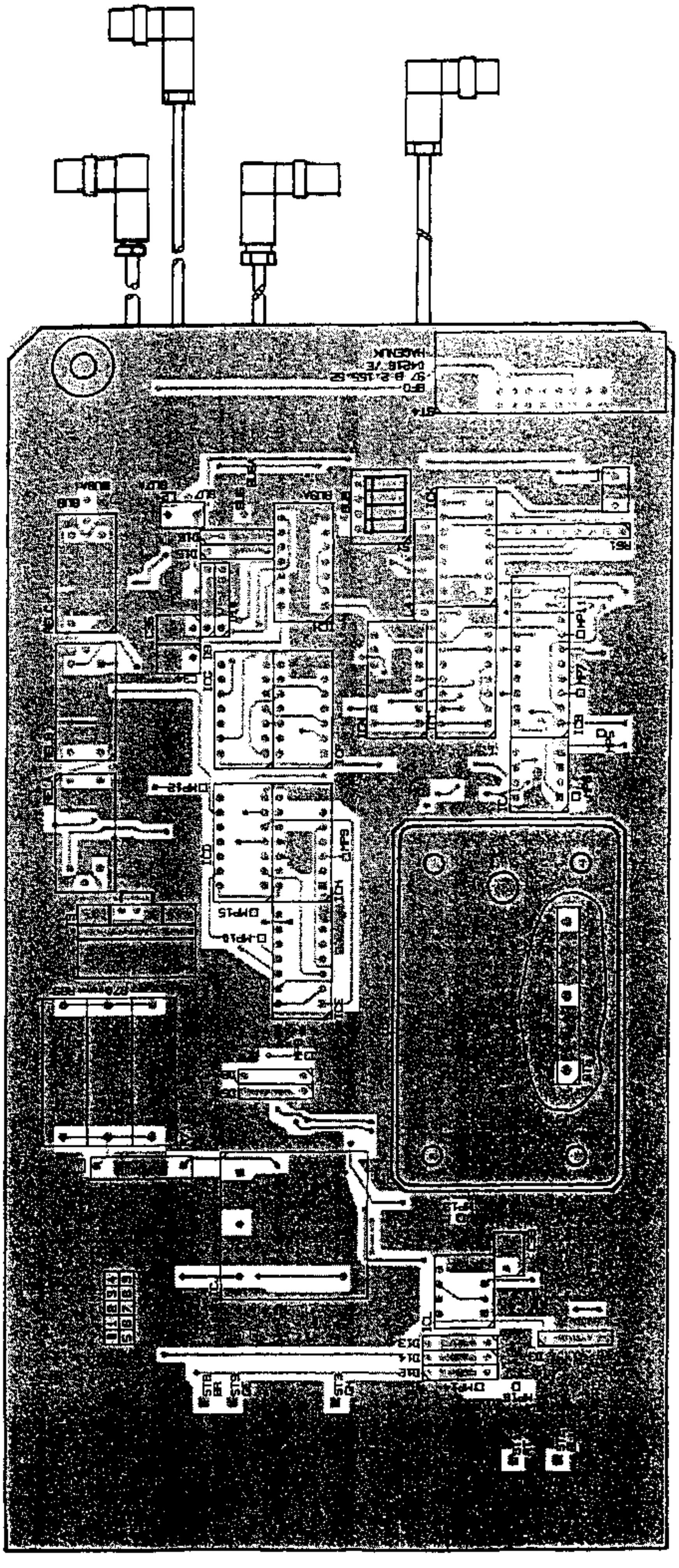
10 MHz TCXO drawing No. 97 E 2.155.52-3

-BFO-

see circuit diagram - BFO 97 Sa C.2155.50/50 B

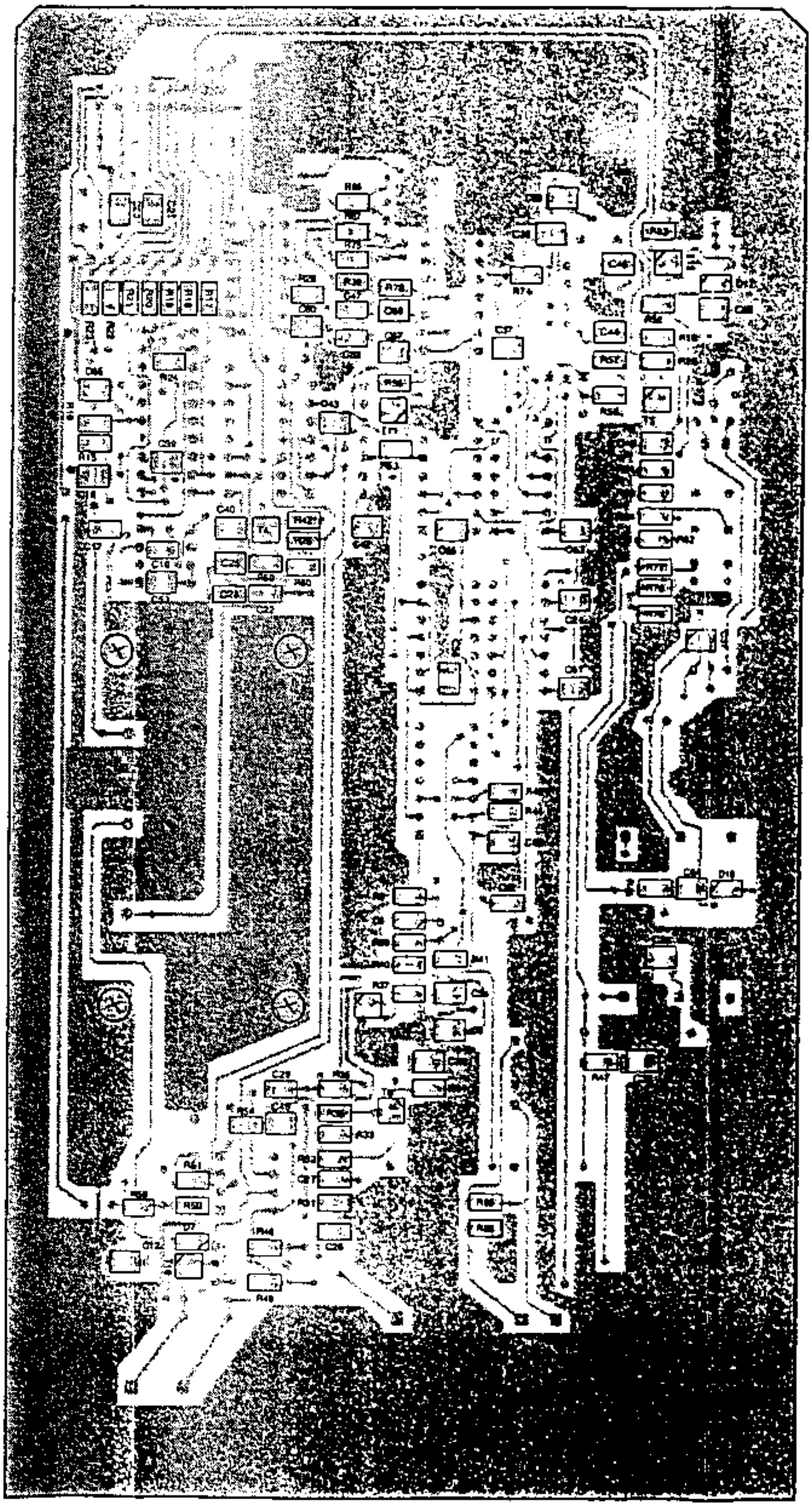


BFO-VCO - 97 E 2.155.53

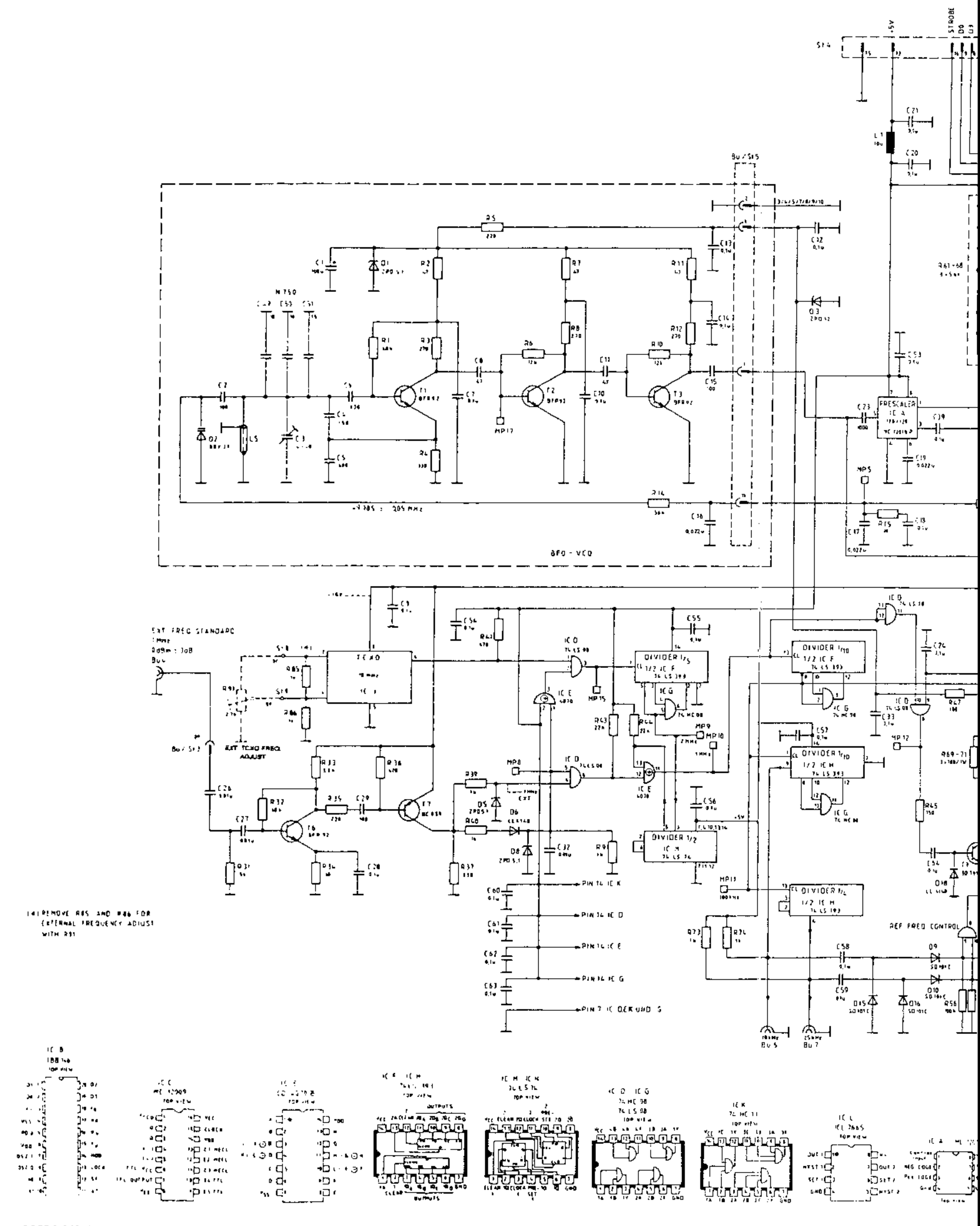


HAG/ROD 015-04 93

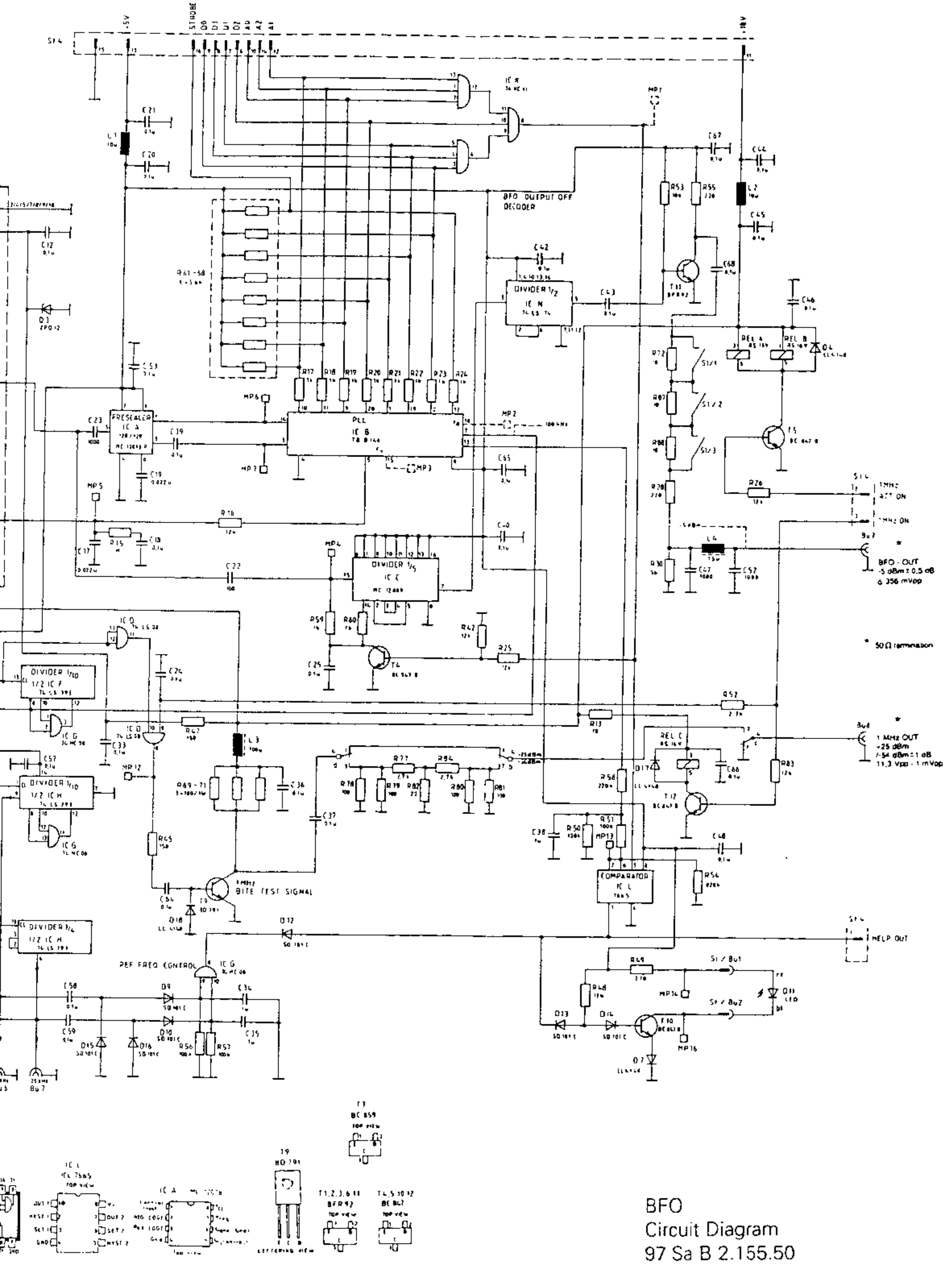
see circuit diagram - BFO 97 Sa B 2.155.50



Printed Circuit Board
BFO
97 E 2.155.52



HAG/ROD 016-08 92



BFO
Circuit Diagram
97 Sa B 2.155.50

Parts lists No.
97 Sa 2.155.50

-BFO-PCB-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Capacitors:				
1692.070	C1	100 µ/20/10 V		ELKO
1646.958	C2	100/5/63 V	0805	VALVO
1826.530	C3	4-40	Bestnr. 119390104	DAU
1646.842	C4	150/5/63 V	0805	VALVO
1643.991	C5	680/5/63 V	2x1, 25x1, 27	VALVO
1647.784	C6	330/5/63 V	0805	VALVO
1646.990	C7	0,1 µ/10/63 V	1210	VALVO
1643.932	C8	47/5/63 V	2x1, 25x0,5/0,7	VALVO
1646.990	C9	0,1 µ/10/63 V	1210	VALVO
1646.990	C10	0,1 µ/10/63 V	1210	VALVO
1643.932	C11	47/5/63 V	2x1, 25x0,5/0,7	VALVO
1646.990	C12	0,1 µ/10/63 V	1210	VALVO
1646.990	C13	0,1 µ/10/63 V	1210	VALVO
1646.990	C14	0,1 µ/10/63 V	1210	VALVO
1646.958	C15	100/5/63 V	0805	VALVO
1646.931	C16	0,022 µ/10/63 V	0805	VALVO
1646.931	C17	0,022 µ/10/63 V	0805	VALVO
1646.990	C18	0,1 µ/10/63 V	1210	VALVO
1646.931	C19	0,022 µ/10/63 V	0805	VALVO
1646.990	C20	0,1 µ/10/63 V	1210	VALVO
1646.990	C21	0,1 µ/10/63 V	1210	VALVO
1646.958	C22	100/5/63 V	0805	VALVO
1646.885	C23	1000/5/63 V	0805	VALVO
1646.990	C24	0,1 µ/10/63 V	1210	VALVO
1546.990	C25	0,1 µ/10/63 V	1210	VALVO
1556.029	C26	0,01 µ/10/63 V	1206	VALVO
1556.029	C27	0,01 µ/10/63 V	1206	VALVO
1646.990	C28	0,1 µ/10/63 V	1210	VALVO
1646.958	C29	100/5/63 V	0805	VALVO
1556.029	C32	0,01 µ/10/63 V	1206	VALVO
1646.990	C33	0,1 µ/10/63 V	1210	VALVO
1469.053	C34	1 µ MKS	R 5	WIMA
1469.053	C35	1 µ MKS	R 5	WIM A
1646.990	C36	0,1 µ/10/63 V	1210	VALVO
1646.990	C37	0,1 µ/10/63 V	1210	VALVO
1469.053	C38	1 µ MKS	R 5	WIMA
1646.990	C39	0,1/10/63 V	1210	VALVO
1646.990	C40	0,1/10/63 V	1210	VALVO
1646.990	C42	0,1/10/63 V	1210	VALVO
1646.990	C43	0,1/10/63 V	1210	VALVO
1646.990	C44	0,1/10/63 V	1210	VALVO
1646.990	C45	0,1/10/63 V	1210	VALVO

-BFO-PCB-

Parts lists No.
97 Sa 2.155.50

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1646.990	C46	0,1/10/63 V	1210	VALVO
1646.885	C47	1000/5/63 V	0805	VALVO
1646.990	C48	0,1/10/63 V	1210	VALVO
	C49	10/5/63 V N750	0805	VALVO
	C50	10/5/63 V N750	0805	VALVO
	C51	15/5/63 V N750	0805	VALVO
1646.885	C52	1000/5/63 V	0805	VALVO
1646.990	C53	0,1/10/63 V	1210	VALVO
1646.990	C54	0,1/10/63 V	1210	VALVO
1646.990	C55	0,1/10/63 V	1210	VALVO
1646.990	C56	0,1/10/63 V	1210	VALVO
1646.990	C57	0,1/10/63 V	1210	VALVO
1646.990	C58	0,1/10/63 V	1210	VALVO
1646.990	C59	0,1/10/63 V	1210	VALVO
1646.990	C60	0,1/10/63 V	1210	VALVO
1646.990	C61	0,1I10/63 V	1210	VALVO
1646.990	C62	0,1/10/63 V	1210	VALVO
1646.990	C63	0,1/10/63 V	1210	VALVO
1646.990	C64	0,1/10/63 V	1210	VALVO
1646.990	C65	0,1/10/63 V	1210	VALVO
1646.990	C66	0,1/10/63 V	1210	VALVO
1646.990	C67	0,1/10/63 V	1210	VALVO
1646.990	C68	0,1/10/63 V	1210	VALVO

Integrated circuits:

1710.605	IC A		MC 120 18 P	MOTOROLA
1826.425	IC B		TB B 146	SIEMENS
1865.323	IC C		MC 120 09	MOTOROLA
1398.393	IC D		74 LS 08 N	
1336.193	IC E	4070 BF		
1570.676	IC F	74 LS 393 P		
1665.030	IC G	74 NC 08		
1570.676	IC H	74 LS 393 P		
1847.740	IC J	TCXO 10 MHz	97 E 2.155.52-3	
1878.069	IC K	74 HC 11		TEXAS
1630.180	IC L	L 7665 PA		
1653.172	IC M	74 LS 74		
1653.172	IC N	74 LS 74		

Parts lists No.
97 Sa 2.155.50

-BFO-PCB-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Diodes:				
0758.353	D1		ZPD 5,1	
1652.478	D2		BBY 31	
0922.684	D3		ZPD 12	
1613.162	D4		LL 4148	
0758.353	D5		ZPD 5,1	
1613.162	D6		LL 4148	
1613.162	D7		LL 4148	
0758.353	D8		ZPD 5,1	
1465.740	D9		SD 101	
1465.740	D10		SD 101	
1465.121	D11		LED TLUR 5400	
1465.740	D12		SD 101	
1465.740	D13		SD 101	
1465.740	D14		SD 101	
1465.740	D15		SD 101	
1465.740	D16		SK 101	
1613.162	D17		LL 4148	
1613.162	D18		LL 4148	
Coils:				
1500.678	L1	10 µH		NEOSID
1500.678	L2	10 µH		NEOSID
0747.572	L3	100 µH		JAHRE
1068.164	L4	1,5 µH		JAHRE
1824.341	L5			97 E 2.155.53-3
Relays:				
1249.053	Rel A		RS 16 V	SDS
1249.053	Rel B		RS 16 V	SDS
1249.053	Rel C		RS 16 V	SDS
Resistors:				
1612.964	R1	68 K-5-0,125 W	3,2 x 1,6 x 0,58	
1647.180	R2	47 K-5-0,125 W	3,2 x 1,6 x 0,58	
1612.875	R3	270 K-5-0,125 W	3,2 x 1,6 x 0,58	
1643.363	R4	330-5-0,125 W	3,2 x 1,6 x 0,58	

Parts lists No.
97 Sa 2.155.50

-BFO-PCB-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1612.859	R5	100-5-0,125 W	3,2 x 1,6 x 0,58	
1647.202	R6	12 K-5-0,125 W	3,2 x 1,6 x 0,58	
1647.180	R7	47 K-5-0,125 W	3,2 x 1,6 x 0,58	
1612.875	R8	270 K-5-0,125 W	3,2 x 1,6 x 0,58	
1643.460	R9	1 K-5-0,125 W	3,2 x 1,6 x 0,58	
1647.202	R10	12 K-5-0,125 W	3,2 x 1,6 x 0,58	
1647.180	R11	47 K-5-0,125 W	3,2 x 1,6 x 0,58	
1612.875	R12	270 K-5-0,125 W	3,2 x 1,6 x 0,58	
1672.738	R13	10 K-5-0,125 W	3,2 x 1,6 x 0,58	
1647.156	R14	56 K-5-0,125 W	3,2 x 1,6 x 0,58	
1555.987	R15	1 M-5-0,125 W	3,2 x 1,6 x 0,58	
1647.202	R16	12 K-5-0,125 W	3,2 x 1,6 x 0,58	
1643.460	R17	1 K-5-0,125 W	3,2 x 1,6 x 0,58	
1643.460	R18	1 K-5-0,125 W	3,2 x 1,6 x 0,58	
1643.460	R19	1 K-5-0,125 W	3,2 x 1,6 x 0,58	
1643.460	R20	1 K-5-0,125 W	3,2 x 1,6 x 0,58	
1643.460	R21	1 K-5-0,125 W	3,2 x 1,6 x 0,58	
1643.460	R22	1 K-5-0,125 W	3,2 x 1,6 x 0,58	
1643.460	R23	1 K-5-0,125 W	3,2 x 1,6 x 0,58	
1643.460	R24	1 K-5-0,125 W	3,2 x 1,6 x 0,58	
1647.202	R25	12 K-5-0,125 W	3,2 x 1,6 x 0,58	
1647.202	R26	12 K-5-0,125 W	3,2 x 1,6 x 0,58	
1612.875	R28	270-5-0,125 W	3,2 x 1,6 x 0,58	
1878.050	R30	56-5-0,125 W	3,2 x 1,6 x 0,58	
1878.050	R31	56-5-0,125 W	3,2 x 1,6 x 0,58	
1612.964	R32	68 K-5-0,125 W	3,2 x 1,6 x 0,58	
1649.094	R33	3,3 K-5-0,125 W	3,2 x 1,6 x 0,58	
1650.238	R34	68-5-0,125 W	3,2 x 1,6 x 0,58	
1612.859	R35	220-5-0,125 W	1,5 x 3,5	
1704.621	R36	470-5-0,125 W	3,2 x 1,6 x 0,58	
1643.398	R37	330-5-0,125 W	1,5 x 3,5	
1643.460	R39	1 K-5-0,125 W	3,2 x 1,6 x 0,58	
1643.460	R40	1 K-5-0,125 W	3,2 x 1,6 x 0,58	
1704.621	R41	470 Ohm-5-0,125 W	3,2 x 1,6 x 0,58	
1647.202	R42	12 K-5-0,125 W	3,2 x 1,6 x 0,58	
1650.130	R43	22 K-5-0,125 W	3,2 x 1,6 x 0,58	
1650.130	R44	22 K-5-0,125 W	3,2 x 1,6 x 0,58	
1760.017	R45	150 K-5-0,125 W	3,2 x 1,6 x 0,58	
1866.540	R47	180 K-5-0,125 W	3,2 x 1,6 x 0,58	
1647.202	R48	12 K-5-0,125 W	3,2 x 1,6 x 0,58	
1612.875	R49	270 K-5-0,125 W	3,2 x 1,6 x 0,58	
1709.127	R50	120 K-5-0,125 W	3,2 x 1,6 x 0,58	
1612.980	R51	100 K-5-0,125 W	3,2 x 1,6 x 0,58	
1643.525	R52	2,2 K-5-0,125 W	3,2 x 1,6 x 0,58	

Parts lists No.
97 Sa 2.155.50

-BFO-PCB-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1612.948	R53	10 K-5-0,125 W	3,2 x 1,6 x 0,58	
1785.346	R54	820 K-5-0,125 W	3,2 x 1,6 x 0,58	
1643.363	R55	330 K-5-0,125 W	3,2 x 1,6 x 0,58	
1612.980	R56	100 K-5-0,125 W	3,2 x 1,6 x 0,58	
1612.980	R57	100 K-5-0,125 W	3,2 x 1,6 x 0,58	
1613.006	R58	220 K-5-0,125 W	3,2 x 1,6 x 0,58	
1643.460	R59	1 K-5-0,125 W	3,2 x 1,6 x 0,58	
1643.460	R60	1 K-5-0,125 W	3,2 x 1,6 x 0,58	
1595.695	R61			
1595.695	R62			
1595.695	R63			
1555.695	R64		network 5,6 K	
1595.695	R65			
1595.695	R66			
1595.695	R67			
1595.695	R68			
0793.507	R69	180-5-0,8-0719	DIN 44052-6	
0793.507	R70	180-5-0,8-0719	DIN 44052-6	
0793.507	R71	180-5-0,8-0719	DIN 44052-6	
1672.738	R72	1 K-5-0,125 W	3,2 x 1,6 x 0,58	
1643.460	R73	1 K-5-0,125 W	3,2 x 1,6 x 0,58	
1643.460	R74	1 K-5-0,125 W	3,2 x 1,6 x 0,58	
1647.431	R77	2,7 K-5-0,125 W	3,2 x 1,6 x 0,58	
1647.105	R78	100 K-5-0,125 W	3,2 x 1,6 x 0,58	
1647.105	R79	100-5-0,125 W	3,2 x 1,6 x 0,58	
1647.105	R80	100-5-0,125 W	3,2 x 1,6 x 0,58	
1647.105	R81	100-5-0,125 W	3,2 x 1,6 x 0,58	
1709.054	R82	27-5-0,125 W	3,2 x 1,6 x 0,58	
1647.202	R83	12 K-5-0,125 W	3,2 x 1,6 x 0,58	
1647.431	R84	2,7 K-5-0,125 W	3,2 x 1,6 x 0,58	
1643.460	R85	1 k-5-0,125 W	3,2 x 1,6 x 0,58	
1643.460	R86	1 k-5-0,125 W	3,2 x 1,6 x 0,58	
1672.738	R87	10-5-0,125 W	3,2 x 1,6 x 0,58	
1672.738	R88	10-5-0,125 W	3,2 x 1,6 x 0,58	
	R91	2,7 k/20	Lin D 13 C 61 CK/P 9	DRA

Switches:

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1315.293	S1/1 S1/2 S1/3		Nr.435166-2	AMP

Parts lists No.
97 Sa 2.155.50

-BFO-PCB-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Transistors:				
1647.385	T1		BFR 92	MOTOROLA
1647.385	T2		BFR 92	MOTOROLA
1647.385	T3		BFR 92	MOTOROLA
1647.393	T4		BC 847 B	VALVO
1647.393	T5		BC 847 B	VALVO
1647.385	T6		BFR 92	MOTOROLA
1740.520	T7		BC 859 B	VALVO
1826.522	T9		BD 971	MOTOROLA
1647.393	T10		BC 847 B	VALVO
1647.385	T11		BFR 92	MOTOROLA
1647.393	T12		BC 847 B	VALVO

- BFO II-

Technical description

The beat frequency oscillator (BFO) cassette, in addition to the actual BFO contains the TCXO and driver stages for the reference frequency of the VCOs A and B.
A temperature compensated X-tal oscillator (TCXO) with a frequency of 10 MHz is used as a frequency standard. This frequency is divided down to 1 MHz by a :10 divider. If an external 1/10 MHz frequency standard is connected, and the level is high enough (0 dBm ± 3 dB) the external signal is selected and processed further. A 1/10 MHz ref. frequency output is also available.

NOTE
As an option frequency standards with a higher frequency accuracy can be used. (Refer to drawings 2.155.52-3B; -5; -6).

The 1 MHz signal is used either as a BITE signal for the self test or for generation of the reference frequency for the VCOs A, B and the BFO PLL. The 10 kHz reference for the VCO A is generated by twice dividing the 1 MHz frequency by :10. After the first division by :10, 100 kHz is obtained. This frequency is fed to the BFO PLL IC. The 25 kHz reference frequency for the VCO B is generated by dividing the 100 kHz frequency by a factor of 4. The BFO frequency is obtained by dividing the 50 MHz BFO - VCO frequency by a factor of 10. The exact BFO frequency is 4.9995 MHz in the A1A mode (CW) and can be adjusted by ± 5 kHz in 10 Hz steps. The 10 times VCO frequency was selected to achieve a higher reference frequency (100 Hz) and thus make possible a faster transient response of the PLL when the frequency of the BFO is changed.
The 1:10 division is accomplished by IC C (division :5 and division :2). If the BFO is not required (DSB Mode), IC C is disabled. The PLL IC (IC B) contains four important modules: a programmable divider R for the reference frequency (here conversion of 100 kHz to 100 Hz), two programmable dividers (A and N) for the VCO frequency and the phase discriminator with tristate output. The frequency of the BFO should be able to be altered from 4.9935 to 5.0035 MHz, thus the frequency of the BFO-VCO range is 49.935 to 50.035 MHz. Since the reference frequency for the phase comparator is 100 Hz, division factors of 499350 to 500350 result. The PLL IC is used in conjunction with a dual modulus prescaler. This procedure allows the use of a reference frequency, which corresponds to the channel interval (here 100 Hz), in spite of using a prescaler. For this purpose a divider N (3 ... 4096), a divider A (O ... 127) and the modulus control are integrated into the PLL (IC B).

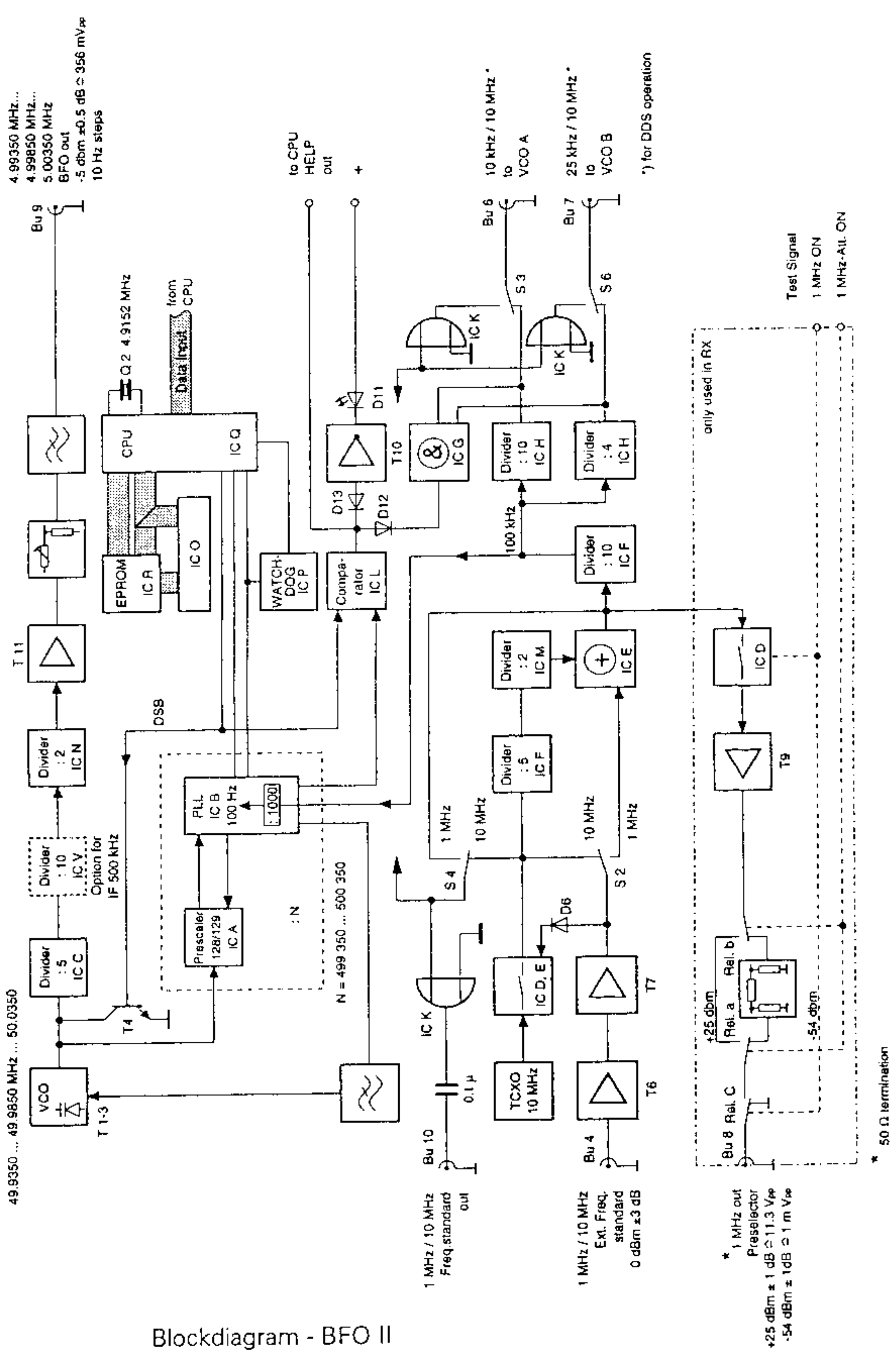
- BFO II-

The total division ratio is calculated by:

$$N_T = N \times P + A$$

For NT = 499350 and P = 128 the division ratios are N = 3901 and A = 22. The prescaler IC A can divide, through the modulus control input (Pin 1) by 128 or 129. For the BFO II a PLL - IC is used which receives data and addresses serially from a microprocessor IC Q, in conjunction with the ICs Q, S and R. This processor is used as an interface and code converter for the information which is coming from the receiver processor.The respective division ratios of the dividers are loaded into the microprocessor by address and data lines and the STROBE signal. The passive loop filter is comprised of RC elements. The lock detect output (LD, Pin 14 IC B) is connected with the input of the comparator IC L via an RC element for integration. LD is HIGH in the locked status of the phase control loop and pulses towards LOW, when the control loop is not locked.
The 1 MHz test signal is amplified to the level of +25 dBm by the switching transistor T9. Because this signal is a square wave, it has harmonics at 1 MHz intervals. In the self test, the preselector (if fitted as an option) is tested in every filter range with these harmonics. For this purpose a frequency in every filter range is selected and the AGC voltage compared with the preselector switched on and switched off. Deviations in the AGC voltage, greater than 10 dB (maximum insertion loss of the preselector = 10 dB) indicate a fault in the preselector. The processor of the receiver can reduce the level from +25 dBm to -54 dBm by switching on an attenuator with the relays A and B. The 1st Mixer, 2nd Mixer, the Filter Board and the Demodulator are tested with this input level.
The reference frequency outputs (10 kHz, 25 kHz) for the VCOs A and B are monitored for the correct level by rectifying the voltage via D15, D16, D9 and D10 and filtering with C34 and C35. If the two frequencies are present the AND gate in IC G outputs a HIGH signal. An OR connection of the output signals in IC G and IC L is created via D12/D13. In the case of errorfree functioning of the modules T10 switches on LED D11, which is located at the back of the cassette. The HELP OUT signal (LOW = no fault) tells the microprocessor of the operating unit that the BFO module is functioning properly.

-BFO II-



Blockdiagram - BFO II

-BFO II-

Test and alignment instructions (BFO - VCO)

Required: Circuit diagram BFO II- Hagenuk Drawing No. 97 Sa B 2.155.50 B
frequency counter, spectrum analyser, power supply

Test configuration: The BFO module is removed, the cassette is opened and the BFO - VCO is removed from the BFO board.

Testing the BFO-VCO

Connect the BFO-VCO board plug ST 5 pin 2 to earth
ST 5 pin 6 to +12 V
ST 5 pin 1 to frequency counter/spectrum analyser

Measuring the current consumption

Test values: specified < 50 mA

Tuning range of VCO

Connect a voltage of +2.5 V to plug ST 5 pin 11.

Test values:

The VCO frequency should be 50 MHz ± 10 kHz (it can be trimmed with C 3). Vary the voltage on plug St 5 pin 11 from +1 V to +4 V.

Test values:

The frequency change of the VCO should be > 100 kHz and the output level should be > 4 dBm.

-BFO II-

Test and alignment instructions

Required: Circuit diagram BFO II- Hagenuk Drawing No. 97 Sa B 2.155.50 B
spectrum analyser, frequency counter

Test configuration: The BFO module is removed and cassette cover is taken off. The module is reconnected to the receiver by means of the service adapter.

Test the TCXO
Connect the frequency counter to MP 15.
Test values:
The output frequency should be 10 MHz ± 3 Hz (the frequency can be trimmed.)
Test values:

Frequency at	MP 9 should be	2 MHz
	MP 10 should be	1 MHz
	MP 11 should be	100 kHz

Disconnect plug ST 4 pins 2 and 3. Connect the spectrum analyser to socket Bu 8 (1 MHz OUT). Connect plug ST 4 pin 3 to HIGH level (1 MHz ON).
Connect plug ST 4 pin 2 to HIGH (1 MHz ATT. ON)
Test values:
Output level on socket Bu 8 should be -54 dBm ± 1 dB connect plug ST 4 pin 2 to LOW level (1 MHz ATT.OFF)
Test values:
Output level on socket Bu 8 should be +25 dBm ± 1 dB
Connect plug ST 4 pin 3 to LOW level.
Test values:
Functional test: no 1 MHz signal on socket Bu 8.

Testing the BFO frequency
Select module A1A on receiver; BFO offset 0.00 kHz.
Measure output signal on socket Bu 9 (50 Ohm termination).

Test values:
Specified: f_{out} 4.9985 MHz, P_{out} -5 dBm ± 1 dB.
Vary frequency offset from -5.00 kHz to +5.00 kHz on BFO knob.
Test values:
f_{out} - 4.9935 MHz (Deviation - 5 kHz) up to 5.0035 MHz (Deviation +5 kHz)
Functional test: the output frequency must track the frequency offset.

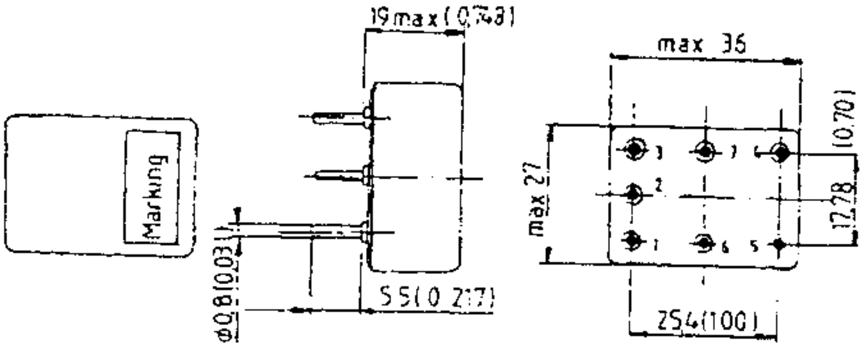
-BFO II-

TCXO

1.	Output frequency		f_0 = 10.000 MHz
2.	Frequency stability vs temperature	-20°C to +70°C	Δ f/f ≤ ± 0.5 x 10^{-6}
		-25°C to +75°C	Δ f/f ≤ ± 1 x 10^{-6}
3.	Frequency stability vs aging		Δ f/f ≤ ± 1 x 10^{-6}/year
4.	Frequency stability vs supply voltage		Δ f/f ≤ ± 0.3 ppm
5.	Supply voltage		U_B = 12V ± 10%
6.	Dissipation current		I_B ≤ 20 mA
7.	Output voltage		U_0 = 5V CMOS Compatible
8.	Frequency adjustment with external trimmer in any case it must be possible to compensate the frequency drift because of aging over a period of ten years.		Δ f/f ≥ ± 5 x 10^{-6}
9.	Suppression of spurious frequencies (except harmonics)		< 80 dB
10.	Vibration		
11.	Shock		50g. 6ms, 1/2 sinus, all directions
12.	Storage temperature		-40...+85°C
13.	Humidity		75 % for 60 days
14.	Dimension and pin connections		

Vibration:

Frequency	Amplitude
0...12.5 Hz	3.2 mm
12.5...25 Hz	0.76 mm
25...50 Hz	0.2 mm

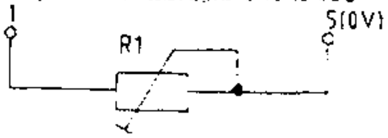


PIN CONNECTIONS

1: freq. adjust
2: V ref.
3: +supply
4: output
5: GND
6: nc
7: nc

FREQUENCY ADJUST

By external resistor R1: 0 to 10 kΩ



all Dimensions in mm (inches)

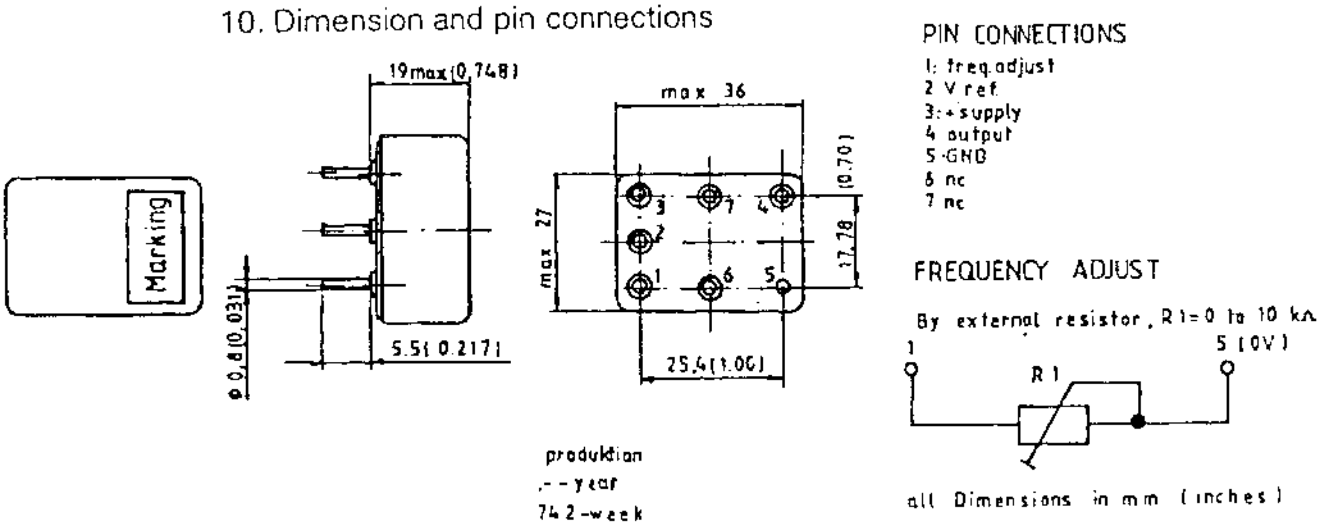
15. Label of marking 10 MHz, 97 E 2.155.53-3B

BFO II specification of 10 MHz TCXO Drawing No. 2.155.52-3 B

-BFO II-

D-TCXO

1. Output frequency — f_0 = 10.000 MHz
2. Frequency stability
   vs temperature -20°C to +70°C — $\Delta f/f \leq \pm 0.3 \times 10^{-6}$
3. Frequency stability vs aging — $\Delta f/f \leq \pm 1 \times 10^{-6}$/1st year
   $\leq \pm 0.5 \times 10^{-6}$/following years
4. Frequency stability vs supply voltage — $\Delta f/f \leq \pm 1 \times 10^{-7}$
5. Power supply requirements
   Input voltage — U_B = 12 V ± 10 %
   Power drain — P_D < 200 mW
6. Output voltage — U_0 = 5 V CMOS compatible
7. Frequency adjustment with external resistor 0-10 K Ω. In any case it must be possible to compensate the frequency drift because of aging over a period of ten years. — $\Delta f/f \geq \pm 5 \times 10^{-6}$
8. Suppression of spurious frequencies (except harmonics) — < 80 dB
9. Environment
   Storage temperature — -60 to + 125 °C
   Vibrations — MIL-STD 810 C, meth.514,I,curve J (5-2000Hz max. 5g)
   Shocks — MIL-STD 202,meth 213 B,cond. K
   Pressure — MIL-STD 202,meth 105,C.cond. B (down to 11.7 kN/m²)
   Humidity — 95 % rel. at 65°C
10. Dimension and pin connections



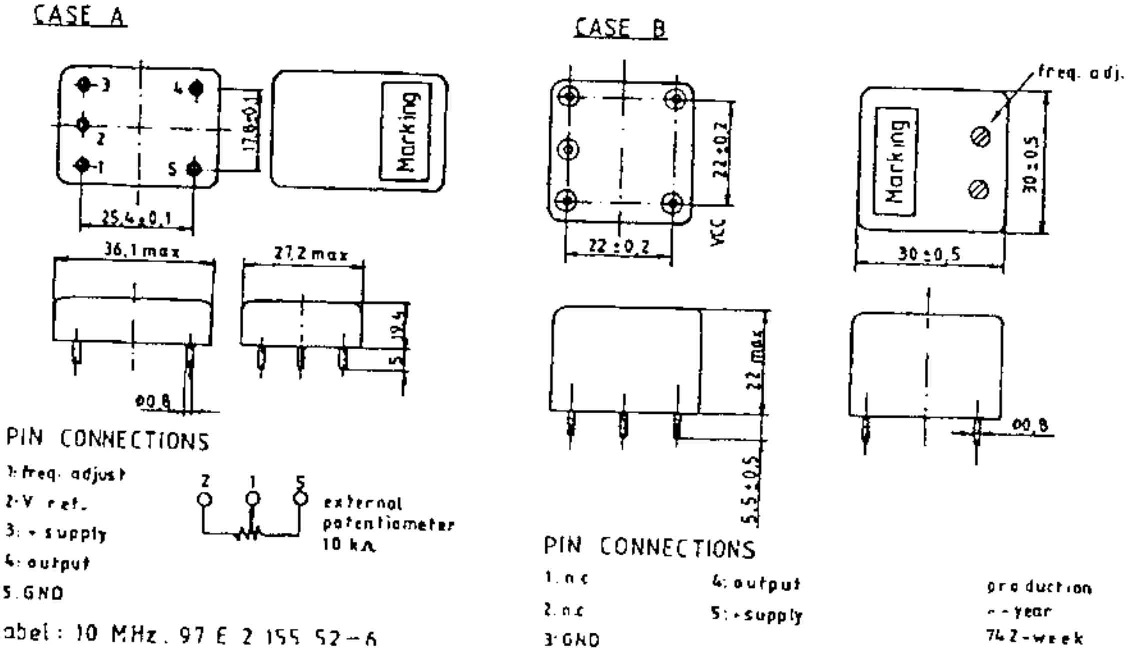
11. Label: 10 MHz, 97 E 2.155.52-5

BFO II specification of 10 MHz D-TCXO Drawing No. 2.155.52-5

-BFO II-

OCXO

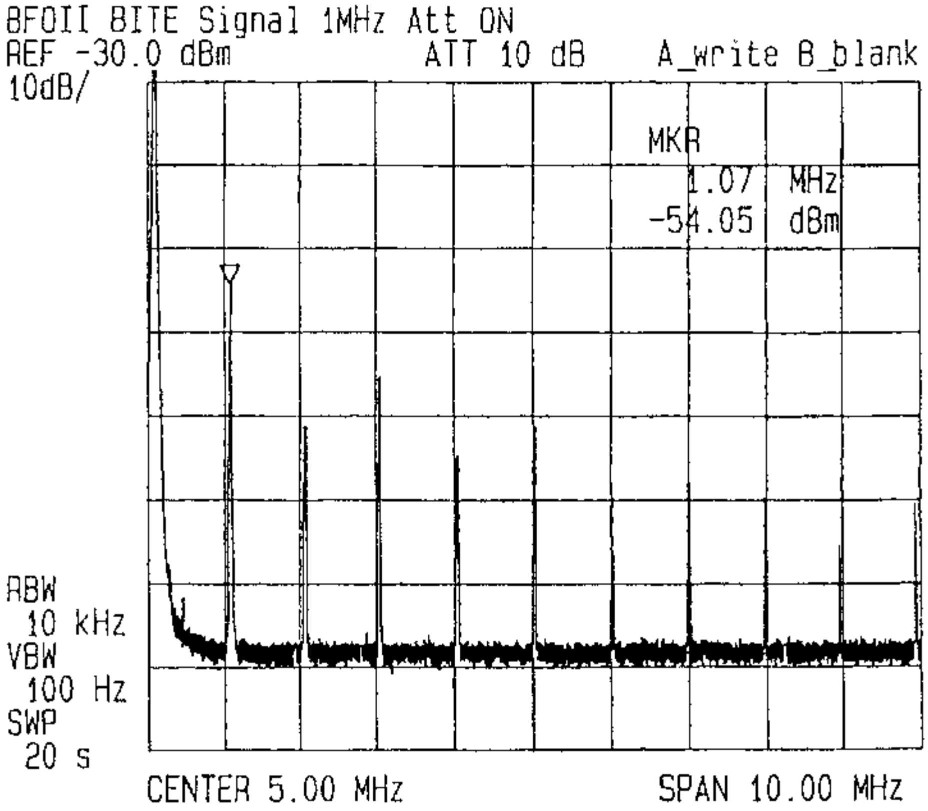
1. Output frequency — f_0 = 10.000 MHz
2. Frequency stability vs temperature -10°C to +70°C — $\Delta f/f \leq \pm 0.5 \times 10^{-8}$
3. Frequency stability vs aging — $\Delta f/f \leq \pm 2 \times 10^{-7}$
4. Frequency stability vs temperature -20°C to +75°C — $\Delta f/f \leq \pm 1 \times 10^{-7}$
5. Frequency stability vs supply voltage — $\Delta f/f \leq \pm 3 \times 10^{-8}$
6. Supply voltage — U_B = 12V ± 5 %
7. Dissipation current — I_D = 150 mA max when warm up; 70 mA max stable at 25°C
8. Output voltage — U_0 = 5V CMOS comp.
9. Frequency adjustment
   case A: with external trimmer
   case B: with internal trimmer
   In any case it must be possible to compensate the frequency drift because of aging over a period of ten years — $\Delta f/f \geq \pm 1 \times 10^{-6}$
10. Suppression of spurious frequencies (except harmonics) — < 80 dB
11. Environment, storage temperatur — -40°C to 85 °C
    Humidity — 95 % rel. at 65°C
    Vibration — 10 Hz to 55 Hz ± 0.76 mm; 55 Hz to 2 kHz ± 0.4 mm; 1 hour/Axis
    Shock — 50g,6ms,1/2 sinus all dir.
12. Dimension and pin connections

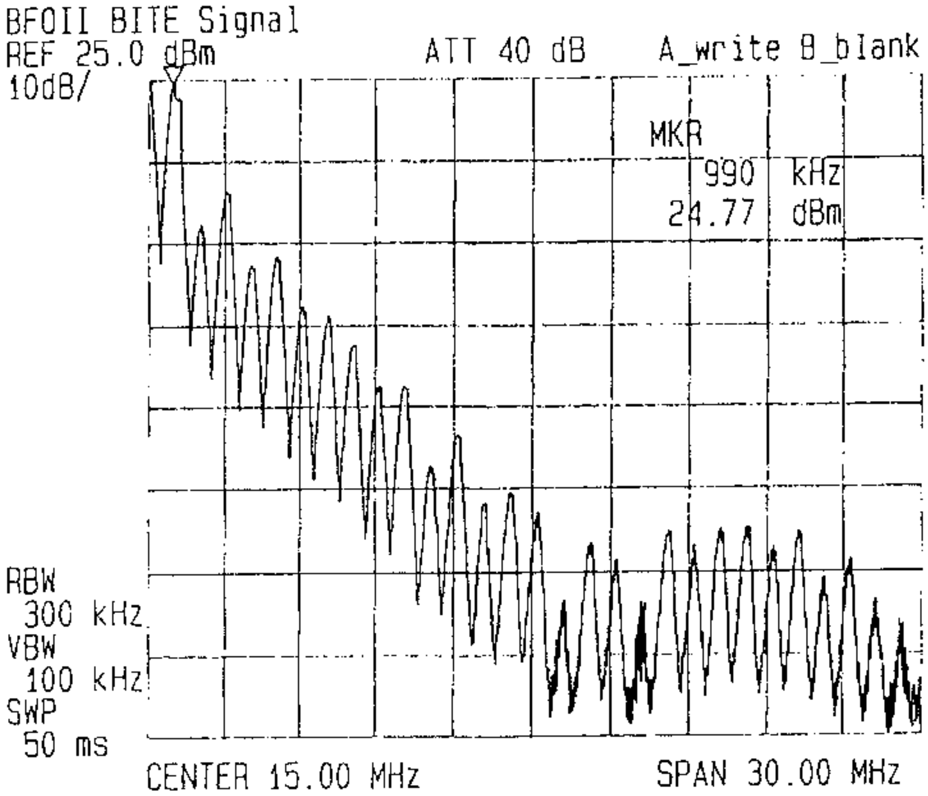


13. Label: 10 MHz. 97 E 2 155 52-6

BFO II specification of 10 MHz OCXO Drawing No. 2.155.52-6

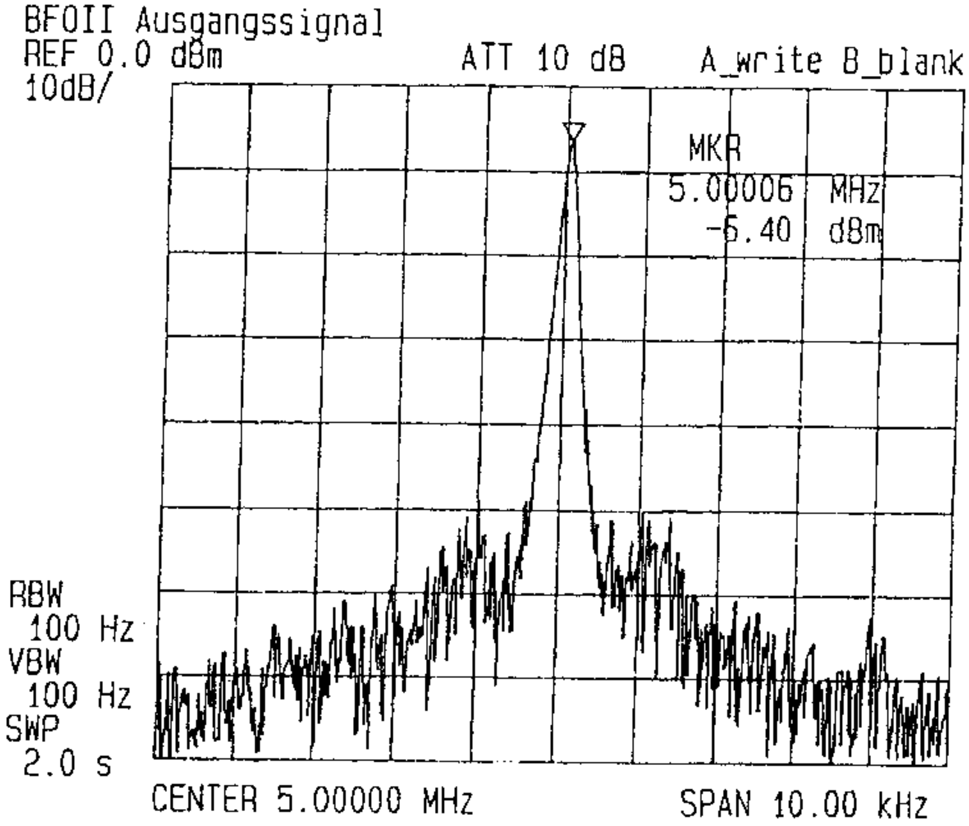
-BFO II-





BFO II Signal Diagrams

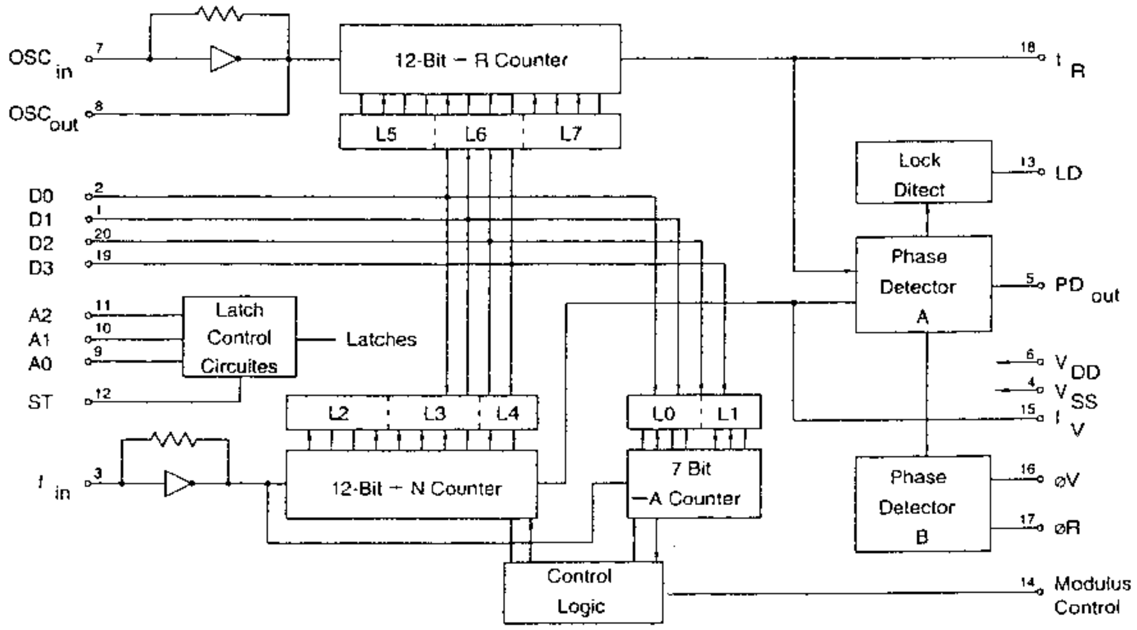
-BFO II-



BFO II Signal Diagrams

-BFO II-

Principle of setting dual modulus PLL ICs like TBB 146 or TBB 200 in TX 1001 M / RX 5001 / EX 1010 in conjunction with a 128/129 dual modulus prescaler



Blockdiagram TBB 146

Coding principle of BFO-Data

BFO-Frequency	Division ratio Counter A (H)		Division ratio Counter N (H)			Remark
Sequence of data entry	1	2	3	4	5	
4.993 50 MHz	6	1	D	3	F	LS Division ratio
4.993 51 MHz	7	1	D	3	F	
4.993 52 MHz	8	1	D	3	F	
4.993 53 MHz	9	1	D	3	F	
4.993 54 MHz	A	1	D	3	F	
4.993 55 MHz	B	1	D	3	F	
4.993 56 MHz	C	1	D	3	F	
4.993 57 MHz	D	1	D	3	F	
4.993 58 MHz	E	1	D	3	F	
4.993 59 MHz	F	1	D	3	F	
4.993 60 MHz	0	2	D	3	F	
.	.				.	
.	.				.	
4.994 54 MHz	E	7	D	3	F	
4.994 55 MHz	F	7	D	3	F	Carry on 7 } with 128/129
4.994 56 MHz	0	0	E	3	F	Counter A } d.m. prescaler
4.994 57 MHz	1	0	E	3	F	
.	.				.	
.	.				.	
5.003 47 MHz	B	7	4	4	F	
5.003 48 MHz	C	7	4	4	F	
5.003 49 MHz	D	7	4	4	F	
5.003 50 MHz	E	7	4	4	F	MS Division ratio

-BFO II-

The following Table shows the BFO-VCO frequency [MHz] versus the BFO output frequency [MHz] versus the overall divisionratio G (including dual modulus prescaler) versus divisionratios of internal dividers N and A.

VCO	BFO	G	N	A	VCO	BFO	G	N	A	VCO	BFO	G	N	A
49.935	4.9935	499350	3901	22	49.9405	4.99405	499405	3901	77	49.946	4.9946	499460	3902	4
49.9351	4.99351	499351	3901	23	49.9406	4.99406	499406	3901	78	49.9461	4.99461	499461	3902	5
49.9352	4.99352	499352	3901	24	49.9407	4.99407	499407	3901	79	49.9462	4.99462	499462	3902	6
49.9353	4.99353	499353	3901	25	49.9408	4.99408	499408	3901	80	49.9463	4.99463	499463	3902	7
49.9354	4.99354	499354	3901	26	49.9409	4.99409	499409	3901	81	49.9464	4.99464	499464	3902	8
49.9355	4.99355	499355	3901	27	49.941	4.9941	499410	3901	82	49.9465	4.99465	499465	3902	9
49.9356	4.99356	499356	3901	28	49.9411	4.99411	499411	3901	83	49.9466	4.99466	499466	3902	10
49.9357	4.99357	499357	3901	29	49.9412	4.99412	499412	3901	84	49.9467	4.99467	499467	3902	11
49.9358	4.99358	499358	3901	30	49.9413	4.99413	499413	3901	85	49.9468	4.99468	499468	3902	12
49.9359	4.99359	499359	3901	31	49.9414	4.99414	499414	3901	86	49.9469	4.99469	499469	3902	13
49.936	4.9936	499360	3901	32	49.9415	4.99415	499415	3901	87	49.947	4.9947	499470	3902	14
49.9361	4.99361	499361	3901	33	49.9416	4.99416	499416	3901	88	49.9471	4.99471	499471	3902	15
49.9362	4.99362	499362	3901	34	49.9417	4.99417	499417	3901	89	49.9472	4.99472	499472	3902	16
49.9363	4.99363	499363	3901	35	49.9418	4.99418	499418	3901	90	49.9473	4.99473	499473	3902	17
49.9364	4.99364	499364	3901	36	49.9419	4.99419	499419	3901	91	49.9474	4.99474	499474	3902	18
49.9365	4.99365	499365	3901	37	49.942	4.9942	499420	3901	92	49.9475	4.99475	499475	3902	19
49.9366	4.99366	499366	3901	38	49.9421	4.99421	499421	3901	93	49.9476	4.99476	499476	3902	20
49.9367	4.99367	499367	3901	39	49.9422	4.99422	499422	3901	94	49.9477	4.99477	499477	3902	21
49.9368	4.99368	499368	3901	40	49.9423	4.99423	499423	3901	95	49.9478	4.99478	499478	3902	22
49.9369	4.99369	499369	3901	41	49.9424	4.99424	499424	3901	96	49.9479	4.99479	499479	3902	23
49.937	4.9937	499370	3901	42	49.9425	4.99425	499425	3901	97	49.948	4.9948	499480	3902	24
49.9371	4.99371	499371	3901	43	49.9426	4.99426	499426	3901	98	49.9481	4.99481	499481	3902	25
49.9372	4.99372	499372	3901	44	49.9427	4.99427	499427	3901	99	49.9482	4.99482	499482	3902	26
49.9373	4.99373	499373	3901	45	49.9428	4.99428	499428	3901	100	49.9483	4.99483	499483	3902	27
49.9374	4.99374	499374	3901	46	49.9429	4.99429	499429	3901	101	49.9484	4.99484	499484	3902	28
49.9375	4.99375	499375	3901	47	49.943	4.9943	499430	3901	102	49.9485	4.99485	499485	3902	29
49.9376	4.99376	499376	3901	48	49.9431	4.99431	499431	3901	103	49.9486	4.99486	499486	3902	30
49.9377	4.99377	499377	3901	49	49.9432	4.99432	499432	3901	104	49.9487	4.99487	499487	3902	31
49.9378	4.99378	499378	3901	50	49.9433	4.99433	499433	3901	105	49.9488	4.99488	499488	3902	32
49.9379	4.99379	499379	3901	51	49.9434	4.99434	499434	3901	106	49.9489	4.99489	499489	3902	33
49.938	4.9938	499380	3901	52	49.9435	4.99435	499435	3901	107	49.949	4.9949	499490	3902	34
49.9381	4.99381	499381	3901	53	49.9436	4.99436	499436	3901	108	49.9491	4.99491	499491	3902	35
49.9382	4.99382	499382	3901	54	49.9437	4.99437	499437	3901	109	49.9492	4.99492	499492	3902	36
49.9383	4.99383	499383	3901	55	49.9438	4.99438	499438	3901	110	49.9493	4.99493	499493	3902	37
49.9384	4.99384	499384	3901	56	49.9439	4.99439	499439	3901	111	49.9494	4.99494	499494	3902	38
49.9385	4.99385	499385	3901	57	49.944	4.9944	499440	3901	112	49.9495	4.99495	499495	3902	39
49.9386	4.99386	499386	3901	58	49.9441	4.99441	499441	3901	113	49.9496	4.99496	499496	3902	40
49.9387	4.99387	499387	3901	59	49.9442	4.99442	499442	3901	114	49.9497	4.99497	499497	3902	41
49.9388	4.99388	499388	3901	60	49.9443	4.99443	499443	3901	115	49.9498	4.99498	499498	3902	42
49.9389	4.99389	499389	3901	61	49.9444	4.99444	499444	3901	116	49.9499	4.99499	499499	3902	43
49.939	4.9939	499390	3901	62	49.9445	4.99445	499445	3901	117	49.95	4.995	499500	3902	44
49.9391	4.99391	499391	3901	63	49.9446	4.99446	499446	3901	118	49.9501	4.99501	499501	3902	45
49.9392	4.99392	499392	3901	64	49.9447	4.99447	499447	3901	119	49.9502	4.99502	499502	3902	46
49.9393	4.99393	499393	3901	65	49.9448	4.99448	499448	3901	120	49.9503	4.99503	499503	3902	47
49.9394	4.99394	499394	3901	66	49.9449	4.99449	499449	3901	121	49.9504	4.99504	499504	3902	48
49.9395	4.99395	499395	3901	67	49.945	4.9945	499450	3901	122	49.9505	4.99505	499505	3902	49
49.9396	4.99396	499396	3901	68	49.9451	4.99451	499451	3901	123	49.9506	4.99506	499506	3902	50
49.9397	4.99397	499397	3901	69	49.9452	4.99452	499452	3901	124	49.9507	4.99507	499507	3902	51
49.9398	4.99398	499398	3901	70	49.9453	4.99453	499453	3901	125	49.9508	4.99508	499508	3902	52
49.9399	4.99399	499399	3901	71	49.9454	4.99454	499454	3901	126	49.9509	4.99509	499509	3902	53
49.94	4.994	499400	3901	72	49.9455	4.99455	499455	3901	127	49.951	4.9951	499510	3902	54
49.9401	4.99401	499401	3901	73	49.9456	4.99456	499456	3902	0	49.9511	4.99511	499511	3902	55
49.9402	4.99402	499402	3901	74	49.9457	4.99457	499457	3902	1	49.9512	4.99512	499512	3902	56
49.9403	4.99403	499403	3901	75	49.9458	4.99458	499458	3902	2	49.9513	4.99513	499513	3902	57
49.9404	4.99404	499404	3901	76	49.9459	4.99459	499459	3902	3	49.9514	4.99514	499514	3902	58

-BFO II-

VCO	BFO	G	N	A	VCO	BFO	G	N	A	VCO	BFO	G	N	A
49.9515	4.99515	499515	3902	59	49.9577	4.99577	499577	3902	121	49.9639	4.99639	499639	3903	55
49.9516	4.99516	499516	3902	60	49.9578	4.99578	499578	3902	122	49.964	4.9964	499640	3903	56
49.9517	4.99517	499517	3902	61	49.9579	4.99579	499579	3902	123	49.9641	4.99641	499641	3903	57
49.9518	4.99518	499518	3902	62	49.958	4.9958	499580	3902	124	49.9642	4.99642	499642	3903	58
49.9519	4.99519	499519	3902	63	49.9581	4.99581	499581	3902	125	49.9643	4.99643	499643	3903	59
49.952	4.9952	499520	3902	64	49.9582	4.99582	499582	3902	126	49.9644	4.99644	499644	3903	60
49.9521	4.99521	499521	3902	65	49.9583	4.99583	499583	3902	127	49.9645	4.99645	499645	3903	61
49.9522	4.99522	499522	3902	66	49.9584	4.99584	499584	3903	0	49.9646	4.99646	499646	3903	62
49.9523	4.99523	499523	3902	67	49.9585	4.99585	499585	3903	1	49.9647	4.99647	499647	3903	63
49.9524	4.99524	499524	3902	68	49.9586	4.99586	499586	3903	2	49.9648	4.99648	499648	3903	64
49.9525	4.99525	499525	3902	69	49.9587	4.99587	499587	3903	3	49.9649	4.99649	499649	3903	65
49.9526	4.99526	499526	3902	70	49.9588	4.99588	499588	3903	4	49.965	4.9965	499650	3903	66
49.9527	4.99527	499527	3902	71	49.9589	4.99589	499589	3903	5	49.9651	4.99651	499651	3903	67
49.9528	4.99528	499528	3902	72	49.959	4.9959	499590	3903	6	49.9652	4.99652	499652	3903	68
49.9529	4.99529	499529	3902	73	49.9591	4.99591	499591	3903	7	49.9653	4.99653	499653	3903	69
49.953	4.9953	499530	3902	74	49.9592	4.99592	499592	3903	8	49.9654	4.99654	499654	3903	70
49.9531	4.99531	499531	3902	75	49.9593	4.99593	499593	3903	9	49.9655	4.99655	499655	3903	71
49.9532	4.99532	499532	3902	76	49.9594	4.99594	499594	3903	10	49.9656	4.99656	499656	3903	72
49.9533	4.99533	499533	3902	77	49.9595	4.99595	499595	3903	11	49.9657	4.99657	499657	3903	73
49.9534	4.99534	499534	3902	78	49.9596	4.99596	499596	3903	12	49.9658	4.99658	499658	3903	74
49.9535	4.99535	499535	3902	79	49.9597	4.99597	499597	3903	13	49.9659	4.99659	499659	3903	75
49.9536	4.99536	499536	3902	80	49.9598	4.99598	499598	3903	14	49.966	4.9966	499660	3903	76
49.9537	4.99537	499537	3902	81	49.9599	4.99599	499599	3903	15	49.9661	4.99661	499661	3903	77
49.9538	4.99538	499538	3902	82	49.96	4.996	499600	3903	16	49.9662	4.99662	499662	3903	78
49.9539	4.99539	499539	3902	83	49.9601	4.99601	499601	3903	17	49.9663	4.99663	499663	3903	79
49.954	4.9954	499540	3902	84	49.9602	4.99602	499602	3903	18	49.9664	4.99664	499664	3903	80
49.9541	4.99541	499541	3902	85	49.9603	4.99603	499603	3903	19	49.9665	4.99665	499665	3903	81
49.9542	4.99542	499542	3902	86	49.9604	4.99604	499604	3903	20	49.9666	4.99666	499666	3903	82
49.9543	4.99543	499543	3902	87	49.9605	4.99605	499605	3903	21	49.9667	4.99667	499667	3903	83
49.9544	4.99544	499544	3902	88	49.9606	4.99606	499606	3903	22	49.9668	4.99668	499668	3903	84
49.9545	4.99545	499545	3902	89	49.9607	4.99607	499607	3903	23	49.9669	4.99669	499669	3903	85
49.9546	4.99546	499546	3902	90	49.9608	4.99608	499608	3903	24	49.967	4.9967	499670	3903	86
49.9547	4.99547	499547	3902	91	49.9609	4.99609	499609	3903	25	49.9671	4.99671	499671	3903	87
49.9548	4.99548	499548	3902	92	49.961	4.9961	499610	3903	26	49.9672	4.99672	499672	3903	88
49.9549	4.99549	499549	3902	93	49.9611	4.99611	499611	3903	27	49.9673	4.99673	499673	3903	89
49.955	4.9955	499550	3902	94	49.9612	4.99612	499612	3903	28	49.9674	4.99674	499674	3903	90
49.9551	4.99551	499551	3902	95	49.9613	4.99613	499613	3903	29	49.9675	4.99675	499675	3903	91
49.9552	4.99552	499552	3902	96	49.9614	4.99614	499614	3903	30	49.9676	4.99676	499676	3903	92
49.9553	4.99553	499553	3902	97	49.9615	4.99615	499615	3903	31	49.9677	4.99677	499677	3903	93
49.9554	4.99554	499554	3902	98	49.9616	4.99616	499616	3903	32	49.9678	4.99678	499678	3903	94
49.9555	4.99555	499555	3902	99	49.9617	4.99617	499617	3903	33	49.9679	4.99679	499679	3903	95
49.9556	4.99556	499556	3902	100	49.9618	4.99618	499618	3903	34	49.968	4.9968	499680	3903	96
49.9557	4.99557	499557	3902	101	49.9619	4.99619	499619	3903	35	49.9681	4.99681	499681	3903	97
49.9558	4.99558	499558	3902	102	49.962	4.9962	499620	3903	36	49.9682	4.99682	499682	3903	98
49.9559	4.99559	499559	3902	103	49.9621	4.99621	499621	3903	37	49.9683	4.99683	499683	3903	99
49.956	4.9956	499560	3902	104	49.9622	4.99622	499622	3903	38	49.9684	4.99684	499684	3903	100
49.9561	4.99561	499561	3902	105	49.9623	4.99623	499623	3903	39	49.9685	4.99685	499685	3903	101
49.9562	4.99562	499562	3902	106	49.9624	4.99624	499624	3903	40	49.9686	4.99686	499686	3903	102
49.9563	4.99563	499563	3902	107	49.9625	4.99625	499625	3903	41	49.9687	4.99687	499687	3903	103
49.9564	4.99564	499564	3902	108	49.9626	4.99626	499626	3903	42	49.9688	4.99688	499688	3903	104
49.9565	4.99565	499565	3902	109	49.9627	4.99627	499627	3903	43	49.9689	4.99689	499689	3903	105
49.9566	4.99566	499566	3902	110	49.9628	4.99628	499628	3903	44	49.969	4.9969	499690	3903	106
49.9567	4.99567	499567	3902	111	49.9629	4.99629	499629	3903	45	49.9691	4.99691	499691	3903	107
49.9568	4.99568	499568	3902	112	49.963	4.9963	499630	3903	46	49.9692	4.99692	499692	3903	108
49.9569	4.99569	499569	3902	113	49.9631	4.99631	499631	3903	47	49.9693	4.99693	499693	3903	109
49.957	4.9957	499570	3902	114	49.9632	4.99632	499632	3903	48	49.9694	4.99694	499694	3903	110
49.9571	4.99571	499571	3902	115	49.9633	4.99633	499633	3903	49	49.9695	4.99695	499695	3903	111
49.9572	4.99572	499572	3902	116	49.9634	4.99634	499634	3903	50	49.9696	4.99696	499696	3903	112
49.9573	4.99573	499573	3902	117	49.9635	4.99635	499635	3903	51	49.9697	4.99697	499697	3903	113
49.9574	4.99574	499574	3902	118	49.9636	4.99636	499636	3903	52	49.9698	4.99698	499698	3903	114
49.9575	4.99575	499575	3902	119	49.9637	4.99637	499637	3903	53	49.9699	4.99699	499699	3903	115
49.9576	4.99576	499576	3902	120	49.9638	4.99638	499638	3903	54	49.97	4.997	499700	3903	116

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VCO	BFO	G	N	A
49.9701	4.99701	499701	3903	117
49.9702	4.99702	499702	3903	118
49.9703	4.99703	499703	3903	119
49.9704	4.99704	499704	3903	120
49.9705	4.99705	499705	3903	121
49.9706	4.99706	499706	3903	122
49.9707	4.99707	499707	3903	123
49.9708	4.99708	499708	3903	124
49.9709	4.99709	499709	3903	125
49.971	4.9971	499710	3903	126
49.9711	4.99711	499711	3903	127
49.9712	4.99712	499712	3904	0
49.9713	4.99713	499713	3904	1
49.9714	4.99714	499714	3904	2
49.9715	4.99715	499715	3904	3
49.9716	4.99716	499716	3904	4
49.9717	4.99717	499717	3904	5
49.9718	4.99718	499718	3904	6
49.9719	4.99719	499719	3904	7
49.972	4.9972	499720	3904	8
49.9721	4.99721	499721	3904	9
49.9722	4.99722	499722	3904	10
49.9723	4.99723	499723	3904	11
49.9724	4.99724	499724	3904	12
49.9725	4.99725	499725	3904	13
49.9726	4.99726	499726	3904	14
49.9727	4.99727	499727	3904	15
49.9728	4.99728	499728	3904	16
49.9729	4.99729	499729	3904	17
49.973	4.9973	499730	3904	18
49.9731	4.99731	499731	3904	19
49.9732	4.99732	499732	3904	20
49.9733	4.99733	499733	3904	21
49.9734	4.99734	499734	3904	22
49.9735	4.99735	499735	3904	23
49.9736	4.99736	499736	3904	24
49.9737	4.99737	499737	3904	25
49.9738	4.99738	499738	3904	26
49.9739	4.99739	499739	3904	27
49.974	4.9974	499740	3904	28
49.9741	4.99741	499741	3904	29
49.9742	4.99742	499742	3904	30
49.9743	4.99743	499743	3904	31
49.9744	4.99744	499744	3904	32
49.9745	4.99745	499745	3904	33
49.9746	4.99746	499746	3904	34
49.9747	4.99747	499747	3904	35
49.9748	4.99748	499748	3904	36
49.9749	4.99749	499749	3904	37
49.975	4.9975	499750	3904	38
49.9751	4.99751	499751	3904	39
49.9752	4.99752	499752	3904	40
49.9753	4.99753	499753	3904	41
49.9754	4.99754	499754	3904	42
49.9755	4.99755	499755	3904	43
49.9756	4.99756	499756	3904	44
49.9757	4.99757	499757	3904	45
49.9758	4.99758	499758	3904	46
49.9759	4.99759	499759	3904	47
49.976	4.9976	499760	3904	48
49.9761	4.99761	499761	3904	49
49.9762	4.99762	499762	3904	50
49.9763	4.99763	499763	3904	51
49.9764	4.99764	499764	3904	52
49.9765	4.99765	499765	3904	53
49.9766	4.99766	499766	3904	54
49.9767	4.99767	499767	3904	55
49.9768	4.99768	499768	3904	56
49.9769	4.99769	499769	3904	57
49.977	4.9977	499770	3904	58
49.9771	4.99771	499771	3904	59
49.9772	4.99772	499772	3904	60
49.9773	4.99773	499773	3904	61
49.9774	4.99774	499774	3904	62
49.9775	4.99775	499775	3904	63
49.9776	4.99776	499776	3904	64
49.9777	4.99777	499777	3904	65
49.9778	4.99778	499778	3904	66
49.9779	4.99779	499779	3904	67
49.978	4.9978	499780	3904	68
49.9781	4.99781	499781	3904	69
49.9782	4.99782	499782	3904	70
49.9783	4.99783	499783	3904	71
49.9784	4.99784	499784	3904	72
49.9785	4.99785	499785	3904	73
49.9786	4.99786	499786	3904	74
49.9787	4.99787	499787	3904	75
49.9788	4.99788	499788	3904	76
49.9789	4.99789	499789	3904	77
49.979	4.9979	499790	3904	78
49.9791	4.99791	499791	3904	79
49.9792	4.99792	499792	3904	80
49.9793	4.99793	499793	3904	81
49.9794	4.99794	499794	3904	82
49.9795	4.99795	499795	3904	83
49.9796	4.99796	499796	3904	84
49.9797	4.99797	499797	3904	85
49.9798	4.99798	499798	3904	86
49.9799	4.99799	499799	3904	87
49.98	4.998	499800	3904	88
49.9801	4.99801	499801	3904	89
49.9802	4.99802	499802	3904	90
49.9803	4.99803	499803	3904	91
49.9804	4.99804	499804	3904	92
49.9805	4.99805	499805	3904	93
49.9806	4.99806	499806	3904	94
49.9807	4.99807	499807	3904	95
49.9808	4.99808	499808	3904	96
49.9809	4.99809	499809	3904	97
49.981	4.9981	499810	3904	98
49.9811	4.99811	499811	3904	99
49.9812	4.99812	499812	3904	100
49.9813	4.99813	499813	3904	101
49.9814	4.99814	499814	3904	102
49.9815	4.99815	499815	3904	103
49.9816	4.99816	499816	3904	104
49.9817	4.99817	499817	3904	105
49.9818	4.99818	499818	3904	106
49.9819	4.99819	499819	3904	107
49.982	4.9982	499820	3904	108
49.9821	4.99821	499821	3904	109
49.9822	4.99822	499822	3904	110
49.9823	4.99823	499823	3904	111
49.9824	4.99824	499824	3904	112
49.9825	4.99825	499825	3904	113
49.9826	4.99826	499826	3904	114
49.9827	4.99827	499827	3904	115
49.9828	4.99828	499828	3904	116
49.9829	4.99829	499829	3904	117
49.983	4.9983	499830	3904	118
49.9831	4.99831	499831	3904	119
49.9832	4.99832	499832	3904	120
49.9833	4.99833	499833	3904	121
49.9834	4.99834	499834	3904	122
49.9835	4.99835	499835	3904	123
49.9836	4.99836	499836	3904	124
49.9837	4.99837	499837	3904	125
49.9838	4.99838	499838	3904	126
49.9839	4.99839	499839	3904	127
49.984	4.9984	499840	3905	0
49.9841	4.99841	499841	3905	1
49.9842	4.99842	499842	3905	2
49.9843	4.99843	499843	3905	3
49.9844	4.99844	499844	3905	4
49.9845	4.99845	499845	3905	5
49.9846	4.99846	499846	3905	6
49.9847	4.99847	499847	3905	7
49.9848	4.99848	499848	3905	8
49.9849	4.99849	499849	3905	9
49.985	4.9985	499850	3905	10
49.9851	4.99851	499851	3905	11
49.9852	4.99852	499852	3905	12
49.9853	4.99853	499853	3905	13
49.9854	4.99854	499854	3905	14
49.9855	4.99855	499855	3905	15
49.9856	4.99856	499856	3905	16
49.9857	4.99857	499857	3905	17
49.9858	4.99858	499858	3905	18
49.9859	4.99859	499859	3905	19
49.986	4.9986	499860	3905	20
49.9861	4.99861	499861	3905	21
49.9862	4.99862	499862	3905	22
49.9863	4.99863	499863	3905	23
49.9864	4.99864	499864	3905	24
49.9865	4.99865	499865	3905	25
49.9866	4.99866	499866	3905	26
49.9867	4.99867	499867	3905	27
49.9868	4.99868	499868	3905	28
49.9869	4.99869	499869	3905	29
49.987	4.9987	499870	3905	30
49.9871	4.99871	499871	3905	31
49.9872	4.99872	499872	3905	32
49.9873	4.99873	499873	3905	33
49.9874	4.99874	499874	3905	34
49.9875	4.99875	499875	3905	35
49.9876	4.99876	499876	3905	36
49.9877	4.99877	499877	3905	37
49.9878	4.99878	499878	3905	38
49.9879	4.99879	499879	3905	39
49.988	4.9988	499880	3905	40
49.9881	4.99881	499881	3905	41
49.9882	4.99882	499882	3905	42
49.9883	4.99883	499883	3905	43
49.9884	4.99884	499884	3905	44
49.9885	4.99885	499885	3905	45
49.9886	4.99886	499886	3905	46

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VCO	BFO	G	N	A	VCO	BFO	G	N	A	VCO	BFO	G	N	A
49.9887	4.99887	499887	3905	47	49.9949	4.99949	499949	3905	109	50.0011	5.00011	500011	3906	43
49.9888	4.99888	499888	3905	48	49.995	4.9995	499950	3905	110	50.0012	5.00012	500012	3906	44
49.9889	4.99889	499889	3905	49	49.9951	4.99951	499951	3905	111	50.0013	5.00013	500013	3906	45
49.989	4.9989	499890	3905	50	49.9952	4.99952	499952	3905	112	50.0014	5.00014	500014	3906	46
49.9891	4.99891	499891	3905	51	49.9953	4.99953	499953	3905	113	50.0015	5.00015	500015	3906	47
49.9892	4.99892	499892	3905	52	49.9954	4.99954	499954	3905	114	50.0016	5.00016	500016	3906	48
49.9893	4.99893	499893	3905	53	49.9955	4.99955	499955	3905	115	50.0017	5.00017	500017	3906	49
49.9894	4.99894	499894	3905	54	49.9956	4.99956	499956	3905	116	50.0018	5.00018	500018	3906	50
49.9895	4.99895	499895	3905	55	49.9957	4.99957	499957	3905	117	50.0019	5.00019	500019	3906	51
49.9896	4.99896	499896	3905	56	49.9958	4.99958	499958	3905	118	50.002	5.0002	500020	3906	52
49.9897	4.99897	499897	3905	57	49.9959	4.99959	499959	3905	119	50.0021	5.00021	500021	3906	53
49.9898	4.99898	499898	3905	58	49.996	4.9996	499960	3905	120	50.0022	5.00022	500022	3906	54
49.9899	4.99899	499899	3905	59	49.9961	4.99961	499961	3905	121	50.0023	5.00023	500023	3906	55
49.99	4.999	499900	3905	60	49.9962	4.99962	499962	3905	122	50.0024	5.00024	500024	3906	56
49.9901	4.99901	499901	3905	61	49.9963	4.99963	499963	3905	123	50.0025	5.00025	500025	3906	57
49.9902	4.99902	499902	3905	62	49.9964	4.99964	499964	3905	124	50.0026	5.00026	500026	3906	58
49.9903	4.99903	499903	3905	63	49.9965	4.99965	499965	3905	125	50.0027	5.00027	500027	3906	59
49.9904	4.99904	499904	3905	64	49.9966	4.99966	499966	3905	126	50.0028	5.00028	500028	3906	60
49.9905	4.99905	499905	3905	65	49.9967	4.99967	499967	3905	127	50.0029	5.00029	500029	3906	61
49.9906	4.99906	499906	3905	66	49.9968	4.99968	499968	3906	0	50.003	5.0003	500030	3906	62
49.9907	4.99907	499907	3905	67	49.9969	4.99969	499969	3906	1	50.0031	5.00031	500031	3906	63
49.9908	4.99908	499908	3905	68	49.997	4.9997	499970	3906	2	50.0032	5.00032	500032	3906	64
49.9909	4.99909	499909	3905	69	49.9971	4.99971	499971	3906	3	50.0033	5.00033	500033	3906	65
49.991	4.9991	499910	3905	70	49.9972	4.99972	499972	3906	4	50.0034	5.00034	500034	3906	66
49.9911	4.99911	499911	3905	71	49.9973	4.99973	499973	3906	5	50.0035	5.00035	500035	3906	67
49.9912	4.99912	499912	3905	72	49.9974	4.99974	499974	3906	6	50.0036	5.00036	500036	3906	68
49.9913	4.99913	499913	3905	73	49.9975	4.99975	499975	3906	7	50.0037	5.00037	500037	3906	69
49.9914	4.99914	499914	3905	74	49.9976	4.99976	499976	3906	8	50.0038	5.00038	500038	3906	70
49.9915	4.99915	499915	3905	75	49.9977	4.99977	499977	3906	9	50.0039	5.00039	500039	3906	71
49.9916	4.99916	499916	3905	76	49.9978	4.99978	499978	3906	10	50.004	5.0004	500040	3906	72
49.9917	4.99917	499917	3905	77	49.9979	4.99979	499979	3906	11	50.0041	5.00041	500041	3906	73
49.9918	4.99918	499918	3905	78	49.998	4.9998	499980	3906	12	50.0042	5.00042	500042	3906	74
49.9919	4.99919	499919	3905	79	49.9981	4.99981	499981	3906	13	50.0043	5.00043	500043	3906	75
49.992	4.9992	499920	3905	80	49.9982	4.99982	499982	3906	14	50.0044	5.00044	500044	3906	76
49.9921	4.99921	499921	3905	81	49.9983	4.99983	499983	3906	15	50.0045	5.00045	500045	3906	77
49.9922	4.99922	499922	3905	82	49.9984	4.99984	499984	3906	16	50.0046	5.00046	500046	3906	78
49.9923	4.99923	499923	3905	83	49.9985	4.99985	499985	3906	17	50.0047	5.00047	500047	3906	79
49.9924	4.99924	499924	3905	84	49.9986	4.99986	499986	3906	18	50.0048	5.00048	500048	3906	80
49.9925	4.99925	499925	3905	85	49.9987	4.99987	499987	3906	19	50.0049	5.00049	500049	3906	81
49.9926	4.99926	499926	3905	86	49.9988	4.99988	499988	3906	20	50.005	5.0005	500050	3906	82
49.9927	4.99927	499927	3905	87	49.9989	4.99989	499989	3906	21	50.0051	5.00051	500051	3906	83
49.9928	4.99928	499928	3905	88	49.999	4.9999	499990	3906	22	50.0052	5.00052	500052	3906	84
49.9929	4.99929	499929	3905	89	49.9991	4.99991	499991	3906	23	50.0053	5.00053	500053	3906	85
49.993	4.9993	499930	3905	90	49.9992	4.99992	499992	3906	24	50.0054	5.00054	500054	3906	86
49.9931	4.99931	499931	3905	91	49.9993	4.99993	499993	3906	25	50.0055	5.00055	500055	3906	87
49.9932	4.99932	499932	3905	92	49.9994	4.99994	499994	3906	26	50.0056	5.00056	500056	3906	88
49.9933	4.99933	499933	3905	93	49.9995	4.99995	499995	3906	27	50.0057	5.00057	500057	3906	89
49.9934	4.99934	499934	3905	94	49.9996	4.99996	499996	3906	28	50.0058	5.00058	500058	3906	90
49.9935	4.99935	499935	3905	95	49.9997	4.99997	499997	3906	29	50.0059	5.00059	500059	3906	91
49.9936	4.99936	499936	3905	96	49.9998	4.99998	499998	3906	30	50.006	5.0006	500060	3906	92
49.9937	4.99937	499937	3905	97	49.9999	4.99999	499999	3906	31	50.0061	5.00061	500061	3906	93
49.9938	4.99938	499938	3905	98	50	5	500000	3906	32	50.0062	5.00062	500062	3906	94
49.9939	4.99939	499939	3905	99	50.0001	5.00001	500001	3906	33	50.0063	5.00063	500063	3906	95
49.994	4.9994	499940	3905	100	50.0002	5.00002	500002	3906	34	50.0064	5.00064	500064	3906	96
49.9941	4.99941	499941	3905	101	50.0003	5.00003	500003	3906	35	50.0065	5.00065	500065	3906	97
49.9942	4.99942	499942	3905	102	50.0004	5.00004	500004	3906	36	50.0066	5.00066	500066	3906	98
49.9943	4.99943	499943	3905	103	50.0005	5.00005	500005	3906	37	50.0067	5.00067	500067	3906	99
49.9944	4.99944	499944	3905	104	50.0006	5.00006	500006	3906	38	50.0068	5.00068	500068	3906	100
49.9945	4.99945	499945	3905	105	50.0007	5.00007	500007	3906	39	50.0069	5.00069	500069	3906	101
49.9946	4.99946	499946	3905	106	50.0008	5.00008	500008	3906	40	50.007	5.0007	500070	3906	102
49.9947	4.99947	499947	3905	107	50.0009	5.00009	500009	3906	41	50.0071	5.00071	500071	3906	103
49.9948	4.99948	499948	3905	108	50.001	5.0001	500010	3906	42	50.0072	5.00072	500072	3906	104

-BFO II-

VCO	BFO	G	N	A
50.0073	5.00073	500073	3906	105
50.0074	5.00074	500074	3906	106
50.0075	5.00075	500075	3906	107
50.0076	5.00076	500076	3906	108
50.0077	5.00077	500077	3906	109
50.0078	5.00078	500078	3906	110
50.0079	5.00079	500079	3906	111
50.008	5.0008	500080	3906	112
50.0081	5.00081	500081	3906	113
50.0082	5.00082	500082	3906	114
50.0083	5.00083	500083	3906	115
50.0084	5.00084	500084	3906	116
50.0085	5.00085	500085	3906	117
50.0086	5.00086	500086	3906	118
50.0087	5.00087	500087	3906	119
50.0088	5.00088	500088	3906	120
50.0089	5.00089	500089	3906	121
50.009	5.0009	500090	3906	122
50.0091	5.00091	500091	3906	123
50.0092	5.00092	500092	3906	124
50.0093	5.00093	500093	3906	125
50.0094	5.00094	500094	3906	126
50.0095	5.00095	500095	3906	127
50.0096	5.00096	500096	3907	0
50.0097	5.00097	500097	3907	1
50.0098	5.00098	500098	3907	2
50.0099	5.00099	500099	3907	3
50.01	5.001	500100	3907	4
50.0101	5.00101	500101	3907	5
50.0102	5.00102	500102	3907	6
50.0103	5.00103	500103	3907	7
50.0104	5.00104	500104	3907	8
50.0105	5.00105	500105	3907	9
50.0106	5.00106	500106	3907	10
50.0107	5.00107	500107	3907	11
50.0108	5.00108	500108	3907	12
50.0109	5.00109	500109	3907	13
50.011	5.0011	500110	3907	14
50.0111	5.00111	500111	3907	15
50.0112	5.00112	500112	3907	16
50.0113	5.00113	500113	3907	17
50.0114	5.00114	500114	3907	18
50.0115	5.00115	500115	3907	19
50.0116	5.00116	500116	3907	20
50.0117	5.00117	500117	3907	21
50.0118	5.00118	500118	3907	22
50.0119	5.00119	500119	3907	23
50.012	5.0012	500120	3907	24
50.0121	5.00121	500121	3907	25
50.0122	5.00122	500122	3907	26
50.0123	5.00123	500123	3907	27
50.0124	5.00124	500124	3907	28
50.0125	5.00125	500125	3907	29
50.0126	5.00126	500126	3907	30
50.0127	5.00127	500127	3907	31
50.0128	5.00128	500128	3907	32
50.0129	5.00129	500129	3907	33
50.013	5.0013	500130	3907	34
50.0131	5.00131	500131	3907	35
50.0132	5.00132	500132	3907	36
50.0133	5.00133	500133	3907	37
50.0134	5.00134	500134	3907	38
50.0135	5.00135	500135	3907	39
50.0136	5.00136	500136	3907	40
50.0137	5.00137	500137	3907	41
50.0138	5.00138	500138	3907	42
50.0139	5.00139	500139	3907	43
50.014	5.0014	500140	3907	44
50.0141	5.00141	500141	3907	45
50.0142	5.00142	500142	3907	46
50.0143	5.00143	500143	3907	47
50.0144	5.00144	500144	3907	48
50.0145	5.00145	500145	3907	49
50.0146	5.00146	500146	3907	50
50.0147	5.00147	500147	3907	51
50.0148	5.00148	500148	3907	52
50.0149	5.00149	500149	3907	53
50.015	5.0015	500150	3907	54
50.0151	5.00151	500151	3907	55
50.0152	5.00152	500152	3907	56
50.0153	5.00153	500153	3907	57
50.0154	5.00154	500154	3907	58
50.0155	5.00155	500155	3907	59
50.0156	5.00156	500156	3907	60
50.0157	5.00157	500157	3907	61
50.0158	5.00158	500158	3907	62
50.0159	5.00159	500159	3907	63
50.016	5.0016	500160	3907	64
50.0161	5.00161	500161	3907	65
50.0162	5.00162	500162	3907	66
50.0163	5.00163	500163	3907	67
50.0164	5.00164	500164	3907	68
50.0165	5.00165	500165	3907	69
50.0166	5.00166	500166	3907	70
50.0167	5.00167	500167	3907	71
50.0168	5.00168	500168	3907	72
50.0169	5.00169	500169	3907	73
50.017	5.0017	500170	3907	74
50.0171	5.00171	500171	3907	75
50.0172	5.00172	500172	3907	76
50.0173	5.00173	500173	3907	77
50.0174	5.00174	500174	3907	78
50.0175	5.00175	500175	3907	79
50.0176	5.00176	500176	3907	80
50.0177	5.00177	500177	3907	81
50.0178	5.00178	500178	3907	82
50.0179	5.00179	500179	3907	83
50.018	5.0018	500180	3907	84
50.0181	5.00181	500181	3907	85
50.0182	5.00182	500182	3907	86
50.0183	5.00183	500183	3907	87
50.0184	5.00184	500184	3907	88
50.0185	5.00185	500185	3907	89
50.0186	5.00186	500186	3907	90
50.0187	5.00187	500187	3907	91
50.0188	5.00188	500188	3907	92
50.0189	5.00189	500189	3907	93
50.019	5.0019	500190	3907	94
50.0191	5.00191	500191	3907	95
50.0192	5.00192	500192	3907	96
50.0193	5.00193	500193	3907	97
50.0194	5.00194	500194	3907	98
50.0195	5.00195	500195	3907	99
50.0196	5.00196	500196	3907	100
50.0197	5.00197	500197	3907	101
50.0198	5.00198	500198	3907	102
50.0199	5.00199	500199	3907	103
50.02	5.002	500200	3907	104
50.0201	5.00201	500201	3907	105
50.0202	5.00202	500202	3907	106
50.0203	5.00203	500203	3907	107
50.0204	5.00204	500204	3907	108
50.0205	5.00205	500205	3907	109
50.0206	5.00206	500206	3907	110
50.0207	5.00207	500207	3907	111
50.0208	5.00208	500208	3907	112
50.0209	5.00209	500209	3907	113
50.021	5.0021	500210	3907	114
50.0211	5.00211	500211	3907	115
50.0212	5.00212	500212	3907	116
50.0213	5.00213	500213	3907	117
50.0214	5.00214	500214	3907	118
50.0215	5.00215	500215	3907	119
50.0216	5.00216	500216	3907	120
50.0217	5.00217	500217	3907	121
50.0218	5.00218	500218	3907	122
50.0219	5.00219	500219	3907	123
50.022	5.0022	500220	3907	124
50.0221	5.00221	500221	3907	125
50.0222	5.00222	500222	3907	126
50.0223	5.00223	500223	3907	127
50.0224	5.00224	500224	3908	0
50.0225	5.00225	500225	3908	1
50.0226	5.00226	500226	3908	2
50.0227	5.00227	500227	3908	3
50.0228	5.00228	500228	3908	4
50.0229	5.00229	500229	3908	5
50.023	5.0023	500230	3908	6
50.0231	5.00231	500231	3908	7
50.0232	5.00232	500232	3908	8
50.0233	5.00233	500233	3908	9
50.0234	5.00234	500234	3908	10
50.0235	5.00235	500235	3908	11
50.0236	5.00236	500236	3908	12
50.0237	5.00237	500237	3908	13
50.0238	5.00238	500238	3908	14
50.0239	5.00239	500239	3908	15
50.024	5.0024	500240	3908	16
50.0241	5.00241	500241	3908	17
50.0242	5.00242	500242	3908	18
50.0243	5.00243	500243	3908	19
50.0244	5.00244	500244	3908	20
50.0245	5.00245	500245	3908	21
50.0246	5.00246	500246	3908	22
50.0247	5.00247	500247	3908	23
50.0248	5.00248	500248	3908	24
50.0249	5.00249	500249	3908	25
50.025	5.0025	500250	3908	26
50.0251	5.00251	500251	3908	27
50.0252	5.00252	500252	3908	28
50.0253	5.00253	500253	3908	29
50.0254	5.00254	500254	3908	30
50.0255	5.00255	500255	3908	31
50.0256	5.00256	500256	3908	32
50.0257	5.00257	500257	3908	33
50.0258	5.00258	500258	3908	34

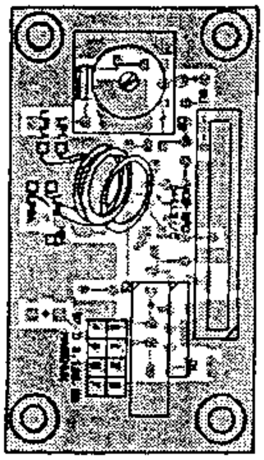
-BFO II-

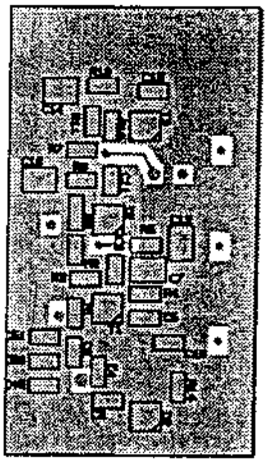
VCO	BFO	G	N	A
50.0259	5.00259	500259	3908	35
50.026	5.0026	500260	3908	36
50.0261	5.00261	500261	3908	37
50.0262	5.00262	500262	3908	38
50.0263	5.00263	500263	3908	39
50.0264	5.00264	500264	3908	40
50.0265	5.00265	500265	3908	41
50.0266	5.00266	500266	3908	42
50.0267	5.00267	500267	3908	43
50.0268	5.00268	500268	3908	44
50.0269	5.00269	500269	3908	45
50.027	5.0027	500270	3908	46
50.0271	5.00271	500271	3908	47
50.0272	5.00272	500272	3908	48
50.0273	5.00273	500273	3908	49
50.0274	5.00274	500274	3908	50
50.0275	5.00275	500275	3908	51
50.0276	5.00276	500276	3908	52
50.0277	5.00277	500277	3908	53
50.0278	5.00278	500278	3908	54
50.0279	5.00279	500279	3908	55
50.028	5.0028	500280	3908	56
50.0281	5.00281	500281	3908	57
50.0282	5.00282	500282	3908	58
50.0283	5.00283	500283	3908	59
50.0284	5.00284	500284	3908	60
50.0285	5.00285	500285	3908	61
50.0286	5.00286	500286	3908	62
50.0287	5.00287	500287	3908	63
50.0288	5.00288	500288	3908	64
50.0289	5.00289	500289	3908	65
50.029	5.0029	500290	3908	66
50.0291	5.00291	500291	3908	67
50.0292	5.00292	500292	3908	68
50.0293	5.00293	500293	3908	69
50.0294	5.00294	500294	3908	70
50.0295	5.00295	500295	3908	71
50.0296	5.00296	500296	3908	72
50.0297	5.00297	500297	3908	73
50.0298	5.00298	500298	3908	74
50.0299	5.00299	500299	3908	75
50.03	5.003	500300	3908	76
50.0301	5.00301	500301	3908	77
50.0302	5.00302	500302	3908	78
50.0303	5.00303	500303	3908	79
50.0304	5.00304	500304	3908	80
50.0305	5.00305	500305	3908	81
50.0306	5.00306	500306	3908	82
50.0307	5.00307	500307	3908	83
50.0308	5.00308	500308	3908	84
50.0309	5.00309	500309	3908	85
50.031	5.0031	500310	3908	86
50.0311	5.00311	500311	3908	87
50.0312	5.00312	500312	3908	88
50.0313	5.00313	500313	3908	89
50.0314	5.00314	500314	3908	90
50.0315	5.00315	500315	3908	91
50.0316	5.00316	500316	3908	92
50.0317	5.00317	500317	3908	93
50.0318	5.00318	500318	3908	94
50.0319	5.00319	500319	3908	95
50.032	5.0032	500320	3908	96

VCO	BFO	G	N	A
50.0321	5.00321	500321	3908	97
50.0322	5.00322	500322	3908	98
50.0323	5.00323	500323	3908	99
50.0324	5.00324	500324	3908	100
50.0325	5.00325	500325	3908	101
50.0326	5.00326	500326	3908	102
50.0327	5.00327	500327	3908	103
50.0328	5.00328	500328	3908	104
50.0329	5.00329	500329	3908	105
50.033	5.0033	500330	3908	106
50.0331	5.00331	500331	3908	107
50.0332	5.00332	500332	3908	108
50.0333	5.00333	500333	3908	109
50.0334	5.00334	500334	3908	110
50.0335	5.00335	500335	3908	111
50.0336	5.00336	500336	3908	112
50.0337	5.00337	500337	3908	113
50.0338	5.00338	500338	3908	114
50.0339	5.00339	500339	3908	115
50.034	5.0034	500340	3908	116
50.0341	5.00341	500341	3908	117
50.0342	5.00342	500342	3908	118
50.0343	5.00343	500343	3908	119
50.0344	5.00344	500344	3908	120
50.0345	5.00345	500345	3908	121
50.0346	5.00346	500346	3908	122
50.0347	5.00347	500347	3908	123
50.0348	5.00348	500348	3908	124
50.0349	5.00349	500349	3908	125
50.035	5.0035	500350	3908	126

-BFO II-

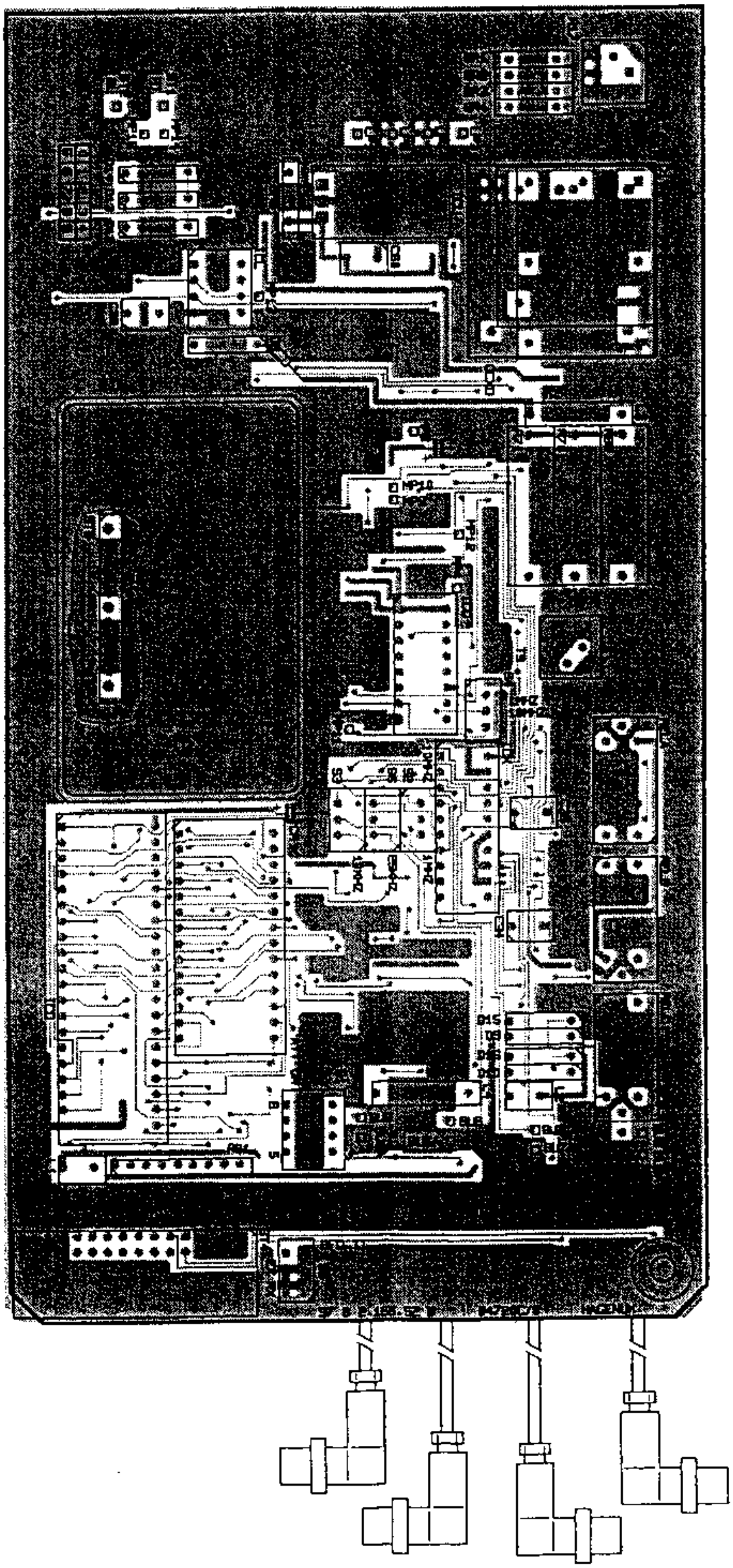
see circuit diagram - 97 Sa B 2.155.50 B





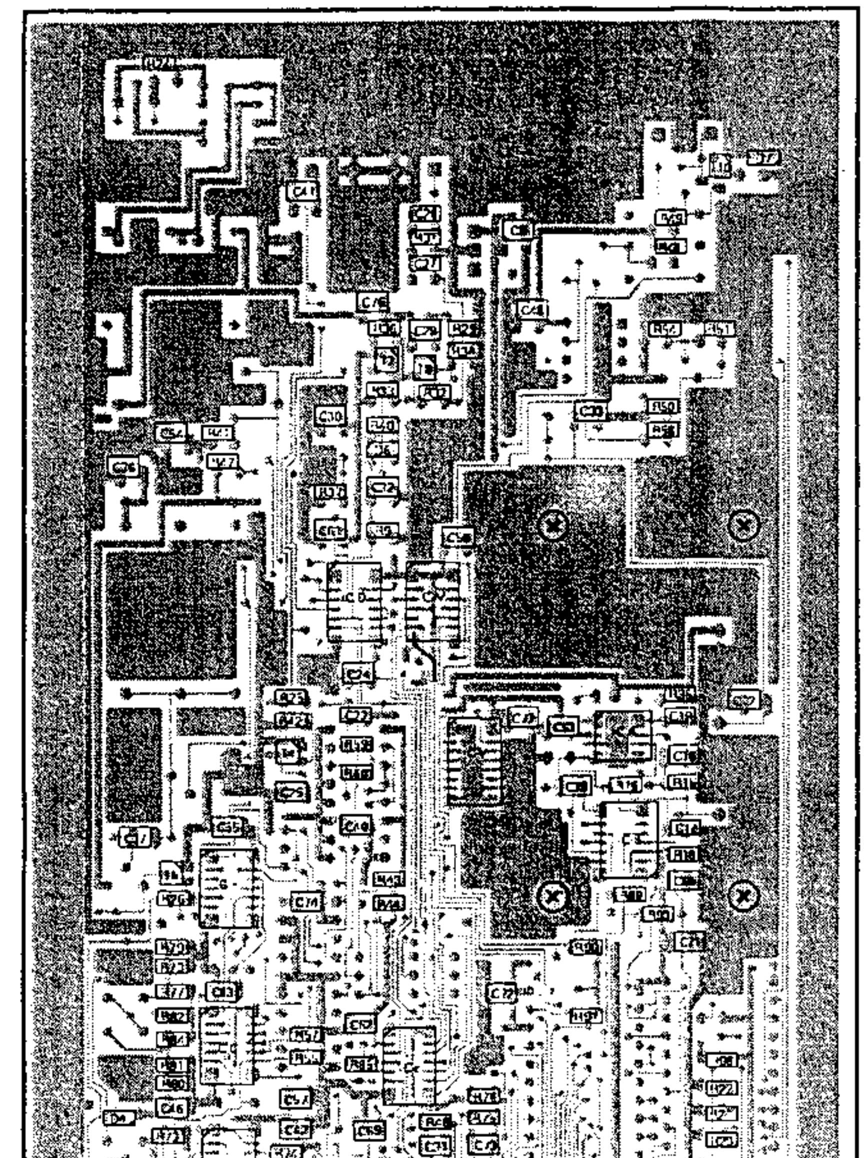
BFO-VCO - 97 E 2.155.53

HAG/ROD 016-04 93

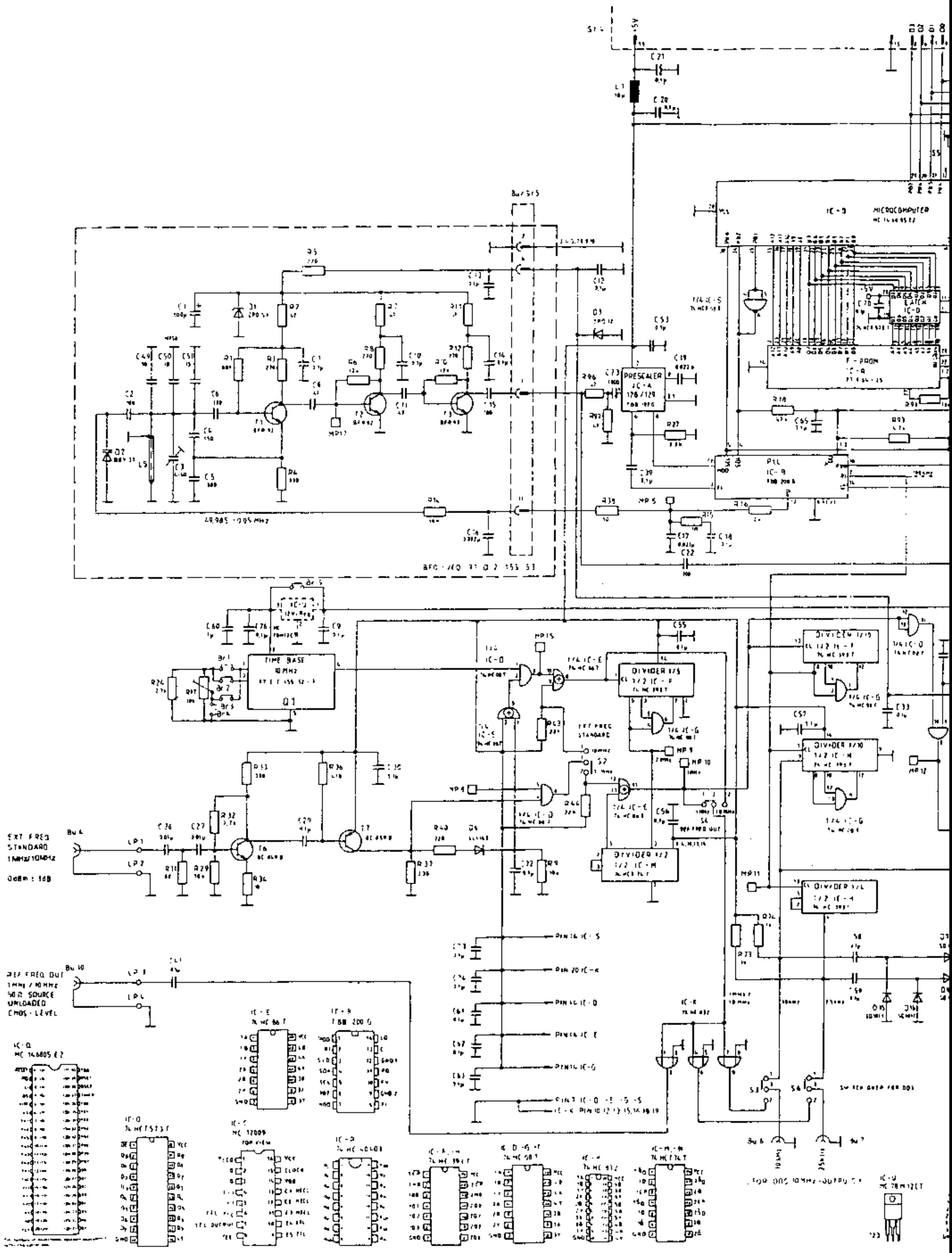


HAG/ROD 016-08.92

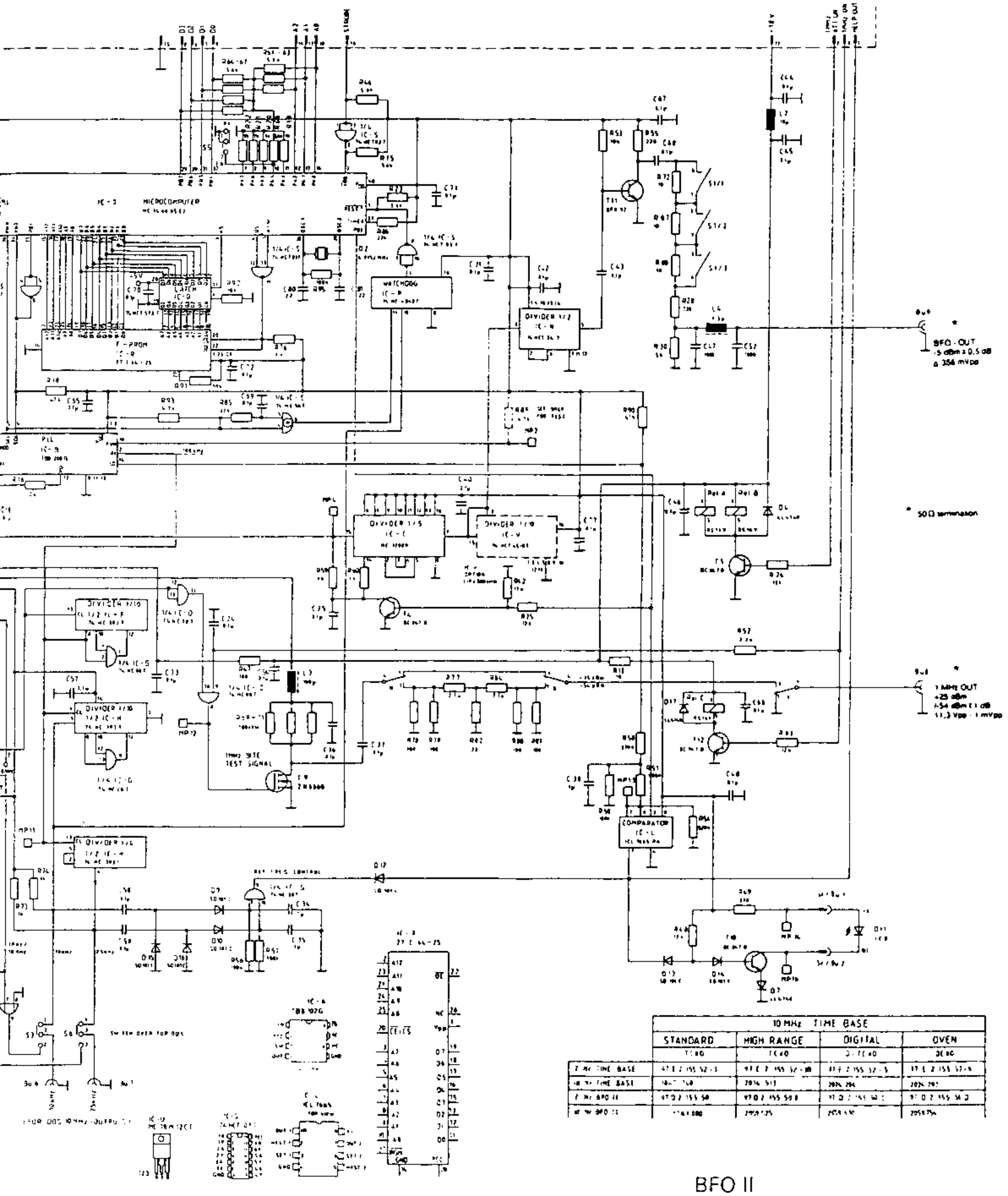
see circuit diagram - BFO II 97 Sa B 2.155.50B



Printed Circuit Board
BFO II
97 B 2.155.52B



MICROCOMPUTER
LATCH
E - PROM
PRESCALER
PLL
TIME BASE 10 MHz
DIVIDER 1/5
DIVIDER 1/10
DIVIDER 1/2
DIVIDER 1/2
DIVIDER 1/10
DIVIDER 1/4
EXT. FREQ. STANDARD 1MHz/10MHz
0dBm ± 3dB
REF. FREQ. OUT 1MHz / 10MHz 50 Ω SOURCE UNLOADED CMOS - LEVEL
49,985 - 0,05 MHz



	10 MHz TIME BASE			
	STANDARD	HIGH RANGE	DIGITAL	OVEN
	TCXO	TCXO	D-TCXO	OCXO
2 MHz TIME BASE	97 E 2.155.52-3	97 E 2.155.52-[illegible]	97 E 2.155.52-5	97 E 2.155.52-[illegible]
10 MHz TIME BASE	[illegible]	2016.513	2016.[illegible]	2016.[illegible]
2 MHz BFO II	97 D 2.155.50	97 D 2.155.50 B	97 D 2.155.50 C	97 D 2.155.50 D
10 MHz BFO II	[illegible]	[illegible]	[illegible]	[illegible]

BFO II
Circuit Diagram
97 Sa B 2.155.50 B

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Cpacitors:				
1692.070	C1	100/20/10 V	AS 2222 021 34101	VALVO
1646.958	C2	100pF/5/63 V	KEFQ 0805 NPO	VALVO
1826.530	C3	4-40pF	119 390 104	VALVO
1646.842	C4	150pF/5/63 V	KEFQ 0805 NPO	VALVO
1643.991	C5	680pF/5/63 V	KEFQ NPO	VALVO
1647.784	C6	330pF/5/63 V	KEFQ 0805	VALVO
1646.990	C7	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1643.932	C8	47pF/5/63 V	KEFQ NPO	VALVO
1646.990	C9	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C10	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1643.932	C11	47pF/5/63 V	KEFQ NPO	VALVO
1646.990	C12	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C13	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C14	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.958	C15	100pFv/5/63 V	KEFQ 0805 NPO	VALVO
1646.931	C16	0,022/10/63 V	KEFQ 0805 X7R	VALVO
1646.931	C17	0,022/10/63 V	KEFQ 0805 X7R	VALVO
1663.852	C18	0,22/10/63 V	KEFQ 1210 X7R	VALVO
1646.931	C19	0,022/10/63 V	KEFQ 0805 X7R	VALVO
1646.990	C20	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C21	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.958	C22	100pF/5/63 V	KEFQ 0805 NPO	VALVO
1646.885	C23	1000pF/5/63 V	KEFQ 0805 NPO	VALVO, SIEMENS RÖDERSTEIN
1646.990	C24	01/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C25	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1556.029	C26	0,01/10/50 V	KEFQ 1206 X7R	VALVO
1556.029	C27	0,01/10/50 V	KEFQ 1206 X7R	VALVO
1959.255	C28	100/20/35 V		VALVO
1646.990	C29	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C30	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C31	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C32	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C33	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1469.053	C34	1/10/50 V	MKS 2 RM 5	WIMA
1469.053	C35	1/10/50 V	MKS 2 RM 5	WIMA
1646.990	C36	01/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C37	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1469.053	C38	1/10/50 V	MKS 2 RM 5	WIMA
1646.990	C39	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C40	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C41	0,1/10/63 V	KEFQ 1210 X7R	VALVO

-BFO II-

Parts lists No.
97 Sa 2.155.50 B

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1646.990	C42	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C43	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C44	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C45	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C46	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.885	C47	1000pF/5/63 V	KEFQ 0805 NPO	VALVO, SIEMENS RÖDERSTEIN
1646.990	C48	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1847.724	C49	10 pF/5/63 V	KEFQ 0805 N750	VALVO
1874.724	C50	10 pF/5/63 V	KEFQ 0805 N750	VALVO
1847.732	C51	15 pF/5/63 V	KEFQ 0805 N750	VALVO
1646.885	C52	1000pF/5/63 V	KEFQ 0805 NPO	VALVO, SIEMENS RÖDERSTEIN
1646.990	C53	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C54	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C55	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1423.304	C56	10/20/25 V		VALVO
1646.990	C57	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C58	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C59	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1469.053	C60	1/10/50 V	MKS 2 RM 5	WIMA
1646.990	C61	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C62	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C63	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C64	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C65	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C67	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C68	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C69	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C70	0.1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C71	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C72	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C73	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C74	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C76	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1646.990	C77	0,1/10/63 V	KEFQ 1210 X7R	VALVO
1647.172	C80	22 pF/5/0805	DBL 622 000	
1647.172	C81	22 pF/5/0805	DBL 622 000	

Diodes:

0758.353	D1		ZPD 5,1	ITT
1652.478	D2		BBY 31	VALVO

HAG/ROD 016-09 92

Parts lists No.
97 Sa 2.155.50 B

-BFO II-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
0922.684	D3		ZPD 12 V	ITT
1613.162	D4		LL 4148	ITT
	D5			
1613.162	D6		LL 4148	ITT
1613.162	D7		LL 4148	ITT
	D8			
1465.740	D9		SD 101 C	ITT
1465.740	D10		SD 101 C	ITT
1427.121	D11		TLUR 5400	AEG-TELEF.
1465.740	D12		SD 101 C	ITT
1465.740	D13		SD 101 C	ITT
1465.740	D14		SD 101 C	ITT
1465.740	D15		SD 101 C	ITT
1465.740	D16		SD 101 C	ITT
1613.162	D17		LL4148	ITT

Resistors:

1612.964	R1	68K/5/1206	DBL 616010	
1647.180	R2	47/5/1206	DBL 616010	
1612.875	R3	270/5/1206	DBL 616010	
1643.363	R4	330/5/1206	DBL 616010	
1612.859	R5	220/5/1206	DBL 616010	
1647.202	R6	12K/5/1206	DBL 616010	
1647.180	R7	47/5/1206	DBL 616010	
1612.875	R8	270/5/1206	DBL 616010	
1612.948	R9	10K/5/1206	DBL 616010	
1647.202	R10	12K/5/1206	DBL 616010	
1647.180	R11	47/5/1206	DBL 616010	
1612.875	R12	270/5/1206	DBL 616010	
1672.738	R13	10/5/1206	DBL 616010	
1647.156	R14	56K/5/1206	DBL 616010	
1666.363	R15	15K/5/1206	DBL 616010	
2134.578	R16	0 0204		
2014.416	R17	10K resistor, adjustable	752-10	VITR.
1612.913	R18	4,7K/5/1206	DBL 616010	
1643.460	R19	1K/5/1206	DBL 616010	
1643.460	R20	1K/5/1206	DBL 616010	
1643.460	R21	1K/5/1206	DBL 616010	
1643.460	R22	1K/5/1206	DBL 616010	
1647.431	R24	2,7K/5/1206	DBL 616010	

-BFO II-

Parts lists No.
97 Sa 2.155.50 B

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1647.202	R25	12K/5/1206	DBL 616010	
1647.202	R26	12K/5/1206	DBL 616010	
1612.859	R28	220/5/1206	DBL 616010	
1643.487	R29	1,8K/5/1206	DBL 616010	
1878.050	R30	56/5/1206	DBL 616010	
1650.238	R31	68/5/1206	DBL 616010	
1647.431	R32	2,7K/5/1206	DBL 616010	
1643.363	R33	330/5/1206	DBL 616010	
1672.738	R34	10/5/1206	DBL 616010	
	R35			
1704.621	R36	470/5/1206	DBL 616010	
1643.363	R37	330/5/1206	DBL 616010	
	R38	5/1206	DBL 616010	
	R39			
1612.859	R40	220/5/1206	DBL 616010	
	R41			
1647.202	R42	12K/5/1206	DBL 616010	
1650.130	R43	22K/5/1206	DBL 616010	
1650.130	R44	22K/5/1206	DBL 616010	
1811.126	R46	5,6K/5/1206	DBL 616010	
0744.883	R47	180/5/0,6/0207	DIN 44052-G	
1647.202	R48	12K/5/1206	DBL 616010	
1612.875	R49	270/5/1206	DBL 616010	
1647.113	R50	180K/5/1206	DBL 616010	
1612.980	R51	100K/5/1206	DBL 616010	
1643.525	R52	2,2K/5/1206	DBL 616010	
1612.948	R53	10K/5/1206	DBL 616010	
1785.346	R54	820K/5/1206	DBL 616010	
1643.363	R55	330/5/1206	DBL 616010	
1612.980	R56	100K/5/1206	DBL 616010	
1612.980	R57	100K/5/1206	DBL 616010	
1613.006	R58	220K/5/1206	DBL 616010	
1643.460	R59	1K/5/1206	DBL 616010	
1643.460	R60	1K/5/1206	DBL 616010	
1595.695	R61	8x5,6K-2-200 MW	NW SIL CSN	DALE
1595.695	R62	8x5,6K-2-200 MW	NW SIL CSN	DALE
1595.695	R63	8x5,6K-2-200 MW	NW SIL CSN	DALE
1595.695	R64	8x5,6K-2-200 MW	NW SIL CSN	DALE
1595.695	R65	8x5,6K-2-200 MW	NW SIL CSN	DALE
1595.695	R66	8x5,6K-2-200 MW	NW SIL CSN	DALE
1595.695	R67	8x5,6K-2-200 MW	NW SIL CSN	DALE
1595.695	R68	8x5,6K-2-200 MW	NW SIL CSN	DALE
0793.507	R69	180-5-0,8-0719	DIN 44052-G	
0793.507	R70	180-5-0,8-0719	DIN 44052-G	

Parts lists No.
97 Sa 2.155.50 B

-BFO II-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
0793.507	R71	180-5-0,8-0719	DIN 44052-G	
1672.738	R72	10/5/1206	DBL 616010	
1643.460	R73	1 K/5/1206	DBL 616010	
1643.460	R74	1K/5/1206	DBL 616010	
1811.126	R75	5,6K/5/1206	DBL 616010	
1643.460	R76	1 K/5/1206	DBL 616010	
1647.431	R77	2,7K/5/1206	DBL 616010	
1647.105	R78	100/5/1206	DBL 616010	
1647.105	R79	100/5/1206	DBL 616010	
1647.105	R80	100/5/1206	DBL 616010	
1647.105	R81	100/5/1206	DBL 616010	
1709.054	R82	27/5/1206	DBL 616010	
1647.202	R83	12K/5/1206	DBL 616010	
1647.431	R84	2,7K/5/1206	DBL 616010	
1650.130	R85	22K/5/1206	DBL 616010	
1650.130	R86	22K/5/1206	DBL 616010	
1672.738	R87	10/5/1206	DBL 616010	
1672.738	R88	10/5/1206	DBL 616010	
1612.913	R90	4,7K/5/1206	DBL 616010	
1612.948	R91	10K/5/1206	DBL 616010	
1612.948	R92	10K/5/1206	DBL 616010	
1612.913	R93	4,7K/5/1206	DBL 616010	
1957.635	R95	8,2 M/5/1206	DBL 616010	

Coils:

1500.678	L1	10 µH/5 PCT	SD 75	NEOSID
1500.678	L2	10 µH/5 PCT	SD 75	NEOSID
0747.572	L3	100 µH/10 PCT	72.1	JAHRE
or		100 µH	B78108-S1104-J	SIEMENS
1068.164	L4	1,5 µH/10	72.00	JAHRE
or			15/151	GOWANDA
1824.341	L5		97 E 2.155.53-3	

Integrated circuits:

2023.873	IC A		TBB 202 G	SIEMENS
2014.424	IC B		TBB 200 G	SIEMENS
1865.323	IC C		MC 12009 L	MOTOROLA
2014.440	IC D		74 HC 08 T	VALVO
			MM 74 HC 08 M	NATIONAL
			74 HC 08 D	TEXAS

-BFO II-

Parts lists No.
97 Sa 2.155.50 B

Ident-No.	Mark	Electr. value	Identity	Manufacturer
2014.467	IC E		74 HC 86 T	VALVO
			MM 74 HC 86 M	NATIONAL
			74 HC 86 D	TEXAS
2014.475	IC F		74 HC 393 T	VALVO
			74 HC 393 D	TEXAS
2014.440	IC G		74 HC 08 T	VALVO
			MM 74 HC 08 M	NATIONAL
			74 HC 08 D	TEXAS
2014.475	IC H		74 HC 393 T	VALVO
			74 HC 393 D	TEXAS
2014.491	IC K		74 HC 832	TEXAS
1630.180	IC L		ICL 7665 PA	INTERSIL
2024.020	IC M		74 HCT74 T/SO-14	VALVO
			74 HCT74D	TEXAS
2024.020	IC N		74 HCT74 T/SO-14	VALVO
			74 HCT74D	TEXAS
2014.483	IC O		74 HCT 573 T	VALVO
			MM 74 HCT 573 WM	NATIONAL
			74 HCT 573 D	TEXAS
2014.505	IC P		74 HC 4040 T	VALVO
			4040 D	TEXAS
1712.837	IC Q		MC 146805 E2P	MOTOROLA
2034.158	IC R		97 E 2.155.305	
2014.459	IC S		74 HCT 03 T	TEXAS
	IC U			
	IC V		74 HCT 4510 T	
	IC Z			

Transistors:

1647.385	T1		BFR 92 SOT-23	MOTOROLA
1647.385	T2		BFR 92 SOT-23	MOTOROLA
1647.335	T3		BFR 92 SOT-23	MOTOROLA
1647.393	T4		BC 847 B SOT-23	VALVO
1647.393	T5		BC 847 B SOT-23	VALVO
1710.575	T6		BC 849 B SOT-23	VALVO
1740.520	T7		BC 859 B SOT-23	VALVO
	T8			
2022.362	T9		2 N 6660	MOTOROLA
1647.393	T10		BC847 B SOT-23	VALVO
1647.385	T11		BFR 92 SOT-23	MOTOROLA
1647.393	T12		BC 847 B SOT-23	VALVO
	T999			

-BFO II-

Parts lists No.
97 Sa 2.155.50 B

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Supplements:				
1847.740	Q1		97 E 2.155.52-3	
1496.824	Q2	4,9152 MHz		
1249.053	REL A		RS 16 V	SDS
1249.053	REL B		RS 16 V	SDS
1249.053	REL C		RS 16 V	SDS
	REL Z			
1422.944	S2		TS 1	ITT
1422.944	S3		TS 1	ITT
1422.944	S4		TS 1	ITT
1422.944	S5		TS 1	ITT
1422.944	S6		TS 1	ITT
1315.293	S1/1	4-quad	435166-2	AMP
1315.293	S1/2	4-quad	435166-2	AMP
1315.293	S1/3	4-quad	435166-2	AMP

- Power Supply-

Technical description

Mains power is applied via a filter to the mains transformer Tr 1, whose output is rectified by rectifier GL 1 and fed to the charging capacitor C 10. When the receiver is switched to battery operation, the battery voltage is fed, instead of the output of rectifier GL 1, to charging capacitor C 10. The battery voltage from the rectifier passes via relay contact a (on AUTO.-MAINS/BATT: board) - socket Bu 1 pin 4 b - the MAINS switch - Bu 1 pin 2 b - to charging capacitor C 10 and then via the primary of transformer Tr 2 to the switching transistors T 2, T 4, whose emitters are connected to the negative side of charging capacitor C 10, thus completing the circuit. The current flowing in this circuit is now switched on and off at a frequency of 32-34 kHz by switching transistors T 2, T 4. Regulation is by pulse width control. The voltage induced in the secondary of transformer Tr 2 on switch-off causes a current to flow through the two switching diodes D 8 and D 9. D 9 is connected to a tapping on the transformer and via an output filter to the 5 V output of the power supply.

This 5 V voltage is used as a reference value. If it increases, the conducting time of the switching transistors T 2, T 4 falls slightly; if it falls, the conducting time increases and the 5 V output returns to its specified value; the tolerance is ± 0.2 V.

The pulse width and hence the switching time of the switching transistors is varied as follows:
The 5 V output voltage is fed to the non-inverted input of an operational amplifier IC - C, whose other input is at a fixed reference voltage: The output current of the operational amplifier flows through the diode of optocoupler OK 1 and is proportional to variations of the 5 V output voltage. The diode of the optocoupler controls the relevant phototransistor, which is in turn connected to the switching regulator IC which controls the pulse width determined by R 102 and C 102. The switching regulator IC (output 15) supplies control pulses to the gate of transistor T 101, which is in turn connected via transformer Tr 101 to the base of switching transistor T 2.

The 18 V output voltage is also obtained from transformer Tr 2. The current from the second output of the secondary of transformer Tr 2 flows via switching diode D 8 and the emitter and collector of transistor T 3 to the 18 V output of the power supply. The transistor provides secondary stabilization of the voltage from transformer Tr 2.

-Power Supply-

The base of T 3 is driven by the second operational amplifier of IC - C. One input of the operational amplifier is again at a fixed reference voltage and the 18 Volt to be regulated is connected to its second input.

In addition to the 5 V and 18 V outputs already described, the power supply provides a 12 V supply which is also present when the equipment is switched off. This is produced by an independent second switching power supply consisting of switching transistor T 103, transformer Tr 102 and control transistor T 104. Transistor T 103 and the two windings 6/7 and 5/8 of transformer Tr 102 form a free-running generator with a frequency of approx. 30 kHz. Bias of the transistor T 104 is set by zenerdiode D 103 and changed with varying 12 V output voltage. Thus this voltage is held at a constant level.

If the mains supply or battery voltage falls too low or fails, a warning signal must be supplied to the microprocessor in the receiver; at the same time, the power supply outputs must hold long enough for the processor to go into a defined quiescent condition. This information is provided by the power failure pulse. This is done by monitoring the voltage at the charging capacitor C 10, which may be in the range 18 to 40 V depending on the supply voltage. The failure pulse is supplied by IC - B at about 20 V, controlling the gate of T 102 and passing via optocoupler OK 2 to the relevant output of the power supply. The voltage level at which the power failure pulse occurs must have a very narrow tolerance, as, firstly, it must not shut down the connected equipment too early and, secondly, the supply voltage must not have fallen too low, as the stored energy will then no longer suffice to keep the output voltages constant long enough (specified value: 1 ... 10 ms).

The outputs of the power supply are overload-protected. The overload sensor circuit monitors the collector-emitter saturation voltage of switching transistors T 2, T 4. An overload causes this voltage to rise and switches off the control circuit IC - A via Tr 1. T 2, T 4 are then cut off. After a time, IC - A is re-enabled via T 1 and the power supply unit again produces its output voltages, which however, is immediately disconnected again if the overload is still present. In this case there is a characteristic alternation of connection and disconnection of the power supply's 5 and 18 V outputs.

NOTE
The power fail pulse is not used in the RX 1001 M / RX 5001 / EX 1010. Monitoring of supply voltage is done on the CPU II board.

-Power Supply-

The 12 V switching power supply is protected by R 126, a PTC resistor. If the current through transformer Tr 102 increases, the temperature of R 126 rises and its resistance therefore increases; the current is thus limited.

High voltages with reference to earth on the battery lines may be hazardous to transformers Tr 2 and Tr 102. These are connected to ground by voltage-dependent resistor R 129, whose resistance falls with increasing voltage.

Automatic mains/battery switchover
Mains voltage monitoring is accomplished on the auto mains/batt board. Secondary voltage of the mains transformer Tr1 is rectified by means of the diodes D53 and D54 and filtered with C58. The voltage is fed to the inverted input of the operational amplifier IC F, connected as a comparator, via the voltage divider R51/R54. The reference voltage is determined via D58, this diode is supplied from the voltage at the capacitor C10; or from the battery voltage via the diodes D51/D52, which are connected as OR gates. In the event of a mains failure the voltage across C58 drops faster than the voltage across C10. If the output voltage after voltage divider R51/R54 drops below the reference voltage, the output of the operational amplifier status jumps from LOW to HIGH, so T51 is turned on and the two relays A and B operate. When the contact is closed by relay B, the LED BAT on the front of the receiver lights up. The two relays can only switch if there is actually a battery supply with sufficient voltage. The series circuit R55/C60 in the negative feed back branch of the operational amplifier prevents oscillation during the switching process.
The three output voltages are compared in IC - G with a reference voltage generated by D 59. The 12 V is being tested for low voltage, 5 V for high voltage and 18 V for low and high voltage. If any voltage is incorrect, a fault signal is given by IC - J.
Finally, here are some notes on possible faults and their causes. As already stated, a short circuit or overload of the power supply is indicated by a continual ON-OFF output.
The following points should be noted when measuring the outputs:
If the 5 V output is unloaded (current approx. 100 mA) - e.g., if only a high-resistance voltmeter is connected - usually nothing can be measured at the 18 V output, because the regulation does not work at low current.

If the 5 V is absent, the 18 V can also not be measured unless the output filter is defective.

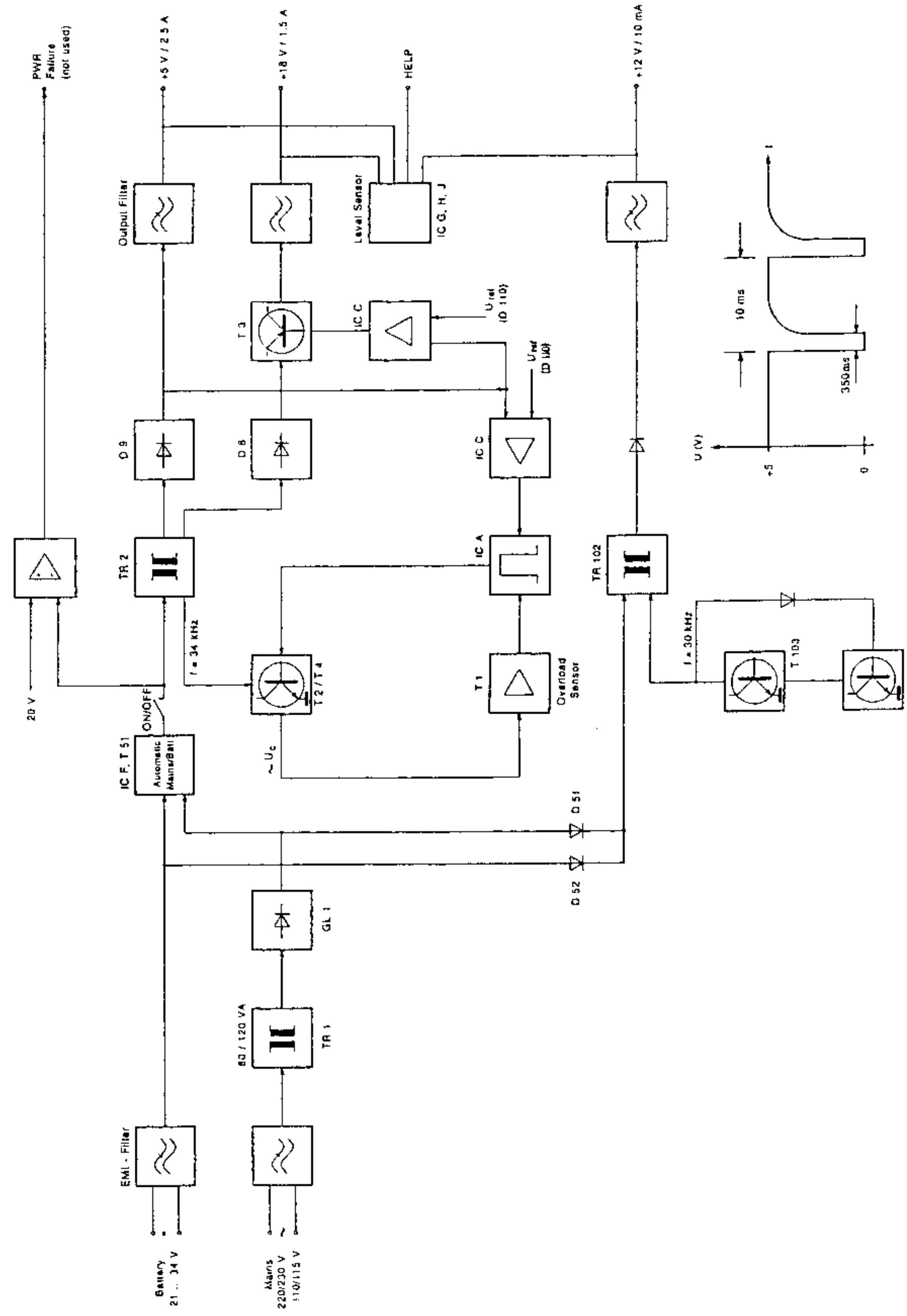
-Power Supply-

WARNING
The power supply should never be connected to the receiver when switched on unloaded. When unloaded, the 5 V could go as high as 8 V (as the regulation does not work in the unloaded condition), or at least to a value above what is permissible for 5 V ICs.

Hence, if neither the 18 V nor the 5 V output is measureable, the next check should be to measure the control pulse for the switching transistors. Pulses of approx. 30 µs period (= 33 kHz) and an amplitude of approx. 12 V_{pp} can be measured at pin 15 of the switching regulator IC - A. The pulse width may vary: it is narrow at high input voltage and increases with lower input voltage. Wide pulses and a hot or even a burnt-out resistor R 120 suggest defective switching transistors T 2, T 4 if the 5 V output voltage can not be measured as well. An apparently overloaded resistor R 120 (1 Ohm) must on no account be replaced by, for example, a 1 W type, as the transformer will burn out instead of the resistor in the event of a fault.

The presence of the 12 V supply is indicated by the LED D 107. As already stated, the 12 V is generated independently of the other two supplies.

-Power Supply-



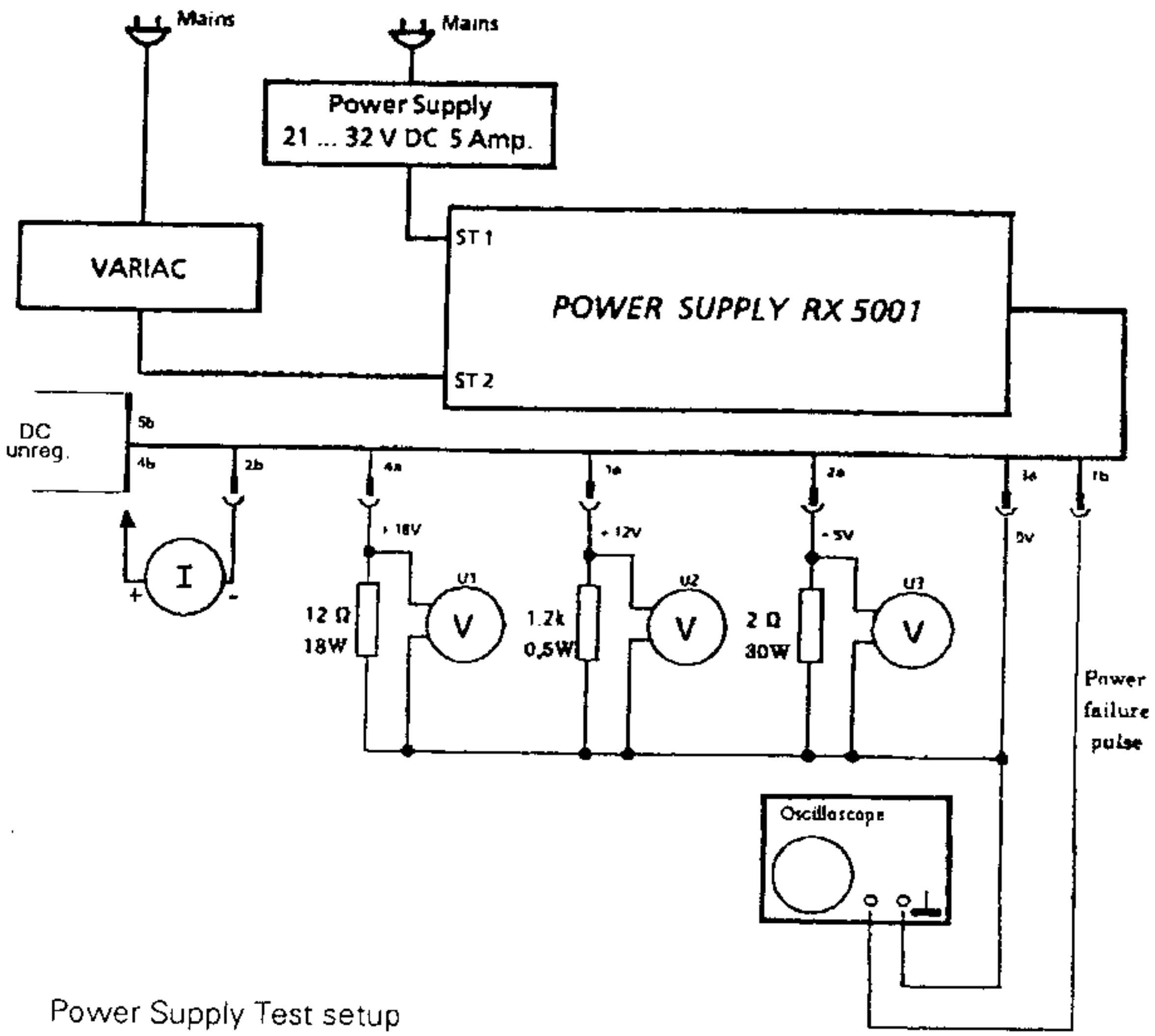
Blockdiagram - Power Supply

-Power Supply-

Test and alignment instructions

Required: Circuit diagram - POWER SUPPLY - Hagenuk Drawing No. 97 Sa B 2.155.21
Power supply, variable-ratio isolating transformer (VARIAC)

Test configuration: Connect up auxilliary circuit as illustrated in the sketch below.
Remove the POWER SUPPLY section and take off the cover.



Power Supply Test setup

-Power Supply-

Testing the power supply
Fit fuses for 110 V 2.0 A and battery 3.15 A.
Connect test power supply to plug St 1 pin A (negative) and ST 1 pin B (positiv). Set voltages to 24 V.
Connect socket Bu 1 pin 2 b to socket Bu 1 pin 4 b (thus switching on power supply)
Test values:
Functional test: LED D 107 on the switching regulator board ON.
Measure voltage U1 = +18 V, U2 = +12 V and U3 = + 5 V.

Remove jumper across socket Bu 1 pins 2 b/4 b.
Connect VARIAC to plug ST 2 pins 1 and 2.
Set voltage to 110 V and refit jumper.
Test values: measure voltages U1 = +18 V, U2 = +12 V and U3 = + 5 V.
Again remove jumper across pins 2 b/4 b of socket Bu 1. Remove 110 V fuse and replace by 220 V 1.6 A fuse. Set VARIAC to 220 V and refit jumper.
Test values: measure voltages U1 = +18 V, U2 = +12 V and U3 = + 5 V.

Testing battery/mains switchover
Connect 24 V DC and 220 V mains voltage. Turn down VARIAC until switchover occurs at 24 V. Increase the voltage again.
Test values:
Voltage difference must be 20 V.

Testing the POWER FAILURE PULSE
Turn down variable-ratio isolating transformer until the POWER FAILURE PULSE appears on the oscilloscope.

NOTE
The voltage must be less than the mains/battery switchover voltage.

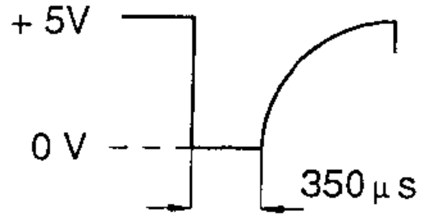
Testing the SWITCHING REGULATOR BOARD
Set variable-ratio isolating transformer to 195 V. Diode D 107 must illuminate:
Test values:
Power supply 5 V should be 5.1 V ± 0.15 V.
Further reduce voltage on variable-ratio isolating transformer.

-Power Supply-

Testing the SWITCHING REGULATOR BOARD
Set variable-ratio isolating transformer to 195 V. Diode D 107 must illuminate:
Test values:
Power supply 5 V should be 5.1 V ± 0.15 V.
Further reduce voltage on variable-ratio isolating transformer.

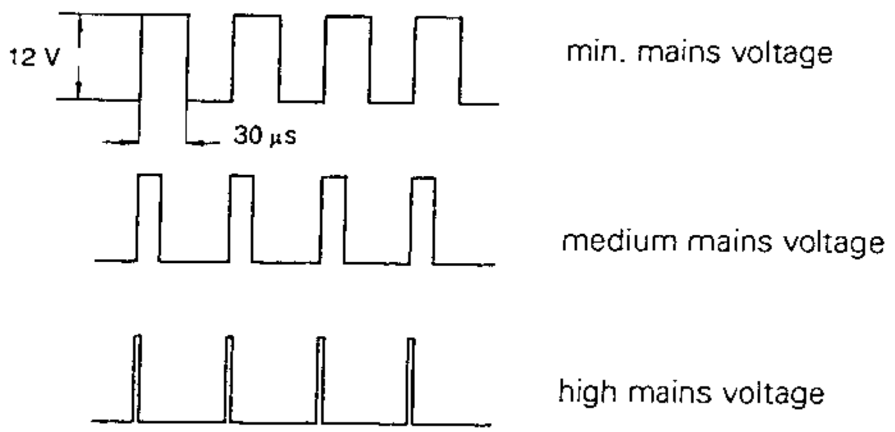
-Power Supply-

Test values:
POWER FAILURE PULSE to appear at 160 - 195 V



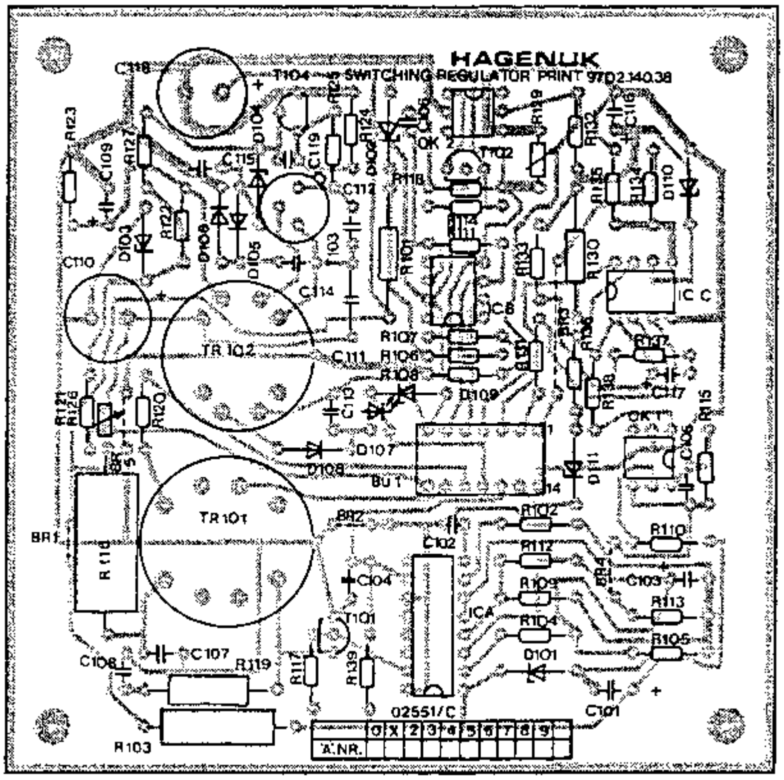
Testing the reference voltage
Switch on power supply and fit jumper across socket BU 1 pins 2 b and 4 b.
Then measure voltage on diode D 59.
Test values:
Specified: 1.200 - 1.265 V (resistor R 65 may be shorted depending on component tolerances).

Check switching frequency at IC - A pin 15 with oscilloscope.
Test values:
Specified 30 kHz - 40 kHz.



-Power Supply-

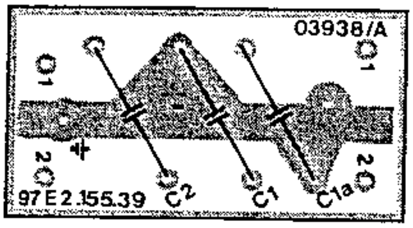
see circuit diagram - 97 Sa B 2.155.21

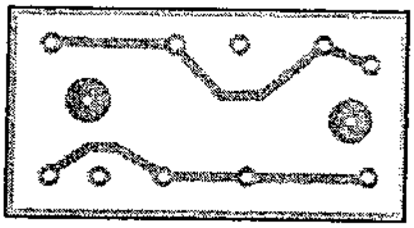


Switching Regulator Print - 97 D 2.140.38

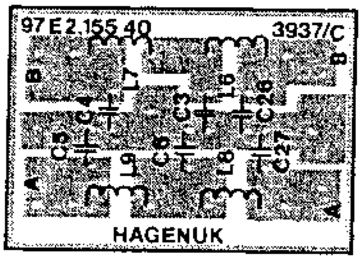
-Power Supply-

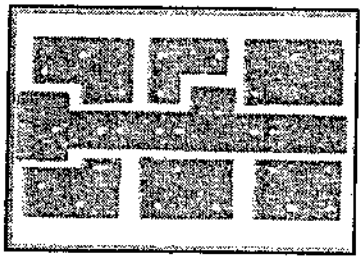
see circuit diagram - 97 Sa B 2.155.21





Filter Mains - 97 E 2.155.39

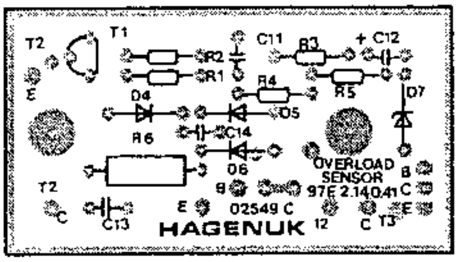


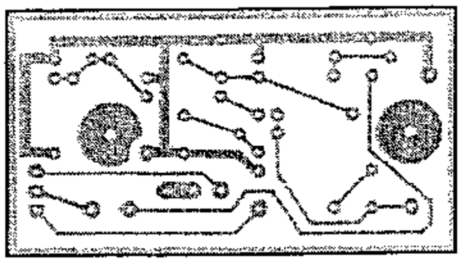


Filter Battery - 97 E 2.155.40

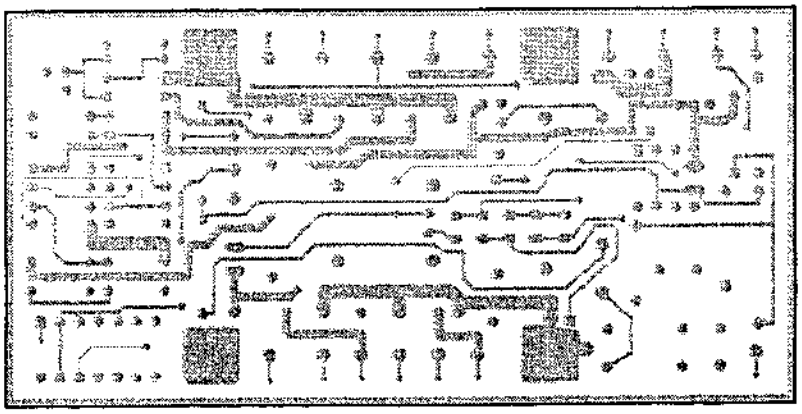
-Power Supply-

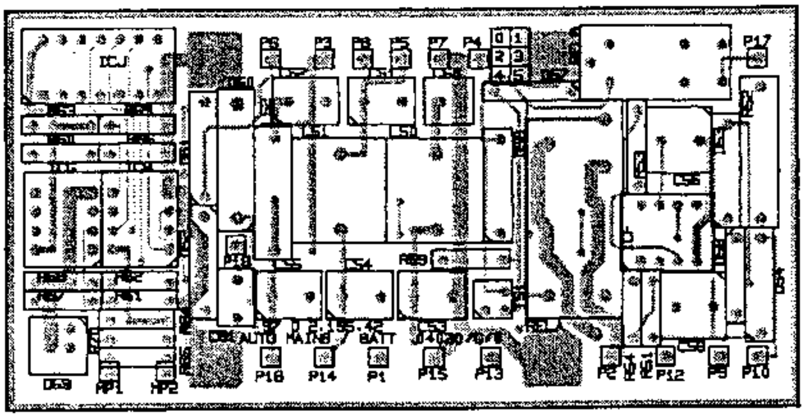
see circuit diagram - 97 Sa B 2.155.21



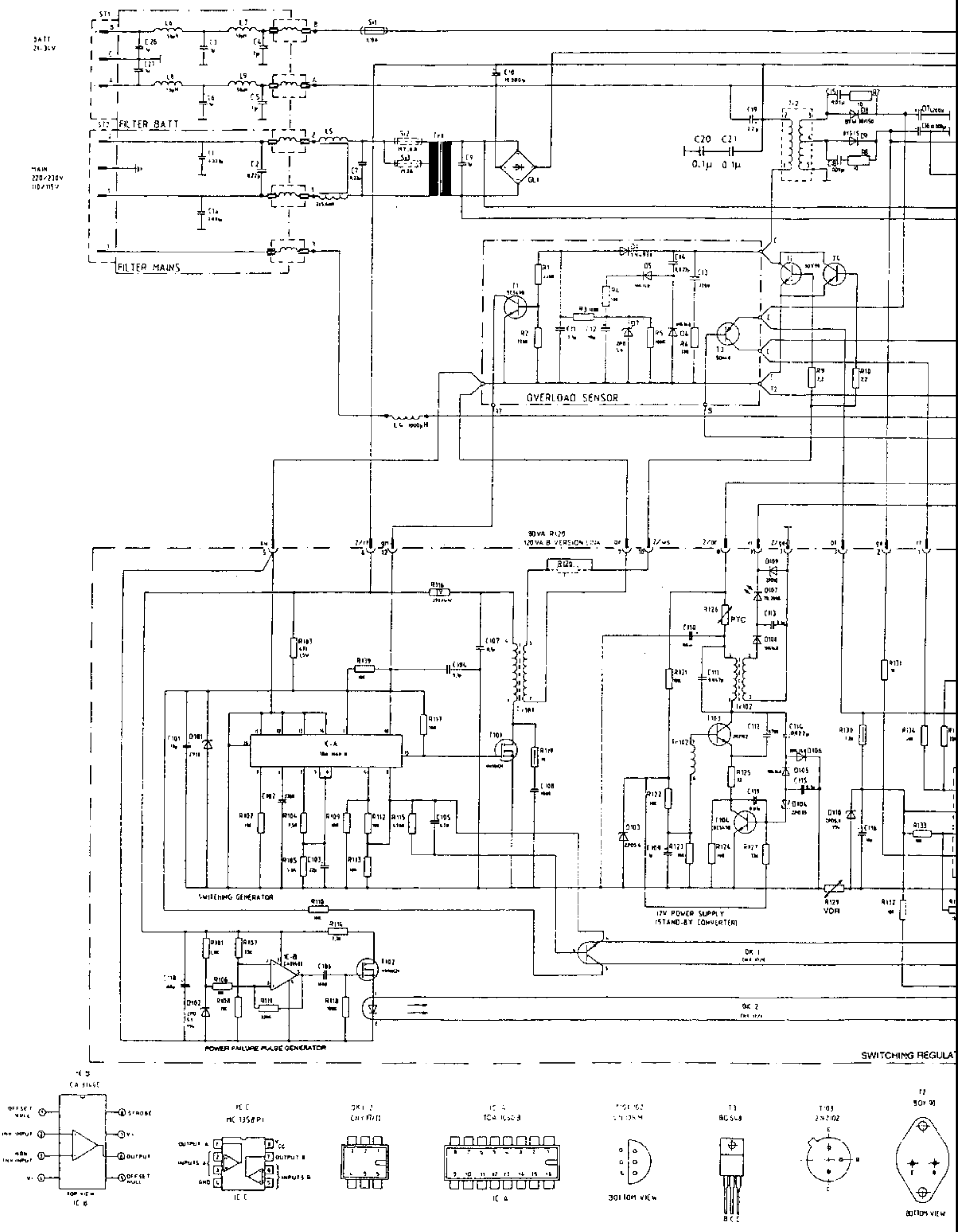


Overload Sensor - 97 E 2.140.41

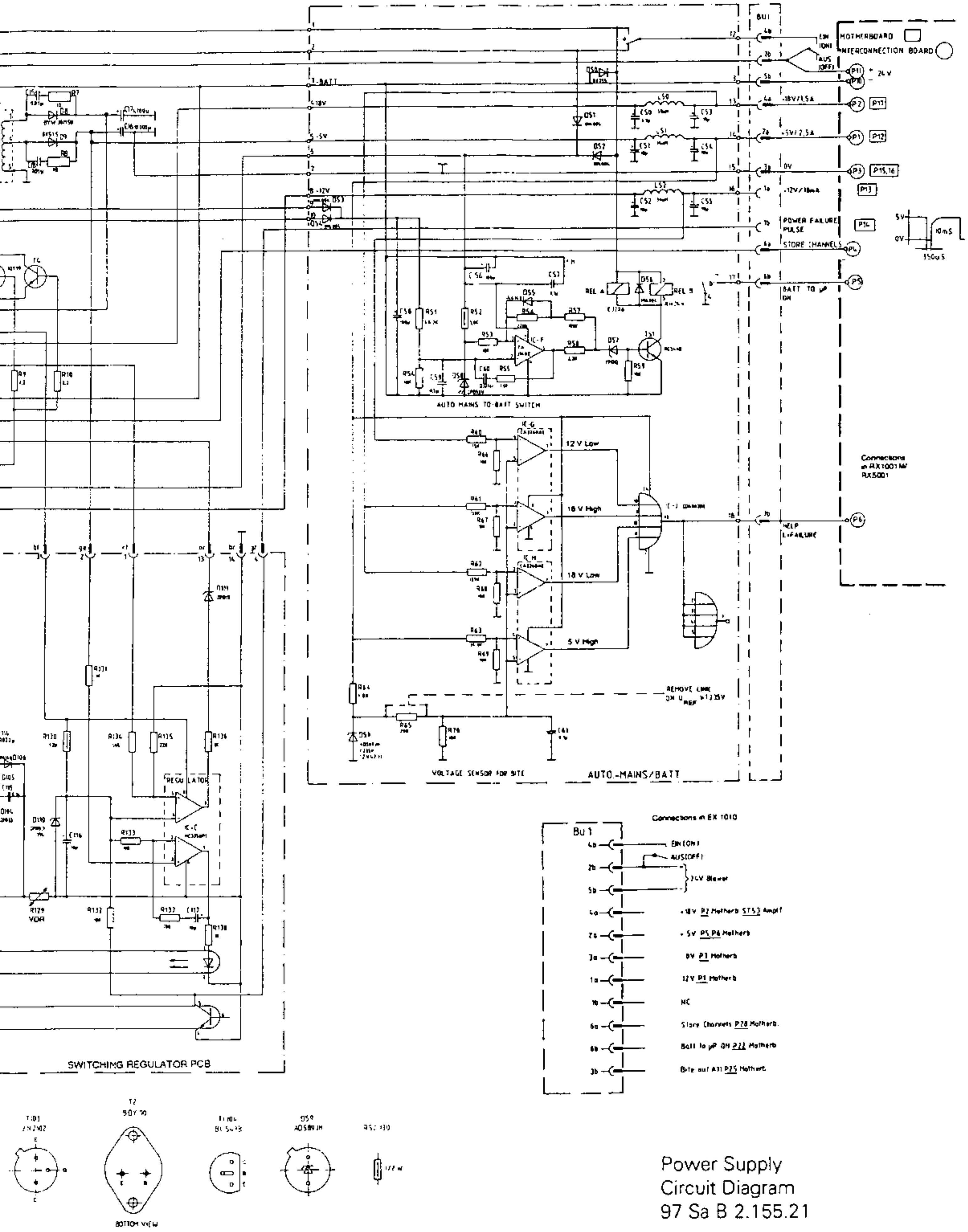




Auto Mains/Batt. - 97 D 2.155.42



HAG/ROD 016-08.92



Power Supply
Circuit Diagram
97 Sa B 2.155.21

Parts lists No.
97 Sa 2.155.21

-Power Supply-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Capacitors:				
1426.583	C1	0,033 µF/380 V	PME 278	RAFI
1426.583	C1a	0,033 µF/380 V	PME 278	RAFI
1426.591	C2	0,22 µF/275 V	PMZ 2050	RAFI
1785.087	C3	1/20/50 V	X7R VPP 44	VITRAMON
1785.087	C4	1/20/50 V	X7R VPP 44	VITRAMON
1785.087	C5	1/20/50 V	X7R VPP 44	VITRAMON
1785.087	C6	1/20/50 V	X7R VPP 44	VITRAMON
1185.594	C7	0,22 µ 250 V	F1773-422-2000	RÖDERSTEIN
0923.796	C9	1 µF/40 V	DIN 44111	
1961.136	C10	10000/20/40 V	2222051 67103	VALVO
1208.225	C11	0,1 µF/100 V	CK 06 BX 104 M	SEC
1423.304	C12	10 µF/25 V	2222.122.90006	VALVO
1426.575	C13	2200 pF/10 %/500 V	2222.655.03222	VALVO
1309.447	C14	0,022 µF/100 V	CK 06 BX 223 K	SEC
1286.285	C15	0,01 µF/200 V	CK 06 BX 103 M	VALVO
1433.911	C16	10000/10 V	2222050 64103	VALVO
1433.903	C17	4700 µF/25 V	2222050 66472	VALVO
1286.285	C18	0,01 µF/200 V	CK 06 BX 103 M	SEC
1179.209	C19	22 µ/100/40 V	EK 22/40	ROE
1208.255	C20	0,1 µF/100 V	CK 06 BX 104 M	SEC
1208.255	C21	0,1 µF/100 V	CK 06 BX 104 M	SEC
1785.087	C26	1/20/50 V	X7R VPP 44	VITRAMON
1785.087	C27	1/20/50 V	X7R VPP 44	VITRAMON
1815.377	C50	47/20/25 V		VALVO
1423.304	C51	10 µF/25 V		VALVO
1423.304	C52	10 µF/25 V		VALVO
1423.304	C53	10 µF/25 V		VALVO
1423.304	C54	10 µF/25 V		VALVO
1423.304	C55	10 µF/25 V		VALVO
	C56	100 µF/50 V	2222 035 90019	VALVO
1646.990	C57	0,1 µF		
	C58	100 µF/50 V	2222 035 90019	VALVO
1646.990	C59	0,1 µF		
1674.897	C60	0,01 µF		
1404.822	C61	0,1 µF		WIMA
1423.304	C101	10 µF/25 V	2222 122. 90006	VALVO
0945.765	C102	3300 pF/63 V	EDPU/0,6 K2000	VALVO
1189.441	C103	22 µF/35 V	ETQ 5	ROE
1208.225	C104	0,1 µF/100 V	CK 06 BX 104 M	SEC

-Power Supply-

Parts lists No.
97 Sa 2.155.21

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1061.070	C105	470 pF/63 V	EDPU/0,6 K2000	VALVO
0944.971	C106	1000 pF/63 V	EDPU/0,6 K2000	VALVO
1208.225	C107	0,1 µF/100 V	CK 06 BX 104 M	SEC
1426.524	C108	1000 pF/500 V	2222.665.03102	VALVO
1118.013	C109	1 µF/35 V	ETQ 2	ROE
1426.540	C110	100 µF/40 V	EKM 100/40	ROE
1177.710	C111	0,047 µF/100 V	MKT 1819-347/0	ROE
1208.217	C112	4700 pF/200 V	CK 06 BX 472 M	SEC
1208.225	C113	0,1 µF/100 V	CK 06 BX 104 M	SEC
1309.447	C114	0,022 µF/100 V	CK 06 BX 233 K	SEC
1208.225	C115	0,1 µF/100 V	CK 06 BX 104 M	SEC
1423.304	C116	10 µF/25 V	2222.122.90006	VALVO
1423.304	C117	10 µF/25 V	2222.122.90006	VALVO
1426.540	C118	100 µF/40 V	EKM 100/40	ROE
0904.988	C119	0,01 µF/40 V	EDPU/0,6 K10000	VALVO

Diodes:

1630.512	D4		1 N 4936	MOTOROLA
0745.677	D5		1 N 4148	
0745.677	D6		1 N 4148	
0745.693	D7		ZPD 5,6	
1434.047	D8		BYW 30/150	VALVO
1434.055	D9		BY5 15	SIEMENS
1255.258	D50		BY 255	
0763.764	D51		1 N 4004	
0763.764	D52		1 N 4004	
0763.764	D53		1 N 4004	
0763.764	D54		1 N 4004	
1613.162	D55		LL 4148	
0763.764	D56		1 N 4004	
0922.684	D57		ZPD 12	
1713.221	D58	5,1 1%		
1469.983	D59		LM 385	
0940.127	D101		ZY 12	ITT
1717.221	D102		ZPD 5,1 1 %	ITT
0745.693	D103		ZPD 5,6	ITT
1426.346	D104		ZPD 33	ITT
0745.677	D105		1 N 4148	
0745.677	D106		1 N 4148	
1096.893	D107		TIL 209 B	TEXAS

Parts lists No.
97 Sa 2.155.21

-Power Supply-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
0745.677	D108		1 N 4148	
0922.684	D109		ZPD 12 V	ITT
1717.221	D110		ZPD 5,1 1%	ITT
0922.684	D111		ZPD 12	ITT

Resistors:

0744.788	R1	330 K 5 % 1/8 W	DIN 44052	
0799.416	R2	220 K 5 % 1/8 W	DIN 44052	
0911.976	R3	180 K 5 % 1/8 W	DIN 44052	
0744.786	R4	18 K 5 % 1/8 W	DIN 44052	
0767.190	R5	100 K 5 % 1/8 W	DIN 44052	
0243.647	R6	390 5 % 1/2 W	DIN 44052	
0626.708	R7	10 5 % 1/8 W	DIN 44052	
0626.708	R8	10 5 % 1/8 W	DIN 44052	
1186.981	R9	2,2 5 % 1/8 W	DIN 44052	
1186.981	R10	2,2 5 % 1/8 W	DIN 44052	
	R40	82 2 W		
1809.490	R51	40,2 k 1 % 0204		
0763.926	R52	1,8 k 5 % 1/2 W	0309	
1190.725	R53	10 k-5-50-0207		
1683.977	R54	10 k 1 % 0204		
1642.227	R55	1,8 k 1 %		
1613.006	R56	220 k 5 %		
1672.827	R57	100 k 1 %		
1674.781	R58	2,2 k 1 %		
1683.977	R59	10 k-1-100-0204		
1756.257	R60	75 k 1 % 0204		
1684.558	R61	150 k 1 % 0204		
1809.512	R62	127 k 1 % 0204		
1809.482	R63	34,8 k 1 % 0204		
1809.474	R64	1,8 k 1 % 0204		
1809.466	R65	200 1 % 0204		
1683.077	R66	10 k 1 % 0204		
1683.077	R67	10 k 1 % 0204		
1683.077	R68	10 k 1 % 0204		
1683.077	R69	10 k 1 % 0204		
1683.077	R70	10 k 1 % 0204		
0181.390	R101	1,8 k 5 % 1/2 W	DIN 44052	
1259.318	R102	11 K 1 % 1/8 W	DIN 44061	

-Power Supply-

Parts lists No.
97 Sa 2.155.21

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1427.865	R103	470/1,5 W	SXA 0617	
1297.074	R104	7,5 K 1 % 1/8 W	DIN 44061	
1060.015	R105	5,6 K 1 % 1/8 W	DIN 44061	
0179.701	R106	10 K 5 % 1l8 W	DIN 44052	
1083.304	R107	33 K 1 % 1/8 W	DIN 44061	
1259.318	R108	11 K 1 % 1/8 W	DIN 44061	
0179.701	R109	10 K 1 % 1/8 W	DIN 44052	
0179.701	R110	10 K 1 % 1/8 W	DIN 44052	
0744.778	R111	330 K 5 % 1/8 W	DIN 44052	
0179.701	R112	10 K 5 % 1/8 W	DIN 44052	
0179.701	R113	10 K 5 % 1/8 W	DIN 44052	
0744.808	R114	2,2 K 5 % 1/8 W	DIN 44052	
0837.075	R115	470 K 5 % 1/8 W	DIN 44052	
1426.532	R116	270/4 W	SXA 0922 DIN 44063	
0179.701	R117	10 K 5 % 1/8 W	DIN 44052	
0767.190	R118	100 K 5 % 1/8 W	DIN 44052	
0181.293	R119	1 K 5 % 1/2 W	DIN 44052	
	R120	1 k 1/8 W	DIN 44052	
0179.701	R121	10 K 5 % 1/8 W	DIN 44052	
0179.701	R122	10 K 5 % 1/8 W	DIN 44052	
0179.701	R123	10 K 5 % 1/8 W	DIN 44052	
0179.639	R124	100 5 % 1/8 W	DIN 44052	
0542.822	R125	33 5 % 1/8 W	DIN 44052	
1426.559	R126		672.91016	VALVO
0627.895	R127	33 K 5 % 1/8 W	DIN 44052	
1426.567	R129		592.12212	VALVO
0181.331	R130	1,3 K 5 % 1/2 W	DIN 44052	
0179.698	R131	1 K 5 % 1/8 W	DIN 44052	
0179.701	R132	10 K 5 % 1/8 W	DIN 44052	
0179.639	R133	100 5 % 1/8 W	DIN 44052	
1174.959	R134	56 K 1 % 1/8 W	DIN 44061	
1265.296	R135	22 K 1 % 1/8 W	DIN 44061	
0179.698	R136	1 K 5 % 1/8 W	DIN 44052	
0179.638	R137	100 5 % 1/8 W	DIN 44052	
0179.698	R138	1 K 5 % 1/8 W	DIN 44052	
0179.701	R139	10 K 5 % 1/8 W	DIN 44052	

Coils:

1433.954	L5	2 x 5,6 mH	B82723-E1-A10	SIEMENS
1426.478	L6		97 E 2.140.124	HAGENUK
1426.478	L7		97 E 2.140.124	HAGENUK
1426.478	L8		97 E 2.140.124	HAGENUK

-Power Supply-

Parts lists No.
97 Sa 2.155.21

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1426.478	L9		97 E 2.140.124	HAGENUK
1426.478	L50		97 E 2.140.124	HAGENUK
1426.435	L51		97 E 2.140.126	HAGENUK
1068.172	L52	56 µH/10 %		JAHRE

Integrated circuits:

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1426.354	IC A		TDA 1060B	VALVO
1300.326	IC B		CA 3140 Ae	RCA
1422.715	IC C		MC 3358 P1	MOTOROLA
1300.326	IC F		CA 3140 AE	
1809.504	IC G		CA 3260 AE	
1809.504	IC H		CA 3260 AE	
1541.137	IC J		SCL 4002 BE	

Transistors:

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1291.033	T1		BC 549 B	
1434.101	T2		BDY 90	VALVO
1426.400	T3		BD 648	VALVO
1434.101	T4		BDY 90	VALVO
1291.092	T51		BC 546 B	ITT,AEG
1426.362	T101		VN 10 KM	SILICONIX
1426.362	T102		VN 10 KM	SILICONIX
1147.765	T103		2 N 2102	
1291.033	T104		BC 549 B	

Supplements:

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1226.169	OK1		CNY 17/II	
1226.169	OK2		CNY 17/II	
1059.378	Si1	M 3,15 A E	DIN 41571	WICKMANN
0215.805	Si2	M 1,6 A E	DIN 41571	WICKMANN
0215.821	Si3	M 2 A E	DIN 41571	WICKMANN

-Power Supply-

Parts lists No.
92 Sa 2.155.21

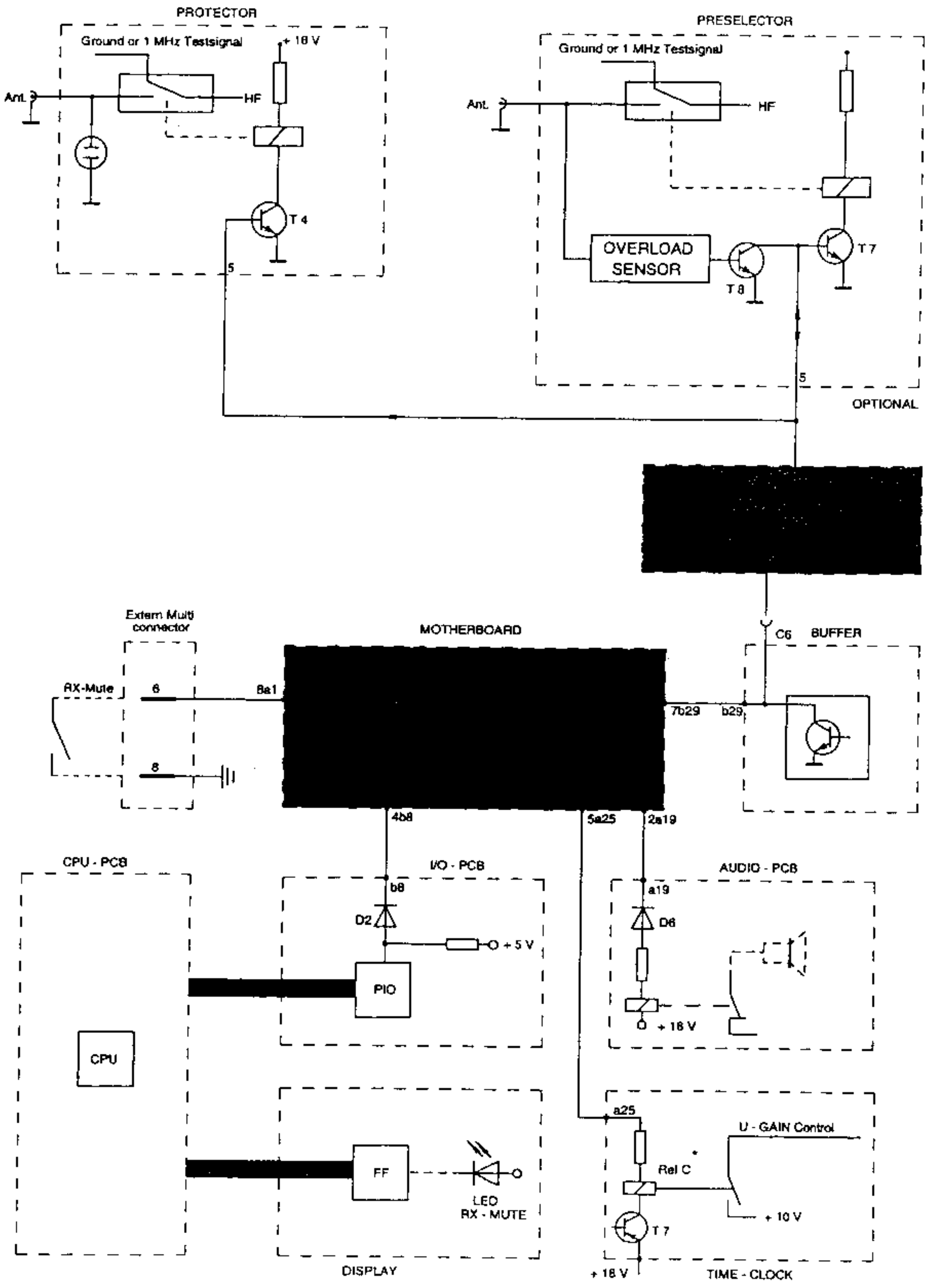
Ident No.	Mark	Electr. value	Identity	Manufacturer
	Tr1		97 E 2.140.19 B	HAGENUK
1432.958	Tr2		97 E 2.140.18	HAGENUK
1426.303	Tr101		97 Bv 2.140.39	HAGENUK
1426.311	Tr102		97 Bv 2.140.40	HAGENUK
0206.652	Bu1	12-pins	DIN 41622	
1433.881	Gl1		200 V KB PC 804/T 400 V	
1433.873	ST1		PT 02 E-12-3P	TELDIX
1168.185	ST2		MC 164-232F-4P	AMPHENOL
	Rel A		E 3206 NI:13	EICHHOFF
1175.394	Rel B	RH 24 V 1xU		

-Interconnection Board and Motherboards-

Part of the interconnection between modules and Printed Circuit Boards are the Interconnection Board and the Motherboard.
The Interconnection Board is the interface between receiver control part and receiver HF-Part.
The Interconnection board is connected to the Buffer D/A Converter board via a 60 core ribbon cable, and rearranges these wires to connect to various 10- and 16 wire ribbon cables, which are connected to the various HF-modules.
Various Byte lines from the individual HF- modules are assembled and connected via a 34 wire ribbon cable to the time clock PCB.
The built in AF-transformers can be utilized by the remote control bus via the 26 wire remote control ribbon cable (if fitted), and finally various power supply connections and frontpanel controls are connected to stand alone solder pins.

All printed circuit boards in the control part of the receiver are plugged in the motherboard. Power supply connection and connections from the front panel control to stand alone solder pins are also made. The difference between the Motherboard 155.24 and 155.23 is that the latter is able to handle ISB audio and squelch control in conjunction with the Audio PCB II.

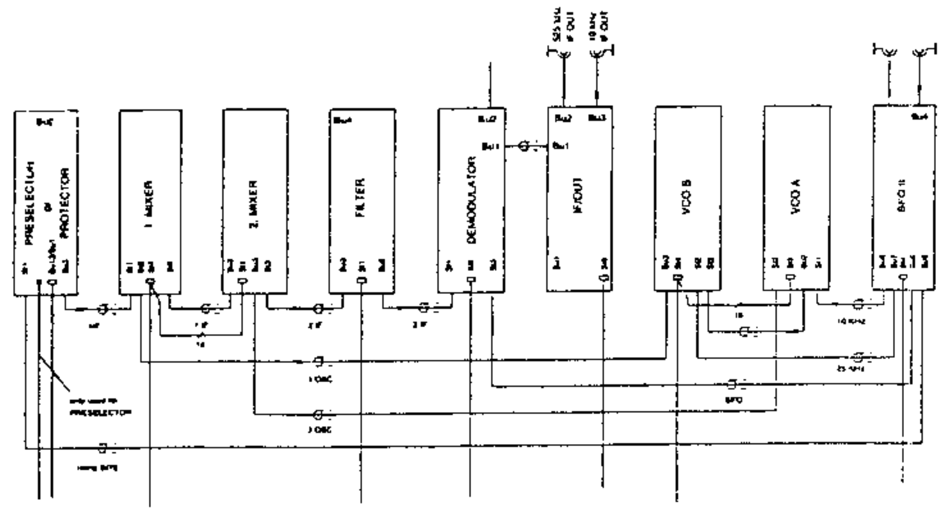
-Interconnection Board and Motherboards-



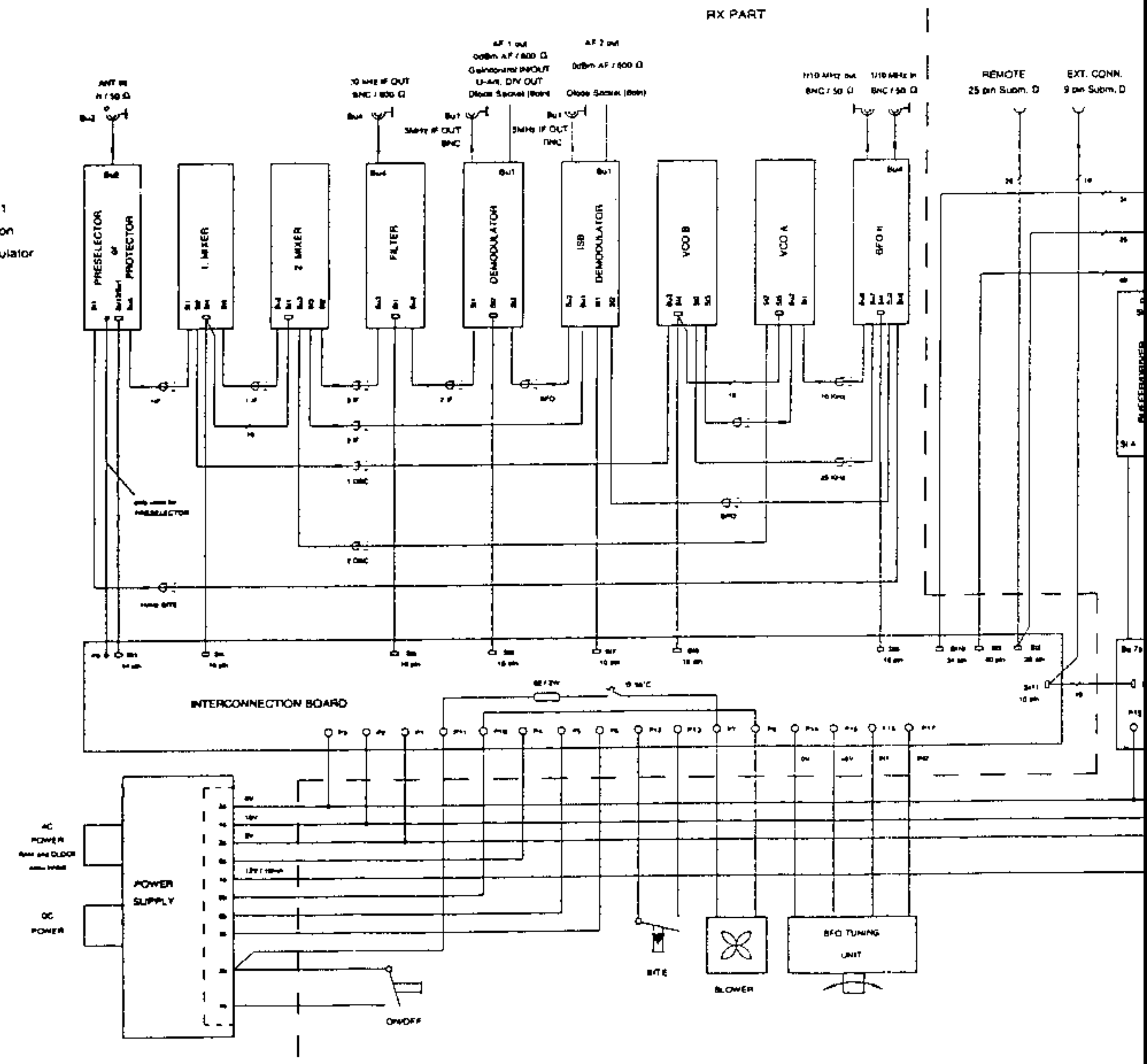
* REL C is disengaged during BITE TEST

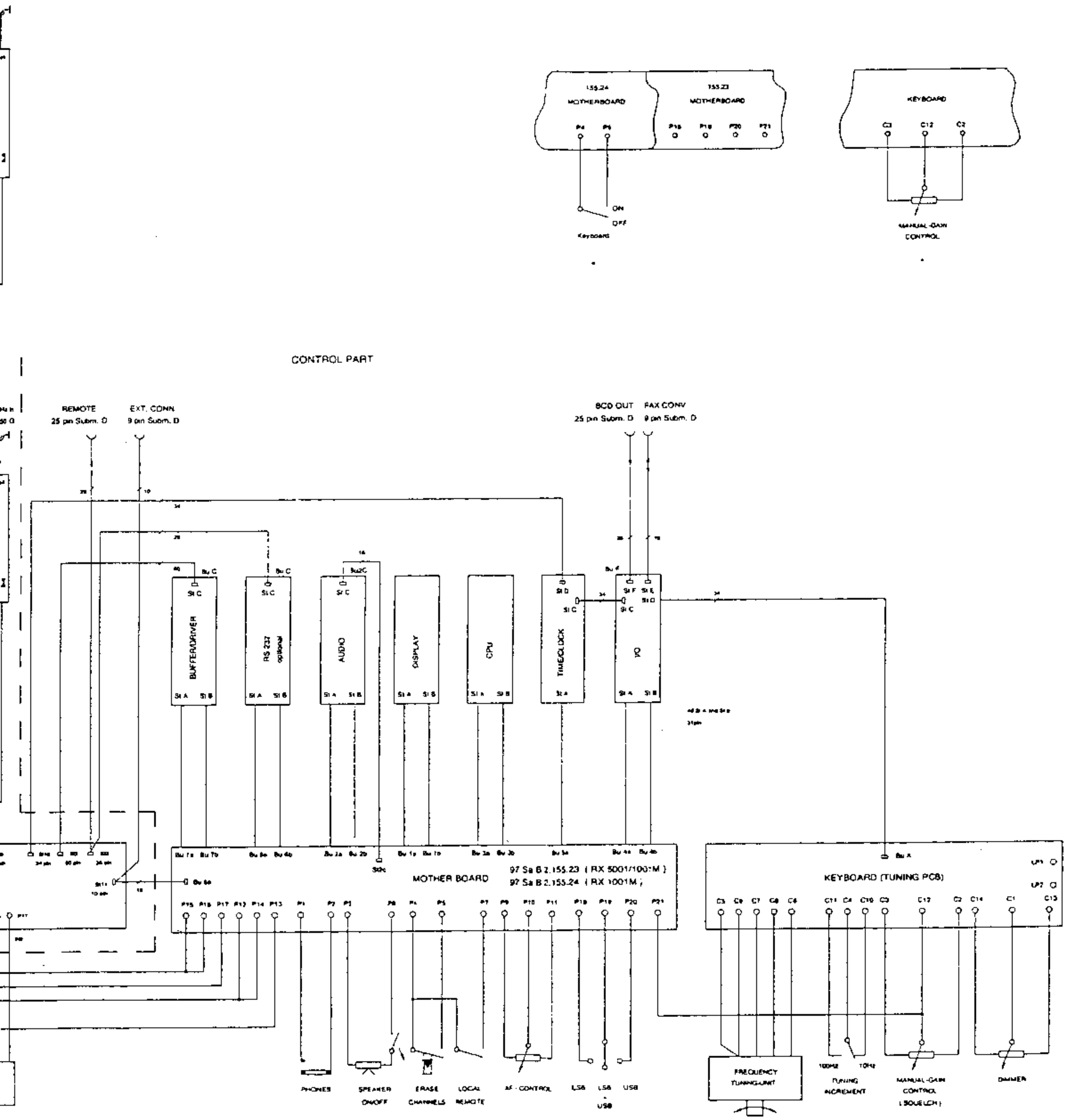
Mute Interconnection

RX 1001 M
or
RX 5001
with option
IF / OUT



RX 5001
with option
ISB Demodulator

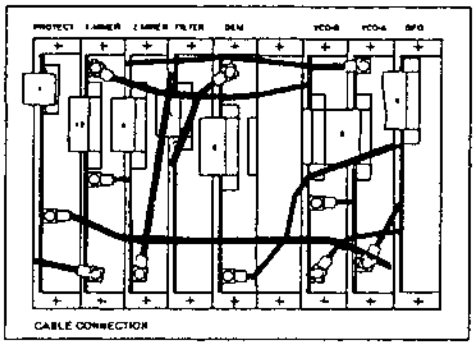




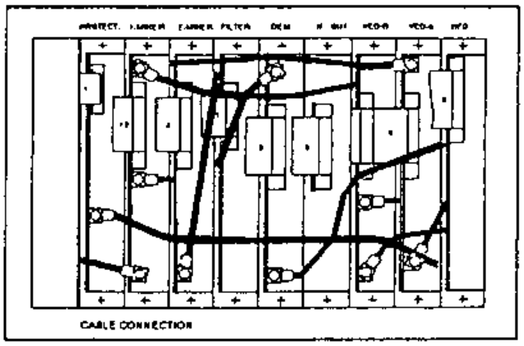
Blockdiagram -Wiring-
RX 1001 M / RX 5001
* RX 1001 M only

-Interconnection Board-

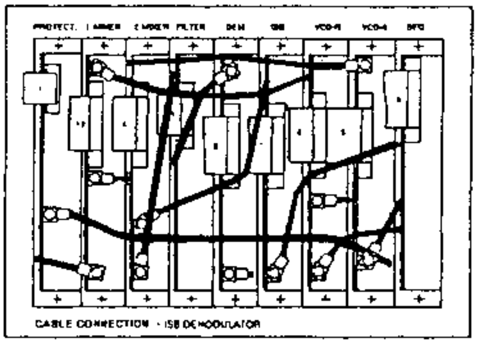
Mechanical layout of HF-Coax interconnections for various options



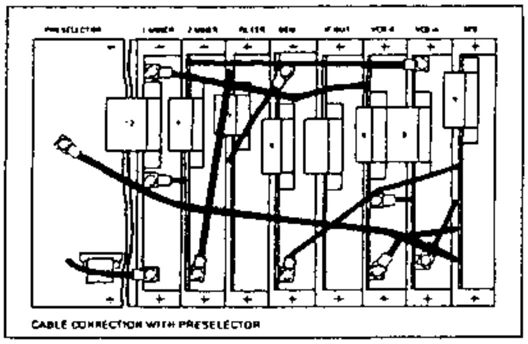
RX 5001 (basic version)



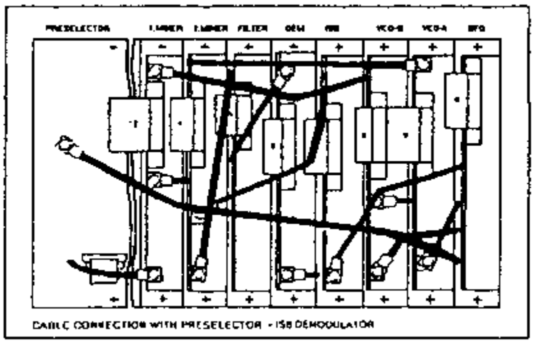
RX 5001 (with option IF-OUT)
RX 1001 MB (basic version)



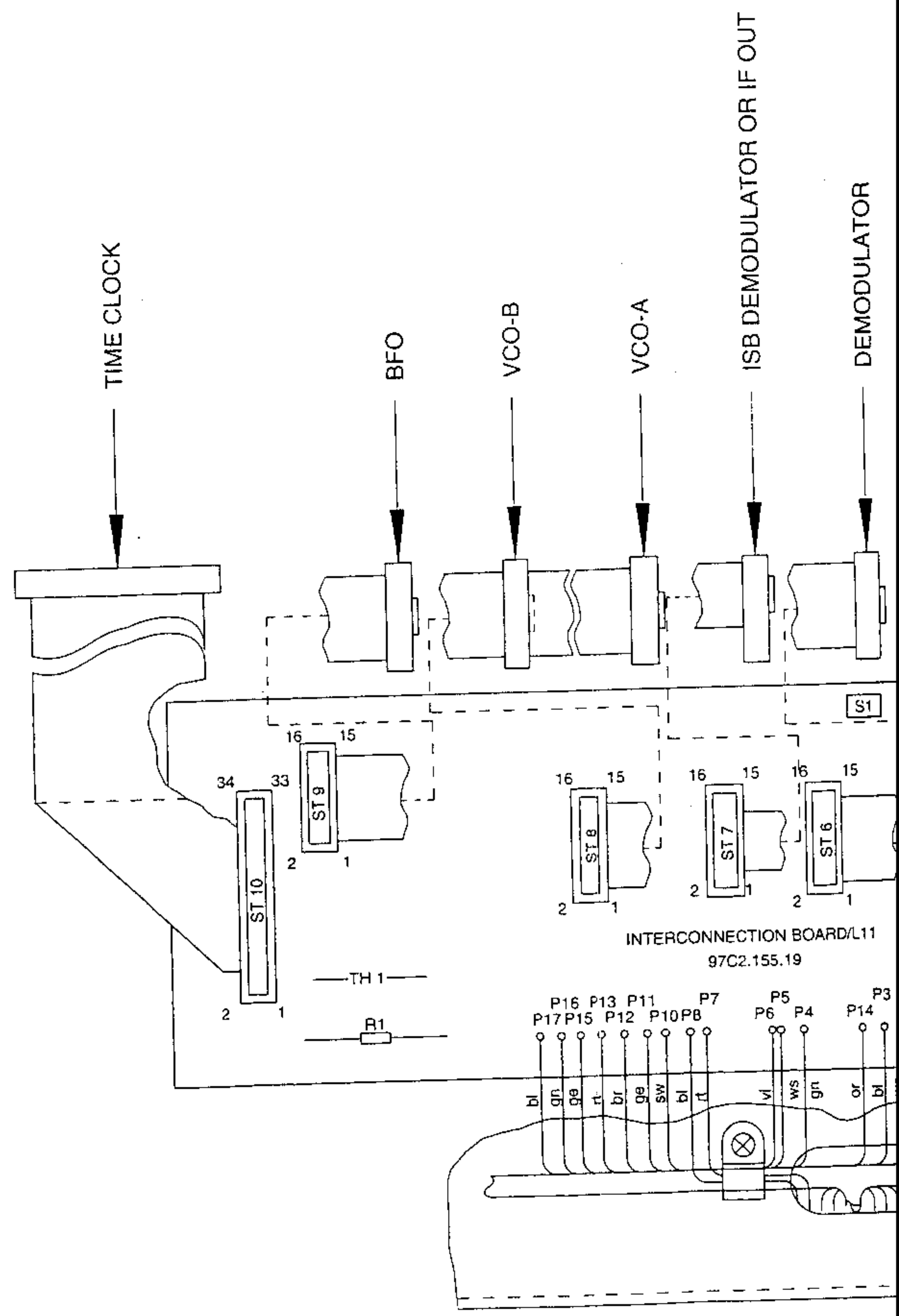
RX 5001 (with option ISB-Demodulator)

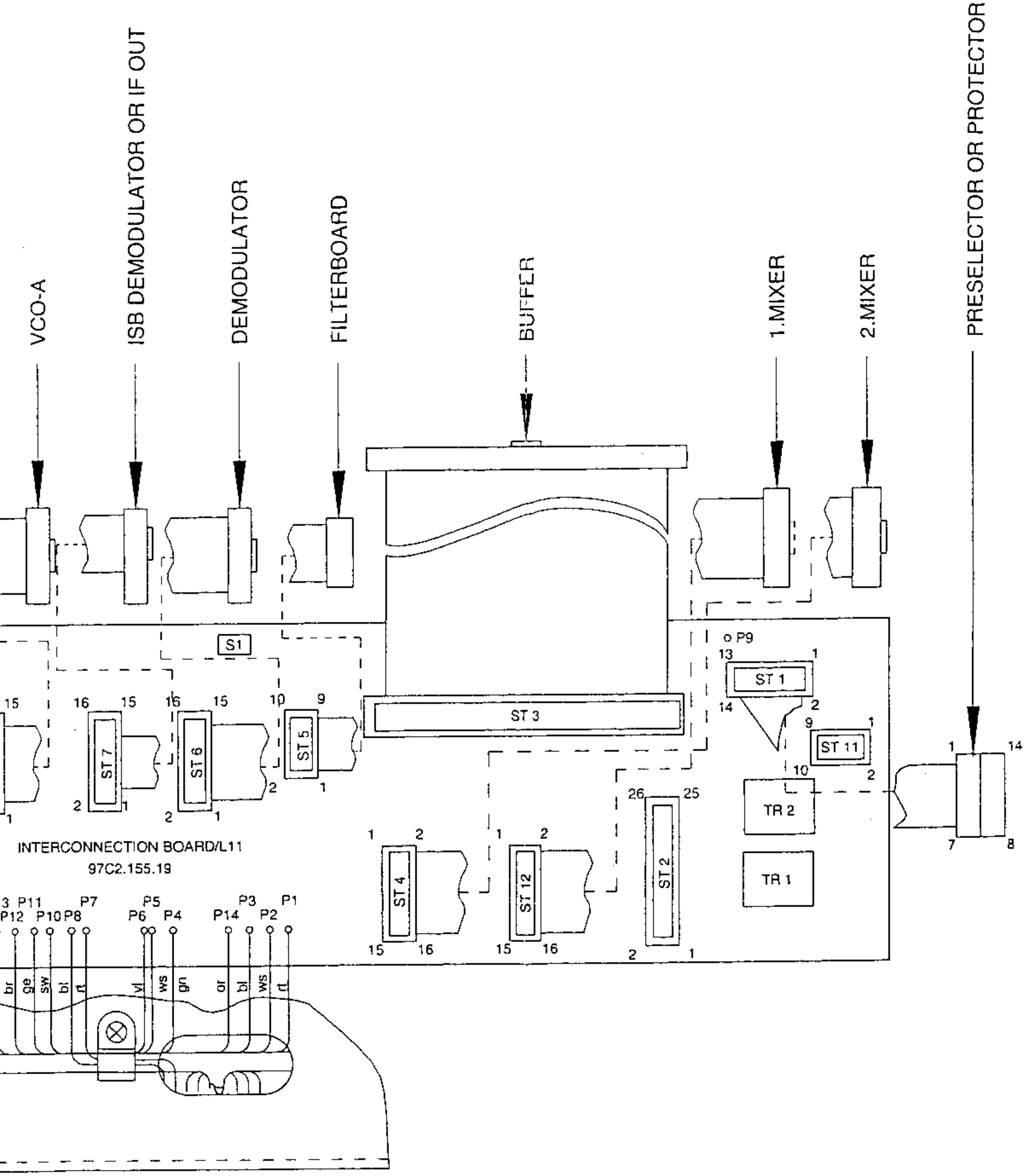


RX 5001 (with option Preselector and IF-OUT) RX 1001 MVB

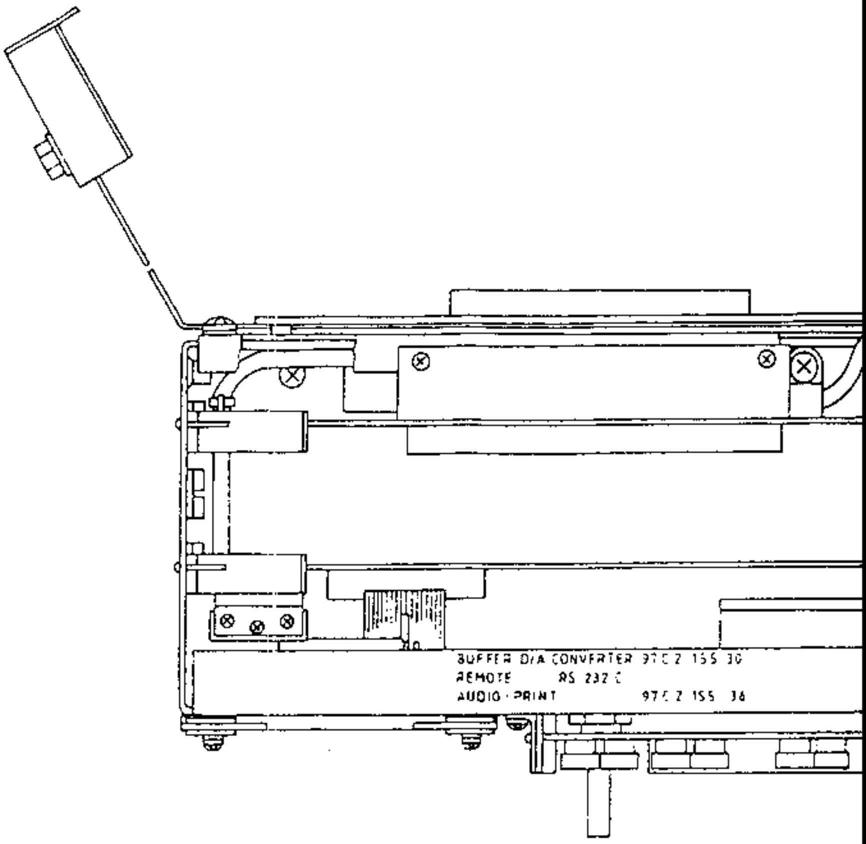


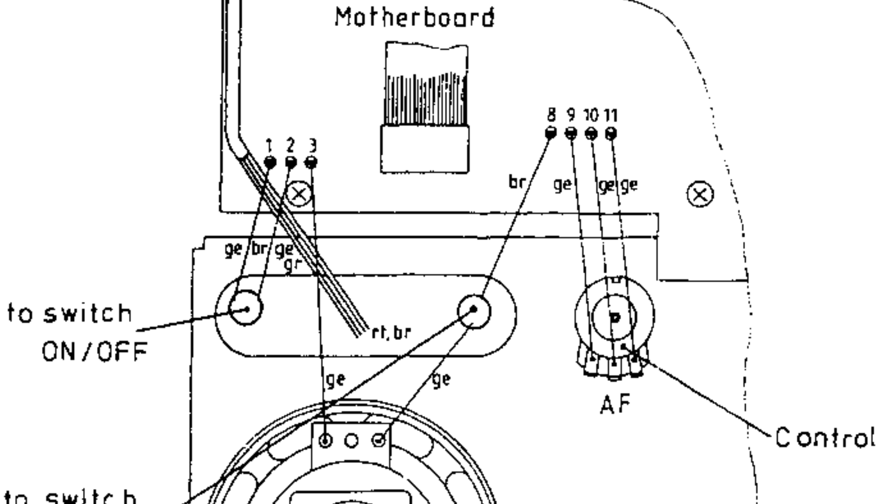
RX 5001 (with option Preselector and ISB-Demodulator)

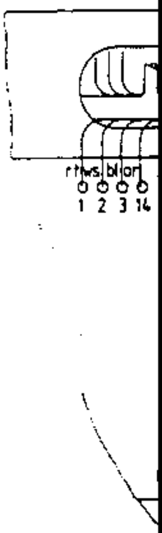

TIME CLOCK
BFO
VCO-B
VCO-A
ISB DEMODULATOR OR IF OUT
DEMODULATOR
S1
ST 10
ST 9
ST 8
ST 7
ST 6
TH 1
R1
INTERCONNECTION BOARD/L11
97C2.155.19
P17 P16 P15 P13 P12 P11 P10 P8 P7 P6 P5 P4 P14 P3
bl gn ge rt br ge sw bl rt vi ws gn or bl

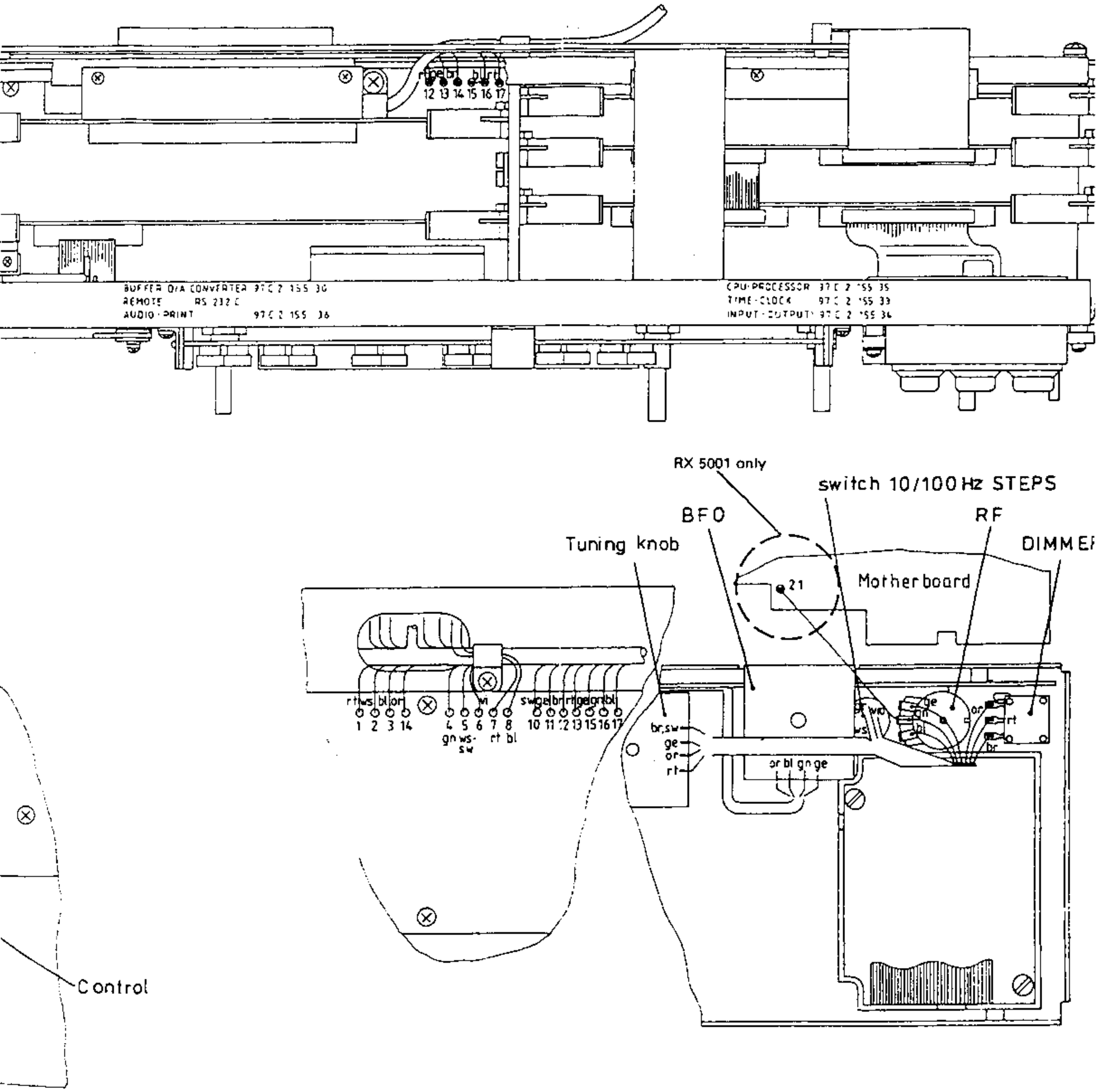


Interconnection Board
Ribbon Cable

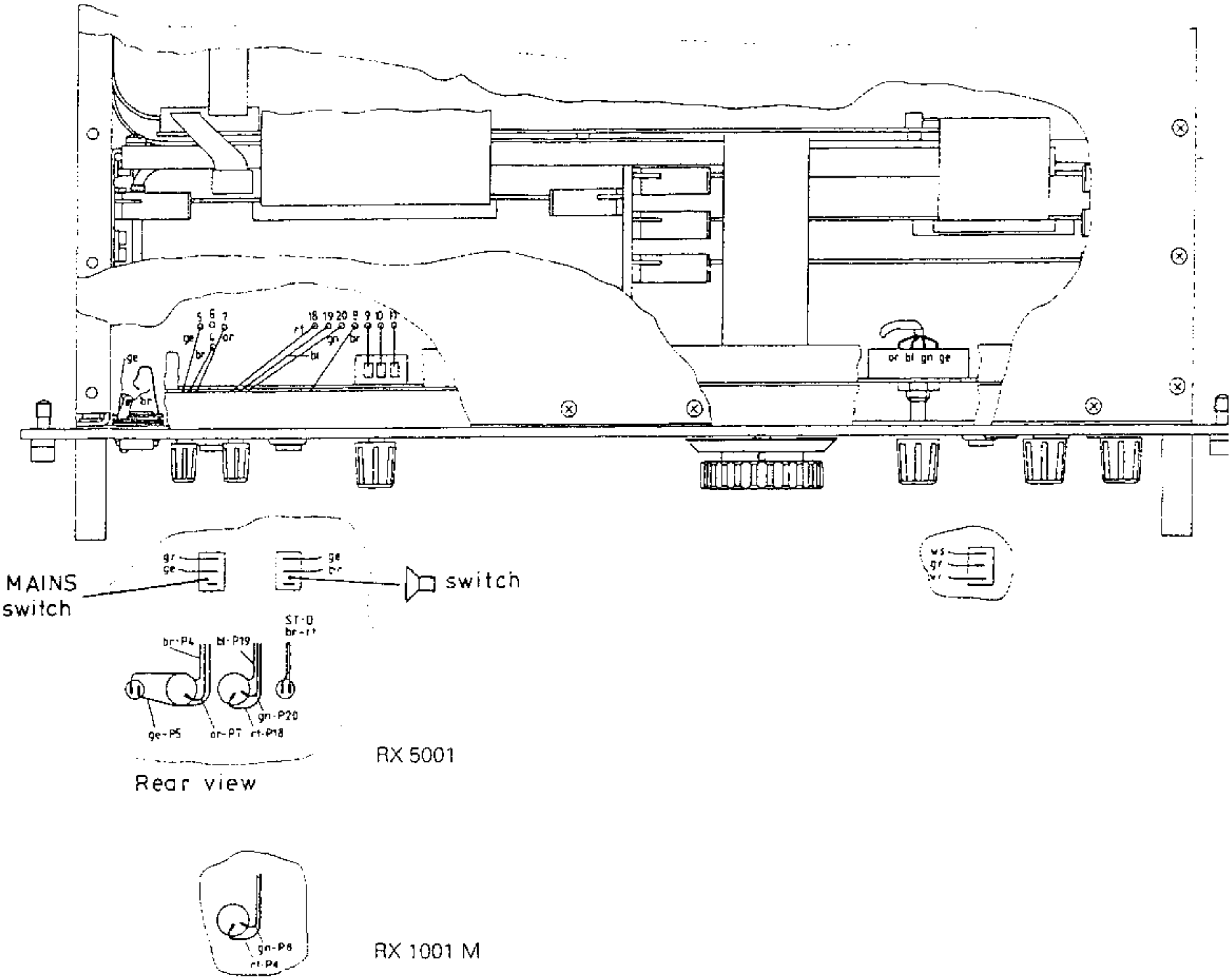

BUFFER D/A CONVERTER 97 C Z 155 30
REMOTE RS 232 C
AUDIO · PRINT 97 C Z 155 36


Motherboard
1 2 3
8 9 10 11
br
ge
ge ge
ge br ge
gr
rt, br
to switch
ON/OFF
ge
ge
AF
Control
to switch


rt ws bl or
1 2 3 14

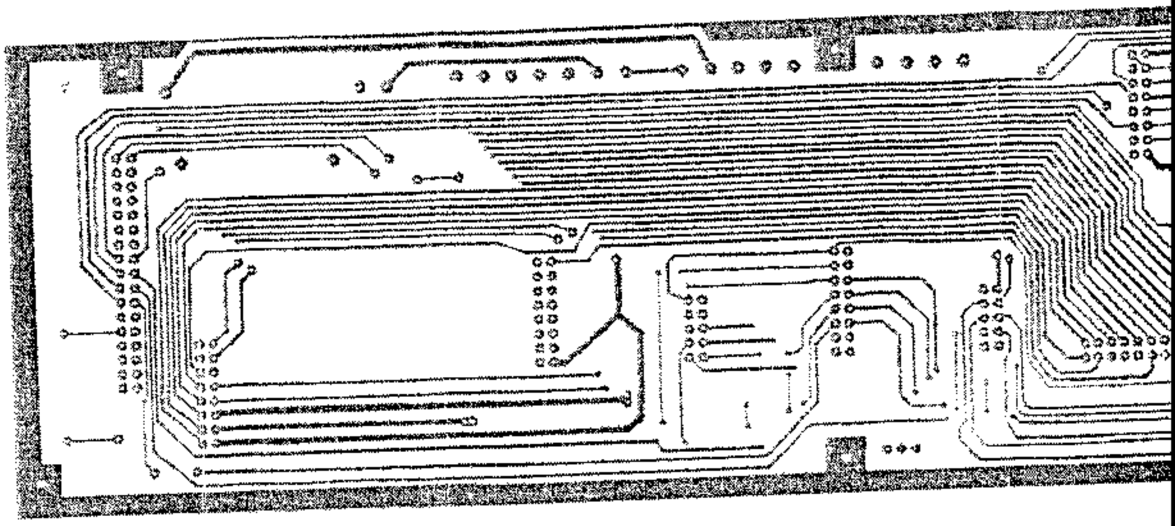


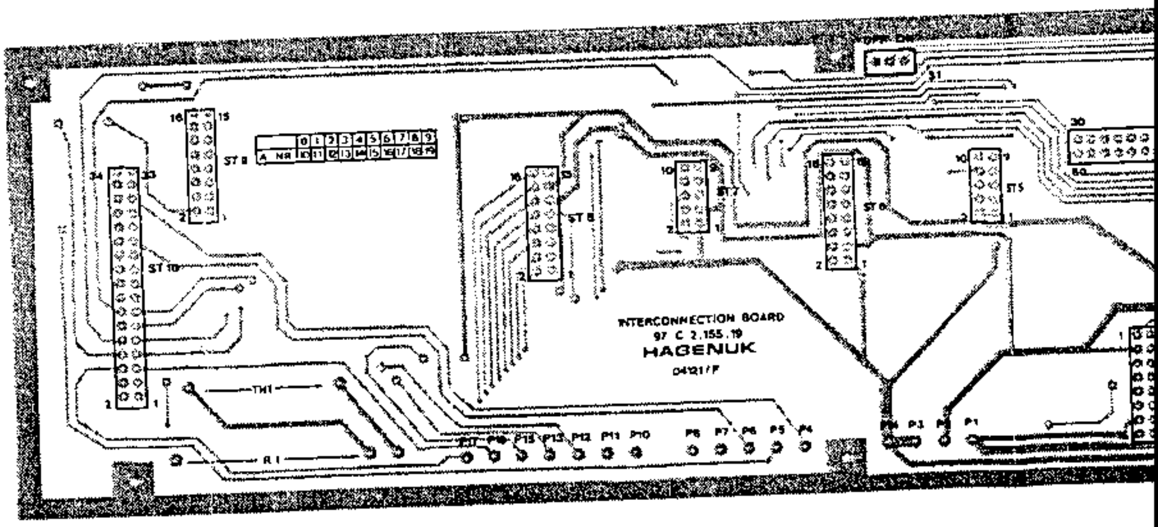
Interconnection Control Part
RX 1001 M / RX 5001



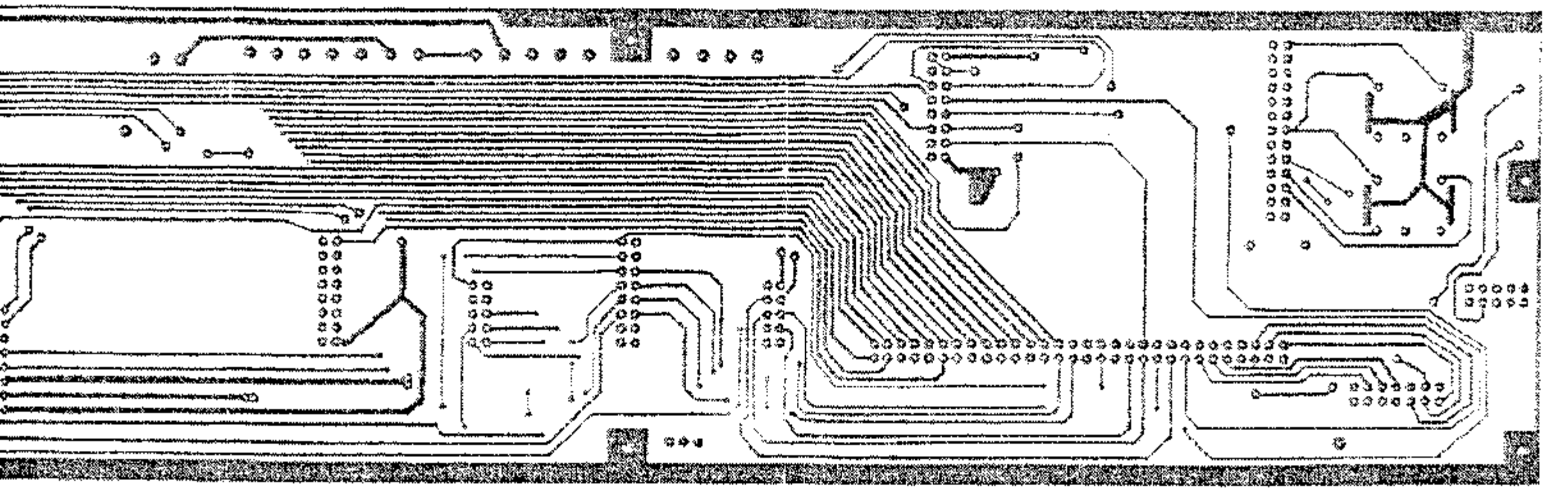
Interconnection of the
Front Panel - Rear Side

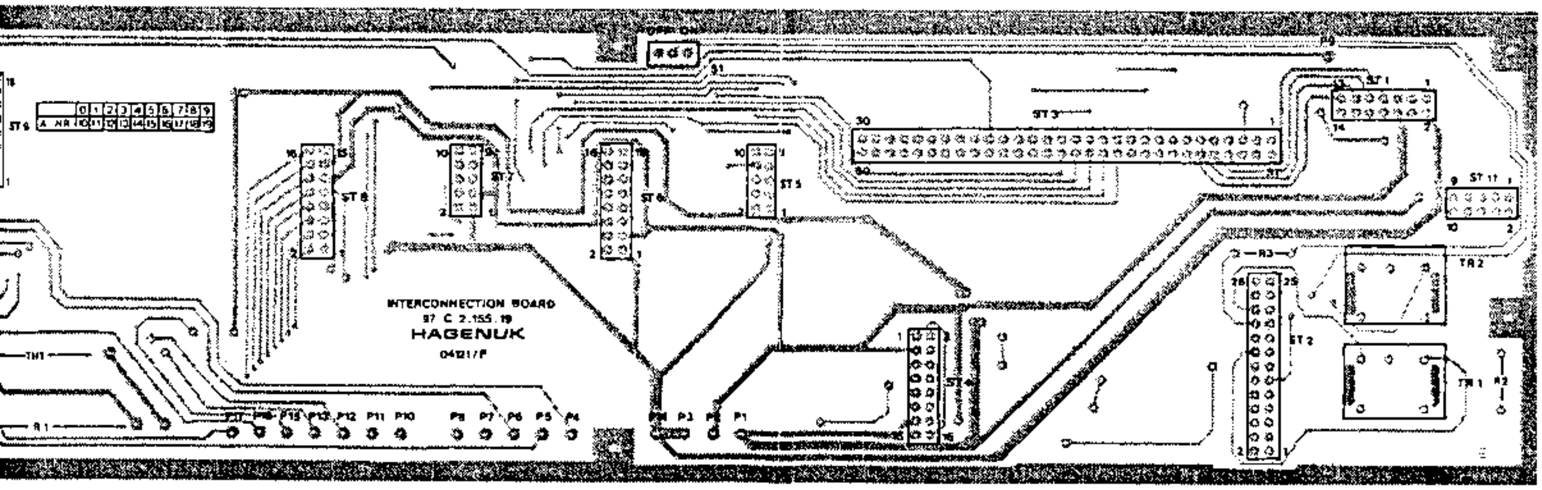
see circuit diagram - INTERCONNECTION BOARD



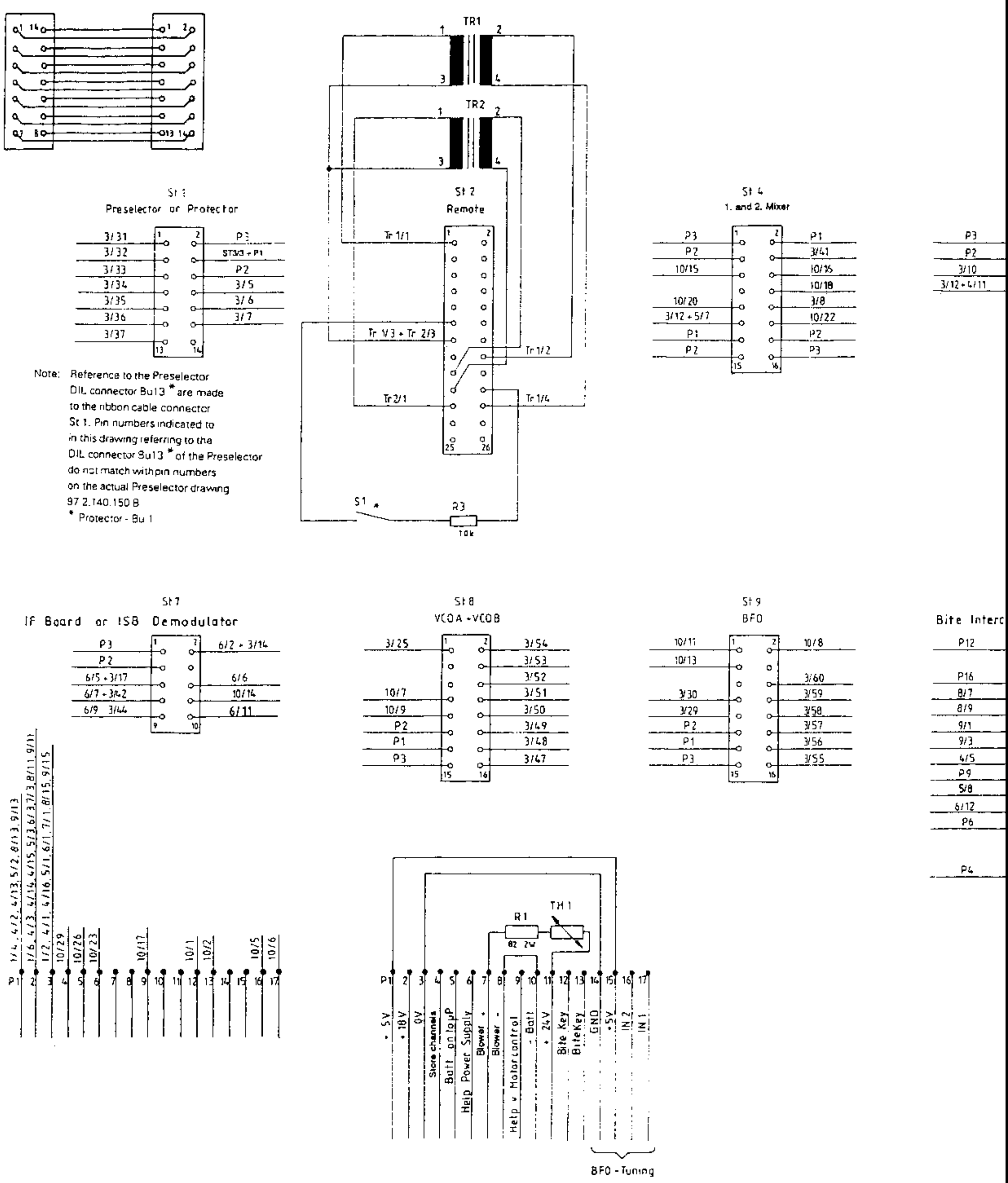


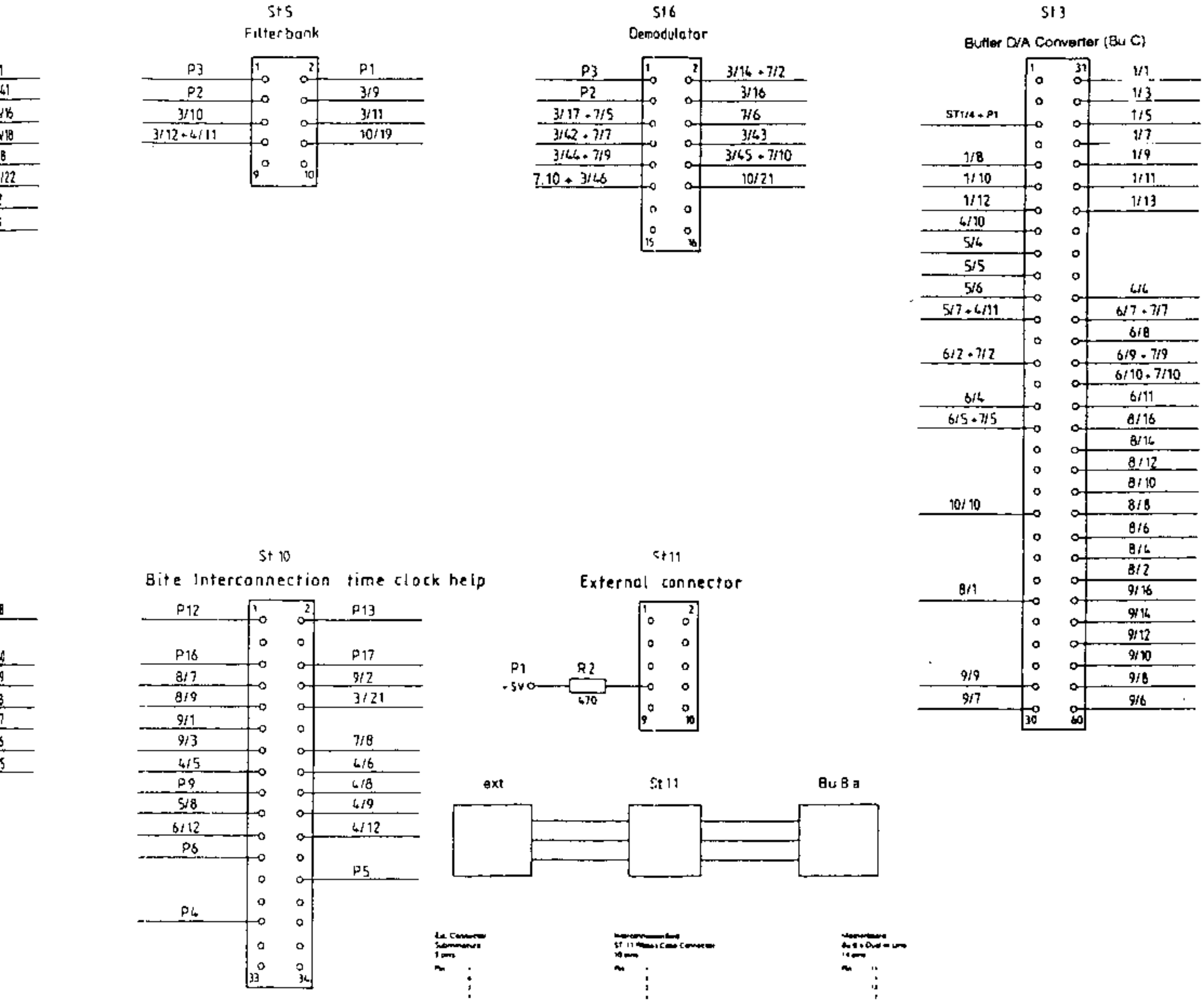
see circuit diagram - INTERCONNECTION BOARD B 97 Sa C 2.155.19

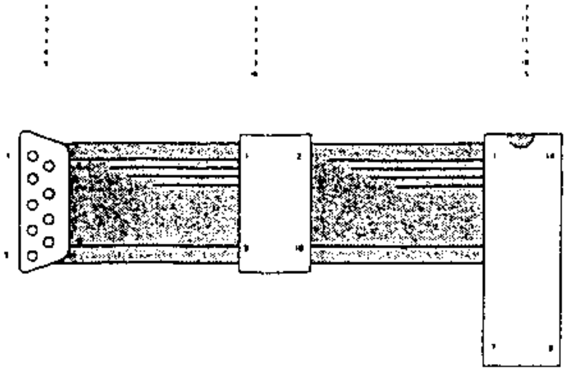




Printed Circuit Board
Interconnection Board
97 C 2.155.19


TR1
TR2
St 1
Preselector or Protector
St 2
Remote
St 4
1. and 2. Mixer
Note: Reference to the Preselector DIL connector Bu13 * are made to the ribbon cable connector St 1. Pin numbers indicated to in this drawing referring to the DIL connector Bu13 * of the Preselector do not match with pin numbers on the actual Preselector drawing 97 2.140.150 B
* Protector - Bu 1
Tr 1/1
Tr 1/3 + Tr 2/3
Tr 1/2
Tr 2/1
Tr 1/4
S1
R3
10k
St 7
IF Board or ISB Demodulator
St 8
VCOA + VCOB
St 9
BFO
Bite Interc
R1
82 2W
TH 1
+5V
+18V
0V
Store channels
Batt. on lo µP
Help Power Supply
Blower +
Blower -
Help v. Motorcontrol
- Batt
+ 24V
Bite Key
BiteKey
GND
+5V
IN 2
IN 1
BFO - Tuning





* S1 has to be switched ON to enable Go/No Go check via V24 interface (DTR/DSR)
In addition S2/2 on I/O p.c.b. has to be On and the switch 600/1200 Baud on the RS 232 Remote p.c.b. has to be set to 600 Baud.
For remote control operation S1 has to be

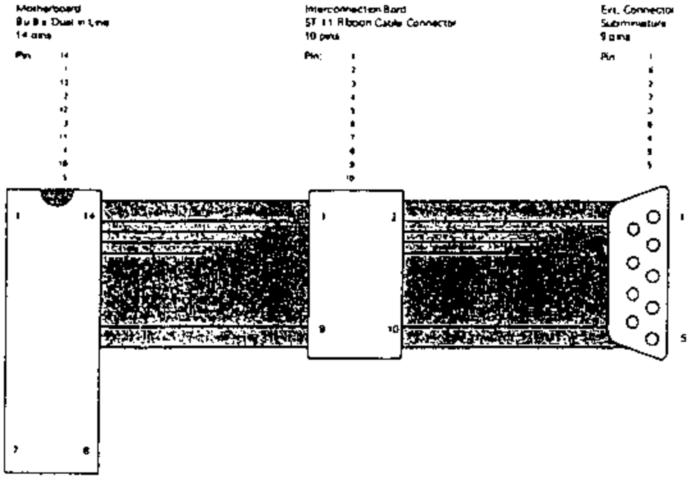
refer also to chapter 3.1.5

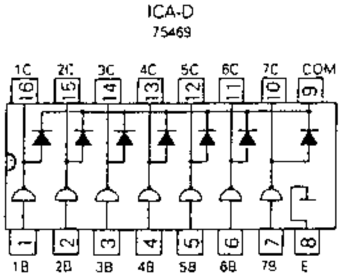
Interconnection Board
Circuit Diagram
97 Sa C 2.155.19

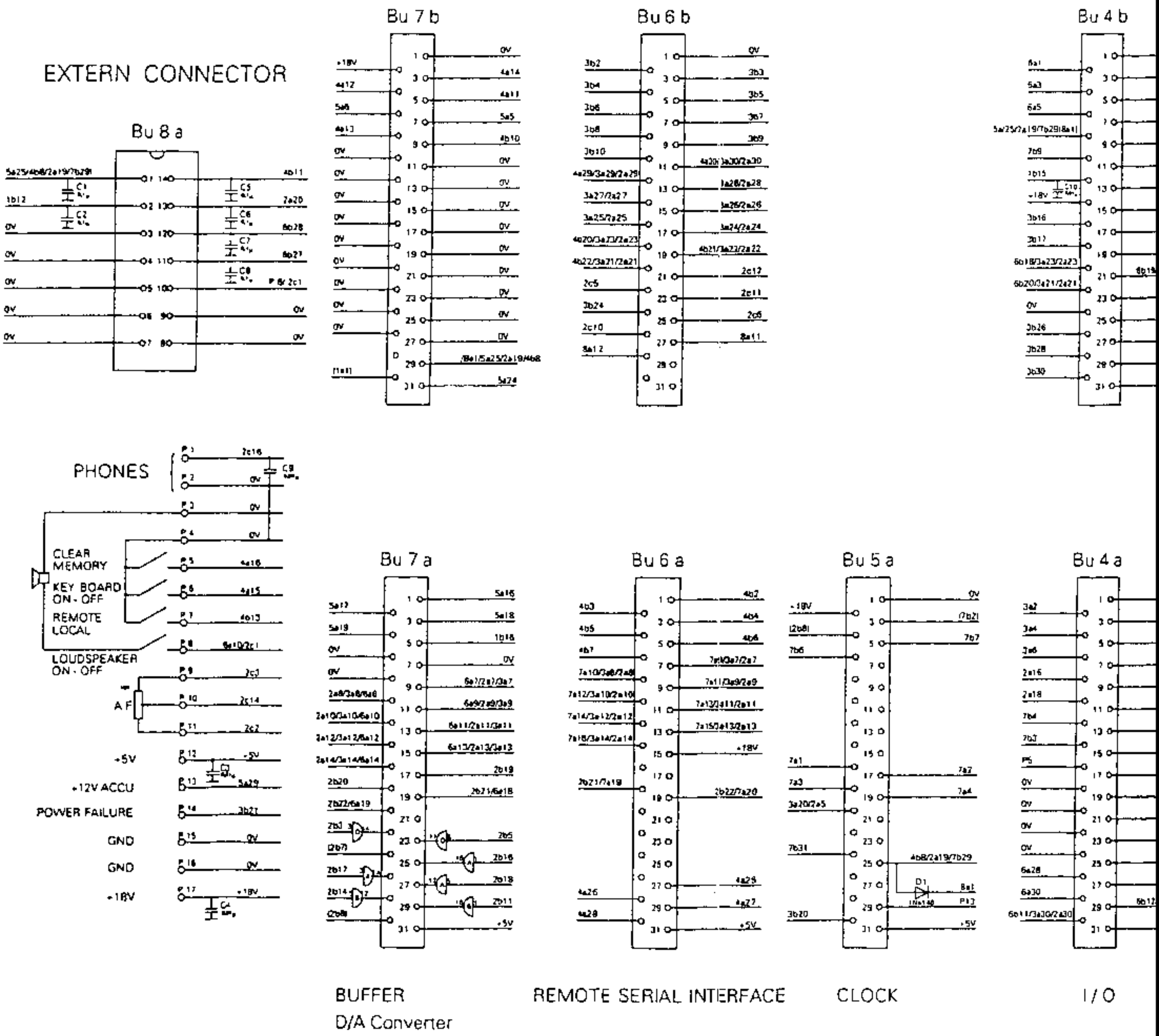
Parts lists No.
97 Sa 2.155.19

-Interconnection Board-

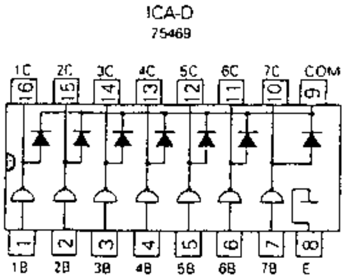
Ident No.	Mark	Electr. value	Identity	Manufacturer
Supplements:				
1810.332	Ribbon Cable		97 E 2.155.110	
1810.340	Ribbon Cable		97 E 2.155.111	
1810.359	Ribbon Cable		97 E 2.155.112	
1810.367	Ribbon Cable		97 E 2.155.113	
1810.375	Ribbon Cable		97 E 2.155.114	
1810.383	Ribbon Cable		97 E 2.155.115	
1905.791	Ribbon Cable		97 E 2.155.118	
1905.805	Ribbon Cable		97 E 2.155.119	
1810.529	Connector Plug 10- pins		609-1027	ANSLEY
1810.537	Connector Plug 26- pins		609-2627	ANSLEY
1841.076	Connector Plug 14- pins		609-1427	ANSLEY
1708.864	Transformer TR1		ST 2524	HAUFE
1708.864	Transformer TR2		ST 2524	HAUFE
1422.944	TS 1	Switch		ITT
1959.492	TS A	Temp. Switch	31.02910	KLUXEN
Resistors:				
1810.634	R1	82 5% 2W	DIN 44063-G	
0554.898	R2	470 5%	DIN 44052-G	
0179.701	R3	10k 5%	DIN 44052-G	





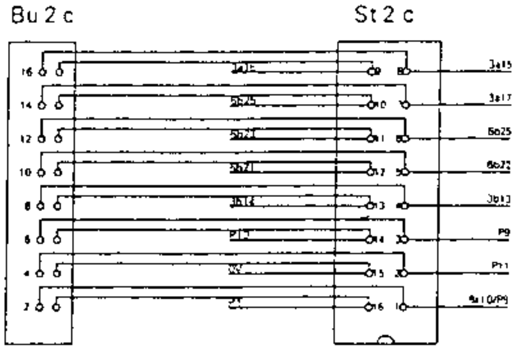


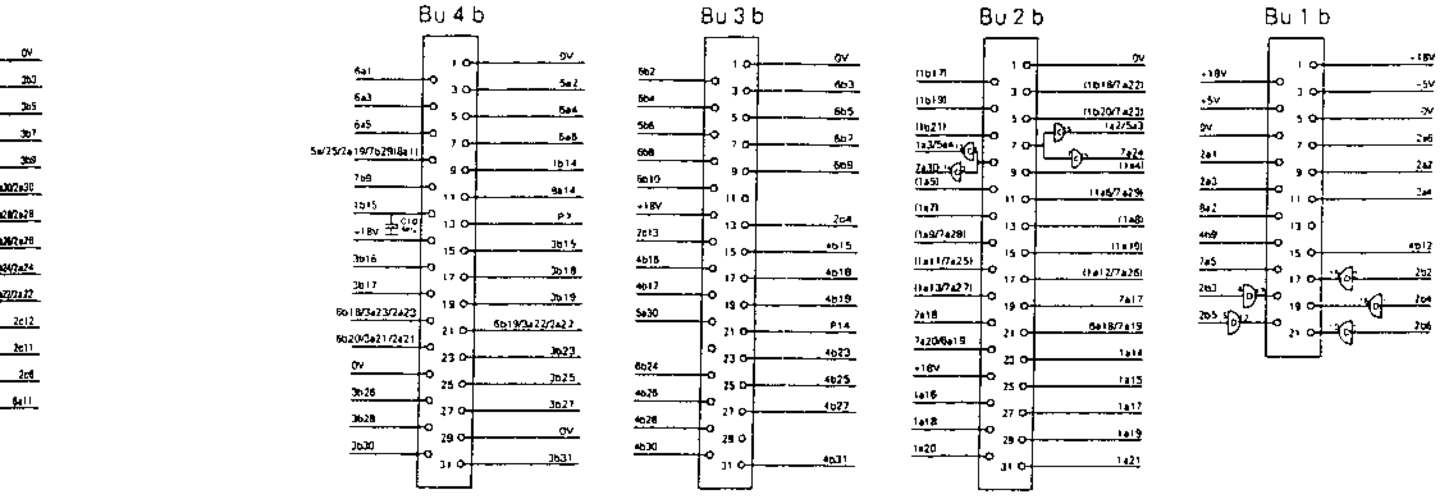
To be fitted in RX 1001 M only

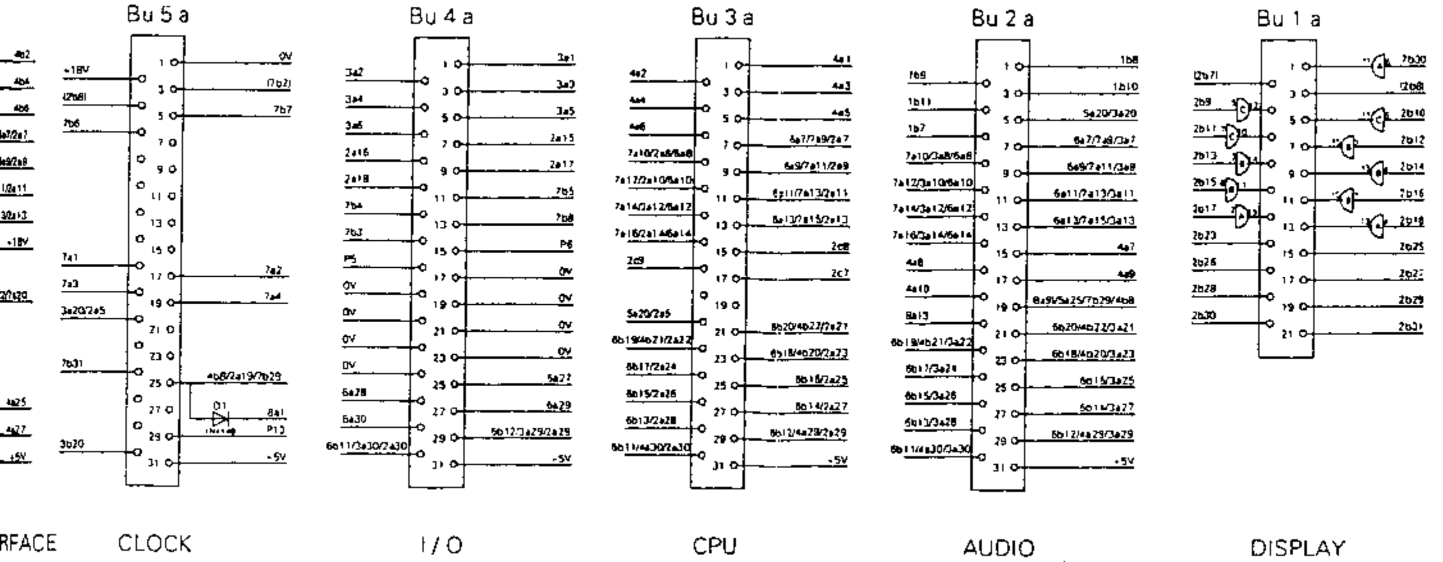


Note:

Reference to the Audio PCB connector C are made to the DIL connector St 2 c. Pin numbers indicated to in this drawing referring to Audio PCB C connector do not match with pin numbers on the actual Audio PCB drawing 97 2.155.37.



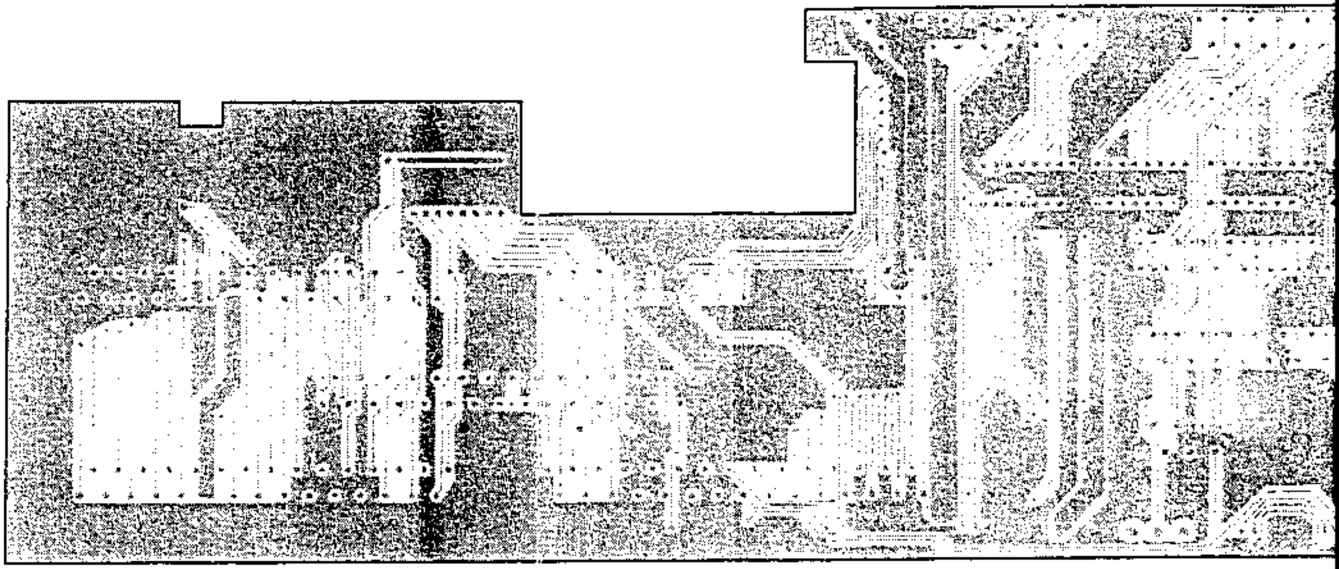


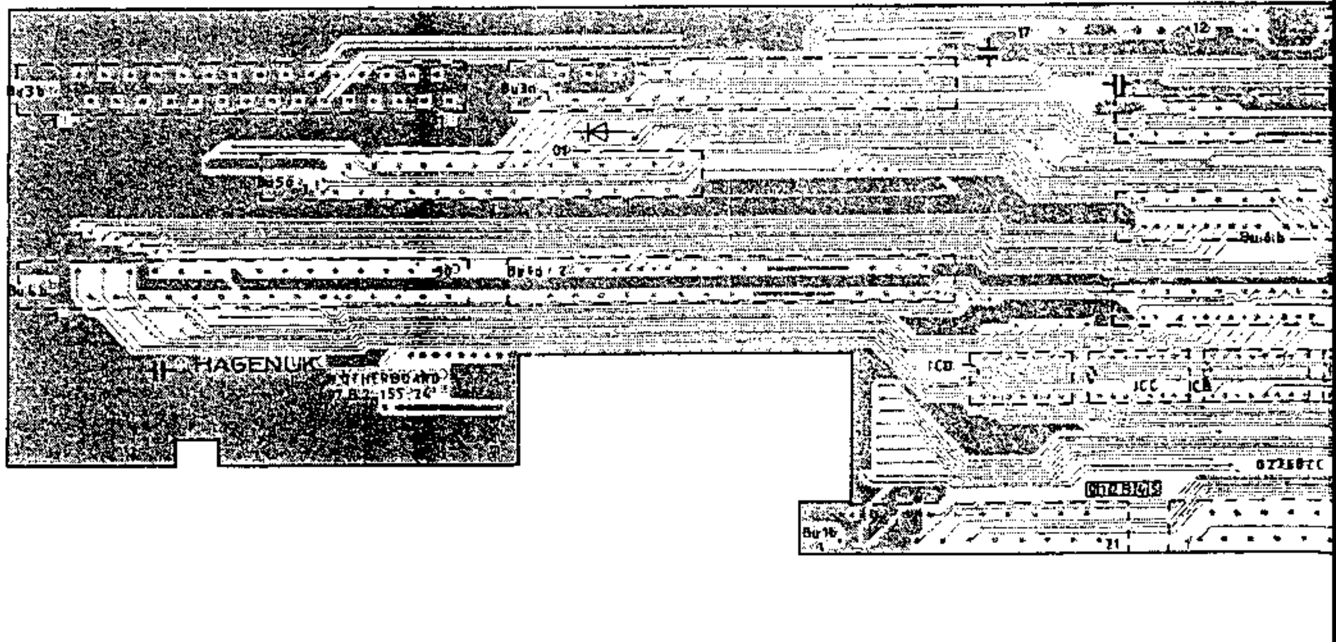


RX 1001 M only

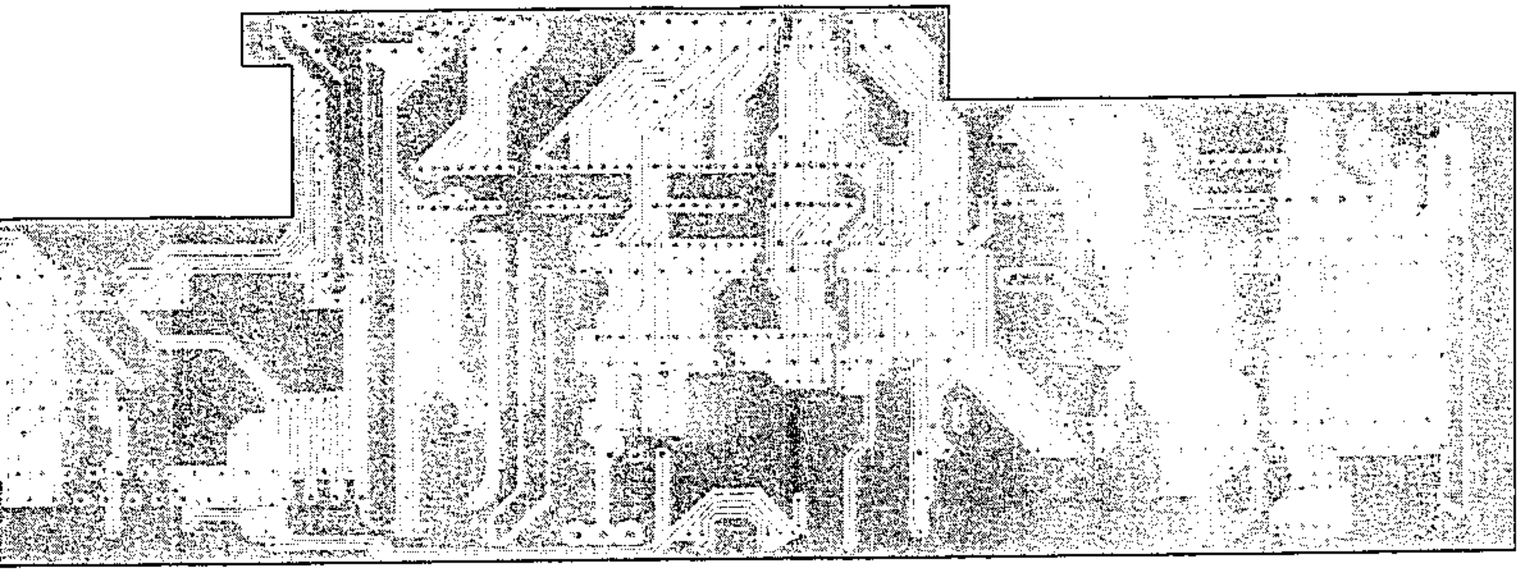
Motherboard
Circuit Diagram
97 Sa B 2.155.24

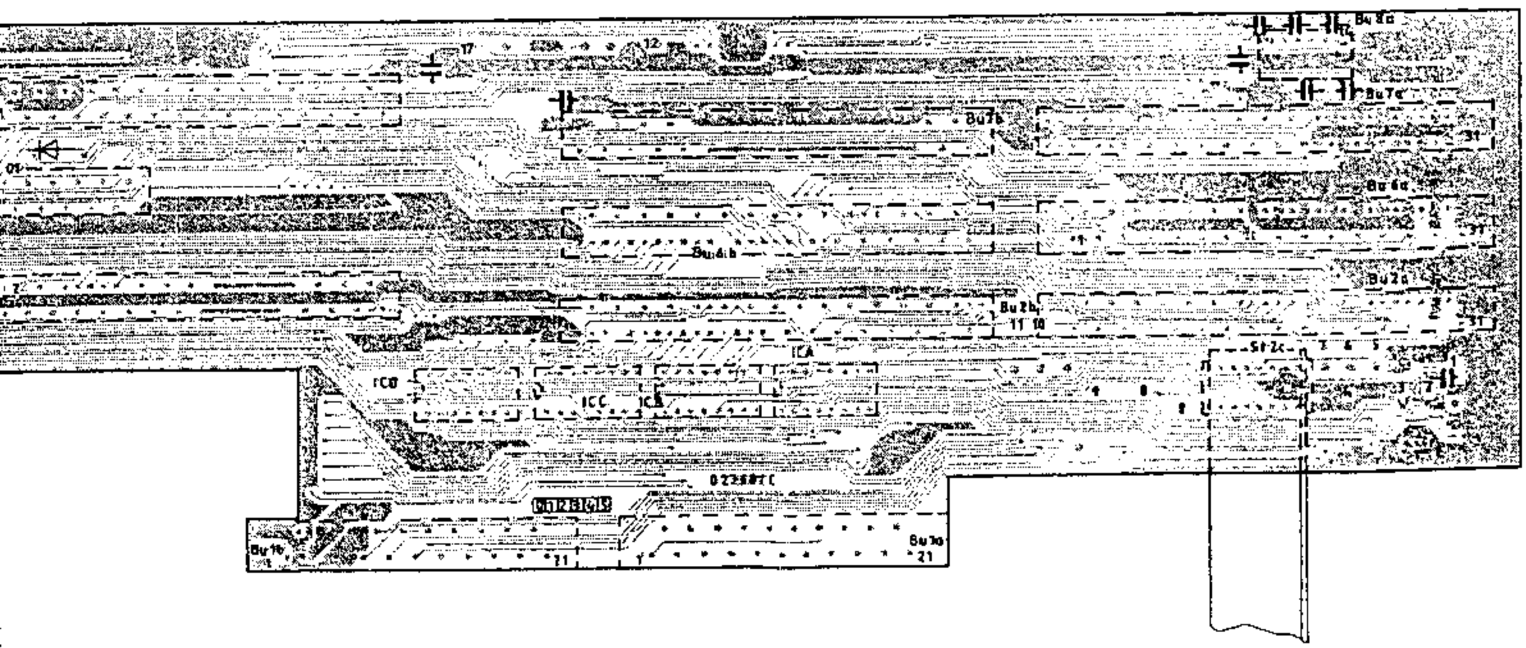
see circuit diagram - MOTHERBOAR





see circuit diagram - MOTHERBOARD B 97 Sa B 2.155.24



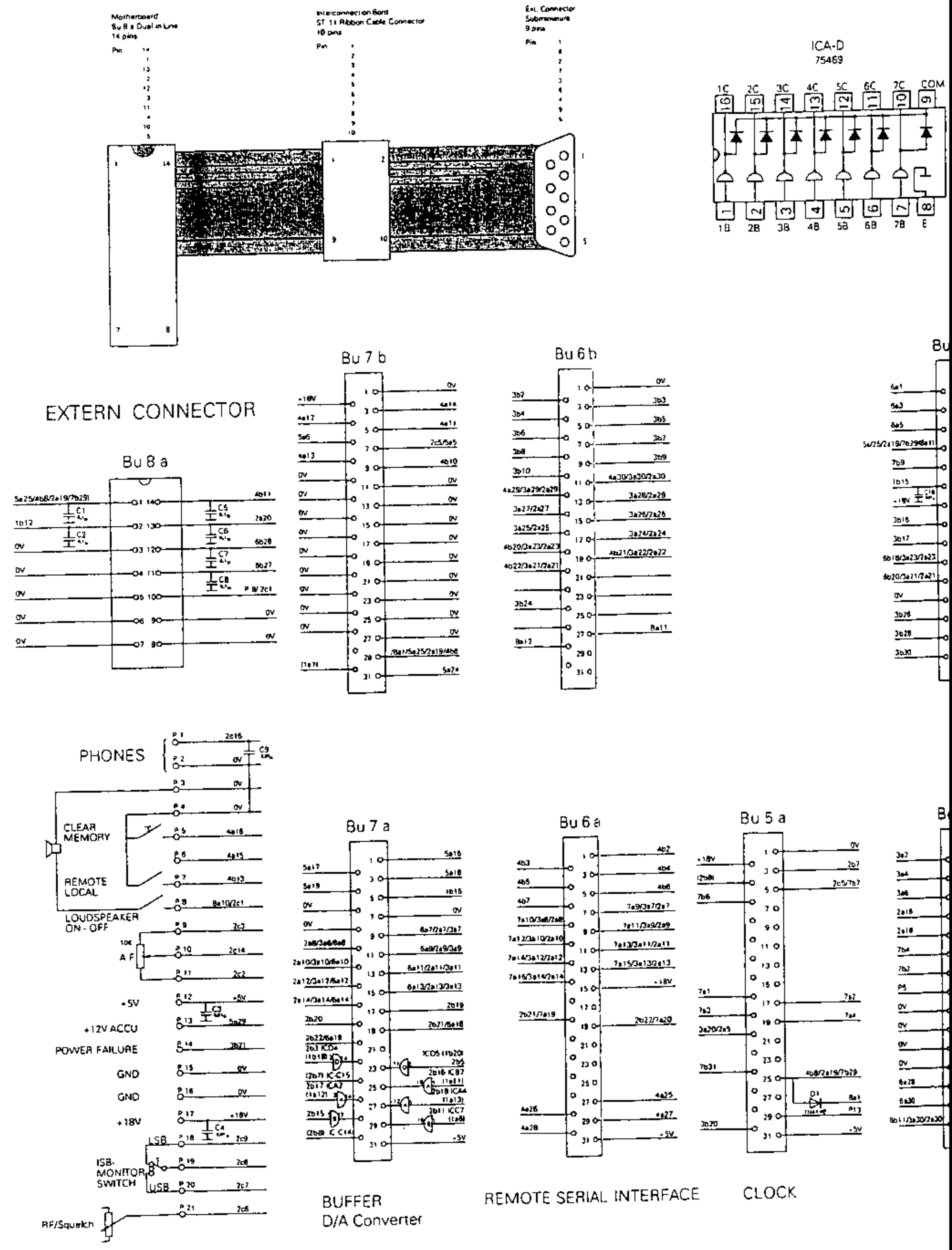


Printed Circuit Board
Motherboard
97 B 2.155.24

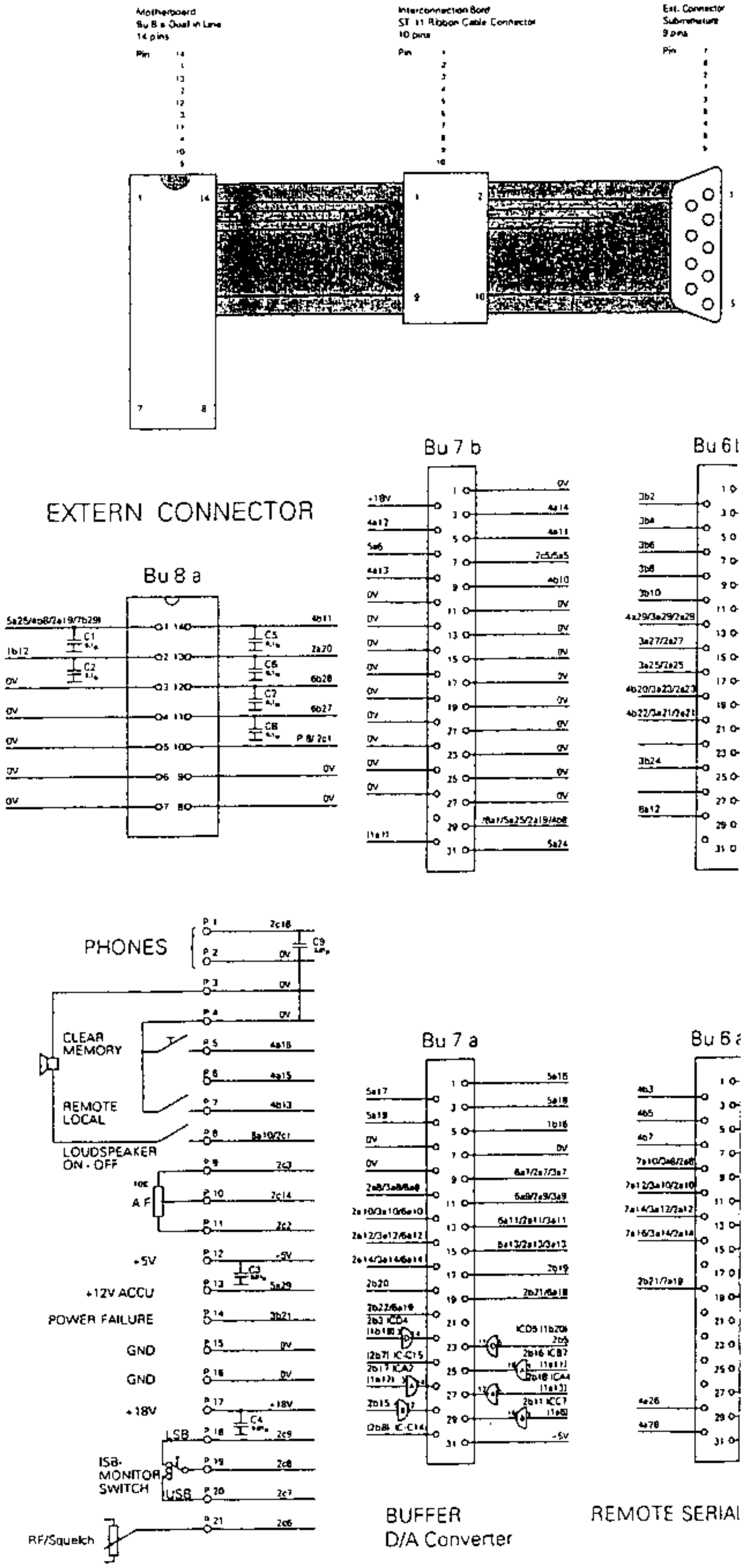
Parts lists No.
97 Sa 2.155.24

-Motherboard RX 1001 M-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Capacitors:				
1208.225	C1	0,1 µF/100 V	CK 06 BX 104 M	SEC
1208.225	C2	0,1 µF/100 V	CK 06 BX 104 M	SEC
1078.607	C3	0,01 µF/100 V	CK 05 BX 103 K	SEC
1078.607	C4	0,01 µF/100 V	CK 05 BX 103 K	SEC
1208.225	C5	0,1 µF/100 V	CK 06 BX 104 M	SEC
1208.225	C6	0,1 µF/100 V	CK 06 BX 104 M	SEC
1208.225	C7	0,1 µF/100 V	CK 06 BX 104 M	SEC
1208.225	C8	0,1 µF/100 V	CK 06 BX 104 M	SEC
1078.607	C9	0,01 µF/100 V	CK 05 BX 103 K	SEC
1208.225	C10	0,1 µF/100 V	CK 06 BX 104 M	SEC
Diodes:				
0745.677	D1		1 N 4148	ITT
Integrated circuits:				
1423.711	IC A		75469	
1423.711	IC B		75469	
1423.711	IC C		75469	
1423.711	IC D		75469	



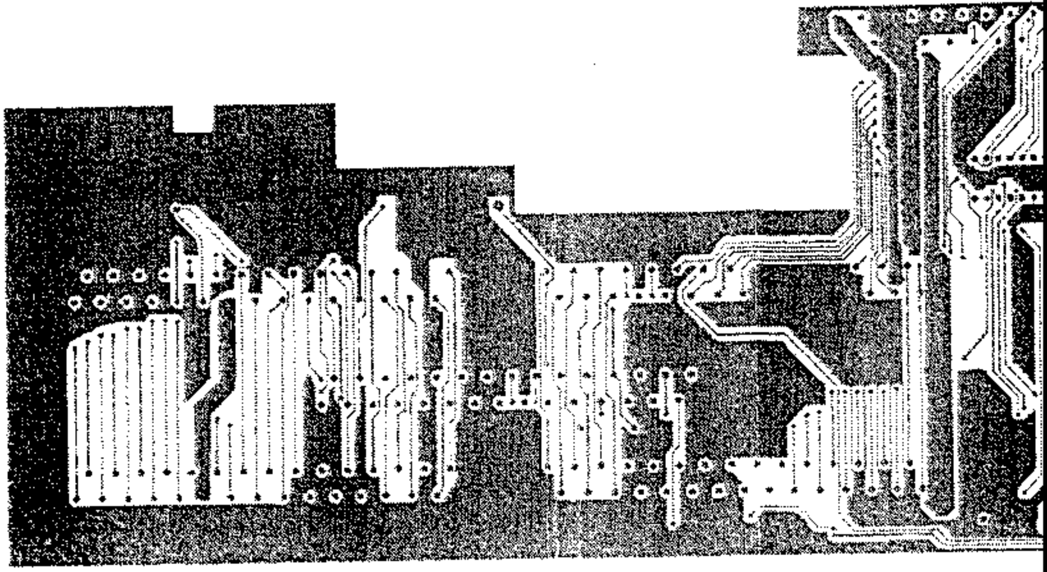
To be fitted in RX 5001 or RX 1001 M

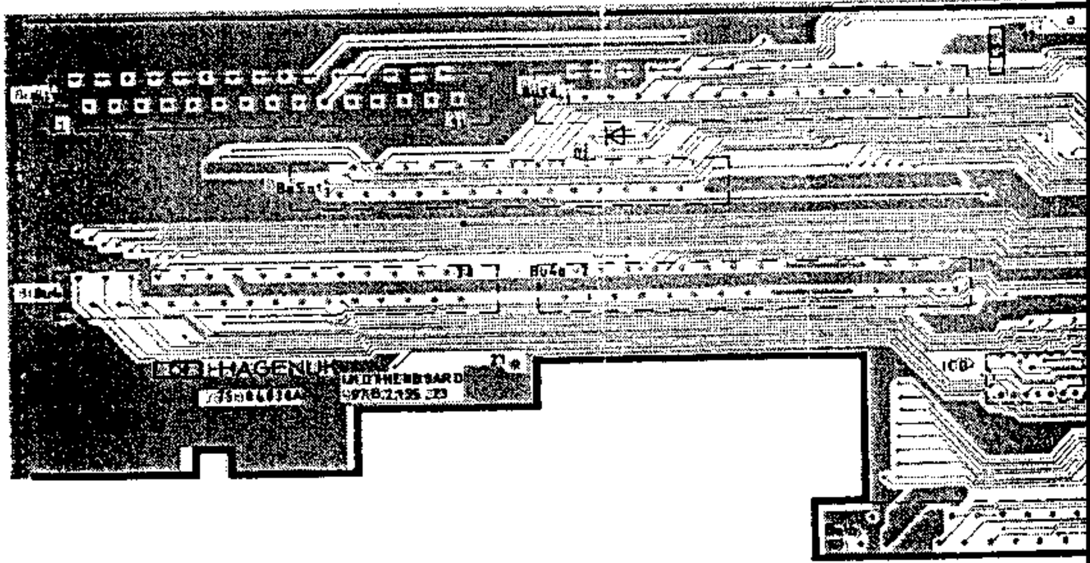


To be fitte

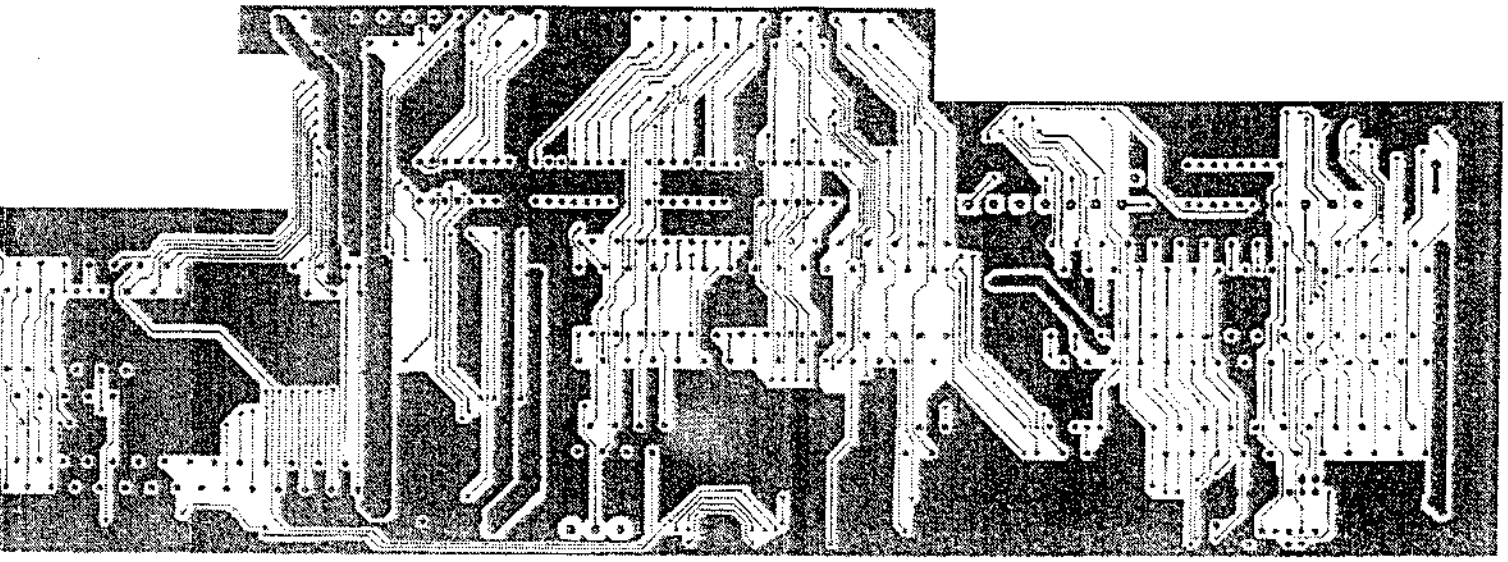
HAG/ROD 016-04 93

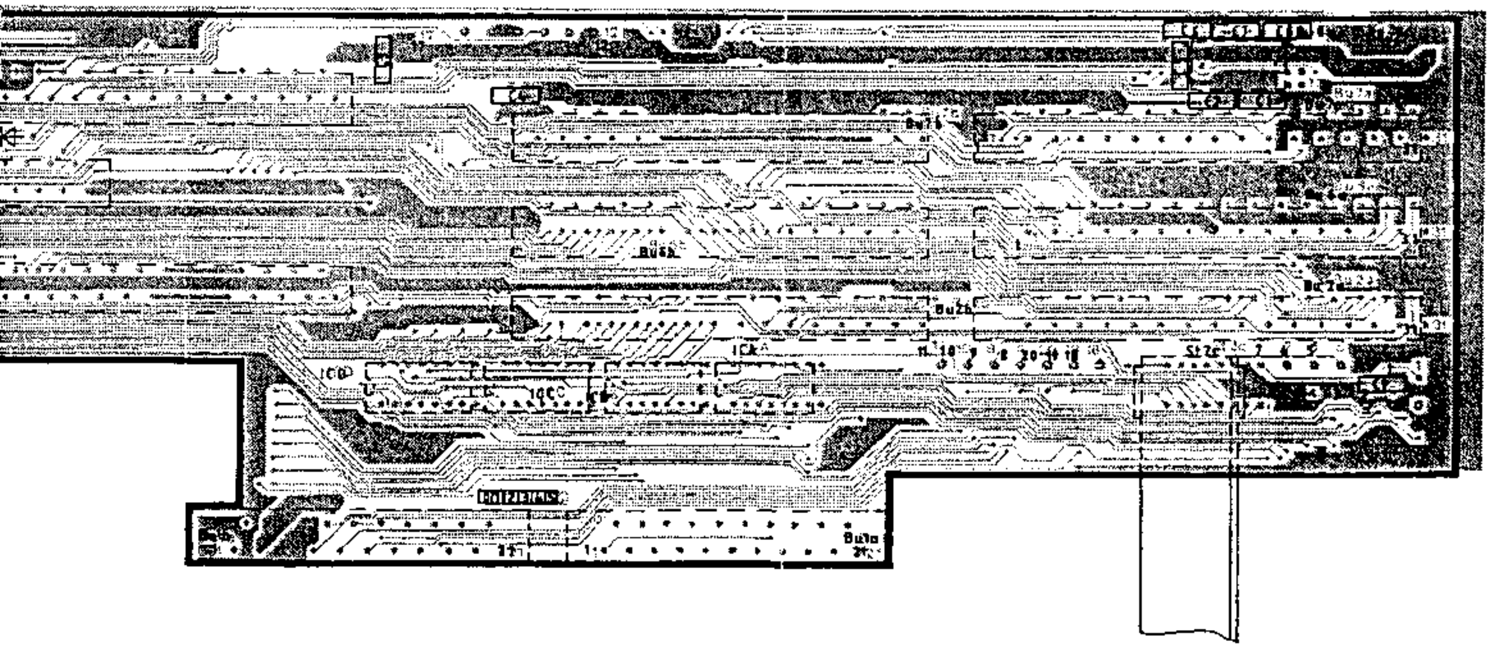
see circuit diagram





see circuit diagram - MOTHERBOARD 97 Sa B 2.155.23





Printed Circuit Board
Motherboard
97 B 2.155.23

Parts lists No.
97 Sa 2.155.23

-Motherboard RX 5001-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Capacitors:				
1208.225	C1	0,1/20/100 V	CK 06 BX 104 K	SEC
1208.225	C2	0,1/20/100 V	CK 06 BX 104 K	SEC
1078.607	C3	0,01/10/100 V	CK 05 BX 103 K	SEC
1078.607	C4	0,01/10/100 V	CK 05 BX 103 K	SEC
1208.225	C5	0,1/20/100 V	CK 06 BX 104 K	SEC
1208.225	C6	0,1/20/100 V	CK 06 BX 104 K	SEC
1208.225	C7	0,1/20/100 V	CK 06 BX 104 K	SEC
1208.225	C8	0,1/20/100 V	CK 06 BX 104 K	SEC
1078.607	C9	0,01/10/100 V	CK 05 BX 103 K	SEC
1208.225	C10	0,1/20/100 V	CK 06 BX 104 K	SEC
Diodes:				
0745.677	D1		1 N 4148	ITT
Integrated circuits:				
1423.711	IC A		IC 75469	
1423.711	IC B		IC 75469	
1423.711	IC C		IC 75469	
1423.711	IC D		IC 75469	

-CPU II-

Technical description
This unit, with the Z80 microprocessor CPU, controls the entire receiver program sequence. See block diagram CPU II for a list of the individual circuits.

Voltage monitoring and Watchdog
The voltage monitoring circuit consists of the ICs B and D, transistors T 3 and T 4 and the other associated components. The voltage monitored is the +5 V supply, which is fed for this purpose direct from the power supply output to pin b 21 of the circuit. The reference voltage is generated by D 1 and applied to operational amplifier IC - D. The response point of the monitoring circuit is set to 4.81 V with R 3. If the voltage falls below this level, the output of IC - D goes HIGH and an NMI signal originates via IC - B and T 3. After the time lag determined by R 9 and C 6, the RESET signal is also activated via T 4. On switch-on, if the response point is exceeded, the opposite process takes place, the RESET signal being cancelled only after the NMI signal. C 5 and R 8, together with the IC - B, facilitate reliable switchover of output 3 of IC - B on switch-on, thereby preventing oscillation.

The Watchdog circuit comprises IC - C and IC - A. IC - C is a counter chip supplied with the CPU clock pulse via pin 9, so that it counts up. The counter is activated via pin 2 and IC - A is reset if NMI is activated by the voltage monitor or if a reset pulse is generated via decoder IC - Y by the current program. If the program is interrupted for instance by an interference pulse, these reset pulses do not occur and the counter will continue to count until its output Q 24 (pin 1) switches over. This triggers a RESET pulse via IC - A and C 7 and R 11, thereby restarting the CPU via IC - B, T 3 and T 4.

Wait pulse generator
The wait pulse generator comprises two flipflops (IC - F) synchronized with the CPU clock pulse (pins 3 and 11). If an MRQ signal occurs on pin 2, a WAIT signal is generated for the following clock cycle. This makes it possible to use also slower memory chips.

CPU
IC-G is the Z80 CPU which controls and monitors all operating sequences in the RX 1001 M / RX 5001 control unit. The signals NMI and RESET have already been discussed, they ensure a defined program start or interruption. The WAIT signal has also been explained. The address bus A 0 to A 15 is used by the CPU to point to individual storage locations or I/0 chips. The MRQ signal is activated upon memory accesses and the signal IORQ is active on access to I/0 chips. The data direction is determined in each case by the signals RD for READ operations and WR for WRITE operations.

-CPU II-

The system clock pulse is fed to the CPU via pin 6. The bidirectional data bus D 0 to D 7 transfers data between the CPU and the memories and input-output chips. The INT input is used by the peripherals for interrupt requests to the CPU if an interrupt-controlled function is to be performed (e.g., alarm or keyboard entry). The CPU shows by activation of output M 1 that it is executing the first machine cycle of a new instruction. This signal synchronizes the PIOs with the CPU. It is also logically combined with RESET, as an M 1 signal without simultaneous activation of RD or IORQ must be generated for resetting of the PIO circuit.

Clock generator
The clock oscillator comprises Q 1, IC - E, C 8 and R 22 and R 23. The frequency generated is divided by 4 in IC - L and is then 2.4576 MHz. These clock pulses are fed to the CPU, the PIOs, the baud rate generator, the USART, the WAIT pulse generator and the Watchdog.

Baud rate generator
The programmable divider IC - M is supplied with the clock pulse and generates at its output pin 10, 16 times the frequency of the baud rate set on S1. This frequency is fed to the USART as send and receive clock.

Baud rate settings on switch S1:

Baud	S1.1	S1.2	S1.3	S1.4
50	ON	ON	OFF	ON
75	ON	ON	OFF	OFF
110	OFF	OFF	OFF	OFF
134,5	ON	OFF	ON	ON
150	OFF	OFF	OFF	ON
200	ON	OFF	ON	OFF
300	OFF	OFF	ON	OFF
600	ON	OFF	OFF	ON
1200	OFF	ON	OFF	OFF
1800	OFF	ON	OFF	ON
2400	ON	OFF	OFF	OFF
2400	OFF	OFF	ON	ON
4800	OFF	ON	ON	OFF
9600	OFF	ON	ON	ON

Bus drivers
To ensure that the bus connections of the CPU are not overloaded almost all the other units are connected to the CPU via bus drivers. These are IC - H and IC - J for the address bus and IC - K for the monitoring bus. These drivers are constantly selected and operate unidirectionally - i.e., only from the CPU to the connected circuit.

The driver for the data bus IC - P, on the other hand, operates bidirectionally, as data must be transmitted in both directions, and it is activated only upon memory access operations by the MRQ signal. The data direction of this driver is controlled by RD. The I/O chips are connected direct to the data bus of the CPU to permit the use of Z 80 interrupt mode 2, in which the CPU reads an interrupt vector from the peripheral which has triggered the interrupt. However, this process takes place without activation of the RD line, so that any interconnected bus driver would cause this vector not to be read by the CPU. The data bus driver is in a high-resistance condition upon access operations to the I/O chips.

EPROMs
The IC - N, IC - O chips and possibly also IC - R contain the program whereby the CPU can control and monitor the processes in the equipment. Permanent data are also stored here. The relevant chip is addressed via the CS inputs pins 20 and 22, the address inputs selecting the individual storage location. The content of this storage location is then placed on the data bus and read by the CPU.

RAM with write protection
Circuit IC - I is a static CMOS-RAM, in which the CPU deposits or temporarily stores variable data. When the receiver is switched off, this circuit is powered by the built-in storage battery, so that the stored data is retained and the former operating condition can be restored when the receiver is switched on again. An individual storage location is accessed in the same way as the EPROMs. However, the WR line is also connected to the RAM via pin 27 so that data can also be written into the memory.

A further RAM, IC - S, can also be used if required. Transistors T 1, T 2 and T 5 constitute the write protection for the RAMs when the receiver is switched off or if the power fails. The RESET signal is applied via series resistors to the base connections. If this signal is activated (i.e., LOW) the CS and WR inputs of the RAMs are disconnected by the transistors and kept at HIGH level via R 16, R 24 and R 30. This ensures that no spurious write operations can be initiated and that the data in the RAM is safely retained.

-CPU II-

Decoder for memory Chips
IC - Y selects whichever chip is required by the CPU for storage access operations. The decoder is activated by the MRQ signal via pins 4 and 5 and then switches the output specified by address lines A 15, A 14 and A 13 to LOW level for selection of the connected memory chip. This results in the following address areas:

A 15	A 14	A 13	Address area	Chip	
0	0	0	0000H-lFFFH	EPROM 1	IC - N
0	0	1	2000H-3FFFH	EPROM 2	IC - O
0	1	0	4000H-5FFFH	EPROM 3	IC - R
0	1	1	6000H-7FFFH	Spare RAM	IC - S
1	0	0	8000H-9FFFH	C4 Dec.1	
1	0	1	A000H-BFFFH	CS 6 (Watchdog Trigger)	
1	1	0	C000H-DFFFH	CS 5	
1	1	1	E000H-FFFFH	RAM	IC - T

Further external storage locations are accessed via the signals CS 5, CS 6 and CS Dec. 1.

Decoder for input/output chips
Decoder IC - X is activated via pin 1 from address line A 5 and selects a PIO circuit according to the states of lines A 2 and A 3. Since IC - X is controlled only by address lines, its outputs will also generate CS signals on memory access operations. However, these do not matter, as the PIOs also evaluate the IORQ signal for activation.

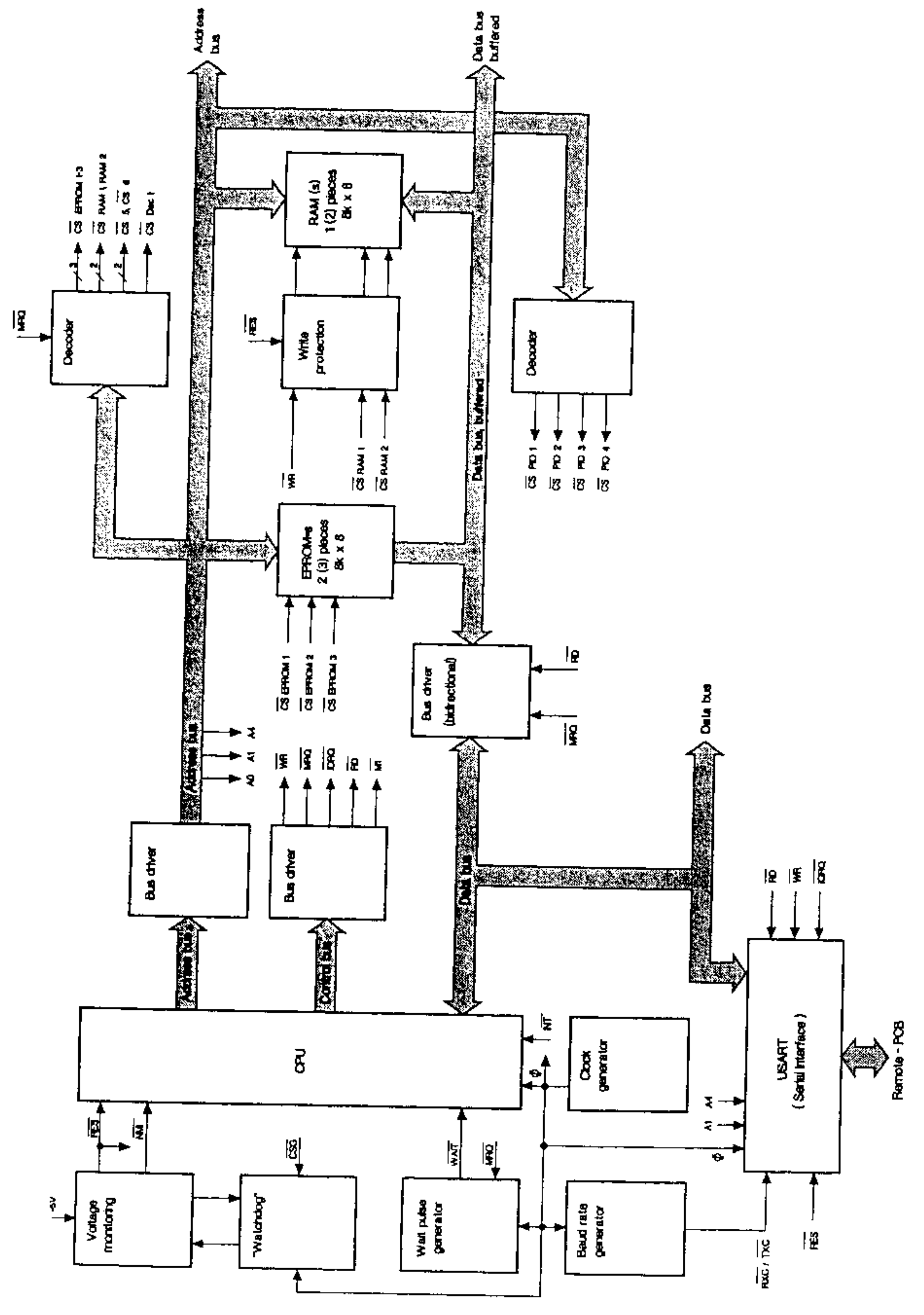
Serial interface (USART)
IC - V is used for operation of the RS-232 interface. The chip receives the clock pulse via pin 20 and the send-and-receive clock from the baud rate generator via pins 9 and 25. The send-and-receive clock is divided internally by 16 and then forms the baud rate for serial data transmission.

The RESET signal is supplied via pin 21. The CPU is connected to the USART via the data bus D 0 to D 7. The chip is selected for this purpose via CS (pin 11) in combination with RD (pin 13) or WR (pin 10). The read or write signals for IC - V are obtained from the CPU signals by a combination of IORQ, with RD or WR by means of IC - W. CS is connected directly to address line A4, which must therefore be kept at HIGH level for access operations to other I/O chips. The address line is connected directly to input C/D and therefore determines whether data or commands or status information is transmitted over the data bus.

-CPU II-

Data is transmitted serially over lines RXD (receive data) and TXD (transmit data). The USART indicates via line RXR that a complete character can be read in serial form. Conversely, an indication is given via TXR that the CPU can write a new character into the chip for serial transmission. When the last character has been completely transmitted, the USART activates the signal TXE. The remaining signals are for modem control: RTS is the request to send, which must be acknowledged by clear to send CTS. The interface signals to the modem that it is ready for operation by DTR (data terminal ready) and the modem activates the DSR (data set ready) line when it is ready for operation.

-CPU II-



Blockdiagram - CPU II

-CPU II-

Test and alignment instrucions

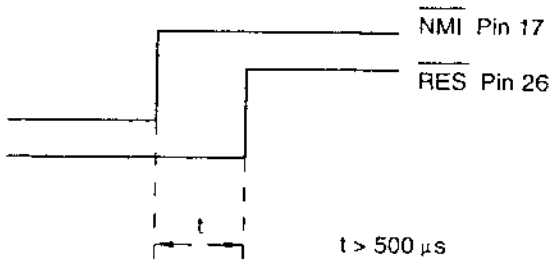
Required: Circuit diagram CPU II - Hagenuk Drawing No. 97 Sa B 2.155.35
DVM, 2-channel oscilloscope, power supply

Test configuration: The PCB is removed and reconnected to the receiver using the extender PCB (service adaptor). Disconnect the 5 V power supply and feed in +5 V externally.

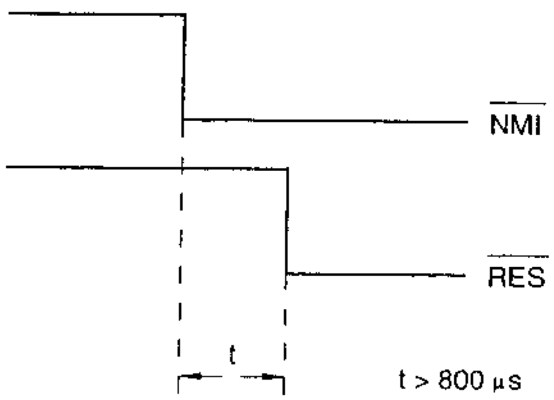
Testing the voltage and current consumption
Set external power supply to 5.0 V ± 0.1 V and measure current consumption: specified value 310 mA ± 31 mA.

Testing the voltage monitor circuit
Reduce supply voltage to 4.810 V. Turn potentiometer R 3 fully counterclockwise. Connect a DVM to MP 8. Turn R 3 clockwise.
Test values:
The voltage on MP 8 must be "definitely" LOW.
Then reduce the supply voltage and increase it again.
Test values:
LOW signal on MP 8 at 4.810 V.

Testing the POWER ON/POWER DOWN circuit
Connect two-channel oscilloscope, channel 1 to IC - G pin 17 and channel 2 to pin 26. Triggering is by the rising edge of the NMI signal. Switch on receiver.
Test values:



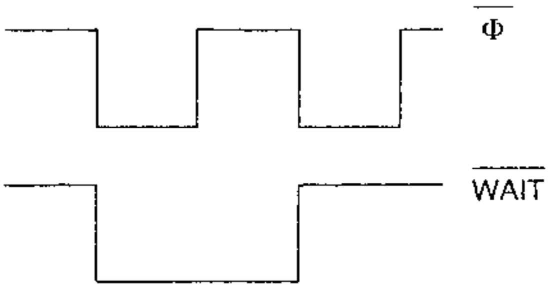
Set triggering to trailing edge of NMI signal.
Interrupt the +5 V power supply.
Test values:



Measurement of CPU clock frequency
Connect oscilloscope to IC - G pin 6. (Ø signal)
Test values:
f = 2.5 MHz.

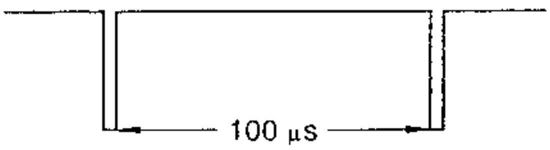
-CPU II-

Measurement of WAIT signal
Connect oscilloscope to IC - G pin 24. (WAIT signal)
Test values:



NOTE
A special test E-PROM is used for further testing of the CPU board.
Remove normal E-PROM set and insert test E-Prom in socket (ICN)

Measure various signals on the CPU board. The test EPROM contains a program which generates all the memory signals. In the subsequent measurement there must be pulses at the measurement points. The pulse form and sequence varies. In the logical "LOW" status the pulses must have a voltage of 0.8 V and in the "HIGH" status a voltage of 2.4 V.
Measure at Pin 20 of IC N, O, R, S, T.
Required: Needle pulses to "LOW", time elapse between the pulses around 100 us.



Measure pulse at Pin 4, 5, 6, 7 IC X.
Required: Pulses

Measure pulses at Pin 9, 10, 11, IC Y.

Measure pulses at the "Data Bus Buffered".
(Pin 7 to Pin 14 St A).

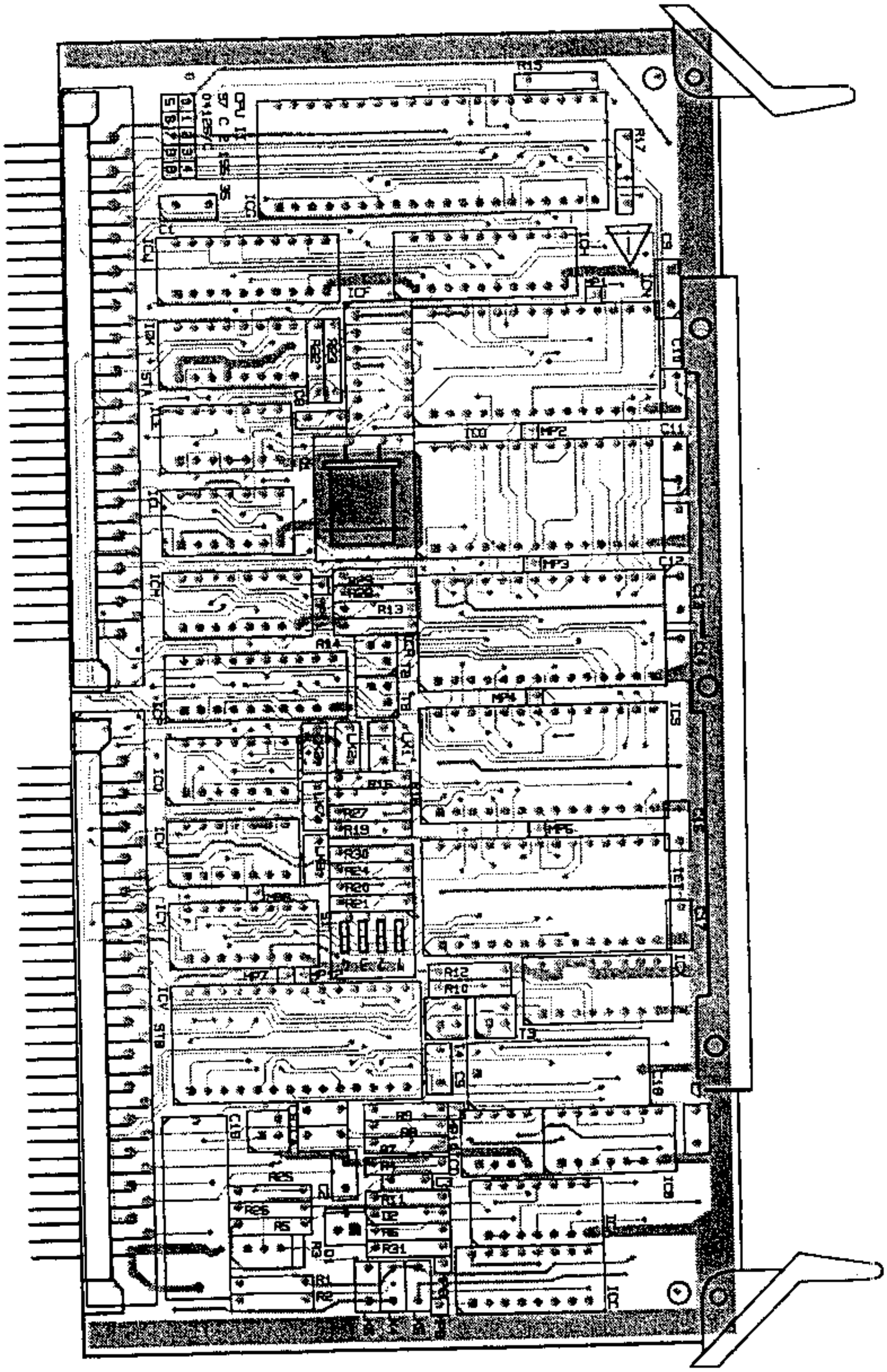
-CPU II-

Measure TXD pulses (Pin 4 socket B).
Measure pulses at IORQ (Pin 23 socket B).
Measure pulses at WR (Pin 24 socket B).
Measure pulses at RD (Pin 25 socket B).
Measure pulses at Φ (Pin 26 socket B).
(Φ timing = symmetrical square wave of 2.5 MHz)

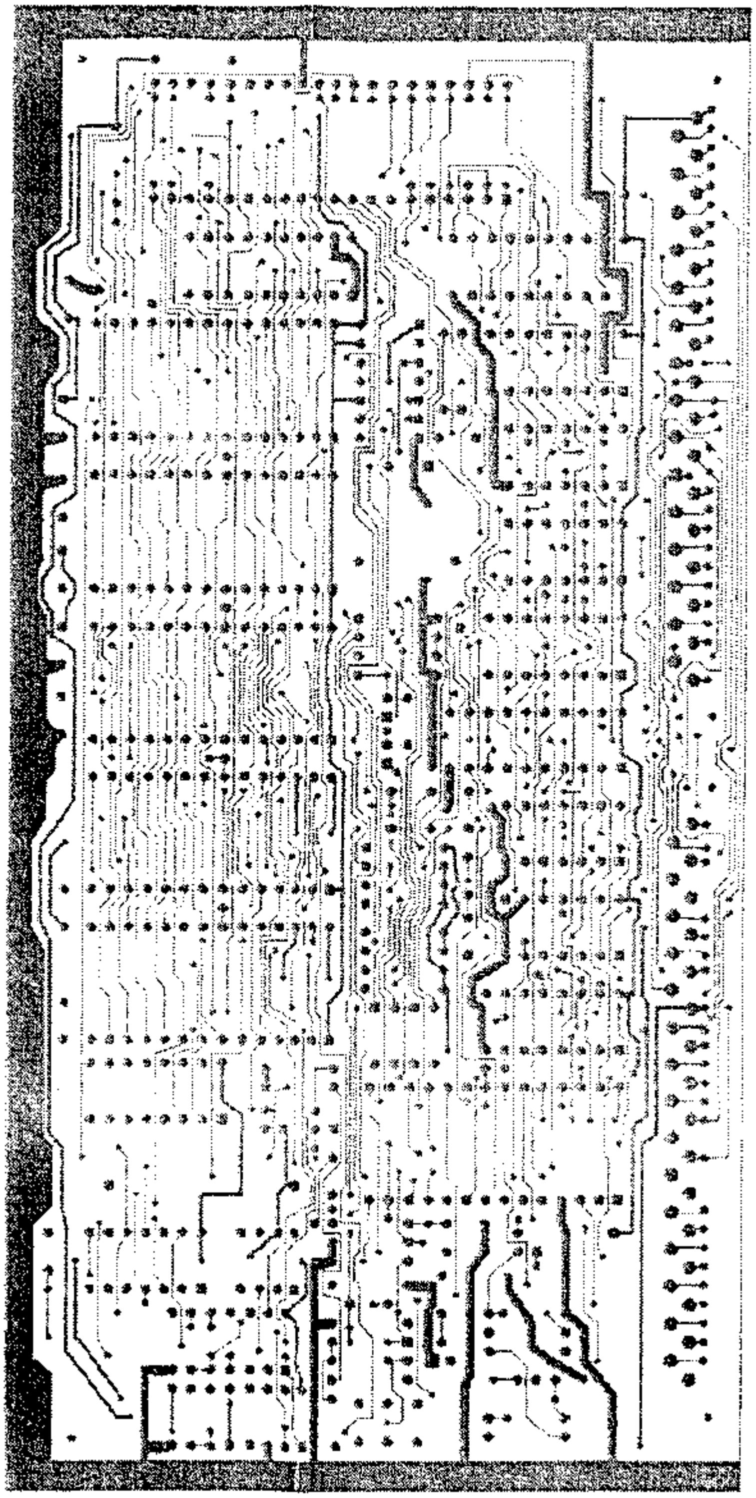
Measure pulses at M1 (Pin 28 socket B).
Measure pulses at MRQ (Pin 29 socket B).
Measure pulses at Address Bus (Pin 15 to 30 socket A).

Remove test EPROM, insert "normal" EPROM set, insert board in a test receiver and test all functions.

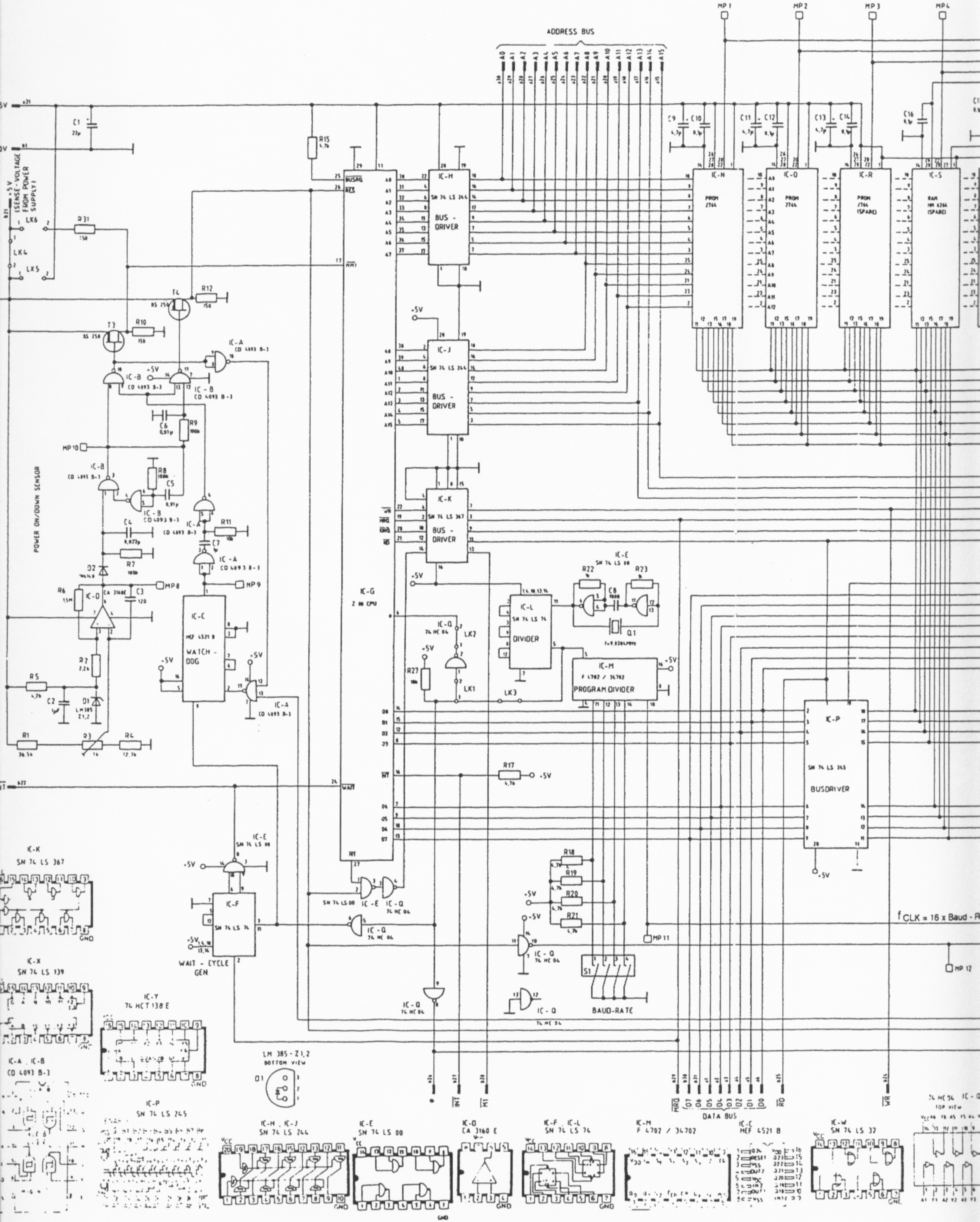
see


R15
R17
MP2
MP3
MP4
MP6
MP7
C11
C12
R13
R14
R27
R19
R30
R24
R20
R21
R12
R10
T3
R25
R26
R5
R3
R1
R2
R11
D2
R31
R6
R7
R8
R9

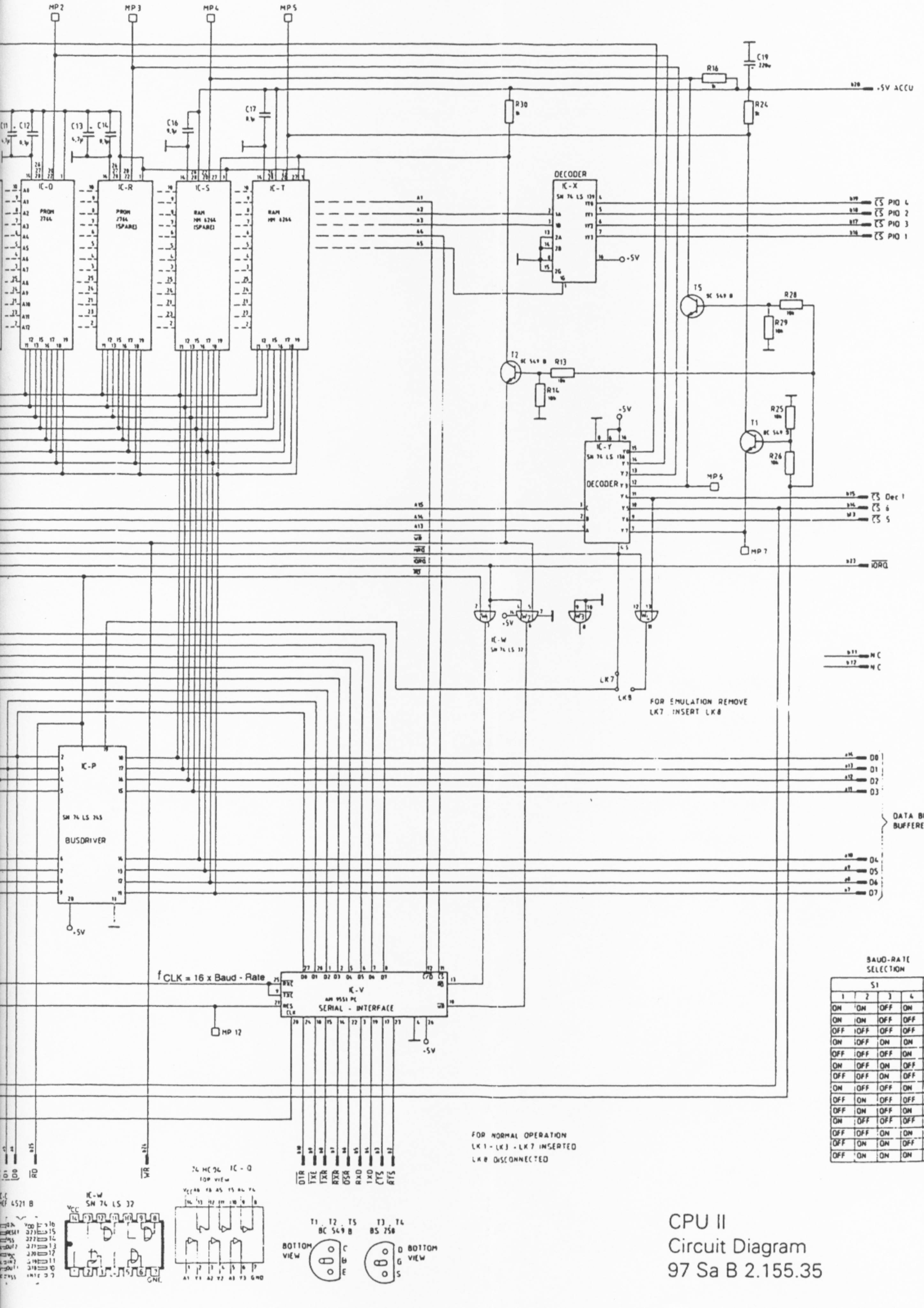
see circuit diagram - 97 Sa B 2.155.35



Printed Circuit Board
CPU II
97 C 2.155.35



ADDRESS BUS
DATA BUS
MP 1
MP 2
MP 3
MP 4
IC-G
Z 80 CPU
IC-H
SN 74 LS 244
BUS - DRIVER
IC-J
IC-K
SN 74 LS 367
IC-N
PROM 2764
IC-O
IC-R
PROM 2764 (SPARE)
IC-S
RAM
IC-P
SN 74 LS 245
BUSDRIVER
IC-L
SN 74 LS 74
DIVIDER
IC-E
SN 74 LS 00
IC-M
F 4702 / 34702
PROGRAM DIVIDER
IC-C
HEF 4521 B
WATCH - DOG
IC-F
WAIT - CYCLE GEN
IC-Q
74 HC 04
IC-A
IC-B
CD 4093 B-3
IC-D
CA 3160 E
POWER ON/DOWN SENSOR
+5V (SENSE-VOLTAGE FROM POWER SUPPLY)
BAUD-RATE
f_{CLK} = 16 x Baud - R
IC-X
SN 74 LS 139
IC-Y
74 HCT 138 E
IC-W
SN 74 LS 32
LM 385 - Z1,2
BOTTOM VIEW
GND



BAUD-RATE SELECTION

S1				BAUD-RATE
1	2	3	4	Bd
ON	ON	OFF	ON	50
ON	ON	OFF	OFF	75
OFF	OFF	OFF	OFF	110
ON	OFF	ON	ON	134.5
OFF	OFF	OFF	ON	150
ON	OFF	ON	OFF	200
OFF	OFF	ON	OFF	300
ON	OFF	OFF	ON	600
OFF	ON	OFF	OFF	1200
OFF	ON	OFF	ON	1800
ON	OFF	OFF	OFF	2400
OFF	OFF	ON	ON	2400
OFF	ON	ON	OFF	4800
OFF	ON	ON	ON	9600

CPU II
Circuit Diagram
97 Sa B 2.155.35

-CPU II-

Parts lists No.
97 Sa 2.155.35

Ident-N0.	Mark	Electr. value	Identity	Manufacturer
Capacitors:				
1401.343	C1	22/20/10 V	2222 122 54229	VALVO
1469.053	C2	1/10/50 V	MKS 2 RM 5	WIMA
1304.291	C3	120 pF/2/63 V	NPO-1 B EDPU DIN 41923	
1672.835	C4	0,022l/5/63 V	MKS 2 RM 5	WIMA
1811.541	C5	0,01/10/63 V	MKS 2	WIMA
1811.541	C6	0,01/10/63 V	MKS 2	WIMA
1469.053	C7	1/10/50 V	MKS 2 RM 5	WIMA
1116.282	C8	1000 PF/20/200 V	CK 05 BX 102 M	SEC
1390.376	C9	4,7/20/10 V	2222 122 54478	VALVO
1423.037	C10	0,1/20/63 V	MKS 2	WIMA
1390.376	C11	4,7/20/10 V	2222 122 54478	VALVO
1423.037	C12	0,1/20/63 V	MKS 2	WIMA
1390.376	C13	4,7/20/10 V	2222 122 54478	VALVO
1423.037	C14	0,1/20/63 V	MKS 2	WIMA
1423.037	C16	0,1/20/63 V	MKS 2	WIMA
1423.037	C17	0,1/20/63 V	MKS 2	WIMA
1183.389	C18	220/50/10/10 V	B41283-C3227-T	SIEMENS
1183.289	C19	220/50/10/10 V	B41283-C3227-T	SIEMENS
Diodes:				
1469.983	D1		LM 385 Z 1,2	NATIONAL
0745.677	D2		1 N 4148	
Resistors:				
1405.381	R1	36,5 k-1-50-0207	DIN 44061-G	
0744.808	R2	2,2 k-5-0,6-0207	DIN 44052	
1539.191	R3	1 k/10/0,5 W	752-208	VITROHM
1491.423	R4	12,1 k-1-50-0207	DIN 44061-G	
0767.212	R5	4,7 k-5-0,6-0207	DIN 44052-G	
0933.716	R6	1,5 M-5-0,6-0207	DIN 44052-G	
0767.190	R7	100 k-5-0,6-0207	DIN 44052-G	
0767.190	R8	100 k-5-0,6-0207	DIN 44052-G	
0767.190	R9	100 k-5-0,6-0207	DIN 44052-G	
0744.743	R10	150-5-0,6-0207	DIN 44052-G	
0179.701	R11	10 k-5-0,6-0207	DIN 44052-G	
0744.743	R12	150-5-0,6-0207	DIN 44052-G	
0179.701	R13	10 k-5-0,6-0207	DIN 44052-G	
0179.701	R14	10 k-5-0,6-0207	DIN 44052-G	

-CPU II-

Parts lists No.
97 Sa 2.155.35

Ident-No.	Mark	Electr. value	Identity	Manufacturer
0767.212	R15	4,7 k-5-0,6-0207	DIN 44052-G	
0179.698	R16	1 k-5-0,6-0207	DIN 44052-G	
0767.212	R17	4,7 k-5-0,6-0207	DIN 44052-G	
0767.212	R18	4,7 k-5-0,6-0207	DIN 44052-G	
0767.212	R19	4,7 k-5-0,6-0207	DIN 44052-G	
0767.212	R20	4,7 k-5-0,6-0207	DIN 44052-G	
0767.212	R21	4,7 k-5-0,6-0207	DIN 44052-G	
0179.698	R22	1 k-5-0,6-0207	DIN 44052-G	
0179.698	R23	1 k-5-0,6-0207	DIN 44052-G	
0179.698	R24	1 k-5-0,6-0207	DIN 44052-G	
0179.701	R25	10 k-5-0,6-0207	DIN 44052-G	
0179.701	R26	10 k-5-0,6-0207	DIN 44052-G	
0179.701	R27	10 k-5-0,6-0207	DIN 44052-G	
0179.701	R28	10 k-5-0,6-0207	DIN 44052-G	
0179.701	R29	10 k-5-0,6-0207	DIN 44052-G	
0179.701	R30	10 k-5-0,6-0207	DIN 44052-G	
0744.743	R31	150-5-0,6-0207	DIN 44052-G	

Integrated circuits:

1331.876	IC A		CD 4093 B	RCA, NATIONAL
1331.876	IC B		CD 4093 B	RCA, NATIONAL
1398.326	IC C		HEF 4521 BP	VALVO
	IC D		CA 3160 E	RCA
1090.895	IC E		ND 74 LS 00 N	
1186.787	IC F		SN 74 LS 74	TEXAS
			DM 74 LS 74 AN	NATIONAL
1911.244	IC G	IC Z 84 C00 AB6 Z 80	CPU, C-MOS, 4 MHz	SGS
1398.296	IC H		74 LS 244 N	
1398.296	IC J		74 LS 244 N	
1398.490	IC K		74 LS 376 N	NS, TEXAS
1186.787	IC L		SN 74 LS 74	TEXAS
			DM 74 LS 74 AN	NATIONAL
1776.029	IC M		F 4702 BPC	
1865.595	IC N			97 E 2.155.260
1865.595	IC O			97 E 2.155.260
1486.756	IC P		74 LS 245	NATIONAL, VALVO, TEXAS, MOTOROLA
	IC Q		74 HC 04	NATIONAL
1713.167	IC T		HM 6264 LP - 15	HITACHI
1478.877	IC V		AM 9551 PC	AMD

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1398.563	IC W		74 LS 32 N	NS, TEXAS
1425.080	IC X		SN 74 LS 139 N	NS, TEXAS, FAIRCHILD
	IC Y		74 HCT 138 E	

Transistors:

1291.033	T1		BC 549 B	ROE, INTERMET, VALVO
1291.033	T2		BC 549 B	ROE, INTERMET, VALVO
1465.767	T3		BS 250	ITT
1465.767	T4		BS 250	ITT
1291.033	T5		BC 549 B	ROE, INTERMET, VALVO

Supplements:

1404.229	Q1	9.8304 MHz	HC-18/U	
1315.293	S1	4-quad	435166-2	AMP
0681.296	ST A		DIN 41617	
0681.296	ST B		DIN 41617	

-Buffer D/A Converter-

Technical description

The buffer D/A converter is the interface between the RF section and digital section.
Some of the lines are fed via this module only to filter out interference- e.g., the +5 V, +18 V and 0 V power supplies, the AF signals AF 1 and AF 2, the AGC voltages and various control signals.

NOTE

The links LK 1, LK 2 and LK 4 must be used for the RX 1001 M / RX 5001.
LK 3 stays open.

For control of the BFO, the VCOs and the PRESELECTOR, the storage flipflops (IC - B, C and D) form an interface between the processor and the driver chips (IC - E, F, G and J).
To drive the PRESELECTOR, the reference voltage, to which the motor must drive the servopotentiometer, must be generated. This voltage U_{REF} is formed in the D/A converter IC - M.

- RX MUTING
  The microprocessor mutes the reveiver by bringing the MUTE line to 0 V. The information L = LOW is contained in memory IC - D and is output via driver circuit IC G pin 16.

- Signals to PRESELECTOR
  If a PRESELECTOR is fitted instead of the PROTECTOR, the microprocessor must switch not only the receiver MUTING and the 20 dB antenna attenuation but also the various filter ranges. The BUFFER D/A CONVERTER constitutes the interface to the processor for this purpose. The filter ranges are switched via the output memories and drivers IC - D and IC - G. The position of the filters (depth of tuning slugs in filter coils) is determined by an analog voltage of 5-10 V (U_{REF}) fed to the MOTOR CONTROL circuit of the preselector. The D/A CONVERTER generating this voltage is also accommodated on the BUFFER D/A CONVERTER board.

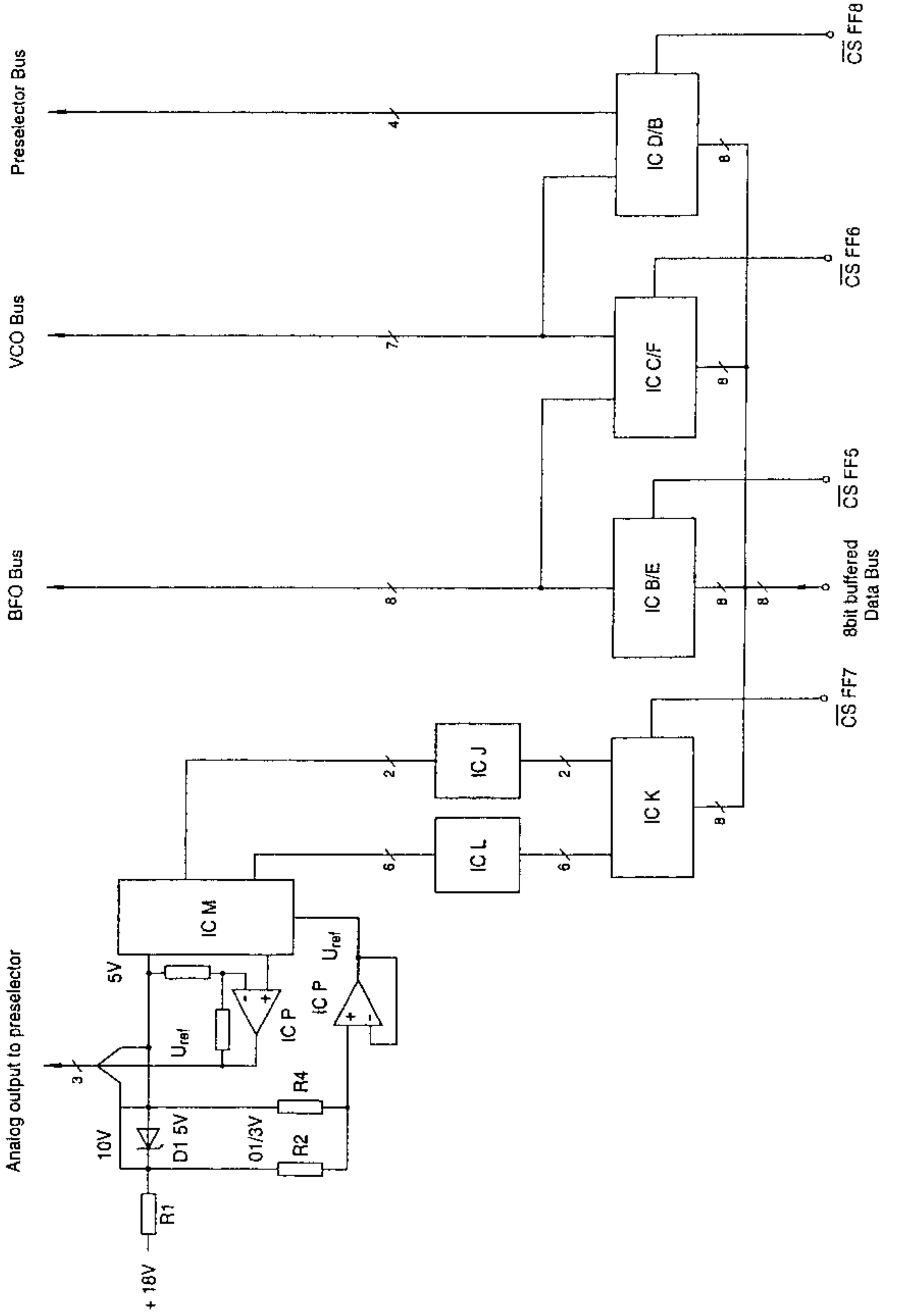
- Signal to FILTERBOARD
  The mircoprocessor controls the selection of the filter bandwidths. To output this information, the microprocessor uses IC - O on the AUDIO BOARD. The signals then pass via the MOTHERBOARD to the BUFFER D/A CONVERTER board. The interface to the RF section is in each case actively LOW with an open collector.

-Buffer D/A Converter-

- Signals to VCO - A and VCO - B
  The interface supplies only dynamic signals - i.e., input of frequencies to the VCO memories takes places in 4-bit parallel form and then in each case serially. Two static signals - 10 MHz and - 20 MHz are also required to select the VCOB oscillator (B 63 -73 MHz) or (73 - 83 MHz,) or (83 - 93 MHz).
  In addition to the 4-bit data lines, the processor also switches line P_{EA} (programmable Counter Enable) = High if VCO - A is to be loaded and P_{EB} if VCO - B is to receive data. The processor writes this data into memories IC - C and IC - D.

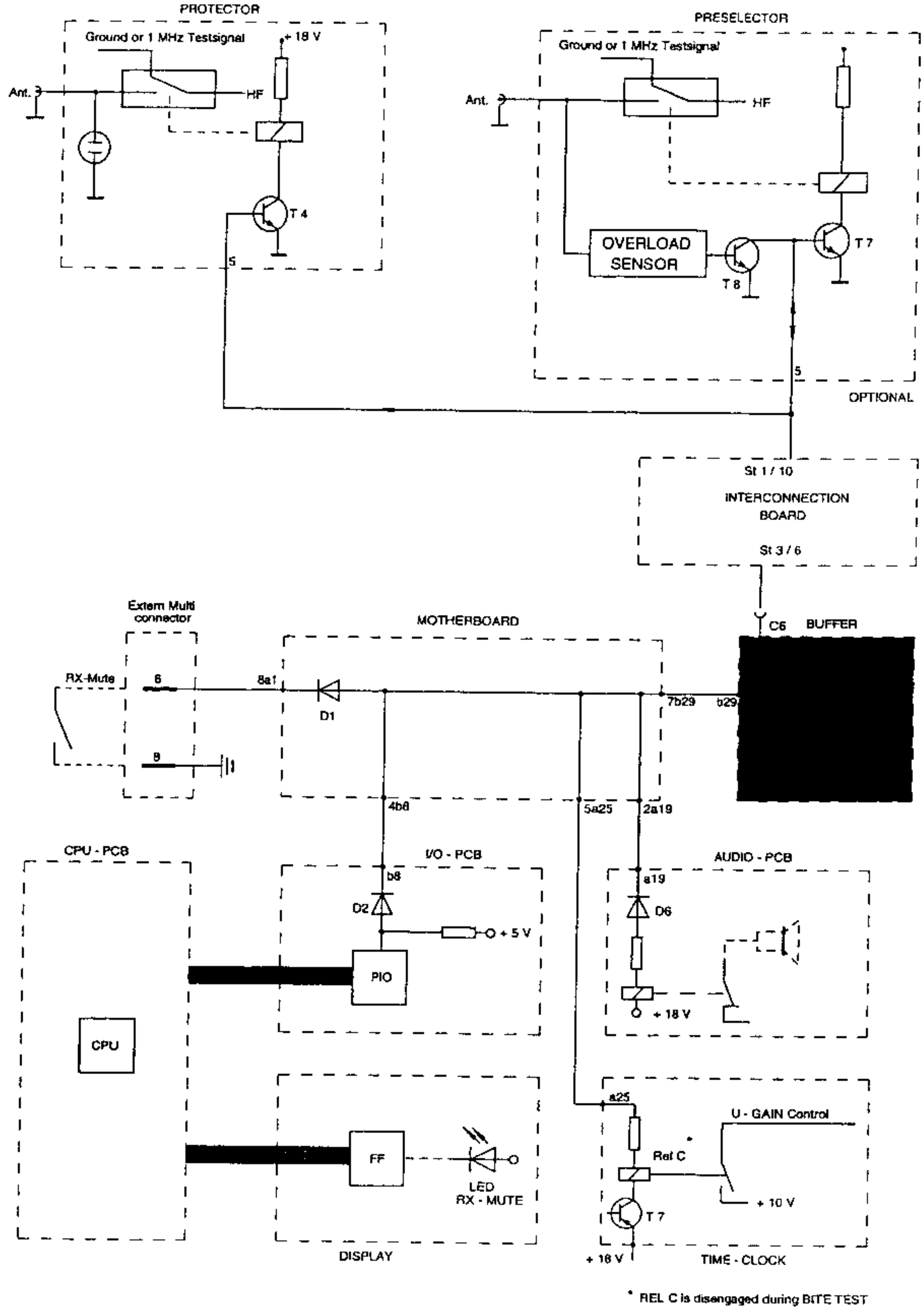
- Signal to BFO
  Depending on mode, the BFO must supply various frequencies around 5 MHz - on USB for instance 5.000 MHz, on LSB for instance 4.9970MHz; on CW, the centre frequency of 4.9985 MHz can be varied by ± 5 kHz in 10 Hz steps.
  For this reason, the processor must send this frequency information to the PLL IC on the BFO PCB. The processor supplies the data via IC - E and F on the BUFFER D/A CONVERTER board to the BFO.

-Buffer D/A Converter-



Blockdiagram Buffer D/A Converter

-Buffer D/A Converter-



Mute Interconnections

-Buffer D/A Converter-

Test and alignment instructions

Required: Circuit diagram BUFFER D/A CONVERTER - Hagenuk Drawing No. 97 Sa C 2.155.34
DVM, power supply, signal generator (TTL level) oscilloscope

Test configuration: The BUFFER D/A CONVERTER module is removed.
Connect power supply to plug ST B pin1 0 V
plug ST B pin 2 +18V
plug ST A pin 31 + 5 V

Checking current consumption
Specified current consumption: at 5 V = 30 mA ± 6 mA
at 18 V = 70 mA ± 10 mA

Testing IC-B
Connect together plug A pins 9 up to 16 and feed in low-frequency TTL pulses at this point. Connect plug B pin 5 CS FF5 to 0 V.
Test values:
Functional test: These signals can be measured with the oscilloscope at the outputs of IC - E; connect the output to be measured via a 1 kOhm resistor to +5 V.

NOTE
IC - C and IC - D should be tested in the same way.

Testing the D/A converter
Use a floating DVM (not connected to earth or equipment earth).

Measure voltage U_{POT} between plug ST C pin 37 and ST C pin 3.
Test values:
U_{POT} should be 5,1 V ± 1 %.

Connect plug ST B pin 8 CS FF7 to 0 V and apply HIGH level to inputs D0 to D7 plug ST A pins 9-16.
Measure voltage U_{REF}
Test values:
U_{REF} should be 0 mV ± 10 mV; reference; U_{POT} +5 V

Connect inputs D0 to D7 to LOW level.
Test values:
Specified values of U_{REF}: see table; tolerance ± 10 mV

-Buffer D/A Converter-

Connect inputs D0 to D7 HIGH level and then connect individual data lines to LOW level (see table).
Test values:
Specified value of U_{REF}: see table; tolerance ± 10 mV

In relationship to the actual measured value of $U/_{POT}$, find a few significant values U_{REF} in the table below.
If values are not being met, re-evaluate R SOT parallel to R5. Refer also to circuit diagram 97 Sa 2.155.30

	$U/_{POT}$ (mV) (socket C, Pin 37 with reference to C, Pin 3)										
	5050	5060	5070	5080	5090	5100	5110	5120	5130	5140	5150
D0-D7 H	00,00	00,00	00,00	00,00	00,00	00,00	00,00	00,00	00,00	00,00	00,00
D0 L	19,73	19,76	19,80	19,84	19,88	19,92	19,96	20,00	20,04	20,08	20,12
D1 L	39,45	39,53	39,61	39,69	39,76	39,84	39,92	40,00	40,08	40,16	40,23
D2 L	78,91	79,06	79,22	79,37	79,53	79,69	79,84	80,00	80,16	80,31	80,47
D3 L	157,8	158,1	158,4	158,7	159,1	159,4	159,7	160,0	160,3	160,6	160,9
D4 L	315,6	316,2	316,9	317,5	318,1	318,7	319,4	320,0	320,6	321,2	321,9
D5 L	631,2	632,5	633,7	635,0	636,2	637,5	638,7	640,0	641,2	642,5	643,7
D6 L	1262	1265	1267	1270	1272	1275	1277	1280	1282	1285	1287
D7 L	2525	2530	2535	2540	2545	2550	2555	2560	2565	2570	2575
D0-D7 L	5030	5040	5050	5060	5070	5080	5090	5100	5110	5120	5130
	U/REF (mV) (socket C, Pin 36 with reference to C, Pin 3)										

-Buffer D/A Converter-

In the following list find all 255 possible D/A-converter input variables in HEX versus the corresponding analog output voltage.
Please note, that the digital input variables D0 ... D7 of the Buffer D/A Converter PCB are generated by inverting the respective HEX value in this Table

HEX:	Uref:	HEX:	Uref:	HEX:	Uref:	HEX:	Uref:	HEX:	Uref:
00	0 mV								
01	20 mV	34	1040 mV	67	2060 mV	9A	3080 mV	CD	4100 mV
02	40 mV	35	1060 mV	68	2080 mV	9B	3100 mV	CE	4120 mV
03	60 mV	36	1080 mV	69	2100 mV	9C	3120 mV	CF	4140 mV
04	80 mV	37	1100 mV	6A	2120 mV	9D	3140 mV	D0	4160 mV
05	100 mV	38	1120 mV	6B	2140 mV	9E	3160 mV	D1	4180 mV
06	120 mV	39	1140 mV	6C	2160 mV	9F	3180 mV	D2	4200 mV
07	140 mV	3A	1160 mV	6D	2180 mV	A0	3200 mV	D3	4220 mV
08	160 mV	3B	1180 mV	6E	2200 mV	A1	3220 mV	D4	4240 mV
09	180 mV	3C	1200 mV	6F	2220 mV	A2	3240 mV	D5	4260 mV
0A	200 mV	3D	1220 mV	70	2240 mV	A3	3260 mV	D6	4280 mV
0B	220 mV	3E	1240 mV	71	2260 mV	A4	3280 mV	D7	4300 mV
0C	240 mV	3F	1260 mV	72	2280 mV	A5	3300 mV	D8	4320 mV
0D	260 mV	40	1280 mV	73	2300 mV	A6	3320 mV	D9	4340 mV
0E	280 mV	41	1300 mV	74	2320 mV	A7	3340 mV	DA	4360 mV
0F	300 mV	42	1320 mV	75	2340 mV	A8	3360 mV	DB	4380 mV
10	320 mV	43	1340 mV	76	2360 mV	A9	3380 mV	DC	4400 mV
11	340 mV	44	1360 mV	77	2380 mV	AA	3400 mV	DD	4420 mV
12	360 mV	45	1380 mV	78	2400 mV	AB	3420 mV	DE	4440 mV
13	380 mV	46	1400 mV	79	2420 mV	AC	3440 mV	DF	4460 mV
14	400 mV	47	1420 mV	7A	2440 mV	AD	3460 mV	E0	4480 mV
15	420 mV	48	1440 mV	7B	2460 mV	AE	3480 mV	E1	4500 mV
16	440 mV	49	1460 mV	7C	2480 mV	AF	3500 mV	E2	4520 mV
17	460 mV	4A	1480 mV	7D	2500 mV	B0	3520 mV	E3	4540 mV
18	480 mV	4B	1500 mV	7E	2520 mV	B1	3540 mV	E4	4560 mV
19	500 mV	4C	1520 mV	7F	2540 mV	B2	3560 mV	E5	4580 mV
1A	520 mV	4D	1540 mV	80	2560 mV	B3	3580 mV	E6	4600 mV
1B	540 mV	4E	1560 mV	81	2580 mV	B4	3600 mV	E7	4620 mV
1C	560 mV	4F	1580 mV	82	2600 mV	B5	3620 mV	E8	4640 mV
1D	580 mV	50	1600 mV	83	2620 mV	B6	3640 mV	E9	4660 mV
1E	600 mV	51	1620 mV	84	2640 mV	B7	3660 mV	EA	4680 mV
1F	620 mV	52	1640 mV	85	2660 mV	B8	3680 mV	EB	4700 mV
20	640 mV	53	1660 mV	86	2680 mV	B9	3700 mV	EC	4720 mV
21	660 mV	54	1680 mV	87	2700 mV	BA	3720 mV	ED	4740 mV
22	680 mV	55	1700 mV	88	2720 mV	BB	3740 mV	EE	4760 mV
23	700 mV	56	1720 mV	89	2740 mV	BC	3760 mV	EF	4780 mV
24	720 mV	57	1740 mV	8A	2760 mV	BD	3780 mV	F0	4800 mV
25	740 mV	58	1760 mV	8B	2780 mV	BE	3800 mV	F1	4820 mV
26	760 mV	59	1780 mV	8C	2800 mV	BF	3820 mV	F2	4840 mV
27	780 mV	5A	1800 mV	8D	2820 mV	C0	3840 mV	F3	4860 mV
28	800 mV	5B	1820 mV	8E	2840 mV	C1	3860 mV	F4	4880 mV
29	820 mV	5C	1840 mV	8F	2860 mV	C2	3880 mV	F5	4900 mV
2A	840 mV	5D	1860 mV	90	2880 mV	C3	3900 mV	F6	4920 mV
2B	860 mV	5E	1880 mV	91	2900 mV	C4	3920 mV	F7	4940 mV
2C	880 mV	5F	1900 mV	92	2920 mV	C5	3940 mV	F8	4960 mV
2D	900 mV	60	1920 mV	93	2940 mV	C6	3960 mV	F9	4980 mV
2E	920 mV	61	1940 mV	94	2960 mV	C7	3980 mV	FA	5000 mV
2F	940 mV	62	1960 mV	95	2980 mV	C8	4000 mV	FB	5020 mV
30	960 mV	63	1980 mV	96	3000 mV	C9	4020 mV	FC	5040 mV
31	980 mV	64	2000 mV	97	3020 mV	CA	4040 mV	FD	5060 mV
32	1000 mV	65	2020 mV	98	3040 mV	CB	4060 mV	FE	5080 mV
33	1020 mV	66	2040 mV	99	3060 mV	CC	4080 mV	FF	5100 mV

-Buffer D/A Converter-

Frequencies versus Buffer D/A-converter data Bus input, versus output voltage U_{REF}

Frequency MHz	to frequency MHz	Data Bus	U_{REF} mV	Frequency MHz	to frequency MHz	Data Bus	U_{REF} mV
00.00	01.60	FA	100	01.99		BD	1320
01.61		F7	160	02.00		BC	1340
01.62		F5	200	02.01		BB	1360
01.63		F2	260	02.02		BA	1380
01.64		F0	300	02.03		B9	1400
01.65		ED	360	02.04		B8	1420
01.66		EB	400	02.05		B7	1440
01.67		EA	420	02.06		B6	1460
01.68		E8	460	02.07		B5	1480
01.69		E6	500	02.08		B4	1500
01.70		E4	540	02.09		B3	1520
01.71		E2	580	02.10		B2	1540
01.72		E1	600	02.11		B1	1560
01.73		DF	640	02.12		B0	1580
01.74		DD	680	02.13	02.14	AF	1600
01.75		DC	700	02.15		AE	1620
01.76		DA	740	02.16		AD	1640
01.77		D9	760	02.17		AC	1660
01.78		D7	800	02.18		AB	1680
01.79		D6	820	02.19		AA	1700
01.80		D4	860	02.20		A9	1720
01.81		D3	880	02.21		A8	1740
01.82		D1	920	02.22	02.23	A7	1760
01.83		D0	940	02.24		A6	1780
01.84		CF	960	02.25		A5	1800
01.85		CD	1000	02.26		A4	1820
01.86		CC	1020	02.27		A3	1840
01.87		CB	1040	02.28	02.29	A2	1860
01.88		CA	1060	02.30		A1	1880
01.89		C9	1080	02.31		A0	1900
01.90		C7	1120	02.32		9F	1920
01.91		C6	1140	02.33	02.34	9E	1940
01.92		C5	1160	02.35		9D	1960
01.93		C4	1180	02.36		9C	1980
01.94		C3	1200	02.37	02.38	9B	2000
01.95		C2	1220	02.39		9A	2020
01.96		C0	1260	02.40		99	2040
01.97		BF	1280	02.41	02.42	98	2060
01.98		BE	1300	02.43		97	2080

-Buffer D/A Converter-

Frequencies versus Buffer DA-converter data Bus input, versus output voltage U_{REF}

Frequency to frequency MHz	MHz	Data Bus	U_{REF} mV	Frequency to frequency MHz	MHz	Data Bus	U_{REF} mV
02.44	02.45	96	2100	0306	03.07	6F	2880 mV
02.46		95	2120	03.08		6E	2900 mV
02.47		94	2140	03.09	03.10	6D	2920 mV
02.48	02.49	93	2160	03.11	03.12	6C	2940 mV
02.50		92	2180	03.13	03.14	6B	2960 mV
02.51	02.52	91	2200	03.15		6A	2980 mV
02.53		90	2220	03.16	03.17	69	3000 mV
02.54	02.55	8F	2240	03.18	03.19	68	3020 mV
02.56		8E	2260	03.20	03.21	67	3040 mV
02.57		8D	2280	03.22	03.22	66	3060 mV
02.58	02.59	8C	2300	03.24		65	3080 mV
02.60		8B	2320	03.25	03.26	64	3100 mY
02.61	02.62	8A	2340	03.27	03.28	63	3120 mV
02.63		89	2360	03.29	03.30	62	3140 mV
02.64	02.65	88	2380	03.31		61	3160 mV
02.66	02.67	87	2400	03.32	03.33	60	3180 mV
02.68		86	2420	03.34		5F	3200 mV
02.69	02.70	85	2440	03.35	03.36	5E	3220 mV
02.71		84	2460	03.37	03.38	5D	3240 mV
02.72	02.73	83	2480	03.39	03.40	5C	3260 mV
02.74		82	2500	03.41		5B	3280 mV
02.75	02.76	81	2520 mV	03.42	03.43	5A	3300 mV
02.77	02.78	80	2540 mV	03.44	03.45	59	3320 mV
02.79	02.80	7F	2560 mV	03.46		58	3340 mV
02.81		7E	2580 mV	03.47	03.48	57	3360 mV
02.82	02.83	7D	2600 mV	03.49		56	3380 mV
02.84	02.85	7C	2620 mV	03.50	03.51	55	3400 mV
02.86		7B	2640 mV	03.52		54	3420 mV
02.87	02.88	7A	2660 mV	03.53	03.54	53	3440 mV
02.89	02.90	79	2680 mV	03.55		52	3460 mV
02.91		78	2700 mV	03.56	03.57	51	3480 mV
02.92	02.93	77	2720 mV	03.58		50	3500 mV
02.94	02.95	76	2740 mV	03.59	03.60	4F	3520 mV
02.96		75	2760 mV	03.61		4E	3540 mV
02.97	02.98	74	2780 mV	03.62	03.63	4D	3560 mV
02.99	03.00	73	2800 mV	03.64		4C	3580 mV
03.01	03.02	72	2820 mV	03.65	03.66	4B	3600 mV
03.03		71	2840 mV	03.67		4A	3620 mV
03.04	03.05	70	2860 mV	03.68		49	3640 mV

-Buffer D/A Converter-

Frequencies versus Buffer DA-converter data Bus input, versus output voltage U_{REF}

Frequency MHz	to frequency MHz	Data Bus	U_{REF} mV	Frequency MHz	to Frequency MHz	Data Bus	U_{REF} mV
03.69		48	3660 mV	04.18	04.19	9F	1920 mV
03.70	03.71	47	3680 mV	04.20	04.21	9D	1960 mV
03.72		46	3700 mV	04.22	04.23	9C	1980 mV
03.73		45	3720 mV	04.24	04.25	9B	2000 mV
03.74		44	3740 mV	04.26	04.27	9A	2020 mV
03.75		43	3760 mV	04.28	04.29	99	2040 mV
03.76		42	3780 mV	04.30	04.31	98	2060 mV
03.77		41	3800 mV	04.32	04.33	97	2080 mV
03.78		40	3820 mV	04.34	04.35	96	2100 mV
03.79		3F	3840 mV	04.36	04.37	95	2120 mV
03.80		3E	3860 mV	04.38	04.39	94	2140 mV
03.81		3D	3880 mV	04.40	04.41	93	2160 mV
03.82		3C	3900 mV	04.42	04.43	92	2180 mV
03.83		3B	3920 mV	04.44	04.45	91	2200 mV
03.84		3A	3940 mV	04.46	04.47	90	2220 mV
03.85		39	3960 mV	04.48	04.49	8F	2240 mV
03.86		37	4000 mV	04.50	04.53	8E	2260 mV
03.87		36	4020 mV	04.54	04.55	8D	2280 mV
03.88		34	4060 mV	04.56	04.57	8C	2300 mV
03.89		33	4080 mV	04.58	04.59	8B	2320 mV
03.90		31	4120 mV	04.60	04.63	8A	2340 mV
03.91		2F	4160 mV	04.64	04.65	89	2360 mV
03.92		2D	4200 mV	04.66	04.67	88	2380 mV
03.93		2A	4260 mV	04.68	04.71	87	2400 mV
03.94		2B	4300 mV	04.72	04.73	86	2420 mV
03.95		24	4380 mV	04.74	04.77	85	2440 mV
03.96		20	4460 mV	04.78	04.79	84	2460 mV
03.97		1B	4560 mV	04.80	04.83	83	2480 mV
03.98		13	4720 mV	04.84	04.87	82	2500 mV
03.99		07	4960 mV	04.88	04.89	81	2520 mV
04.00	04.01	AD	1640 mV	04.90	04.93	80	2540 mV
04.02	04.03	AB	1680 mV	04.94	04.95	7F	2560 mV
04.04	04.05	A9	1720 mV	04.95	04.99	7E	2580 mV
04.06	04.07	A7	1760 mV	05.00	05.03	7D	2600 mV
04.08	04.09	A6	1780 mV	05.04	05.07	7C	2620 mV
04.10	04.11	A4	1820 mV	05.08	05.09	7B	2640 mV
04.12	04.13	A3	1840 mV	05.10	05.13	7A	2660 mV
04.14	04.15	A1	1880 mV	05.14	05.17	79	2680 mV
04.16	04.17	A0	1900 mV	05.18	05.21	79	2700 mV

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-Buffer D/A Converter-

Frequencies versus Buffer D/A-converter data Bus input, versus output voltage U_{REF}

Frequency to frequency MHz	MHz	Data Bus	U_{REF} mV	Frequency to frequency MHz	MHz	Data Bus	U_{REF} mV
05.22	05.25	77	2720 mV	06.90	06.93	50	3500 mV
05.26	05.29	76	2740 mV	06.94	06.97	4F	3520 mV
05.30	05.33	75	2760 mV	06.98	07.03	4E	3540 mV
05.34	05.37	74	2780 mV	07.04	07.05	4D	3560 mV
05.38	05.41	73	2800 mV	07.06	07.09	4C	3580 mV
05.42	05.45	72	2820 mV	07.10	07.13	4B	3600 mV
05.46	05.49	71	2840 mV	07.14	07.17	4A	3620 mV
05.50	05.53	70	2860 mV	07.18	07.21	49	3640 mV
05.54	05.57	6F	2880 mV	07.22	07.25	48	3660 mV
05.58	05.61	6E	2900 mV	07.26	07.27	47	3680 mV
0562	05.65	6D	2920 mV	07.28	07.31	46	3700 mV
05.66	05.69	6C	2940 mV	07.32	07.35	45	3720 mV
05.70	05.73	6B	2960 mV	07.36	07.37	44	3740 mV
05.74	05.77	6A	2980 mV	07.38	07.41	43	3760 mV
05.78	05.83	69	3000 mV	07.42	07.43	42	3780 mV
05.84	05.87	68	3020 mV	07.44	07.45	41	3800 mV
05.88	05.91	67	3040 mV	07.46	07.49	40	3820 mV
05.92	05.95	66	3060 mV	07.50	07.51	3F	3840 mV
05.96	06.01	65	3080 mV	07.52	07.53	3E	3860 mV
06.02	06.05	64	3100 mV	07.54	07.55	3D	3880 mV
06.06	06.09	63	3120 mV	07.56	07.59	3C	3900 mV
06.10	06.15	62	3140 mV	07.60	07.61	3B	3920 mV
06.16	06.19	61	3160 mV	07.62	07.63	3A	3940 mV
06.20	06.23	60	3180 mV	07.64	07.65	39	3960 mV
06.24	06.27	5F	3200 mV	07.66	07.67	38	3980 mV
06.28	06.33	5E	3220 mV	07.68	07.69	36	4020 mV
06.34	06.37	5D	3240 mV	07.70	07.71	35	4040 mV
06.38	06.41	5C	3260 mV	07.72	07.73	34	4060 mV
06.42	06.45	5B	3280 mV	07.74	07.75	32	4100 mV
06.46	06.51	5A	3300 mV	07.76	07.77	30	4140 mV
06.52	06.55	59	3320 mV	07.78	07.79	2F	4160 mV
06.56	06.59	58	3340 mV	07.80	07.91	2D	4200 mV
06.60	06.63	57	3360 mV	07.82	07.83	2B	4240 mV
06.64	06.69	56	3380 mV	07.84	07.85	29	4280 mV
06.70	06.73	55	3400 mV	07.86	07.87	26	4340 mV
06.74	06.77	54	3420 mV	07.88	07.89	23	4400 mV
06.78	06.81	53	3440 mV	07.90	07.91	20	4460 mV
06.82	06.85	52	3460 mV	07.92	07.93	1B	4560 mV
06.86	06.69	51	3480 mV	07.94	07.95	15	4680 mV

-Buffer D/A Converter-

Frequencies versus Buffer D/A-converter data Bus input, versus output voltage U_{REF}

Frequency MHz	to frequency MHz	Data Bus	U_{REF} mV	Frequency MHZ	to frequency MHz	Data Bus	U_{REF} mV
07.96	07.97	0C	4860 mV	10.00	10.04	9C	1980 mV
07.98	07.99	03	5040 mV	10.05	10.09	9B	2000 mV
08.00	08.04	E6	500 mV	10.10	10.19	9A	2020 mV
08.05	08.09	E1	600 mV	10.20	10.24	99	2040 mV
08.10	08.14	DD	680 mV	10.25	10.29	98	2060 mV
08.15	08.19	D9	760 mV	10.30	10.39	97	2080 mV
08.20	08.24	D5	840 mV	10.40	10.44	96	2100 mV
08.25	08.29	D2	900 mV	10.45	10.49	95	2120 mV
08.30	08.34	CF	960 mV	10.50	10.59	94	2140 mV
08.35	08.39	CC	1020 mV	10.60	10.64	93	2160 mV
08.40	08.44	C9	1080 mV	10 65	10.74	92	2180 mV
08.45	08.49	C6	1140 mV	10.75	10.79	91	2200 mV
08.50	08.54	C4	1180 mV	10.80	10.89	90	2220 mV
08.55	08.59	C2	1220 mV	10.90	10.94	8F	2240 mV
08.60	08.64	C0	1260 mV	10.95	11.04	8E	2260 mV
08.65	08.69	BD	1320 mV	11.05	11.09	8D	2280 mV
08.70	08.74	BB	1360 mV	11.10	11.19	8C	2300 mV
08.75	08.79	BA	1380 mV	11.20	11.24	8B	2320 mV
08.80	08.84	B8	1420 mV	11.25	11.34	8A	2340 mV
08.85	08.94	B5	1480 mV	11.35	11.44	89	2360 mV
08.95	08.99	B3	1520 mV	11.45	11.49	88	2380 mV
09.00	09.04	B2	1540 mV	11.50	11.59	87	2400 mV
09.05	09.09	B0	1580 mV	11.60	11.69	86	2420 mV
09.10	09.14	AF	1600 mV	11.70	11.74	85	2440 mV
09.15	09.19	AD	1640 mV	11.75	11.84	84	2460 mV
09.20	09.24	AC	1660 mV	11.85	11.94	83	2480 mV
09.25	09.29	AB	1680 mV	11.95	12.04	82	2500 mV
09 30	09.34	AA	1700 mV	12.05	12.14	81	2520 mV
09.35	09.59	A9	1720 mV	12.15	12.19	80	2540 mV
09.40	09.44	A7	1760 mV	12.20	12.29	7F	2560 mV
09.45	09.49	A6	1780 mV	12.30	12.39	7E	2580 mV
09.50	09.54	A5	1800 mV	12.40	12.49	7D	2600 mV
09.55	09.59	A4	1820 mV	12.50	12.59	7C	2620 mV
09.60	09.64	A3	1840 mV	12.60	12.69	7B	2640 mV
09.65	09.69	A2	1860 mV	12.70	12.79	7A	2660 mV
09.70	09.79	A1	1880 mV	12.80	12.89	79	2680 mV
09.80	09.84	A0	1900 mV	12.90	12.99	78	2700 mV
09.85	09.89	9F	1920 mV	13.00	13.09	77	2720 mV
09.90	09.94	9E	1940 mV	13.10	13.19	76	2740 mV
0995	09.99	9D	1960 mV				

-Buffer D/A Converter-

Frequencies versus Buffer D/A-converter data Bus input, versus output voltage U_{REF}

Frequency MHz	to frequency MHz	Data Bus	U_{REF} mV	Frequency MHZ	to frequency MHz	Data Bus	U_{REF} mV
13.20	13.29	75	2760 mV	16.25	16.29	4D	3560 mV
13.30	13.39	74	2780 mV	16.30	16.34	4C	3580 mV
13.40	13.44	73	2800 mV	16.35	16.39	4A	3620 mV
13.45	13.54	72	2820 mV	16.40	16.44	49	3640 mV
13.55	13.64	71	2840 mV	16.45	16.49	47	3680 mV
13.65	13.74	70	2860 mV	16.50	16.54	45	3720 mV
13.75	13.84	6F	2880 mV	16.55	16.59	43	3760 mV
13.85	13.94	6E	2900 mV	16.60	16.64	41	3800 mV
13.95	14.04	6D	2920 mV	16.65	16.69	3E	3860 mV
14.05	14.14	6C	2940 mV	16.70	16.74	3B	3920 mV
14.15	14.19	6B	2960 mV	16.75	16.79	37	4000 mV
14.20	14.29	6A	2980 mV	16.80	16.84	33	4080 mV
14.30	14.39	69	3000 mV	16.85	16.89	2D	4200 mV
14.40	14.49	68	3020 mV	16.90	16.94	23	4400 mV
14.50	14.59	67	3040 mV	16.95	16.99	14	4700 mV
14.60	14.69	66	3060 mV	17.00	17.09	FA	100 mV
14.70	14.74	65	3080 mV	17.10	17.19	F7	160 mV
14.75	14.84	64	3100 mV	17.20	17.29	F5	200 mV
14.85	14.94	63	3120 mV	17.30	17.39	F4	240 mV
14.95	14.99	62	3140 mV	17.40	17.49	F1	280 mV
15.00	15.09	61	3160 mV	17.50	17.59	EF	320 mV
15.10	15.19	60	3180 mV	17.60	17.69	ED	360 mV
15.20	15.24	5F	3200 mV	17.70	17.79	EB	400 mV
15.25	15.34	5E	3220 mV	17.80	17.89	E9	440 mV
15.35	15.39	5D	3240 mV	17.90	17.99	E7	480 mV
15.40	15.49	5C	3260 mV	18.00	18.09	E5	520 mV
15.50	15.54	5B	3280 mV	18.10	18.19	E3	560 mV
15.55	15.59	5A	3300 mV	18.20	18.29	E1	600 mV
15.60	15.69	59	3320 mV	18.30	18.39	DF	640 mV
15.70	15.74	58	3340 mV	18.40	18.49	DD	680 mV
15.75	15.79	57	3360 mV	18.50	18.59	DB	720 mV
15.80	15.84	56	3380 mV	18.60	18.69	DA	740 mV
15.85	15.89	55	3400 mV	18.70	18.79	D8	780 mV
15.90	15.94	54	3420 mV	18.80	18.89	D6	820 mV
15.95	15.99	53	3440 mV	18.90	18.99	D4	860 mV
16.00	16.09	52	3460 mV	19.00	19.09	D3	880 mV
16.10	16.14	50	3500 mV	19.10	19.19	D1	920 mV
16.15	16.19	4F	3520 mV	19.20	19.29	CF	960 mV
16.20	16.24	4E	3540 mV	19.30	19.39	CD	1000 mV

-Buffer D/A Converter-

Frequencies versus Buffer D/A-converter data Bus input, versus output voltage U_{REF}

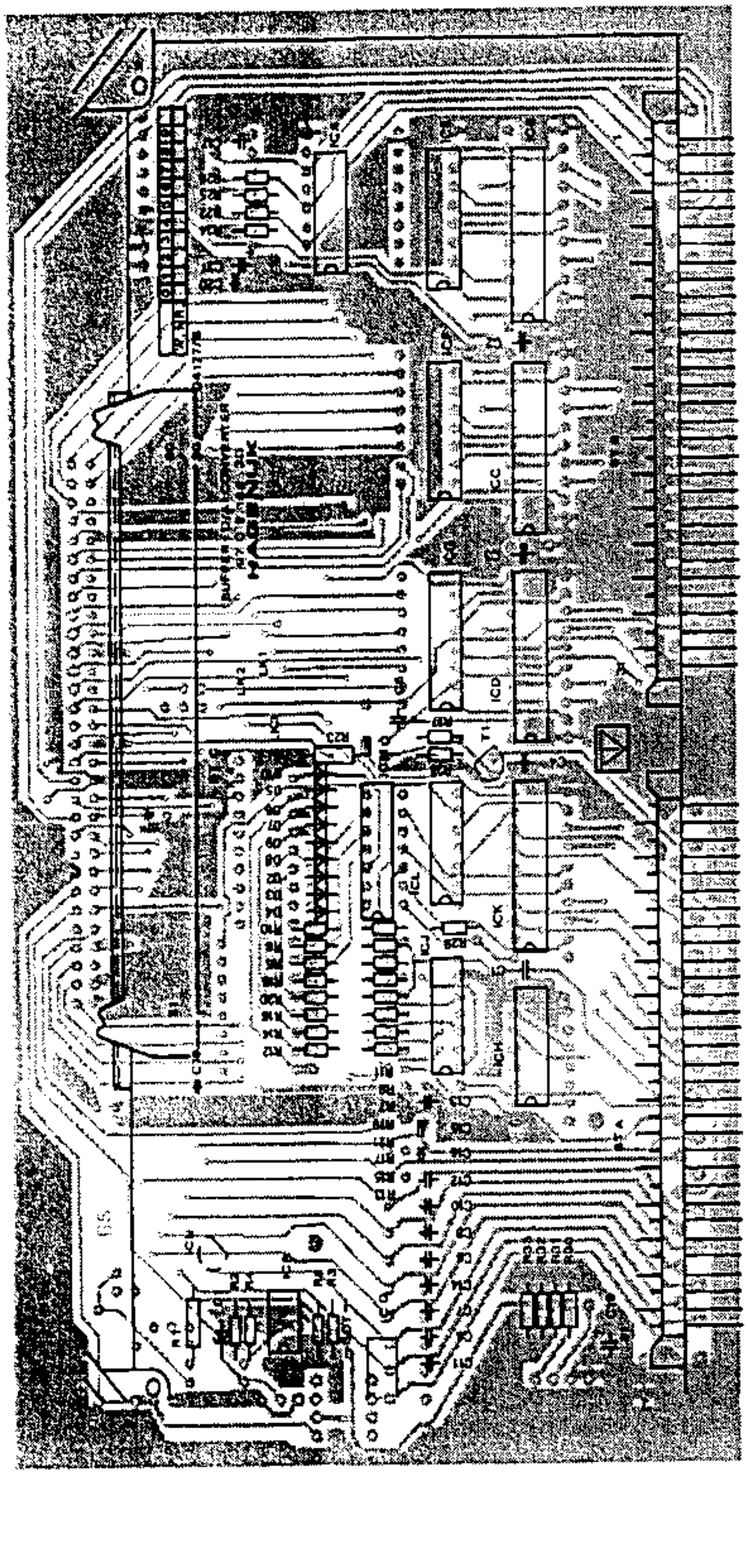
Frequency MHz	to frequency MHz	Data Bus	U_{REF} mV	Frequency MHZ	to frequency MHz	Data Bus	U_{REF} mV
19.40	19.49	CC	1020 mV	23.30	23.39	94	2140 mV
19.50	19.59	CA	1060 mV	23.40	23.49	93	2160 mV
19.60	19.69	C9	1080 mV	23.50	23.59	91	2200 mV
19.70	19.79	C7	1120 mV	23.60	23.69	90	2220 mV
19.80	19.89	C5	1160 mV	23.70	23.79	8F	2240 mV
19.90	19.99	C4	1180 mV	23.80	23.89	8E	2260 mV
20.00	20.09	C2	1220 mV	23.90	23.99	8C	2300 mV
20.10	20.19	C1	1240 mV	24.00	24.09	8B	2320 mV
20.20	20.29	BF	1280 mV	24.10	24.19	8A	2340 mV
20.30	20.39	BE	1300 mV	24.20	24.29	89	2360 mV
20.40	20.49	BC	1340 mV	24.30	24.39	87	2400 mV
20.50	20.59	BA	1380 mV	24.40	24.49	86	2420 mV
20.60	20.69	B9	1440 mV	24.50	24.59	85	2440 mV
20.70	20.79	B8	1420 mV	24.60	24.69	83	2480 mV
20.80	20.89	B6	1460 mV	24.70	24.79	82	2500 mV
20.90	20.99	B5	1480 mV	24.80	24.89	81	2520 mV
21.00	21.09	B3	1520 mV	24.90	24.99	80	2540 mV
21.10	21.19	B2	1540 mV	25.00	25.09	7E	2580 mV
21.20	21.29	B0	1580 mV	25.10	25.19	7D	2600 mV
21.30	21.39	AF	1600 mV	25.20	25.29	7C	2620 mV
21.40	21.49	AE	1620 mV	25.20	25.39	7B	2640 mV
21.50	21.59	AC	1660 mV	25.40	25.49	79	2680 mV
21.60	21.69	AB	1680 mV	25.50	25.59	78	2700 mV
21.70	21.79	A9	1720 mV	25.60	25.69	77	2720 mV
21.80	21.89	A8	1740 mV	25.70	25.79	75	2760 mV
21.90	21.99	A7	1760 mV	25.80	25.89	74	2780 m~
22.00	22.09	A5	1800 mV	25.90	25.99	73	2800 mV
22.10	22.19	A4	1820 mV	26.00	26.09	71	2840 mV
22.20	22.29	A3	1840 mV	26.10	26.19	70	2860 mV
22.30	22.39	A1	1880 mV	26.20	26.29	6F	2880 mV
22.40	22.49	A0	1900 mV	26.30	26.39	6E	2900 mV
22.50	22.59	9F	1920 mV	26.40	26.49	6C	2940 mV
22.60	22.69	9D	1960 mV	26.50	26.59	6B	2960 mV
22.70	22.79	9C	1980 mV	26.60	26.69	69	3000 mV
22.80	22.89	9B	2000 mV	26.70	26.79	68	3020 mV
22.90	22.99	99	2040 mV	26.80	26.89	67	3040 mV
23.00	23.09	98	2060 mV	26.90	26.99	65	3080 mV
23.10	23.19	97	2080 mV	27.00	27.09	64	3100 mV
23.20	23.29	95	2120 mV	27.10	27.19	62	3140mV

-Buffer D/A Converter-

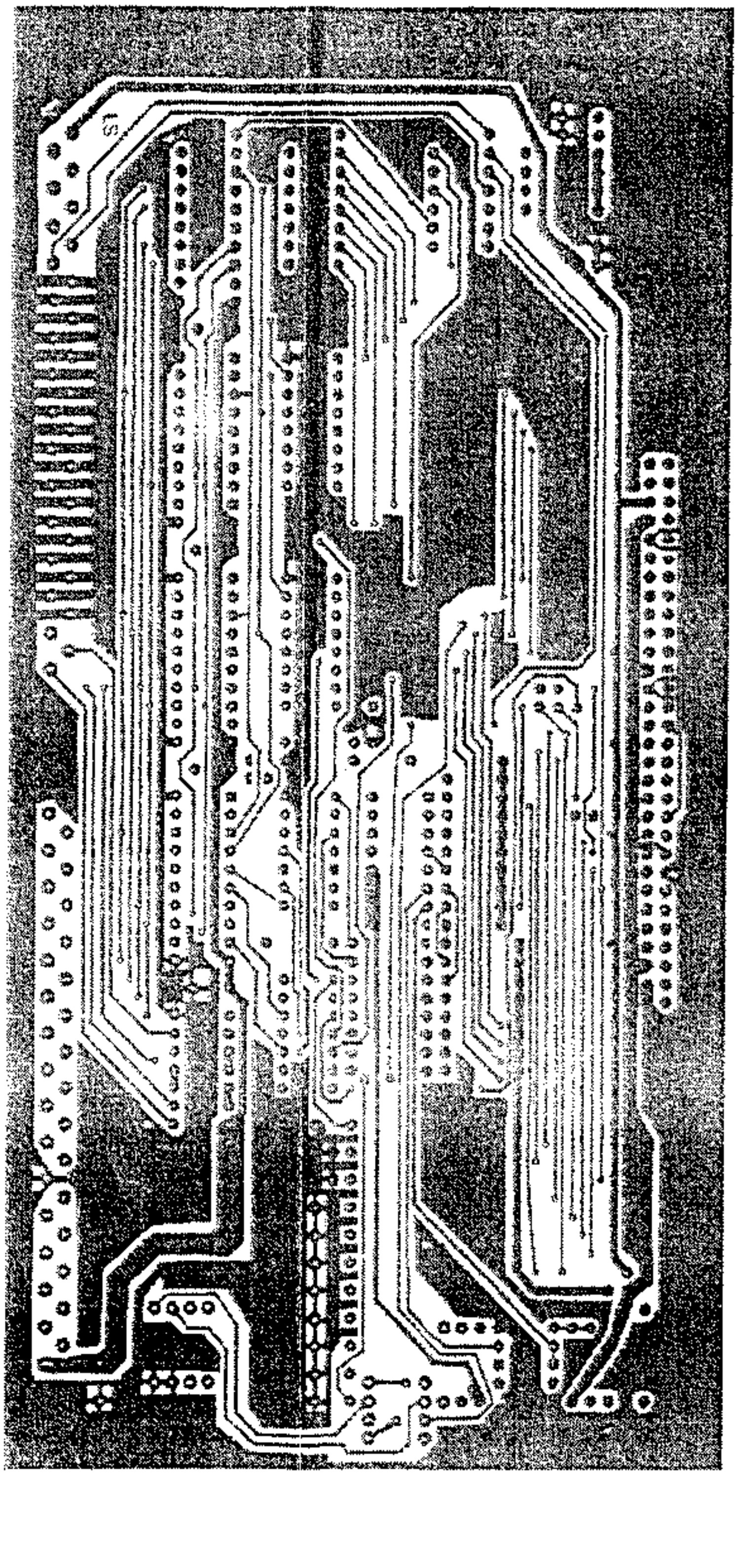
Frequencies versus Buffer D/A-converter data Bus input, versus output voltage U_{REF}

Frequency to frequency MHz	MHz	Data Bus	U_{REF} mV
27.20	27.29	61	3160 mV
27.30	27.39	5F	3200 mV
27.40	27.49	5E	3220 mV
27.50	27.59	5C	3260 mV
27.60	27.69	5B	3280 mV
27.70	27.79	59	3320 mV
27.80	27.89	58	3340 mV
27.90	27.99	56	3380 mV
28.00	28.09	54	3420 mV
28.10	28.19	53	3440 mV
28.20	28.29	51	3480 mV
28.30	28.39	4F	3520 mV
28.40	28.49	4D	3560 mV
28.50	28.59	4B	3600 mV
28.60	28.69	49	3640 mV
28.70	28.79	47	3680 mV
28.80	28.89	45	3720 mV
28.90	28.99	43	3760 mV
29.00	29.09	40	3820 mV
29.10	29.19	3D	3880 mV
29.20	29.29	3B	3920 mV
29.30	29.39	38	3980 mV
29 40	29.49	34	4060 mV
29.50	29.59	30	4140 mV
29.60	29.69	2B	4240 mV
29.70	29.79	24	4380 mV
29.80	29.89	1B	4560 mV
29.90	29.99	0A	4900 mV

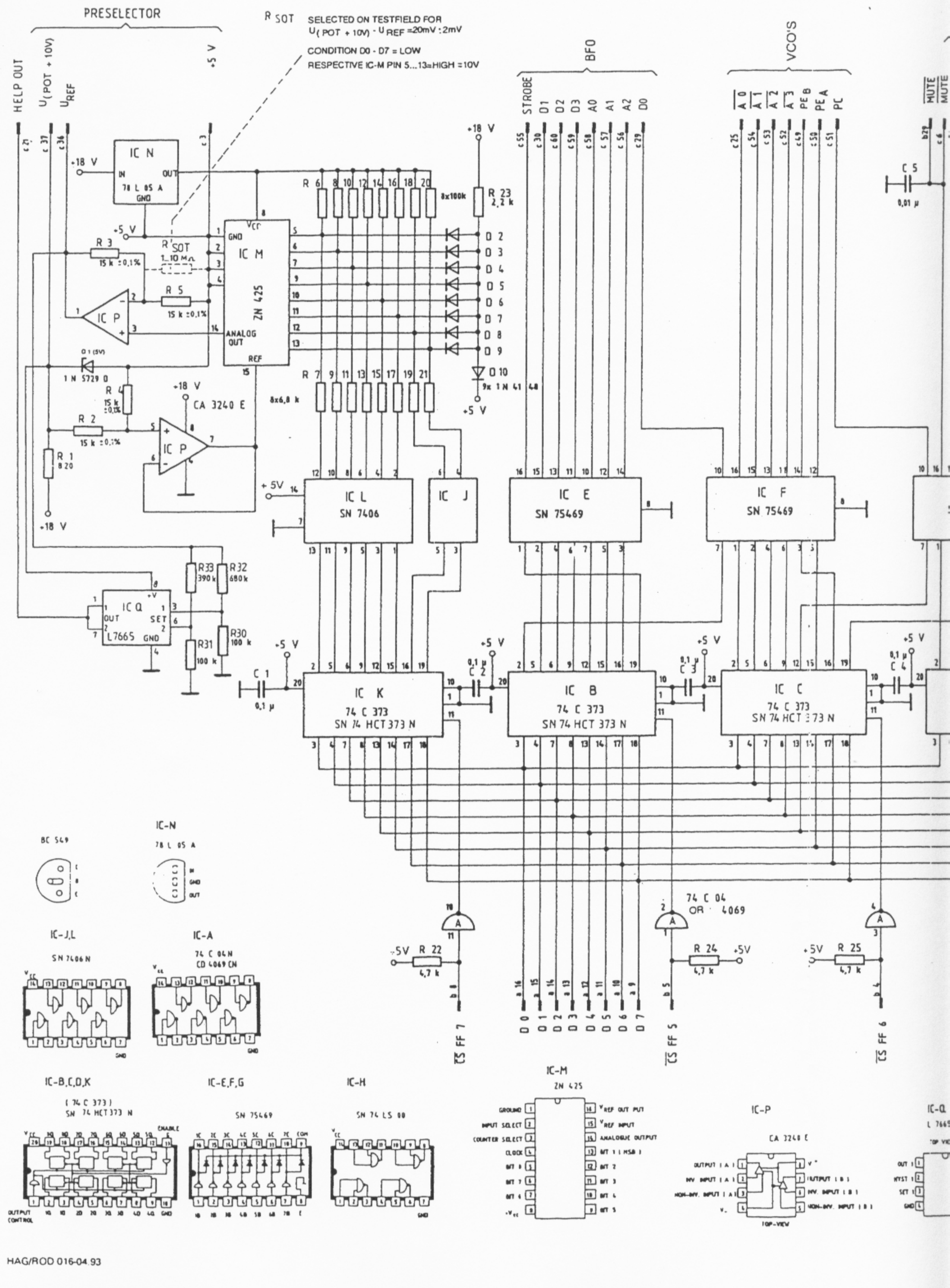
see circuit



see circuit diagram - BUFFER D/A CONVERTER 97 Sa 2.155.30



Printed Circuit Board
Buffer D/A Converter
97 C 2.155.30



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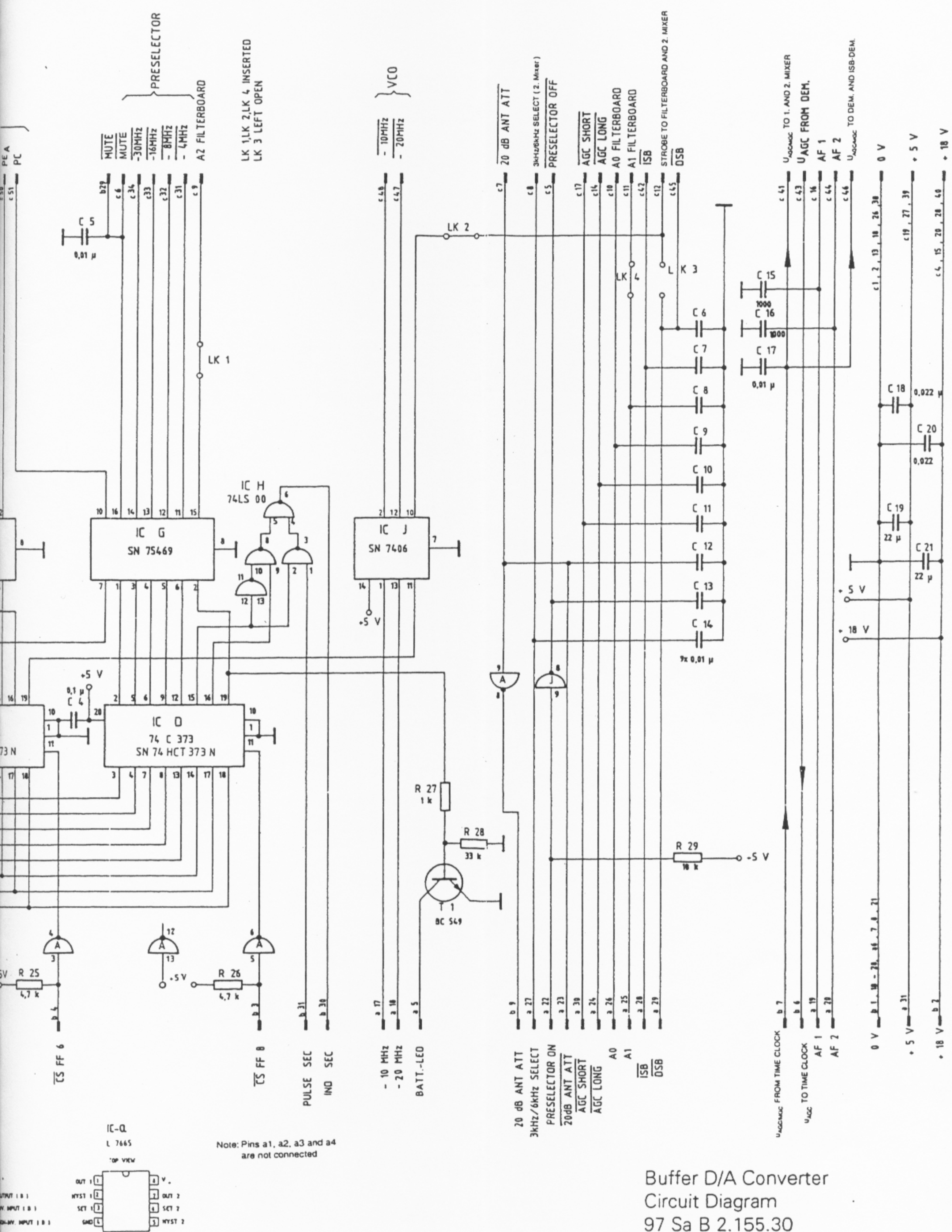


Buffer D/A Converter
Circuit Diagram
97 Sa B 2.155.30

Parts lists No.
97 Sa 2.155.30

-Buffer D/A Converter-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Capacitors:				
1423.037	C1	0,1 µF/63 V	MKS 2	WIMA
1423.037	C2	0,1 µF/63 V	MKS 2	WIMA
1423.037	C3	0,1 µF/63 V	MKS 2	WIMA
1423.037	C4	0,1 µF/63 V	MKS 2	WIMA
1425.196	C5	0,01 µF/63 V	MKS 2	WIMA
1425.196	C6	0,01 µF/63 V	MKS 2	WIMA
1425.196	C7	0,01 µF/63 V	MKS 2	WIMA
1425.196	C8	0,01 µF/63 V	MKS 2	WIMA
1425.196	C9	0,01 µF/63 V	MKS 2	WIMA
1425.196	C10	0,01 µF/63 V	MKS 2	WIMA
1425.196	C11	0,01 µF/63 V	MKS 2	WIMA
1425.196	C12	0,01 µF/63 V	MKS 2	WIMA
1425.196	C13	0,01 µF/63 V	MKS 2	WIMA
1425.196	C14	0,01 µF/63 V	MKS 2	WIMA
0944.971	C15	1000 pF/63 V	EDPU/0,6 K2000	VALVO
0944.971	C16	1000 pF/63 V	EDPU/0,6 K2000	VALVO
1425.196	C17	0,01 µF/63 V	MKS 2	WIMA
1116.207	C18	0,022 µF/40 V	EDPU/0,6 K10000	VALVO
1401.343	C19	22 µF/10 V	2222 122 54229	VALVO
1116.207	C20	0,022 µF/40 V	EDPU/0,6 K10000	VALVO
1189.441	C21	22 µF/35 V	ETQ 5	ROE
Diodes:				
1326.929	D1		1 N 5729 D	
0745.677	D2		1 N 4148	
0745.677	D3		1 N 4148	
0745.677	D4		L N 4148	
0745.677	D5		1 N 4148	
0745.677	D6		1 N 4148	
0745.677	D7		1 N 4148	
0745.677	D8		1 N 4148	
0745.677	D9		1 N 4148	
0745.677	D10		1 N 4148	
Resistors:				
0725.854	R1	820 5 % 1/4 W	DIN 44052	
1524.259	R2	15 K 1/8 W ± 0,1 %	DIN 44061 MK2/TK25	ROE
1524.259	R3	15 K 1/8 W ± 0,1 %	DIN 44061 MK2/TK25	ROE

Parts lists No.
97 Sa 2.155.30

-Buffer D/A Converter-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1524.259	R4	15 K 1/8 W ± 0,1 %	DIN 44061 MK2/TK25	ROE
1524.259	R5	15 K 1/8 W ± 0,1 %	DIN 44061 MK2/TK25	ROE
0767.190	R6	100 K 5 % 1/8 W	DIN 44061	
0767.220	R7	6,8 K 5 % 1/8 W	DIN 44061	
0767.190	R8	100 K 5 % 1/8 W	DIN 44061	
0767.220	R9	6,8 K 5 % 1/8 W	DIN 44061	
0767.190	R10	100 K 5 % W	DIN 44061	
0767.220	R11	6,8 K 5 % 1/8 W	DIN 44061	
0767.190	R12	100 K 5 % 1/8 W	DIN 44061	
0767.220	R13	6,8 K 5 % 1/8 W	DIN 44052	
0767.190	R14	100 K 5 % 1/8 W	DIN 44052	
0767.220	R15	6,8 K 5 % 1/8 W	DIN 44052	
0767.190	R16	100 K 5 % 1/8 W	DIN 44052	
0767.220	R17	6,8 K 5 % 1/8 W	DIN 440S2	
0767.190	R18	100 K 5 % 1/8 W	DIN 44052	
0767.220	R19	6,8 K 5 % 1/8 W	DIN 44052	
0767.190	R20	100 K 5 % 1/8 W	DIN 44052	
0767.220	R21	6,8 K 5 % 1/8 W	DIN 44052	
0767.212	R22	4,7 K 5 % 1/8 W	DIN 44052	
0760.269	R23	2,2 K 5 % 1/4 W	DIN 44052	
0767.212	R24	4,7 K 5 % 1/8 W	DIN 44052	
0767.212	R25	4,7 K 5 % 1/8 W	DIN 44052	
0767.212	R26	4,7 K 5 % 1/8 W	DIN 44052	
0179.698	R27	1 K 5 % 1/8 W	DIN 44052	
0627.895	R28	33 K 5 % 1/8 W	DIN 44052	
0179.701	R29	10 K 5 % 1/8 W	DIN 44052	
0767.190	R30	100 K 5 % 1/8 W	DIN 44052	
0767.190	R31	100 K 5 % 1/8 W	DIN 44052	
0900.419	R32	680 K 5% 1/8 W	DIN 44052	

Integrated circuits:

1423.703	IC A		74 C 04	
1427.393	IC B		74 C 373	
1427.393	IC C		74 C 373	
1427.393	IC D		74 C 373	
1423.711	IC E		75 469	
1423.711	IC F		75 469	
1423.711	IC G		75 469	
1090.895	IC H		74 LS 00	
1076.051	IC J		74 06	
1427.393	IC K		74 C 373	

Parts lists No.
97 Sa 2.155.30

-Buffer D/A Converter-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1076.051	IC L		74 06	
1423.215	IC M		ZN 425 E - 8	FERRANTI
1427.083	IC N		78 L 05 A	
1427.156	IC P		CA 32 40 E	
1630.180	IC Q		ICL 7665 BC PA	INTERSIL

Transistors:

1291.033	T1		BC 549 B	

-Time Clock-

Technical description

This module contains not only the clock but also a number of peripherals

- e.g., AGC switching, storage battery with charging circuit, interrogation of BFO knob, etc.
- Gain control section (automatic mode)
  The AGC voltage U_{AGC} generated by the DEMODULATOR appears on plug ST a pin 6, returning via relay contacts a, b, c to plug ST a pin 5 and hence to the IF amplifier stages. If automatic IF regulation is select, all three relays are in the quiescent condition. Relay A is controlled by the signals AGC-LONG plug ST a pin 3 and AGC-SHORT plug ST a pin 4 via IC - C and transistor T 3. Since an AGC-LONG or an AGC-SHORT signal is always active in the automatic mode, the output of the IC - C gate supplies HIGH level to the base of T 3, causing it to cut off .
  Relay B is controlled by SELECT signal plug ST C pin 13 for the AD/DA converter IC - A via T 2. In the automatic mode the level is HIGH, as A/D conversion of the AGC voltage is required. T 2 thus also remains cut off. Relay C is also not energized because the MUTE signal on plug ST a pin 25 is inactive (open).
  The AGC voltage is also fed via R 9, R 8 and R 7 to IC - B, which operates here as a comparator and compares the AGC voltage with the analog output of the A/D converter. As long as the AGC voltage is greater than the analog voltage, T 1 is cut off by IC - B. Hence the level at the input of the gate made up of IC - C, connected as an inverter, is LOW and the output therefore HIGH, thus enabling the oscillator consisting of IC - C, R 12 and C 5. The pulses generated are fed to the AD/DA converter IC - A, which is set to A/D conversion by a HIGH level at the SELECT input. The pulses increment the internal counter of the converter and at the same time its analog output voltage is also increased. When the two voltages are equal, the comparator changes state and gives a positive voltage at its output. T 1 conducts and the oscillator is cut off via inverter IC - C. The count present in the converter reproduces the level of the AGC voltage in digital form.
  The microprocessor reads the count via data line plug ST C pins 14 - 27, 22 and 23. A LOW level at the RESET input plug ST C pin 26 resets the counter in IC - A and prepares it for the next cycle.

- Gain control section (manual operation)
  In the manual mode, the signals AGC-LONG and AGC-SHORT are inactive (open); both inputs of IC - C are HIGH via R 31 and R 32. T 1 is driven by a LOW level; it conducts and relay A is energized. The voltage set on the RF manual control potentiometer can now be fed from plug ST C pin 2 via relay contact a to the IF amplifier (as in auto). The range (min. and max. value) of the control voltage is determined by R 13, R 29 and R 14. The RF potentiometer (on the front panel) is also connected here via plug ST C pins 1 and 3. The control voltage is converted to a digital value in the same way as in the automatic mode.

-Time Clock-

- Gain control section (manual mode, remote control)
  If the receiver is remotely controlled, the position of the potentiometer in the remote control unit is transmitted to its receiver digitally. The information is present at the data inputs plug ST C pins 14 - 17, 22 and 23 and in IC - A, which is now to operate as a D/A converter, because LOW level is present at the SELECT input. Data inputs D 1 and D 2 of IC - A are also kept at LOW level via the SELECT signal by means of diodes D 21 and D 3. T 2 is also mode to conduct, so that relay B energizes. IC - A now generates an analog voltage corresponding to the digital value, available on output (OUT) pin 14. The RESET and CLK inputs are disregarded. The analog voltage is fed to the input of IC - B, used as a non-inverting amplifier, whose gain is determined by T 1, R 7 and R 8. The output voltage of IC - B passes via relay contacts b and c as a control voltage to plug ST a pin 5 $U_{AGC/MGC}$.

- Gain control section (MUTE signal)
  The IF amplifier stages are to be set to minimum gain by a MUTE signal, which requires a high control voltage. This voltage is produced by the voltage divider R 10 and R 11. If a MUTE signal is applied to plug ST a pin 25 (LOW level), relay C energizes (T 7 conducts in normal operation; the function of T 7 will be explained later). The high control voltage (approx. 10 V) is then fed to the $U_{AGC/MGC}$ output via relay contact c and R 33.

- Power supply for battery charge
  This board receives the +5 V supply on plug St a pin 31 and +18 V on ST a pin 2 from the power supply unit.
  The time clock chip IC - I and the RAMs in the CPU II module are supplied with the +5 V ACCU voltage.
  When the receiver is switched on, this voltage is provided via D 16 from the +5 V supply.
  The +12 V voltage is supplied via plug ST a pin 29 and is present as long as the receiver is connected to a mains or battery power supply.
  Storage battery B 1 supplies the time clock circuit and the RAMs if neither mains nor battery voltage is present. However, if the mains plug on the rear of the POWER SUPPLY module is withdrawn, the link between the negative side of the storage battery via plug St d pin 29 and 0 V is interrupted. If this occurs, the chips lose their supply voltage and the memory contents of the RAMs and clock time are erased. C 23 suppresses interference pulses on the line.
  In normal operation, the storage battery is buffered from the +12 V supply via D 10 and R 26. If both S 1 and S 2 are switched on, rapid charging via R 27 takes place. The base of T 5 is at 5.6 V; as the battery voltage is lower, T 5 remains cut off. If the receiver is switched off, the normal +5 V supply is absent and the time clock and RAMs are powered via D 12. If the +12 V supply also fails, T 5 conducts (its emitter is connected to ACCU and its base via R 25 to earth), supplying the circuit with +5 V ACCU.

-Time Clock-

- Power supply voltage monitor circuit
  The +5 V supply is monitored by IC - R to protect the time clock circuit from data loss during switching on and off. IC - H is blocked at the same time, to prevent interference pulses at the output with undefined address inputs. The switching threshold is set internally to a fixed value of 1.3 V; by the voltage divider R 47 and R 48, the switching point for the operation voltage is 3.9 V.

  NOTE
  The CMOS ICs still operate at this voltage, but the microprocessor ceases to function below 4.75 V.

If the voltage falls below the switching threshold of IC - R inputs pins 3 and 6 (because the receiver is switched off), output pin 7 goes to LOW level, while pin 1 is then open. LOW level on pin 7 also causes the level at input CS 1 of IC - J to be LOW, so that the set clock time cannot be altered if the operating voltage collapses further. In addition, IC - M and IC - N are blocked by HIGH level at inputs MR 1 and MR 2, so that the time clock IC is disconnected from the data bus. The level at the RESET input IC P 2 pin 10 is also HIGH, so that output Q 2 goes LOW and inhibits the INH input of IC - H for the STROBE signal via IC - E.
Conversely, upon switch-on, access to the time clock is prevented by inhibiting CS 1 and resetting IC - M and IC - N until the normal +5 V supply has reached the value of 3.9 V, so that the CMOS-ICs will operate reliably. On switch-on, the RESET signal is present on IC - P 2 until the +5 V supply exceeds 3.9 V. Output Q 2 is first LOW, thereby activating the INH input of IC - H via IC - E. This causes all decoder outputs to be inactive. At the beginning of initialization of the receiver, "rest address 14" is applied to the address inputs of IC - H.
The memory of decoder IC - H can now be loaded, as the STROBE input IC - H pin 1 is HIGH. After this, STROBE input plug ST C pin 21 goes LOW, the Q 2 output receives a HIGH signal via the clock input of IC - P 2, so that all subsequent STROBE pulses can now reach IC - H via gate IC - E.

- Selection of functional units
  After initialization, each unit can be selected via decoder IC - H, in which the relevant address is applied to the inputs. After this the signal STROBE IN briefly goes LOW; this leads to a HIGH signal on the STROBE input of IC - H (pin 1), so that the address can now be read into the memory. For the duration of the STROBE IN signal, all decoder outputs are inhibited via the INH input (pin 23). This prevents interference pulses from initiating malfunctions during decoding process. At the end of the STROBE IN pulse, the selected output will go LOW.

-Time Clock-

- Control of test signal and VLF amplifier
  IC - G contains four RS flipflops, which can all be set together via address 9 and can be reset individually via addresses 10 to 13. The set outputs ensure that the lines 1 MHz ON plug ST d pin 13), 1 MHz ATTENUATOR (plug ST d pin 8) and VLF-AMP. ON (plug ST d pin 22) are kept at LOW level via the three inverters IC - L. The set output IC - G Q 2 also causes transistors T 6 and T 7 to conduct. As a result, the AGC function is blocked via the relay if the RX MUTE signal is active. This is the normal condition.
  If the reception frequency selected is less than 80 kHz, the VLF amplifier (which is in the 1st Mixer module) is switched on via address 12 (HIGH level on plug ST d pin 22). During the BITE test, output Q 3 of IC - G is reset via address 10 and the 1 MHz test signal is switched on in the BFO module via the inverter by a HIGH level on plug ST d pin 13 1 MHz ON. Address 13 brings the 1 MHz ATTENUATOR into circuit (HIGH level on plug ST d pin 8). The test signal is applied to the receiver via the MUTE relay in the PROTECTOR or PRESELECTOR; for this purpose RX-MUTE must be active, but relay C must not energize, as otherwise the AGC is deactivated; output Q 2 is reset via address 11, so that relay C cannot be energized via T 6, T 7.

- Interrogation of BITE test key
  The BITE test key (HELP KEY connection) is activated by addess 15. The LOW level on pin 15 of IC - H can be interrogated via data line D0 with the key depressed. If the key is not pressed, R 17 ensures that the level on pin 15 of IC H is HIGH.

- Time clock circuit
  The time clock circuit IC - J contains date and time functions; only the hours and minutes function is used. The circuit is supplied with +5 V ACCU to ensure that it remains operational even in the event of a mains failure.

  Time and control data is transmitted over the data bus (pins 4-7). For this purpose pin 13 is selected via CS 1 and pin 1 via CS 2. Data read (pulse on RD pin 3) also has to be distinguished from data write (pulse 1 WR pin 2). The internal register must first be selected. For this purpose the address is applied to the data inputs and the input ADR. WR (pin 9) is then activated.

  The internal counting process can be stopped via the STOP input (pin 11) to allow the time clock to be set. The circuit is tested by the input TEST (pin 12) for this purpose the input must be LOW.

-Time Clock-

- Time clock circuit seconds pulse
  Every second the BUSY output of IC - J supplies a brief pulse at LOW level, which switches the D-type flipflop IC - P 1. Output Q changes state on each pulse by feedback to the D input. The signal passes via plug ST a pin 24 to the seven-segment LEDs for the seconds display.

- Time clock circuit clock control
  The control lines of the time clock circuit are controlled via two 4-bit memories in IC - M.

  The outputs are active at all times owing to the LOW level on DIS 1 and DIS 2 of IC - M. All control signals for the time clock are first applied to the data bus (plug ST c pins 8-11); a HIGH signal on ST 1 or ST 2 of IC - M reads the "data word" into the memory. The STROBE signals for IC - M are generated by DECODER ADRESSES 0 and 1 and are fed on via inverters IC - L to IC - M. The control line CS 1 of the time clock circuit can also be blocked by the voltage monitor IC - R.

- Time clock circuit: data lines to clock
  The data lines of the time clock circuit are connected to the data bus via two 4-bit memories in IC - N. To read the time clock data, decoder address 3 is passed with LOW level on input DIS 2 of IC - N. The time clock data is thus available on the data bus. To read data or addresses into the time clock circuit, decoder address 2 is used; this sets flipflop IC - E. The inputs ST 1 and DIS 1 (IC - N) are thus LOW. The data on the data bus is now read in and reaches the time clock circuit . The control inputs of the time clock can now also be addressed via IC - M so as to transfer the data or addresses. After transfer, the decoder is set to the rest address 14. IC - E goes into the quiescent condition and then supplies a HIGH level to DIS 1 of IC - N. The time clock circuit data lines are then free again.

- Interrogation of BFO knob
  Counter IC - F is used for this purpose; it is set at switch-on to the predetermined value 8 via C 17, R 15 and IC - D. This setting process can also be initiated while the program is running by decoder address 8 via the second input of the NAND gate IC - D pin 13. This at the same time sets the RS flipflop, whose output IC - D (pin 3) now goes HIGH and enables the clock input of the counter via IC - D pin 9.

  The BFO knob controls a bit generator; time-duration-dependent pulses arise on inputs IN 2 plug ST d pin 5 and IN 1 plug ST d pin 6 when the knob is turned. The counter IC - F is clocked by the negative edge of signal IN 2. The level on U/D pin 10 of IC - F determines the direction of counting.

-Time Clock-

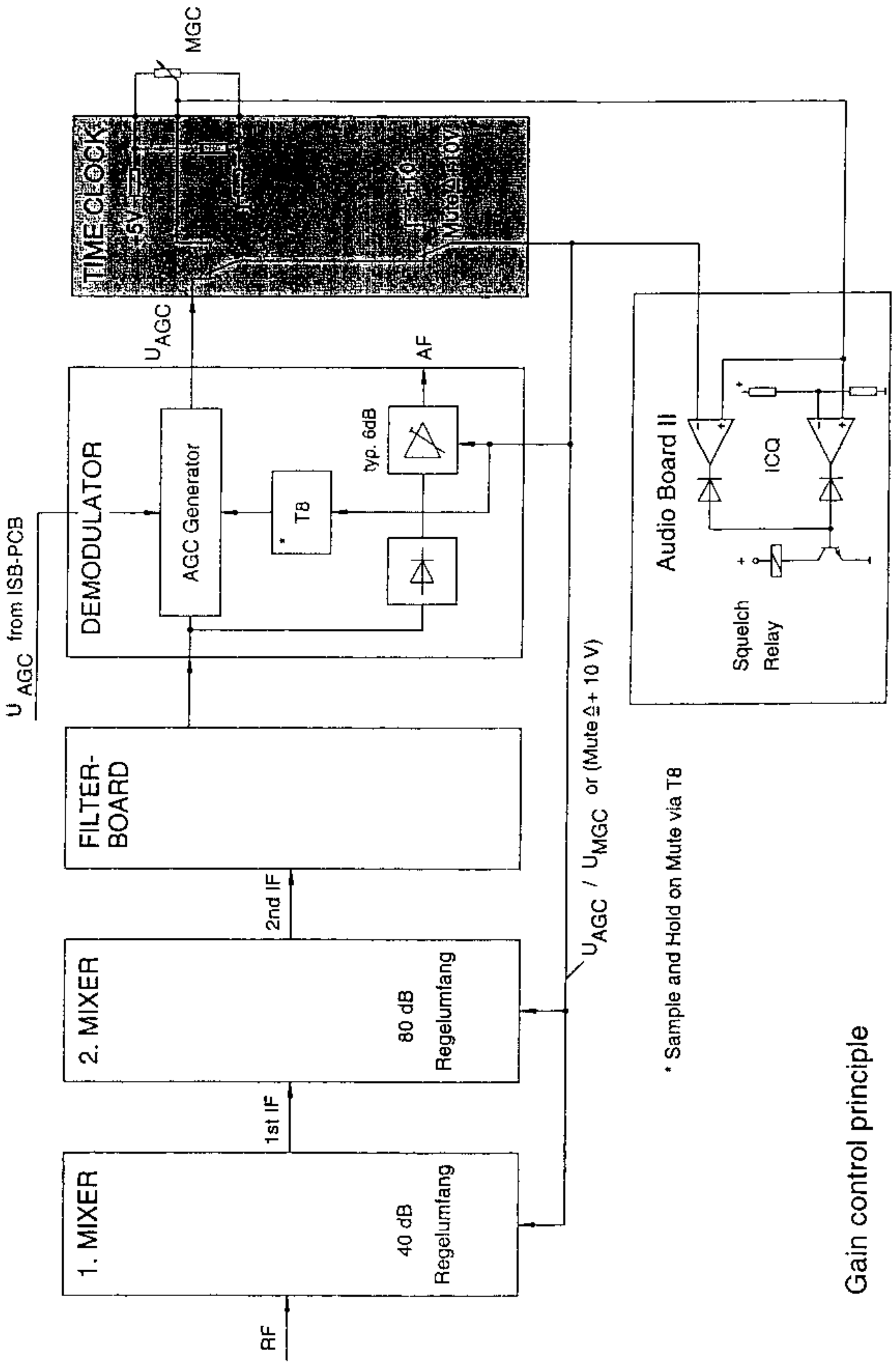
- Counting up
  For this purpose the bit generator supplies a phase-shifted signal to IN 1 which is LOW during the negative edge on IN 2 if the knob is turned clockwise. Since the counter is triggered by the positive edge, it will count up by virtue of the HIGH level on the U/D input while being clocked.

- Counting down
  With the knob turned anticlockwise, the signal on IN 1 is out of phase in the other direction - i.e., the counter receives a LOW level on the U/D input while being clocked. The direction of rotation is recognized by the positive or negative departure of the counter content from 8. For this reason the counter must be stopped if a rapid succession of pulses causes it to reach the lower limit (0) of the upper limit (15) before an interrogation has taken place. When the counting limit is reached, output CO goes LOW, so that flipflop output IC - D pin 3 goes LOW, thus blocking the pulses.

  The counter outputs are connected to IC - O and are switched to the data bus if input DIS 1 of IC - O is made LOW via decoder address 4. The counter content can thus be interrogated and the BFO frequency varied accordingly.

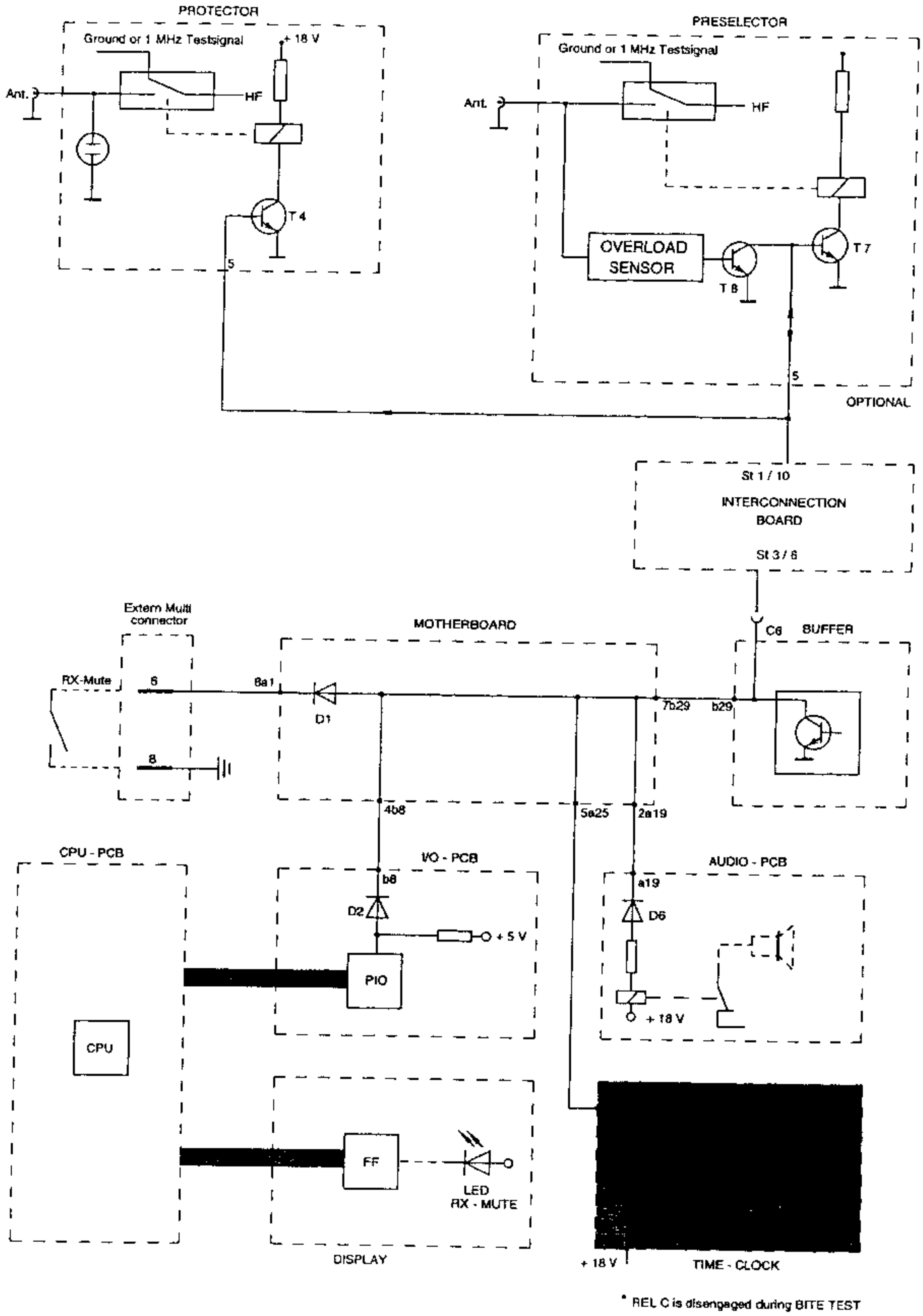
  When the counter content has been read, IC - F is reloaded with the preset value via decoder address 8; the RS flipflop is also reset, the pulse input is enabled and the next cycle can begin.

- Interrogation of fault indications and battery indication
  The fault indications are applied to the 16 inputs of the multiplexer IC - K. If a line is selected, the relevant addess must be applied to the data bus. For this purpose, a HIGH signal is applied via decoder address 5 and IC - L to the STROBE input ST 2 of IC - O; this fixes the address for the multiplexer in the memory of IC - O. Input DIS 2 of IC - O is LOW, so that the address is present on the outputs of IC - O and inputs A - D of IC - K. By virtue of decoder address 6, LOW level is present at the INH input of IC - K, so that the fault indication appears at the OUT output and is applied to data line D0.



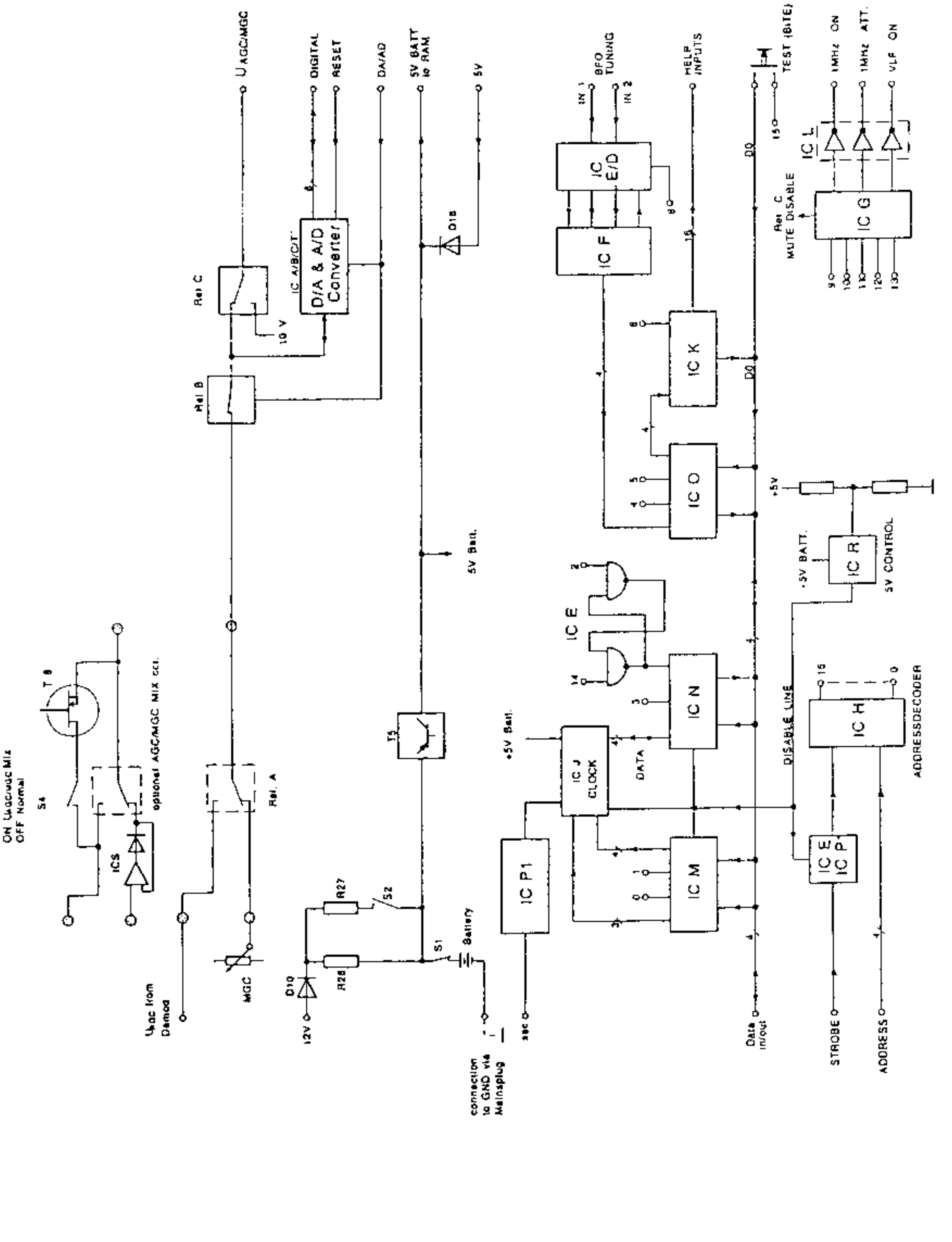
Gain control principle

-Time Clock-



Mute Interconnection

-Time Clock-



Blockdiagram Time Clock

-Time Clock-

Test and alignment instructions

Required: Circuit diagram TIME CLOCK - Hagenuk Drawing No. 97 Sa C 2.155.33
receiver type RX 1001 M / RX 5001, service adapter, DVM

Test configutation: The TIME CLOCK HELP board is tested in an operating RX 1001 M / RX 5001. An adapter board must be connected to the 60-pin terminal strip of the BUFFER D/A CONVERTER module; this board allows the measurement and application of voltages.

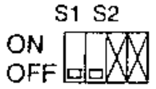
Testing the ACC-section
Switch on receiver to "LOCAL" operation, input "ON".
Switch off antenna attenuation.
Select AGC-short (62 AGC - SHORT).
Feed in DC voltage (1.8 ... 3.5 V) to c 43 on the BUFFER D/A CONVERTER.
Test values:
Functional test: The **RF** LED line is adjustable: At < 2 V only one LED glows; at > 3.2 V all LEDs glow. Measure voltage on c 41 BUFFER D/A CONVERTER.
Select AGC-long (61 AGC-LONG)
Test values:
Repeat functional test.
Select manual gain control (60 AGC OFF)
Turn **RF** control on receiver fully ccw.
Test values:
Voltage on c 41 of BUFFER D/A CONVERTER should be > 3.2 V.
Functional test: all LEDs on **RF** line are on.
Set **RF** knob on receiver fully cw.
Test values:
Voltage on c 41 of BUFFER D/A CONVERTER should be < 2 V.

Connect c 6 of BUFFER D/A CONVERTER to 0 V.
Test values:
Voltage on c 41 should be 10 V.
Disconnect 0 V connection.

-Time Clock-

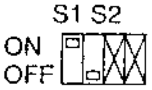
Testing the storage battery
Required condition:
Battery charged, S 1 in ON position, correct time clock setting.

Battery off



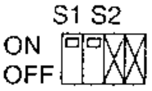
□ = depressed

Battery on



Trickle charge
(normal operation)

Battery on



Rapid charge
Max. charging time 12 h

AGC / MGC - mix

AGC / MGC - mix
Normal

Remark:
Refer to supplementary description AGC/MGC mixing Part 4, Page 4-419.

Functional test: switch off receiver and disconnect mains and battery supply. Reconnect mains supply after about 2 minutes, switch on and check clock time: correct clock time should be displayed.

Functional test:
Switch off receiver and withdraw equiment plug from POWER SUPPLY. Plug in again after about 2 minutes, switch on and check clock time: should be 00:00-.

NOTE
A fully charged battery can maintain time and RAM content for 12 days. Never use quick charge setting with a mains plug which has a missing link (pin 3 and GND)

Testing the VLF amplifier control circuit
Set receiver frequency < 80 kHz.
Test values:
Measure HIGH level on plug ST d pin 22 of TIME CLOCK HELP board.
Set receiver frequency > 80 kHz.
Test values:
Measure LOW level on plug ST d pin 22 of TIME CLOCK HELP board.

Testing the BITE functions
Press CHANNELS CANCEL key.
Test values:
Voltage on c 41 of BUFFER D/A CONVERTER module should be10 V.
Press TEST (BITE) key.
Test values:
Different voltages < 3.5 V should be present on c 41 during the test.

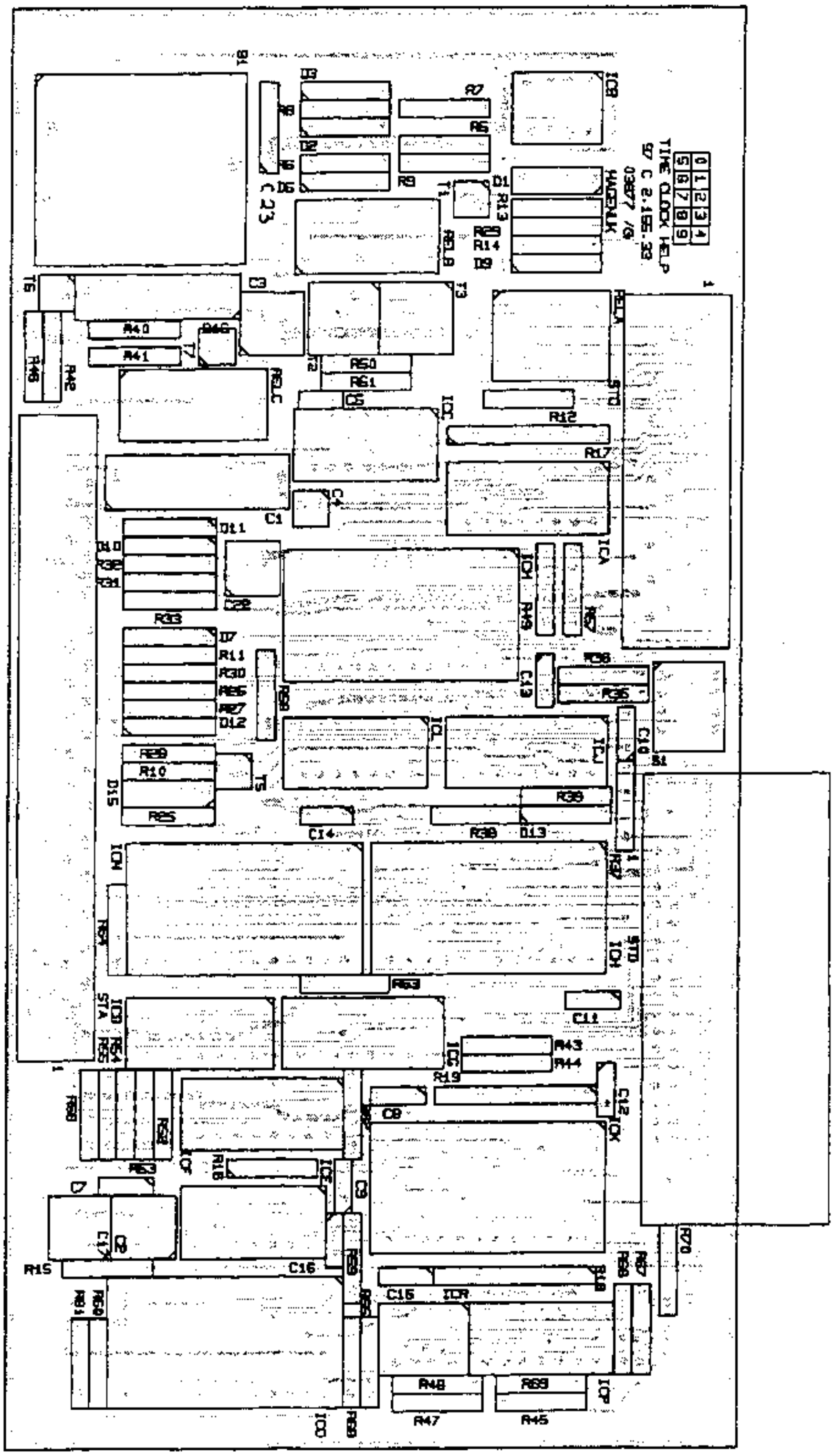
NOTE
If the receiver indicates a fault from, for instance, HELP 07, the voltage of c 41 becomes approx. 10 V.

Connect voltmeter to TIME CLOCK HELP board plug ST d pin 13 (1 MHz ON).
Then press TEST (BITE) key again.
Test values:
HIGH level on plug ST d pin 13.
Connect voltmeter to TIME CLOCK HELP board plug ST d pin 8 (1 MHz ATTENUATOR). Then again press TEST (BITE) key.
Test values:
HIGH level on plug ST d pin 8.

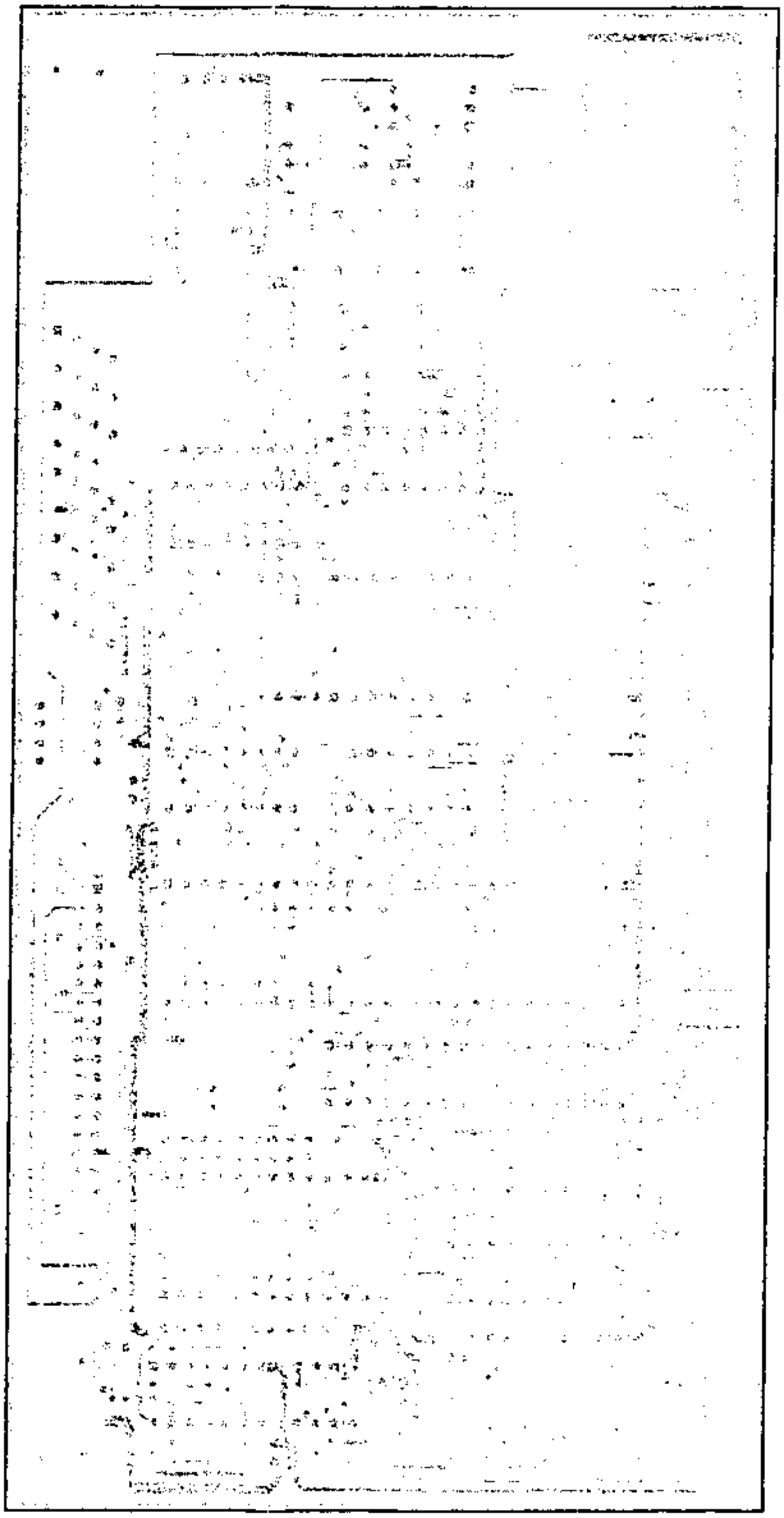
Testing BFO detune
Select mode A1A (14).
Functional test: Turn BFO knob clockwise: display up to +5 kHz.
Turn BFO knob counterclockwise: display down to -5 kHz.

NOTE
On completion of all test operations, switch off battery to prevent complete discharge.

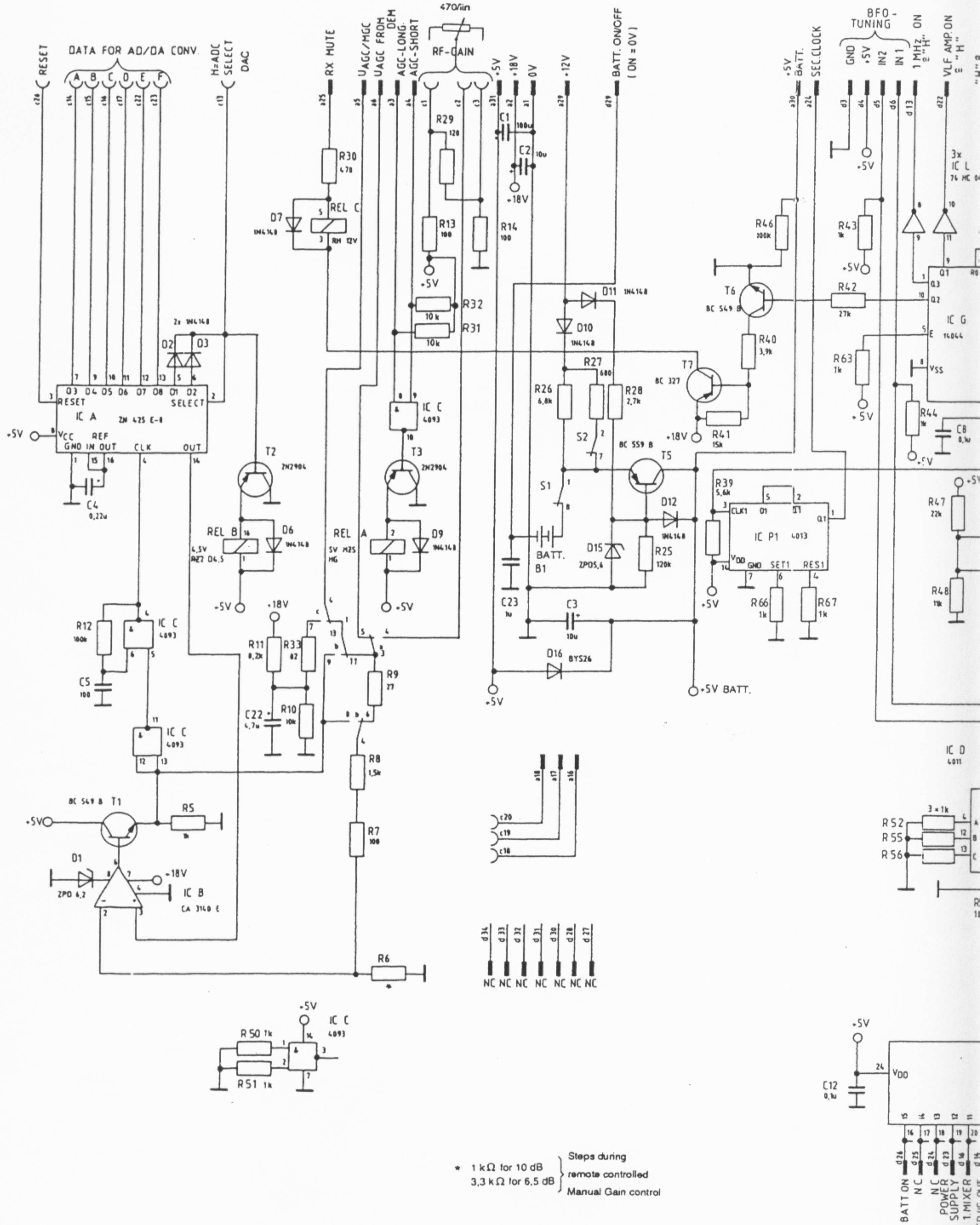
see


R40
R41
R50
R51
C5
R12
R17
C1
D11
R33
D7
R11
R30
D12
R10
R25
C14
R38
D13
R63
C11
R43
R44
R19
C9
R15
C16
C15
R48
R69
R47
R45

see circuit diagram - TIME CLOCK HELP 97 Sa C 2.155.33

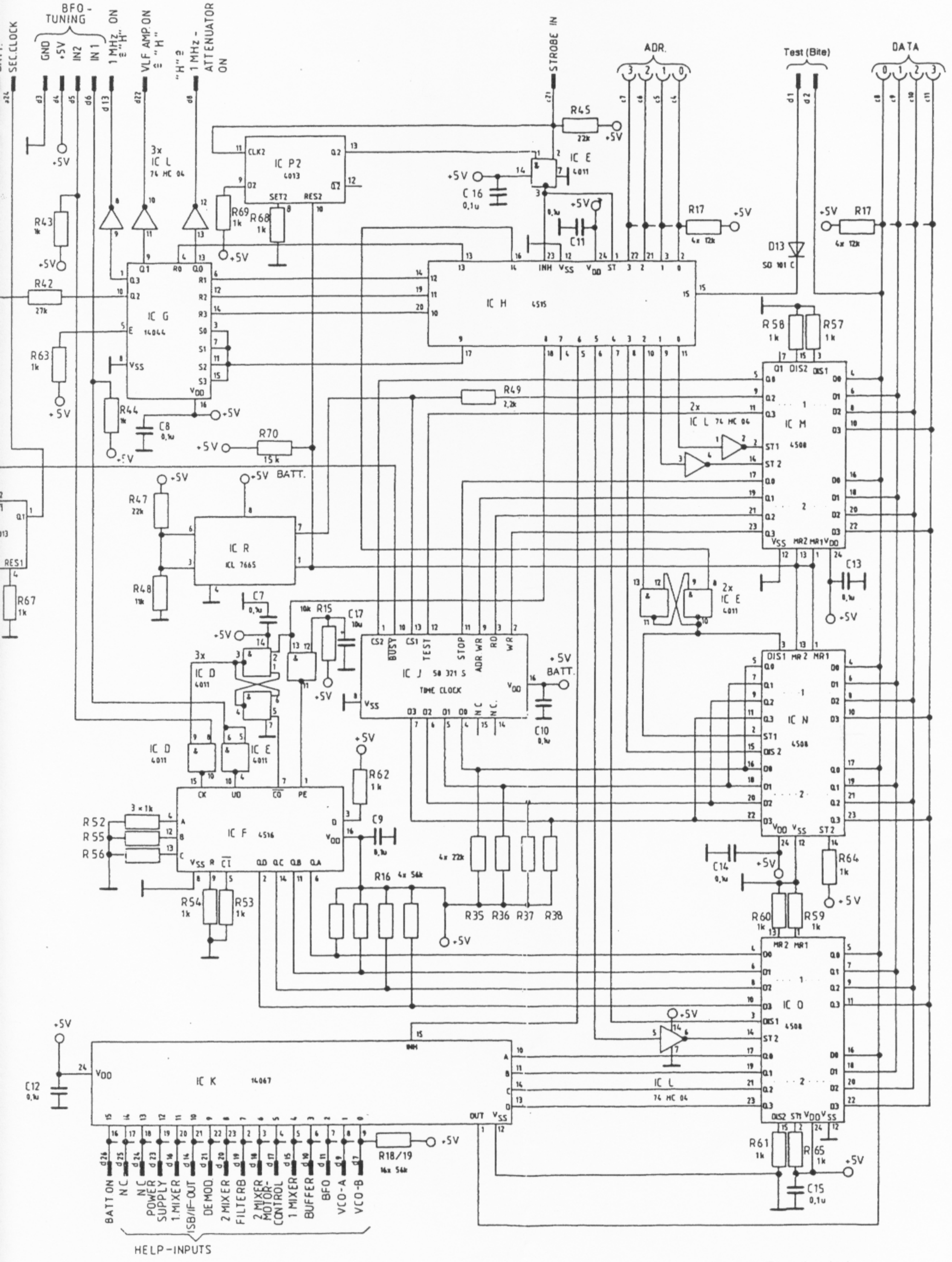


Printed Circuit Board
Time Clock Help
97 C 2.155.33



* 1 kΩ for 10 dB
3,3 kΩ for 6,5 dB } Steps during remote controlled Manual Gain control

HAG/ROD 016-08.92



Time Clock Help
Circuit Diagram
97 Sa C 2.155.33

Supplementary description of AGC-MGC mix conversion

The voltage which controls the gain of the receiver is selected on the Time Clock Help PCB. If automatic gain control is selected (AGC long or AGC short) the AGC-voltage generated in the demodulator module is connected to the receiver, or if manual gain control is selected (AGC off) the receiver is connected to the MGC voltage generated by the RF gain control potentiometer on the front panel.

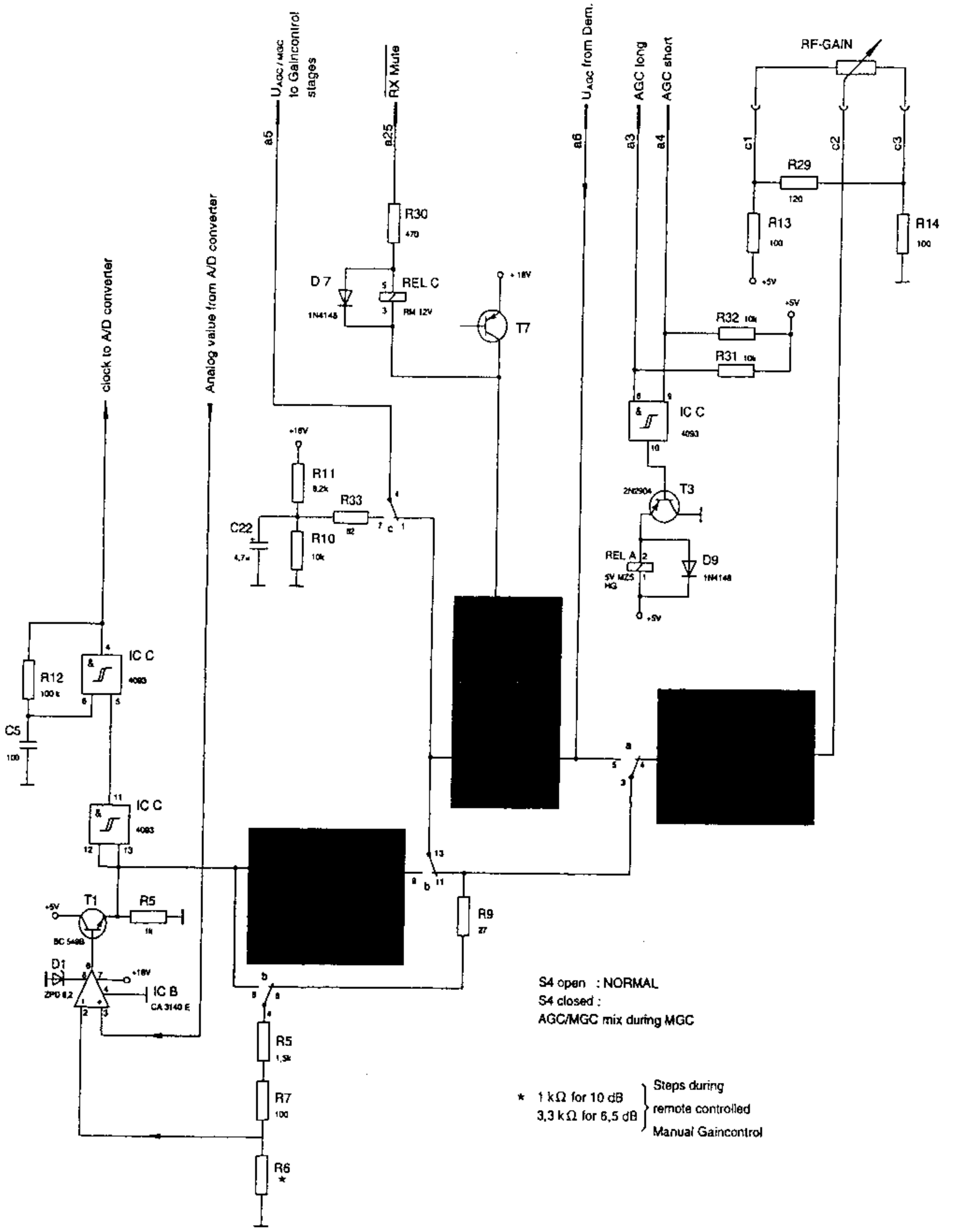
If the coding switch S 4 is in the OFF position, AGC- and MGC mode can be selected in the usual way. For a given gain (set on the frontpanel) in MGC mode a received signal could be too strong which results in an overloaded receiver, generating distorted audio.

If the coding switch S 4 is set to ON, this switch in mode MGC connects the MGC voltage set by the RF-gain potentiometer in parallel to the AGC-voltage generated by the demodulator. Mutual decoupling of these two voltages is achieved by diodes D5 and D6 in the demodulator and D 18 on the Time Clock Help PCB. Polarity of these diodes is such that the more positive voltage gains control of the receiver.

This parallel connection in MGC-mode ensures that the receiver can be gain controlled at the frontpanel, from the normal low gain level (Mute) to the gain level controlled by the AGC-voltage generated by the demodulator. Overloading of the receiver is therefore impossible.

If the receiver is being remote controlled, the MGC voltage is digitally transmitted and on the Time Clock Help PCB it is converted to the original analog voltage. This voltage is decoupled by diode D17 from the parallel connected AGC voltage. During this Mode, Relay B is energized.

Normally transistor T8 is conducting, but at certain BITE test routines this transistor is open, because the receiver has to be set to a certain gain setting by the D/A Converter in these test routines, and the AGC voltage must not interfere with this setting.



Automatic/Manual Gaincontrol Mix Conversion

-Time Clock-

Parts lists No.
97 Sa 2.155.33

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Capacitors:				
1423.010	C1	100 µF/10 V	EB 00 CG 310 C	ROE
1204.521	C2	10 µF/35 V	ETQ 4	ROE
1204.521	C3	10 µF/35 V	ETQ 4	ROE
1257.390	C4	0,22 µF/35 V	ETQ 1	ROE
0945.048	C5	100 pF/63 V	NPO/1B	EDPU
1423.037	C7	0,1 µF/63 V	MKS 2	WIMA
1423.037	C8	0,1 µF/63 V	MKS 2	WIMA
1423.037	C9	0,1 µF/63 V	MKS 2	WIMA
1423.037	C10	0,1 µF/63 V	MKS 2	WIMA
1423.037	C11	0,1 µF/63 V	MKS 2	WIMA
1423.037	C12	0,1 µF/63 V	MKS 2	WIMA
1423.037	C13	0,1 µF/63 V	MKS 2	WIMA
1423.037	C14	0,1 µF/63 V	MKS 2	WIMA
1423.037	C15	0,1 µF/63 V	MKS 2	WIMA
1423.037	C16	0,1 µF/63 V	MKS 2	WIMA
1423.037	C17	0,1 µF/63 V	MKS 2	WIMA
1197.096	C22	4,7 µF/25 V	ETQ 3	ROE
1426.931	C23	1/10/63 V	MKS-4 RM 10	WIMA
1423.037 *	C24	0,1/20/63 V	MKS 2	WIMA
Diodes:				
0943.940	D1	6,2 V 0,5 W	ZPD 6,2	ITT
0745.677	D2		1 N 4148	ITT
0745.677	D3		1 N 4148	ITT
0745.677	D6		1 N 4148	ITT
0745.677	D7		1 N 4148	ITT
0745.677	D9		1 N 4148	ITT
0745.677	D10		1 N 4148	ITT
0745.677	D11		1 N 4148	ITT
0745.677	D12		1 N 4148	ITT
1465.740	D13		SD 101 C	ITT
0745.693	D15	5,6 V 0,5 W	ZPD 5,6	ITT
1423.207	D16		BYS 26	SIEMENS
0745.677 *	D17		1 N 4148	ITT
0745,677 *	D18		1 N 4148	ITT

* AGC/MGC Mix Option

-Time Clock-

Parts lists No.
97 Sa 2.155.33

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Integrated circuits:				
1423.215	IC A		ZN 425 E-8	FERRANTI
1300.326	IC B		CA 3140 AE	RCA
1331.876	IC C		CD 4093 B	
1303.422	IC D		IC HEF 4011 BP	VALVO
1303.422	IC E		IC HEF 4011 BP	VALVO
1428.071	IC F		IC CD 4516 BE	RCA
	IC G		IC MC 14044 BCP	MOTOROLA
1815.075	IC H		IC CD 4515 BE	RCA
1826.409	IC J		IC RTS 58321 S	SPEZ.ELEC.
1826.387	IC K		IC MC 14067 B	MOTOROLA
1496.859	IC L		IC 74 HC 04	
1826.395	IC M		IC CD 4508 BE	RCA
1826.395	IC N		IC CD 4508 BE	RCA
1826.395	IC O		IC CD 4508 BE	RCA
1398.253	IC P		IC 4013 B	
1630.180	IC R		IC ICL 7665 PA	INTERSIL
1427.156 *	IC S		IC CA 3240	
Resistors:				
0179.698	R5	1 K 5 % 1/8 W	DIN 44052	
0179.698	R6	1 K 5 % 1/8 W	DIN 44052	
0179.639	R7	100 5 % 1/8 W	DIN 44052	
0480.444	R8	1,5 K 5 % 1/8 W	DIN 44052	
0830.119	R9	27 5 % 1/8 W	DIN 44052	
0179.701	R10	10 K 5 % 1/8 W	DIN 44052	
0542.814	R11	8,2 K 5 % 1/8 W	DIN 44052	
0767.190	R12	100 K 5 % 1/8 W	DIN 44052	
0179.639	R13	100 5 % 1/8 W	DIN 44052	
0179.639	R14	100 5 % 1/8 W	DIN 44052	
0179.701	R15	10 k 5-0,6-0207	DIN 44052-G	
1826.476	R16	4x56 k NW SIL 004563 J		ROE
1826.492	R17	8x12 k NW SIL 008123 J		ROE
1826.484	R18	8x56 k NW SIL 008563 J		ROE
1826.484	R19	8x56 k NW SIL 008563 J		ROE
0921.580	R25	120 K 5 % 1/8 W	DIN 44052	
0767.220	R26	6,8 K 5 % 1/8 W	DIN 44052	
0698.172	R27	680 5 % 1/8 W	DIN 44052	
0745.820	R28	2,7 K 5 % 1/8 W	DIN 44052	
0497.568	R29	120 5 % 1/8 W	DIN 44052	

* AGC/MGC Mix Option

Parts lists No.
97 Sa 2.155.33

-Time Clock-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
0554.893	R30	470 .5 % 1/8 W	DIN 44052	
0179.701	R31	10 K 5 % 1/8 W	DIN 44052	
0179.701	R32	10 K 5 % 1/8 W	DIN 44052	
0744.913	R33	82-5-0,6-0207	DIN 44052-G	
0767.204	R35	22 k-5-0,6-0207	DIN 44052-G	
0767.204	R36	22 k-5-0,6-0207	DIN 44052-G	
0767.204	R37	22 k-5-0,6-0207	DIN 44052-G	
0767.204	R38	22 k-5-0,6-0207	DIN 44052-G	
0744.840	R39	5,6 k-5-0,6-0207	DIN 44052-G	
0744.905	R40	3,9 k-5-0,6-0207	DIN 44052-G	
0791.733	R41	15 k-5-0,6-0207	DIN 44052-G	
0542.830	R42	27 k-5-0,6-0207	DIN 44052-G	
0179.698	R43	1 k-5-0,6-0207	DIN 44052-G	
0179.698	R44	1 k-5-0,6-0207	DIN 44052-G	
0767.204	R45	22 k-5-0,6-0207	DIN 44052-G	
0767.190	R46	100 k-5-0,6-0207	DIN 44052-G	
0767.204	R47	22 k-5-0,6-0207	DIN 44052-G	
1480.030	R48	11k-5-0,6-0207	DIN 44052-G	
0744.808	R49	2,2 k-5-0,6-0207	DIN 44052-G	
0179.698	R50	1 k-5-0,6-0207	DIN 44052-G	
0179.698	R51	1 k-5-0,6-0207	DIN 44052-G	
0179.698	R52	1 k-5-0,6-0207	DIN 44052-G	
0179.698	R53	1 k-5-0,6-0207	DIN 44052-G	
0179.698	R54	1 k-5-0,6-0207	DIN 44052-G	
0179.698	R55	1 k-5-0,6-0207	DIN 44052-G	
0179.698	R56	1 k-5-0,6-0207	DIN 44052-G	
0179.698	R57	1 k-5-0,6-0207	DIN 44052-G	
0179.698	R58	1 k-5-0,6-0207	DIN 44052-G	
0179.698	R59	1 k-5-0,6-0207	DIN 44052-G	
0179.698	R60	1 k-5-0,6-0207	DIN 44052-G	
0179.698	R61	1 k-5-0,6-0207	DIN 44052-G	
0179.698	R62	1 k-5-0,6-0207	DIN 44052-G	
0179.698	R63	1 k-5-0,6-0207	DIN 44052-G	
0179.698	R64	1 k-5-0,6-0207	DIN 44052-G	
0179.698	R65	1 k-5-0,6-0207	DIN 44052-G	
0179.698	R66	1 k-5-0,6-0207	DIN 44052-G	
0179.698	R67	1 k-5-0,6-0207	DIN 44052-G	
0179.698	R68	1 k-5-0,6-0207	DIN 44052-G	
0179.698	R69	1 k-5-0,6-0207	DIN 44052-G	
0791.733	R70	15 k-5-0,6-0207	DIN 44052-G	
0530.352 *	R71	3,3 k-5 %-1/8 W		
0767.212 *	R72	4,7 k-5-0,6-0207	DIN 44052-G	

* AGC/MGC Mix Option

-Time Clock-

Parts lists No.
97 Sa 2.155.33

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Switches:				
1315.293	S1	4 quad		AMP
Transistors:				
1291.033	T1		BC 549 B	
0732.591	T2		2 N 2904	VALVO
0732.591	T3		2 N 2904	VALVO
1291.181	T5		BC 559 B	
1291.033	T6		BC 549 B	
1648.942	T7		BC 327	
1501.488 *	T8		BSS 89	
Connectors:				
0681.296	St A	31 pins	DIN 41617	SIEMENS
1427.385	ST C	34 pins	97 E 2.140.130	HAGENUK
1423.754	ST D	34 pins		3 M
Supplements:				
1545.094	B1	NCB-Memo-Batt. 4,8 V	NCB-S RM 25,4	DAIMON
Relays:				
1423.142	Rel A	5 V	MZ 5 HG	ITT
1478.575	Rel B	4,5 V	RZ 2 D 4,5	ITT
1076.280	Rel C	12 V	RH 12 V	NATIONAL

* AGC/MGC Mix Option

-Input/Output II-

Technical description
This module comprises mainly the four parallel INPUT/OUTPUT port ICs, by which the microprocessor is connected to the other modules in the receiver. The INPUT/OUTPUT circuit diagram shows which signals pass via the individual ports.
The module also contains the FREQUENCY OFFSET switch, which allows setting of the AF centre frequency of an AFSK Demodulator which might be connected to the receiver. If the receiver is set to the mode F1B (16) and is tuned to a station which emits F1B signals, the receiver can be tuned to the same frequency as the frequency on the transmitter dial. The centre frequency is variable in 100 Hz steps between 1.1 kHz and 2.0 kHz.

Individual programming by switch S 2 is possible for special versions or modes, e. g.:

Switch S 2.1- S 2.3 Remote Control Modes

S 2.1	ON:	Remote control PCB (RS232 or RS422) is fitted
	OFF:	Remote control PCB is not fitted
S 2.2	ON:	GO/NOGO mode via DSR and DTR
	OFF:	Remote control mode according to switch setting S 2.3
S 2.3	ON:	Computer remote control (ASCII)
	OFF:	Protected data transfer (LSV2 protocol)

Possible Combinations

Mode	S 2.1	S 2.2	S 2.3
No Remote Control PCB fitted	OFF	X	X
Remote control via LSV2 protocol	ON	OFF	OFF
Computer remote control	ON	OFF	ON
GO/NOGO Test via DSR and DTR	ON	ON	OFF

Switch S 2.4 HELP 15 stimulation
Remark: Refer to auto-BITE-sequence, step 35 and 36
ON: If during BITE test tuning knob or keyboard is operated receiver will end up with HELP 15.
OFF: Normal BITE procedure.

However, the I/O board also contains the memories (IC - G ,H and I) for frequency output at BCD - TTL level; connections A 1, B 1 are for the 10 MHz position, connections A 2, B 2, C 2 and D 2 for the 1 MHz position and so on up to A 6, B 6, C 6 and D 6 for the 100 Hz position.

-Input/Output II-

If the Input/Output PCB is fitted in the receiver remote control RX 5001 RC or RX 1001 F switch allocation of the switches S 1 and S 2.1 - S2.3 are changed.

Switch S 1 Set number of connected demodulators TG 1001 M (TC 5001) (Mode 2)

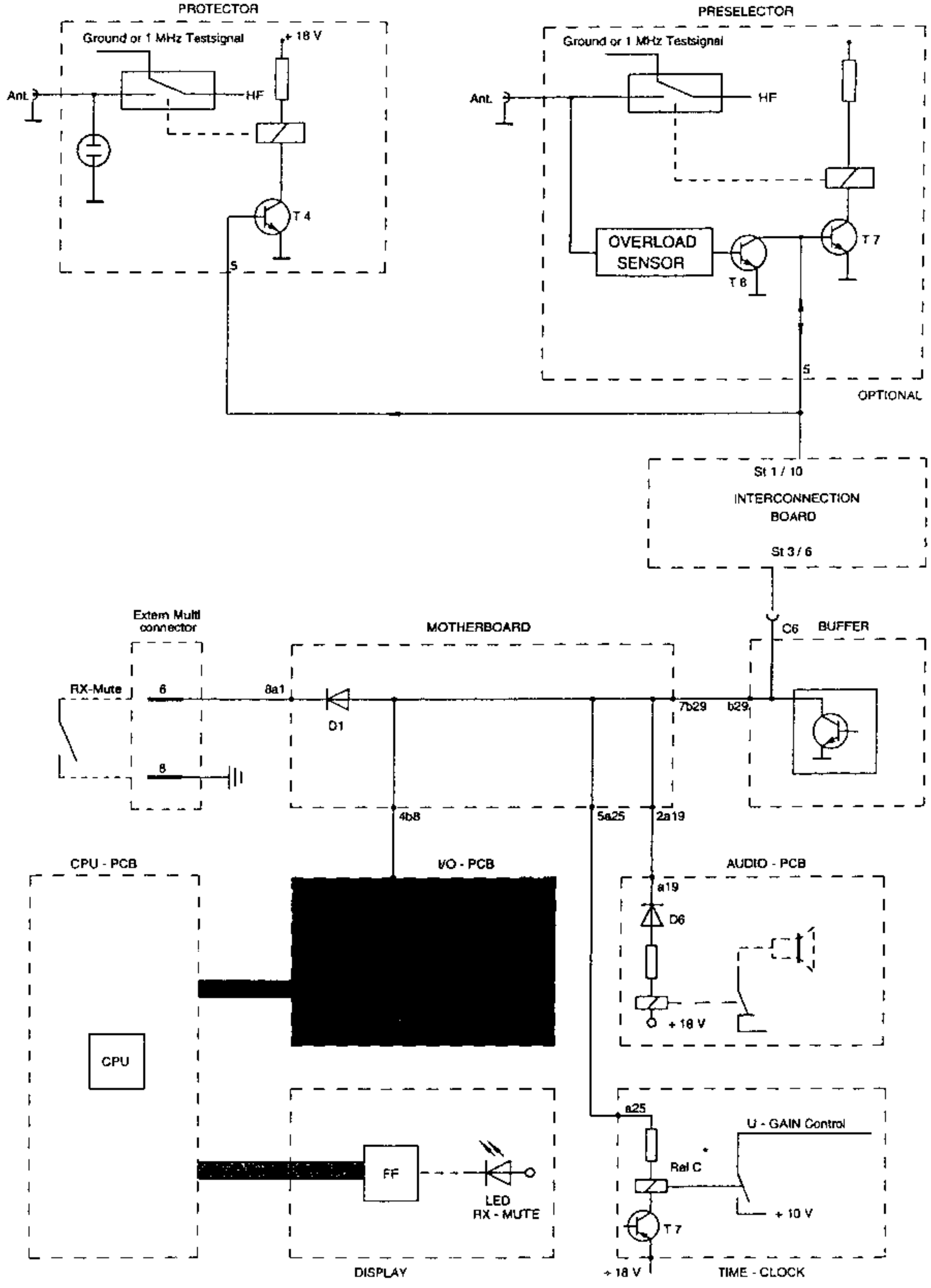
Switch S 2 Mode setting

- Mode 1 one demodulator connected to remote control
- Mode 2 up to 10 Demodulators connected to remote control
- Mode 3 one demodulator connected to remote control
  one demodulator connected to receiver

Mode	S 2.1	S 2.2	S 2.3
1	ON	OFF	OFF
2	OFF	ON	OFF
3	OFF	OFF	ON

At other as the above combinations the connected demodulators TG 1001M (TC 5001) are ignored.

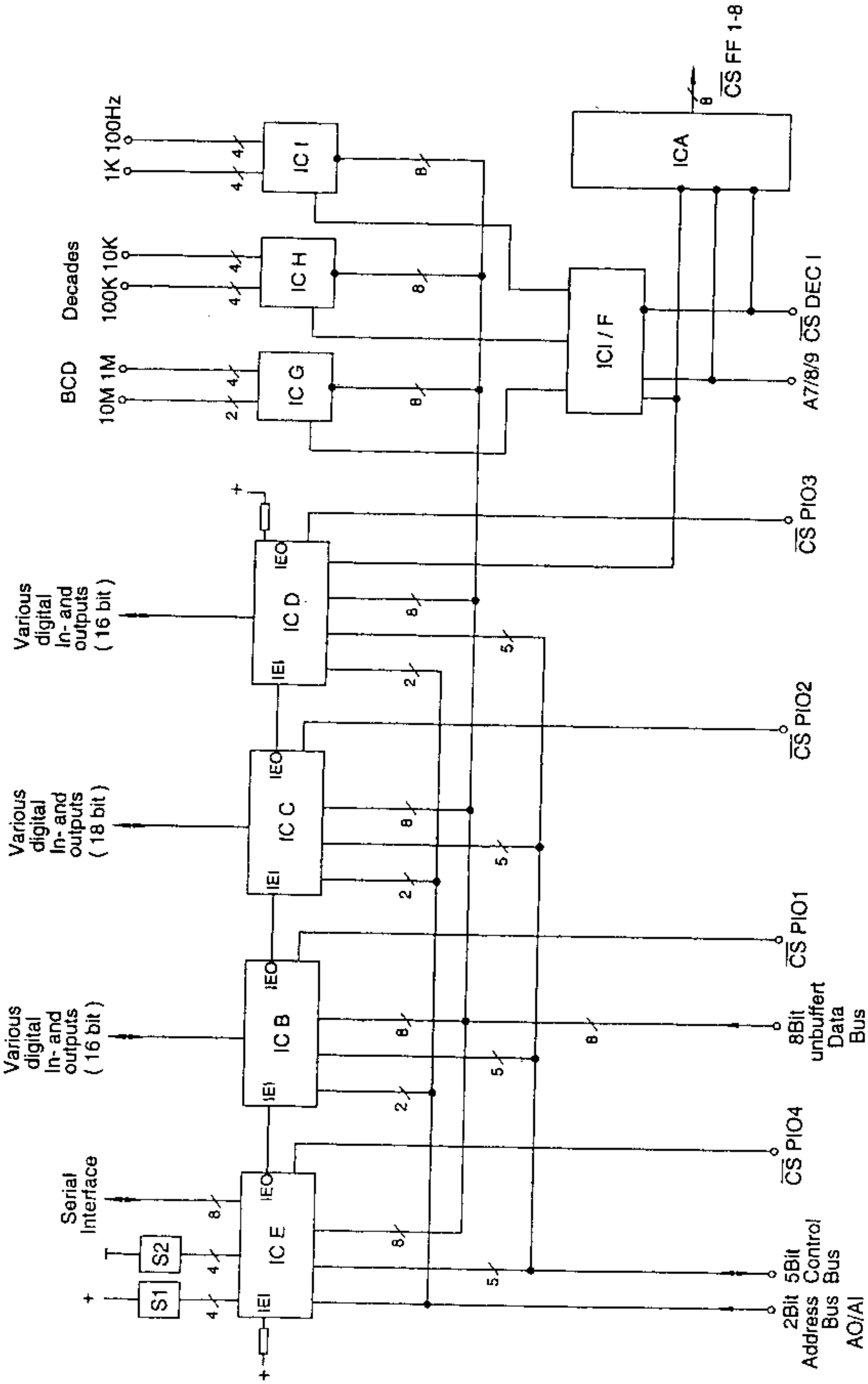
-Input/Output II-



* REL C is disengaged during BITE TEST

Mute Interconnection

-Input/Output II-



Input/Output Blockdiagram

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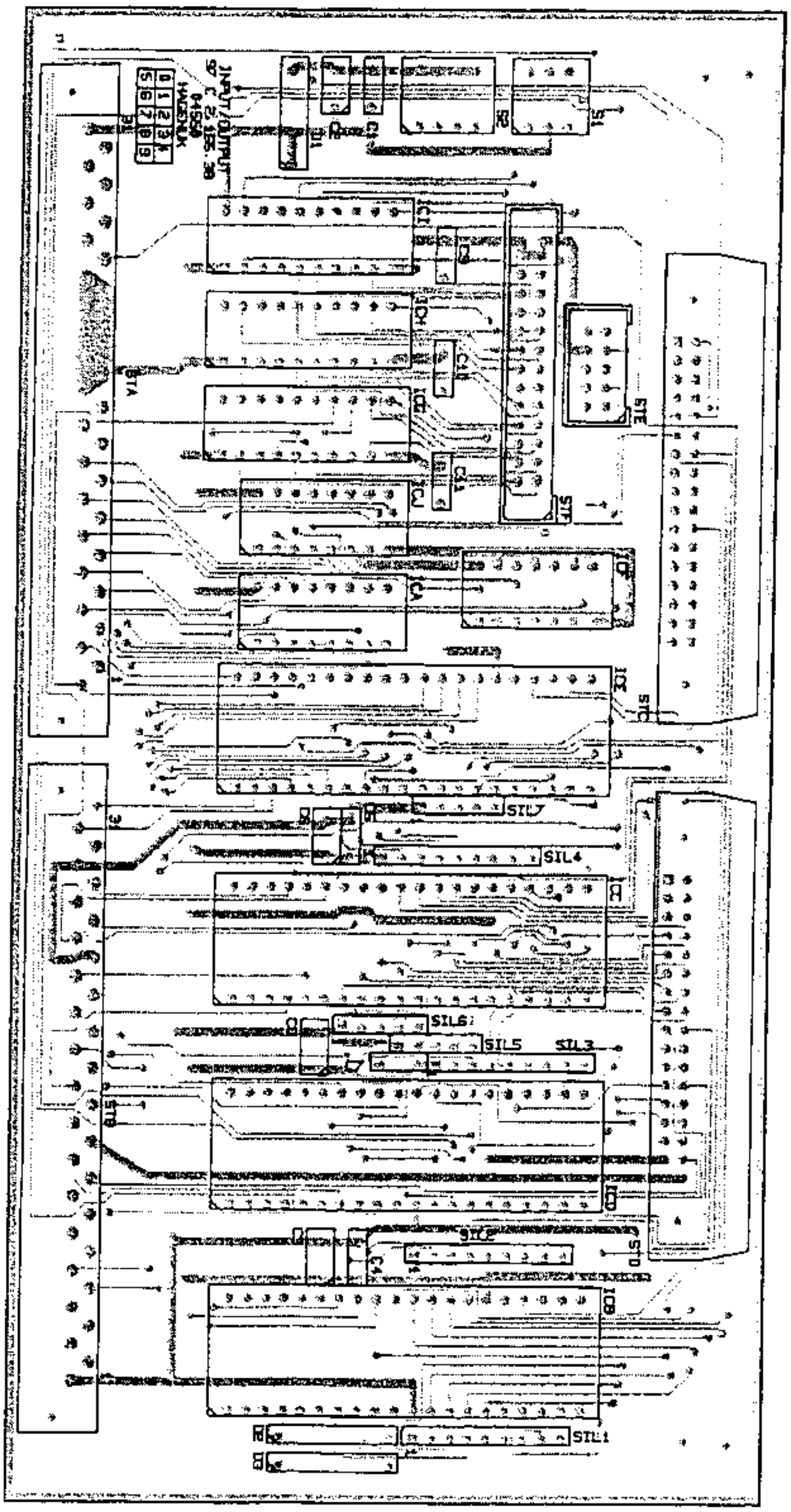
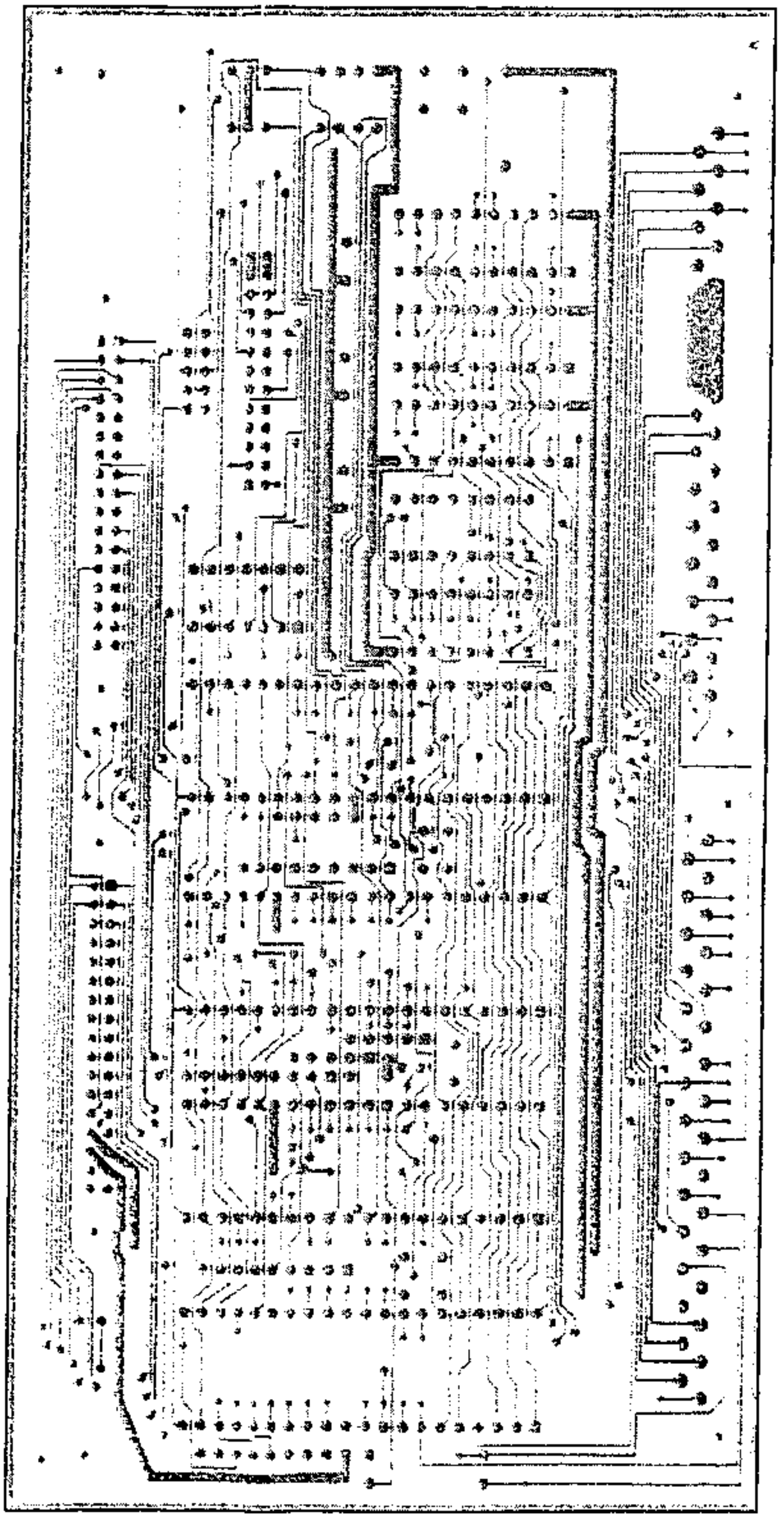
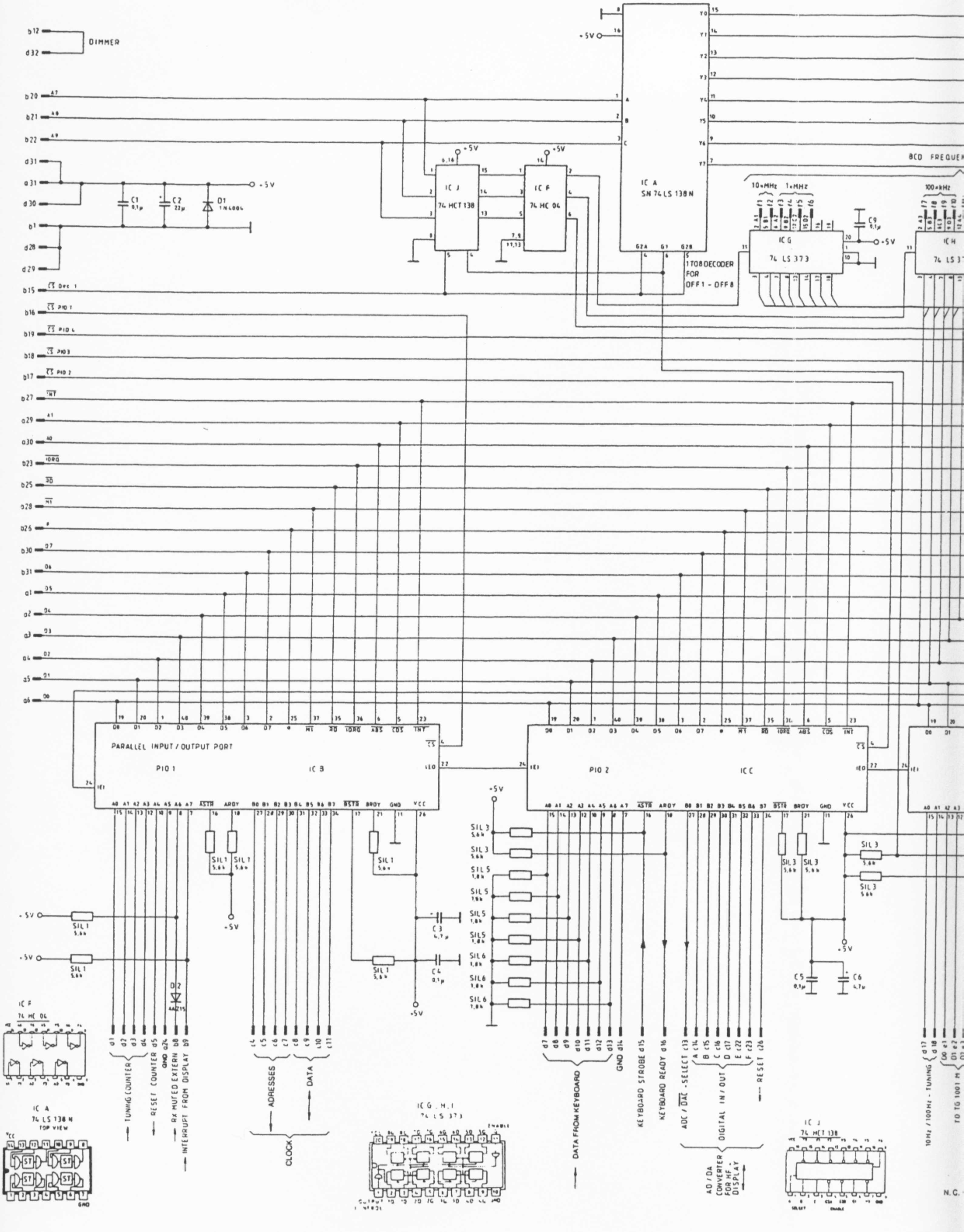
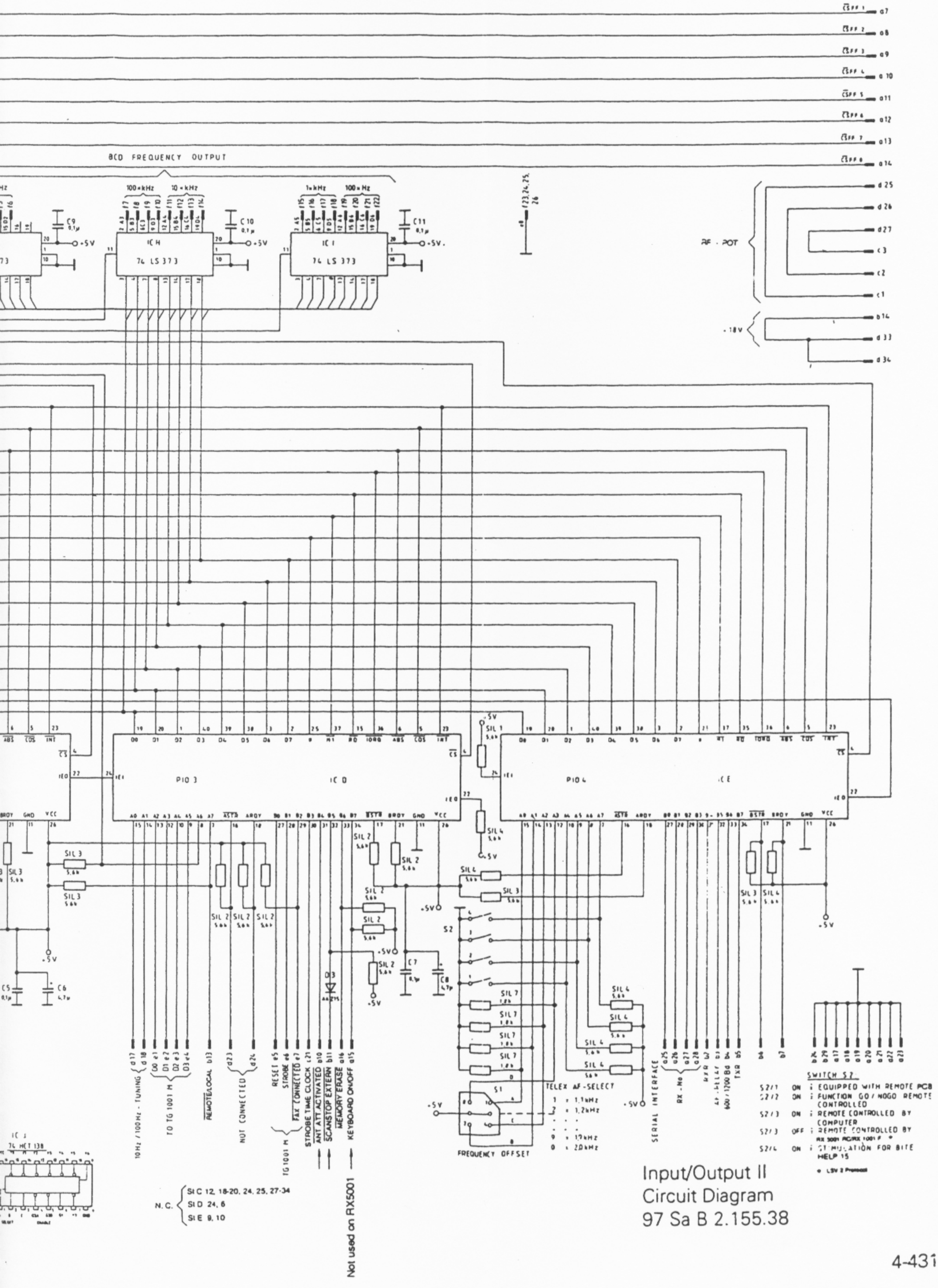


see circuit diagram - INPUT/OUTPUT II 97 Sa B 2.155.38



Printed Circuit Board
Input/Output II
97 C 2.155.38


DIMMER
IC A
SN 74 LS 138 N
IC J
74 HCT 138
IC F
74 HC 04
1 TO 8 DECODER
FOR
OFF 1 - OFF 8
BCD FREQUEN
10×MHz
1×MHz
100×kHz
IC G
74 LS 373
IC H
PARALLEL INPUT / OUTPUT PORT
PIO 1
IC B
PIO 2
IC C
TUNING COUNTER
RESET COUNTER
GND
RX MUTED EXTERN
INTERRUPT FROM DISPLAY
ADRESSES
DATA
CLOCK
DATA FROM KEYBOARD
KEYBOARD STROBE d15
KEYBOARD READY d16
ADC / DAC - SELECT
DIGITAL IN / OUT
RESET
AD / DA
CONVERTER
FOR HF-
DISPLAY
10Hz / 100Hz - TUNING
TO TG 1001 M
IC F
74 HC 04
IC A
74 LS 138 N
TOP VIEW
IC G, H, I
74 LS 373
IC J
74 HCT 138
N.C.



Input/Output II
Circuit Diagram
97 Sa B 2.155.38

Parts lists No.
97 Sa 2.155.38

-Input/Output II-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Capacitors:				
1423.037	C1	MKS-KOND 0,1/20/63V	MKS 2	WIMA
1401.343	C2	22/20/10 V	2222 122 54229	VALVO
1390.376	C3	4,7/20/10 V	2222 122 54478	VALVO
1423.037	C4	0,1/20/63 V	MKS 2	WIMA
1423.037	C5	0,1/20/63 V	MKS 2	WIMA
1390.376	C6	4,7/20/10 V	2222 122 54478	VALVO
1423.037	C7	0,1/20/63 V	MKS 2	WIMA
1390.376	C8	4,7/20/10 V	222 122 54478	VALVO
1423.037	C9	0,1/20/63 V	MKS 2	WIMA
1423.037	C10	0,1/20/63 V	MKS 2	WIMA
1423.037	C11	0,1/20/63V	MKS 2	MIMA
Diodes:				
0763.764	D1		IN 4004	ITT,ROE,GI, THOMSEN
0761.877	D2		AAZ15	ITT
0761.877	D3		AAZ15	ITT
Integrated circuit:				
1398.385	IC A	74 LS 138 N		
1912.178	IC B	Z 80 PIO C-MOS	4 MHz	ZILOG,TOSHIBA SHARP
1912.178	IC C	Z 80 PIO C-MOS	4 MHz	ZILOG, TOSHIBA SHARP
1912.178	IC D	Z 80 PIO C-MOS	4 MHz	ZILOG, TOSHIBA, SHARP
1912.178	IC E	80 PIO C-MOS	4 MHz	ZILOG, TOSHIBA, SHARP
1496.859	IC F	SN 74 HC 04		TEXAS MOTOROLA
1422.855	IC G	74 LS 373		TEXAS
1422.855	IC H	74 LS 373		TEXAS
1422.855	IC I	74 LS 373		TEXAS
1815.024	IC J	74 HCT 138 n-NAT.		

-Input/Output II-

Parts lists No.
97 Sa 2.155.38

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Connectors:				
0681.296	ST A	DIN 41617	Nr. 09.01.031	SIEMENS
0681.296	ST B	DIN 41617	Nr. 09.01.031	SIEMENS
1423.754	ST C	34-pins	3431-1002	3M
1423.754	ST D	34-pins	3431-1002	3M
1766.341	ST E	10-pins	3591-6002	3M
1614.924	ST F	26-pins	3593-6002	3M
Supplements:				
1417.835	S1		TYP 2300/02	EECO
1315.293	S2	4 quad	Nr. 435166-2	AMP
1572.938	SIL 1	8x5,6 K-5-0,6	NW SIL 008 562J	MATSUSHITA, ROE
1572.938	SIL 2	8x5,6 K-5-0,6	NW SIL 008 562J	MATSUSHITA, ROE
1572.938	SIL 3	8x5,6 K-5-0,6	NW SIL 008 562J	MATSUSHITA, ROE
1572.938	SIL 4	8x5,6 K-5-0,6	NW SIL 008 562J	MATSUSHITA, ROE
1572.938	SIL 5	8x5,6 K-5-0,6	NW SIL 008 562J	MATSUSHITA, ROE
1572.938	SIL 6	8x5,6 K-5-0,6	NW SIL 008 562J	MATSUSHITA, ROE
1572.938	SIL 7	8x5,6 K-5-0,6	NW SIL 008 562J	MATSUSHITA, ROE

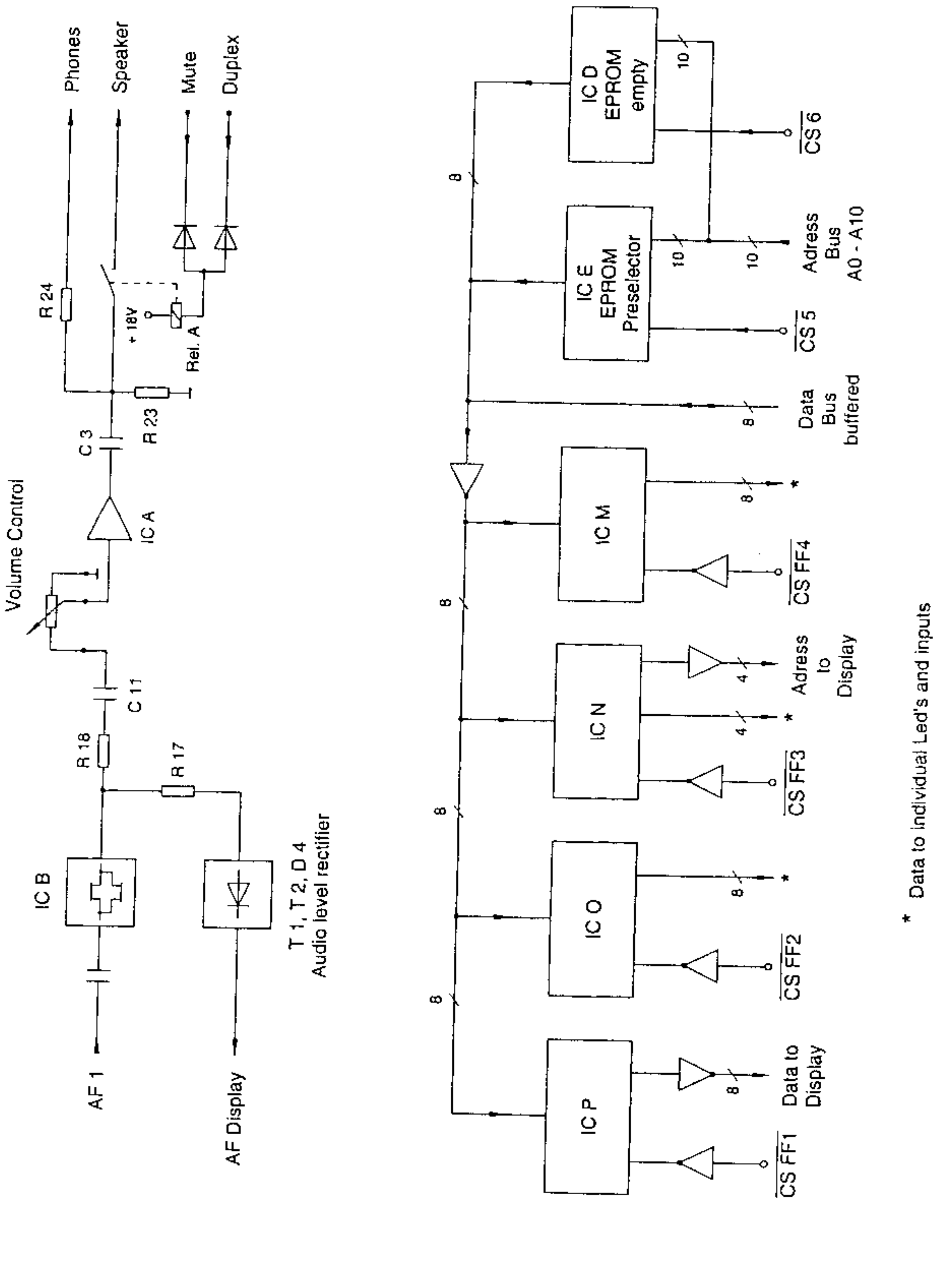
-Audio Board-

Technical description

The AUDIO BOARD contains not only the AF speaker amplifier IC - A and the audio switch IC - B but also some of the microprocessor peripherals - e. g., output flipflops (IC - M, N, O and P), EPROMs (IC - E for the PRESELECTOR and IC -D which is empty but must be fitted to be compatible with the Audio II PCB).

Mode ISB is not used in the type RX 1001 M receiver, so that input AF 2 has no function. The AUDIO SWITCH is therefore permanently set to AF 1. The AF level LED display is driven by the rectified alternating AF signal. The AUDIO LEVEL RECTIFIER with T 2, T 1 is used for this purpose. This module also contains relay Rel. A, which is controlled by the signals MUTE and DUPLEX. The connection to the speaker is interrupted in both cases.

-Audio Board-



Blockdiagram Audio PCB

-Audio Board-

Test and alignment instructions

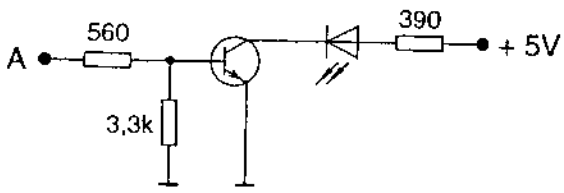
Required: Circuit diagram AUDIO BOARD - Drawing No. 97 Sa B 2.155.36
AF signal generator, oscilloscope, power supply unit

Test configuration: The AUDIO BOARD is removed.
Connect power supply unit as follows:
+18 V to socket Bu B pin 24
+ 5 V to socket Bu B pin 31
earth to socket Bu B pin 1.
Connect a 4 ohm 4 watt resistor across socket Bu C pins 3 and 4.
Connect a link across socket Bu C pins 6 and 5 and a 10 kOhm resistor across pins 6 and 4.

Testing the speaker amplifier
Connect AF signal generator to socket Bu B pin 21 A 1 and oscilloscope to socket Bu C pin 2.
Set AF signal generator to f = 1 kHz U_{OUT} = 0.63 V_{pp}.
Test values:
Output voltage U_{OUT} 8 V_{pp} ± 0.8 V_{pp}.
Vary output frequency of AF signal generator from 30 Hz to 3 kHz.
Test values:
Variations in output voltage should be < 5 %.

Testing the AUDIO LEVEL RECTIFIER

Make up auxiliary circuit as shown:



Connect terminal A to socket Bu A pin 6.
Test values:
Functional test: when an input signal of 0.63 V_{pp} is applied to AF 1, the LED should be on. If the voltage is reduced, the LED should go out.

-Audio Board-

Testing speaker muting

Apply 0 V to socket Bu A pin 19 (MUTE signal).

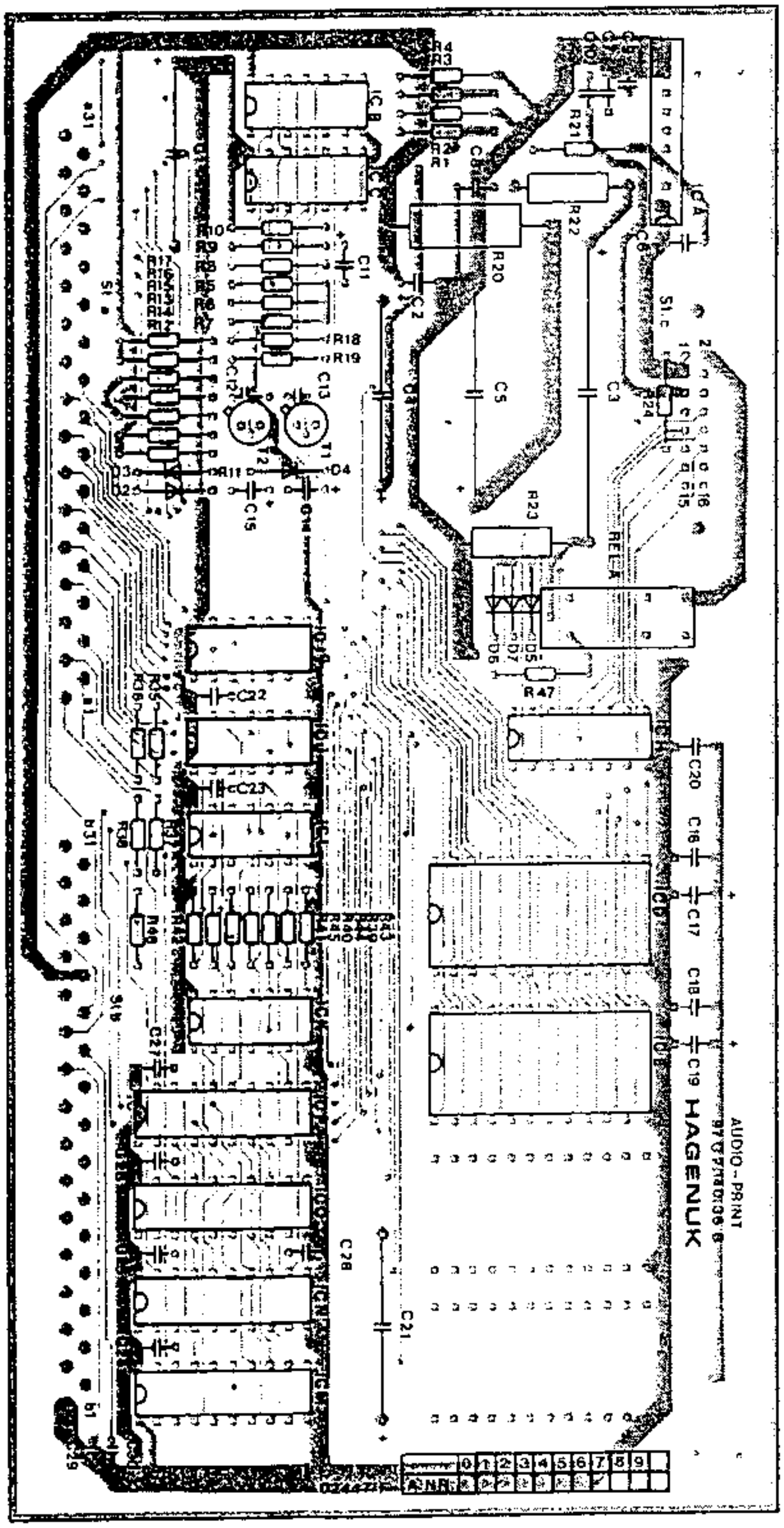
Test values:

Functional test:	No AF signal should be present on socket Bu C pin 2. Connect oscilloscope to socket Bu C pin 1; an AF signal should be present here (headphone output).

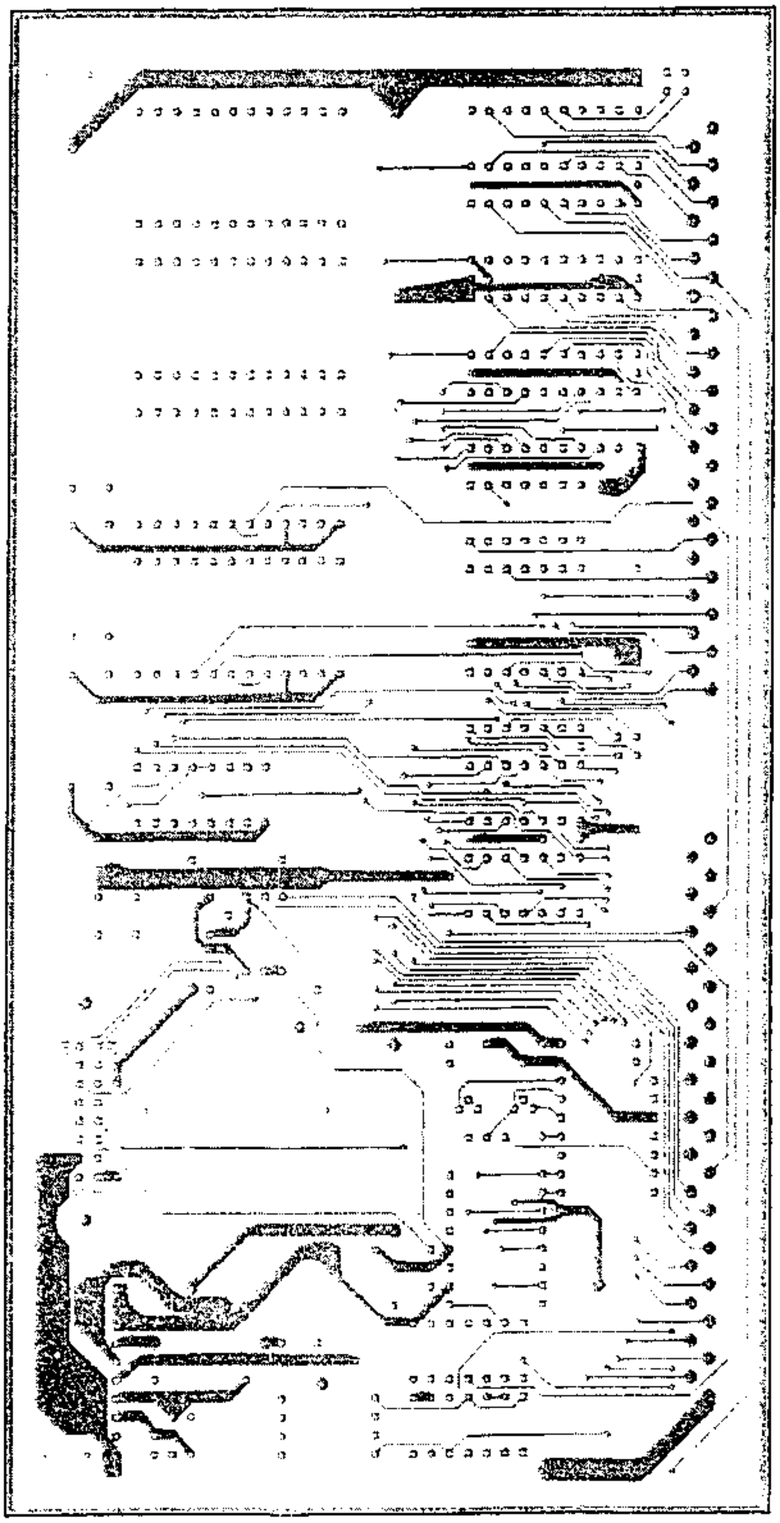
Apply 0 V to socket Bu A pin 20 (DUPLEX signal).

Test values:

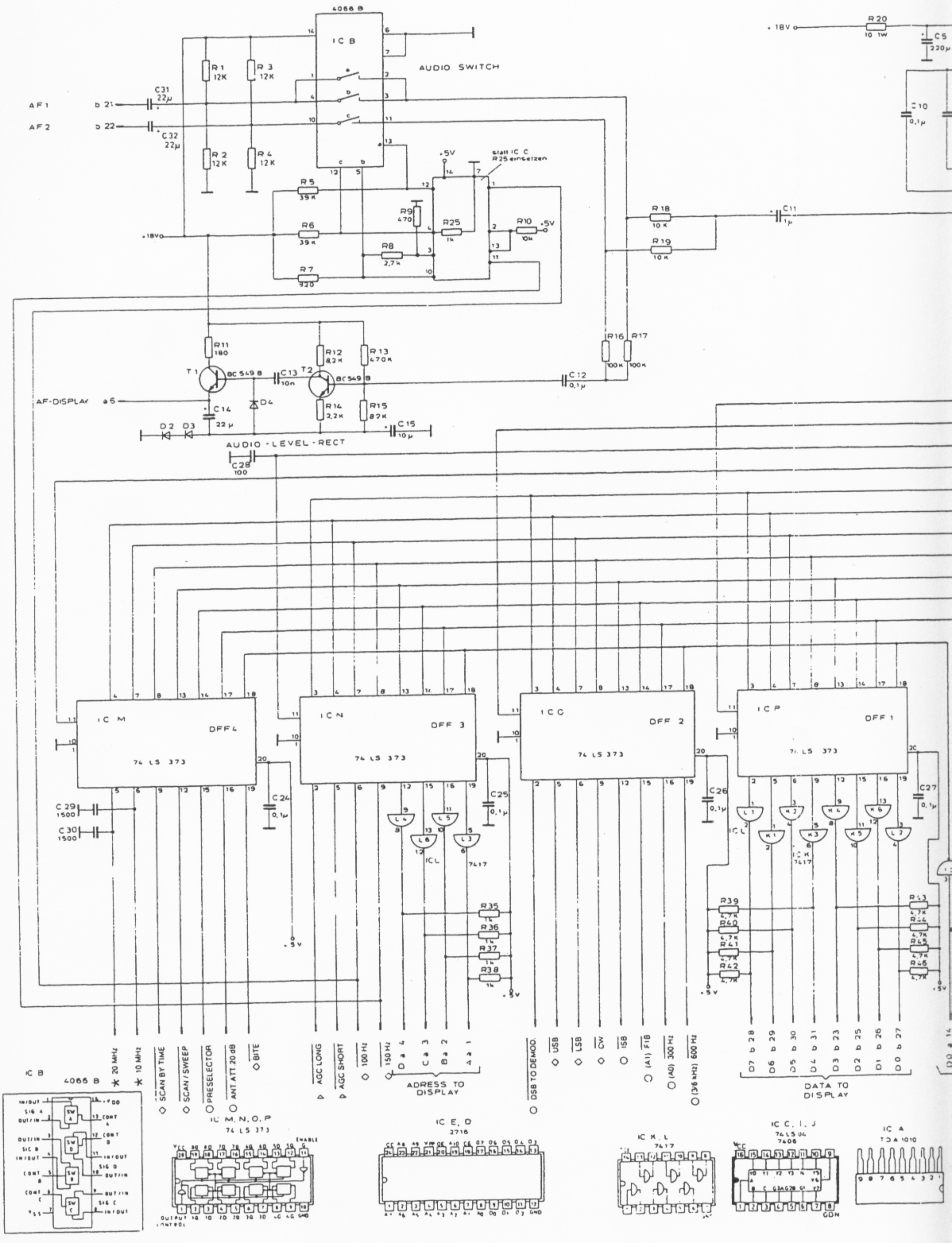
Functional test:	as above.


AUDIO-PRINT
HAGENUK

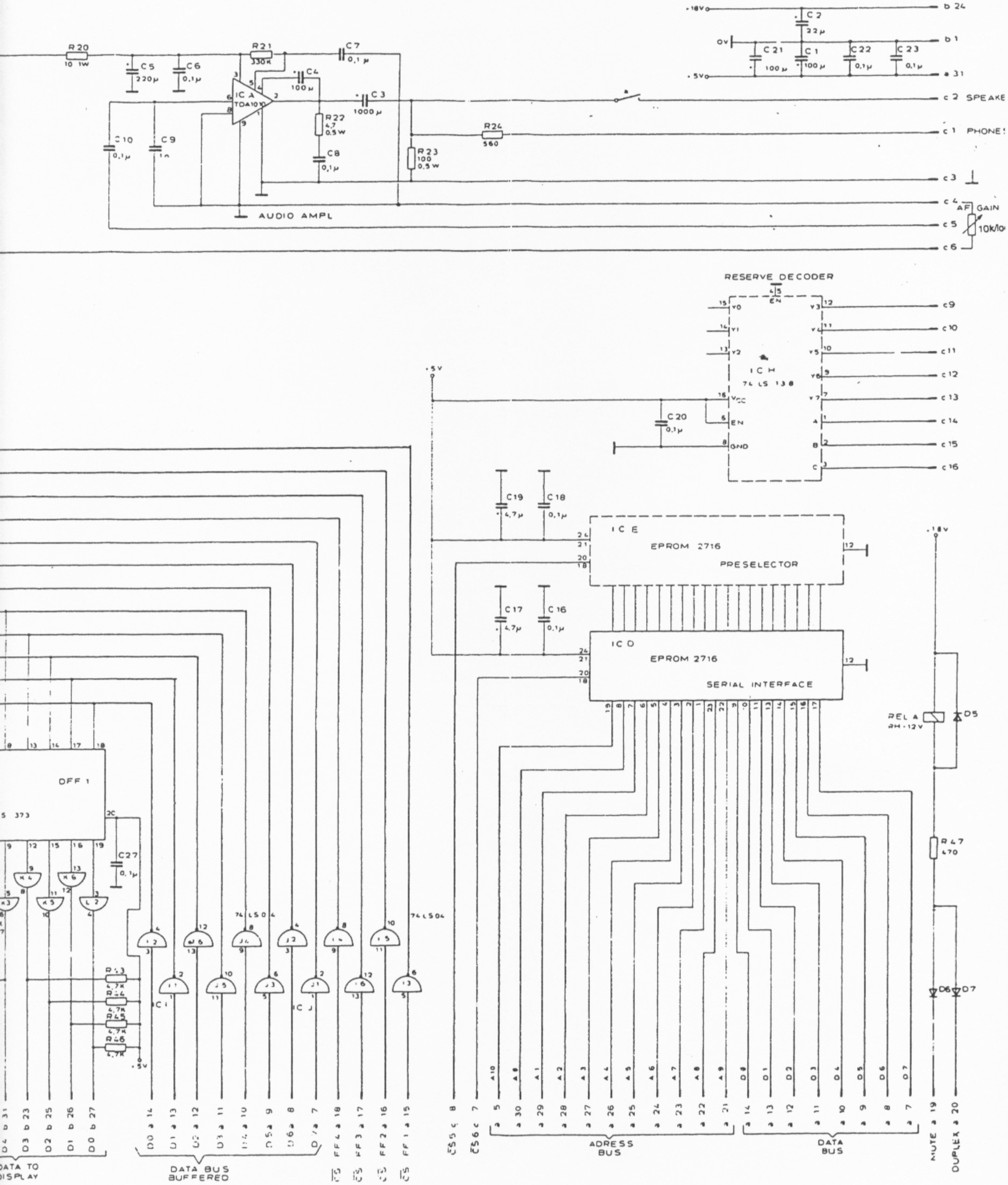
see circuit diagram - AUDIO PRINT 97 Sa 2.155.36

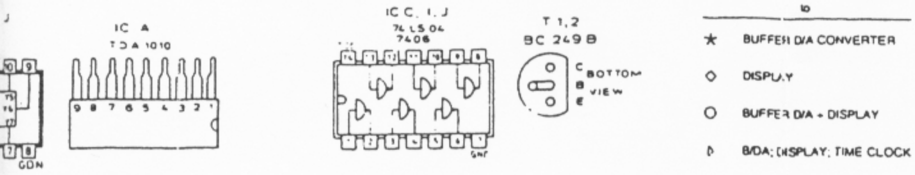


Printed Circuit Board
Audio Board
97 C 2.155.36



HAG/ROD 016-08 92





Audio Board
Circuit Diagram
97 Sa B 2.155.36

Parts lists No. 97 Sa 2.155.36

-Audio Board-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Capacitors:				
1423.010	C1	100 µF/10 V	EB 00 CG 310 C	ROE
1189.441	C2	22 µF/35 V	ETQ 5	ROE
0988.308	C3	1000 µF/40 V	B 41010-C 7108-T	SIEMENS
1116.274	C4	100 µF/25 V	B 41283-B 5107-T	SIEMENS
1067.923	C5	220 µF/25 V	B 41283-B 5227-T	SIEMENS
1423.037	C6	0,1 µF/63 V	MKS 2	WIMA
1423.037	C7	0,1 µF/63 V	MKS 2	WIMA
1423.037	C8	0,1 µF/63 V	MKS 2	WIMA
0944.971	C9	1000 pF/63 V	EDPU K2000	VALVO
1423.037	C10	0,1 µF/63 V	MKS 2	WIMA
1134.027	C11	1 µF/25 V	ETQ 1-S1	ROE
1423.037	C12	0,1 µF/63 V	MKS 2	WIMA
0904.988	C13	0,01 µF/10 %/40 V	EDPU K1000	VALVO
1189.441	C14	22 µF/35 V	ETQ 5	ROE
1423.304	C15	10 µF/25 V		VALVO
1423.037	C16	0,1 µF/63 V	MKS 2	WIMA
1390.376	C17	4,7 µF/10 V	2222.122.54478	VALVO
1423.037	C18	0,1 µF/63 V	MKS 2	WIMA
1390.376	C19	4,7 µF/10 V	2222.122.54478	VALVO
1423.037	C20	0,1 µF/63 V	MKS 2	WIMA
1423.010	C21	100 µF/10 V	EB 00 CG 310 C	ROE
1423.037	C22	0,1 µF/63 V	MKS 2	WIMA
1423.037	C23	0,1 µF/63 V	MKS 2	WIMA
1423.037	C24	0,1 µF/63 V	MKS 2	WIMA
1423.037	C25	0,1 µF/63 V	MKS 2	WIMA
1423.037	C26	0,1 µF/63 V	MKS 2	WIMA
1423.037	C27	0,1 µF/63 V	MKS 2	WIMA
0945.048	C28	100 pF/63 V	EDPU NPO/1B	VALVO
0945.005	C29	1500 pF/10/63 V	EDPU/0,6 K2000	VALVO
0945.005	C30	1500 pF/10/63 V	EDPU/0,6 K2000	VALVO
Relays:				
1076.280	Rel A	12 V	RH 12 V	NATIONAL
Diodes:				
0745.677	D2		1 N 4148	ITT
0745 677	D3		1 N 4148	ITT
0745.677	D4		1 N 4148	ITT
0745.677	D5		1 N 4148	ITT

-Audio Board-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
0745.677	D6		1 N 4148	ITT
0745.677	D7		1 N 4148	ITT

Integrated circuits:

1423.312	IC A	6 W	TDA 1010	VALVO
1410.245	IC B		4066 B	RCA
1076.051	IC C		SN 7406 N	TEXAS
	IC D	2716	97 E 2.140.300	HAGENUK
	IC E	2716	97 E 2.140.301	HAGENUK
1186.841	IC I		74 LS 04	
1186.841	IC J		74 LS 04	
1423.320	IC K		7417	
1423.320	IC L	7417		
1422.855	IC M		74 LS 373	
1422.855	IC N		74 LS 373	
1422.855	IC O		74 LS 373	
1422.855	IC P		74 LS 373	

Resistors:

0744.794	R1	1,2 K 5 % 1/8 W	DIN 44052
0744.794	R2	1,2 K 5 % 1/8 W	DIN 44052
0744.794	R3	1,2 K 5 % 1/8 W	DIN 44052
0744.794	R4	1,2 K 5 % 1/8 W	DIN 44052
0799.300	R5	39 K 5 % 1/8 W	DIN 44052
0799.300	R6	39 K 5 % 1/8 W	DIN 44052
0744.921	R7	820 5 % 1/8 W	DIN 44052
0745.820	R8	2,7 K 5 % 1/8 W	DIN 44052
0554.898	R9	470 5 % 1/8 W	DIN 40052
0179.701	R10	10 K 5 % 1/8 W	DIN 44052
0744.883	R11	180 5 % 1/8 W	DIN 44052
0542.814	R12	8,2 K 5 % 1/8 W	DIN 44052
0837.075	R13	470 K 5 % 1/8 W	DIN 44052
0744.808	R14	2,2 K 5 % 1/8 W	DIN 44052
0744.875	R15	82 K 5 % 1/8 W	DIN 44052
0767.190	R16	100 K 5 % 1/8 W	DIN 44052
0767.190	R17	100 K 5 % 1/8 W	DIN 44052
0179.701	R18	10 K 5 % 1/8 W	DIN 44052
0179.701	R19	10 K 5 % 1/8 W	DIN 44052
0528.315	R20	10 5 % 1 W	DIN 44052
0744.778	R21	330 K 5 % 1/8 W	DIN 44052
0180.726	R22	4,7 5 % 1/2 W	DIN 44052

Parts lists No.
97 Sa 2.155.36

-Audio Board-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
0751.294	R23	100 5 % 1/2 W	DIN 44052	
0542.857	R24	560 5 5 1/8 W	DIN 44052	
0179.698	R35	1 K 5 % 1/8 W	DIN 44052	
0179.698	R36	1 K 5 % 1/8 W	DIN 44052	
0179.698	R37	1 K 5 % 1/8 W	DIN 44052	
0179.698	R32	1 K 5 % 1/8 W	DIN 44052	
0767.212	R39	4,7 K 5 % 1/8 W	DIN 44052	
0767.212	R40	4,7 K 5 % 1/8 W	DIN 44052	
0767.212	R41	4,7 K 5 % 1/8 W	DIN 44052	
0767.212	R42	4,7 K 5 % 1/8 W	DIN 44052	
0767.212	R43	4,7 K 5 % 1/8 W	DIN 44052	
0767.212	R44	4,7 K 5 % 1/8 W	DIN 44052	
0767.212	R45	4,7 K 5 % 1/8 W	DIN 44052	
0767.212	R46	4,7 K 5 % 1/8 W	DIN 44052	
0554.898	R47	470 5 % 1/8 W	DIN 44052	

Transistors:

1291.033	T1		BC 549 B	
1291.033	T2		BC 549 B	

Connectors:

0681.296	St A	31 pins	DIN 41617	
0681.296	St B	31 pins	DIN 41617	
1423.290	St C	16 pins	3408-1002	3 M

-Audio Board II-

Technical description

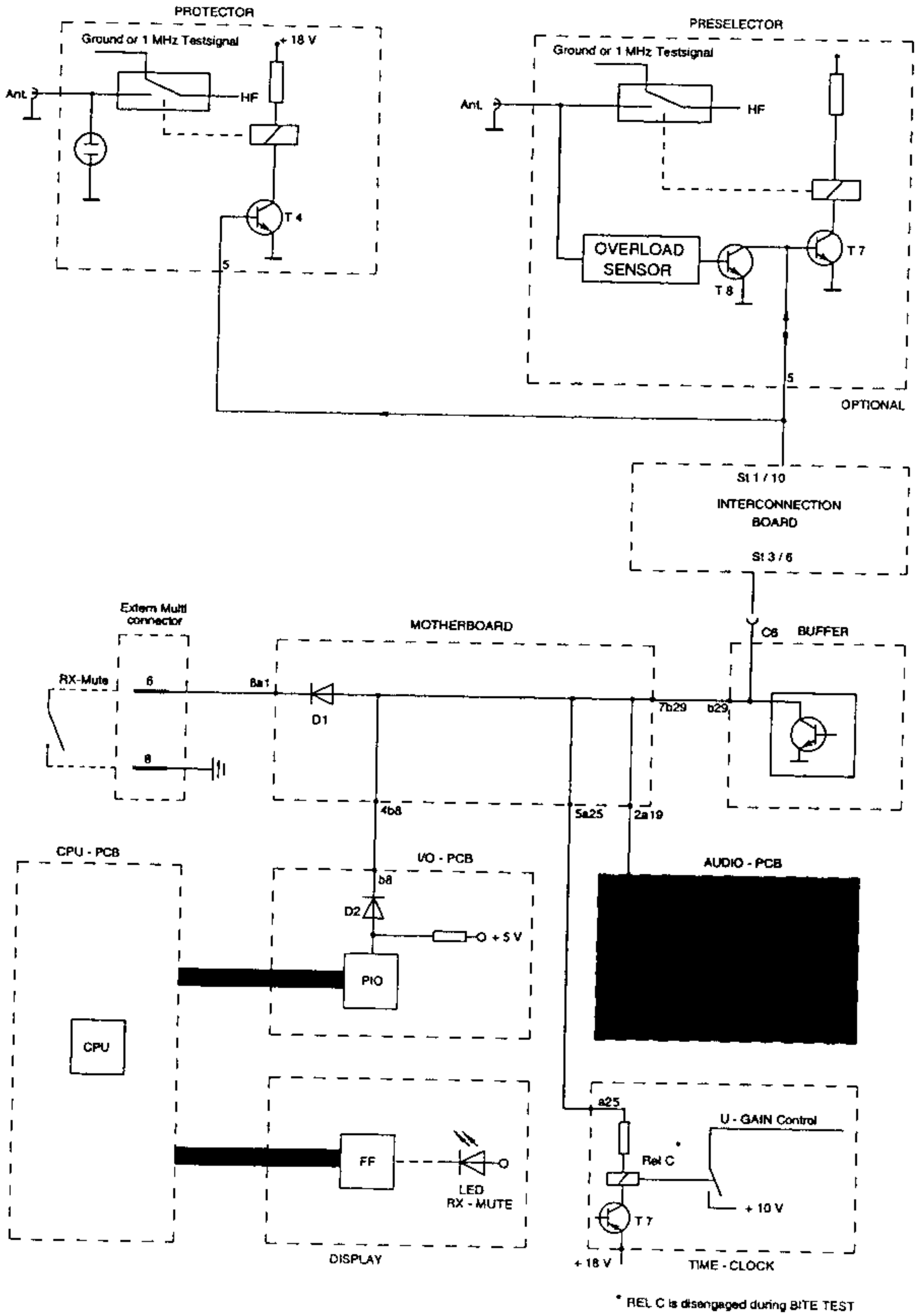
The AUDIO BOARD contains not only the AF speaker amplifier IC - A and the audio switch IC - B but also some of the microprocessor peripherals - e.g., output flipflops (IC - M, N, O and P) and EPROMs (IC - E for the PRESELECTOR; IC - D for the REMOTE SERIAL INTERFACE).

Mode ISB can be used in the type RX 5001 receiver (optional). In this case both AF-inputs of the AUDIO SWITCH (AF 1 and AF 2) are used. Therefore several links have to be set on pcb AUDIO PRINT II drawing No. 97 B 2.155.37 (refer to circuit diagram 97 Sa B 2.155.37 table -LINK SETTINGS-).

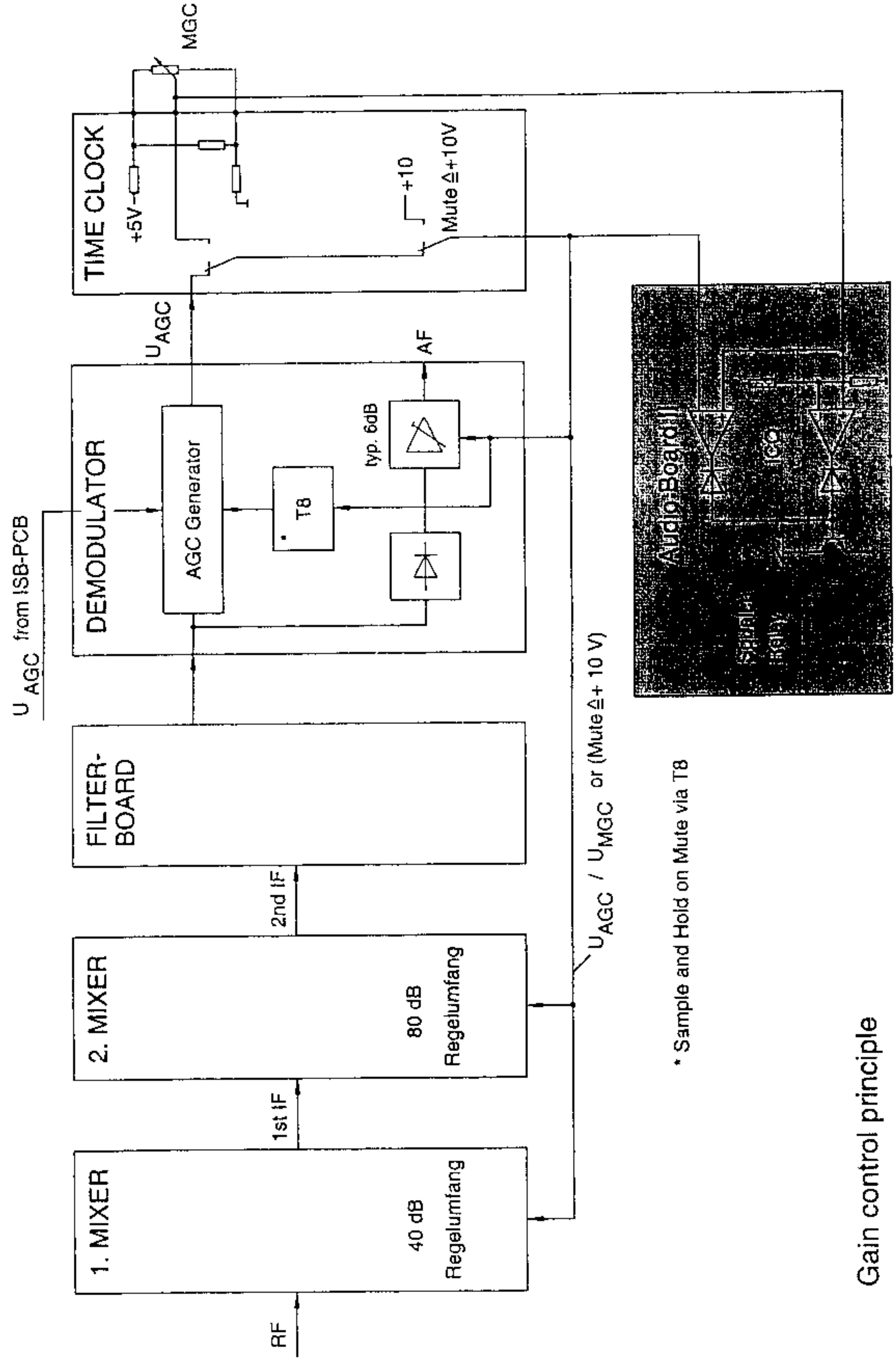
As an additional option a SQUELCH is available. Therefore several links have to be set on pcb AUDIO PRINT II drawing No. 97 B 2.155.37 (refer to circuit diagram 97 Sa B 2.155.37 table -LINK SETTINGS-). The AF level LED display is driven by the rectified AF signal, for which purpose the AUDIO LEVEL RECTIFIER with T2, T1 is used. This module also contains relay A, which is controlled by the signals MUTE and DUPLEX. The connection to the speaker is interrupted in both cases.

Relay B attenuates the loudspeaker Audio when the squelch gate is closed. The squelch circuit consists of IC Q which compares the AGC voltage with the MGC voltage. IF MGC voltage is higher than AGC voltage, the loudspeaker Audio will be attenuated by resistor R 59.

-Audio Board II-

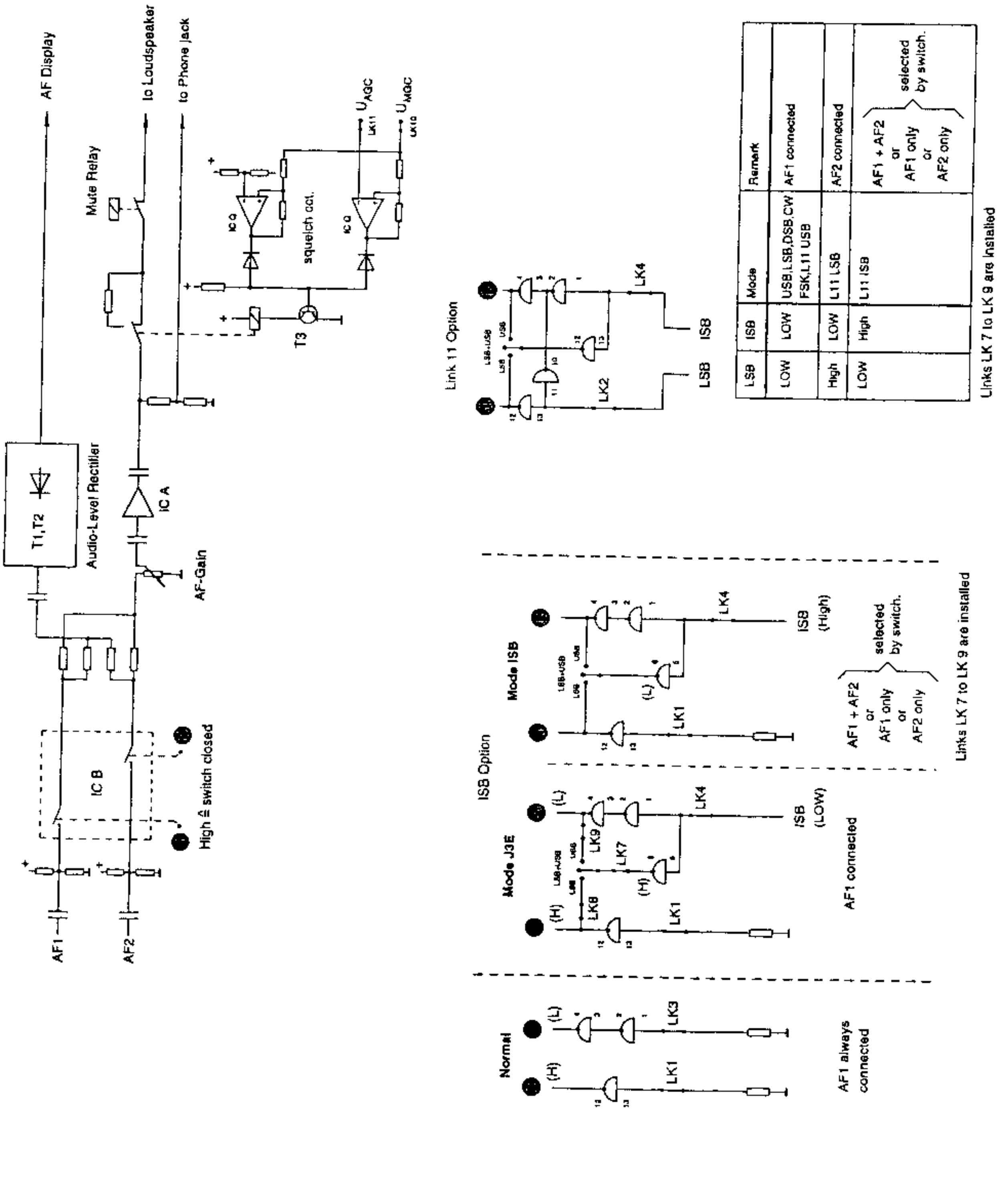


Mute Interconnection



Gain control principle

-Audio Board II-



LSB	ISB	Mode	Remark
LOW	LOW	USB,LSB,DSB,CW FSK,L11 USB	AF1 connected
High	LOW	L11 LSB	AF2 connected
LOW	High	L11 ISB	AF1 + AF2 or AF1 only or AF2 only — selected by switch.

Links LK 7 to LK 9 are installed

AF Connections in Audio Board II

Test and alignment instructions

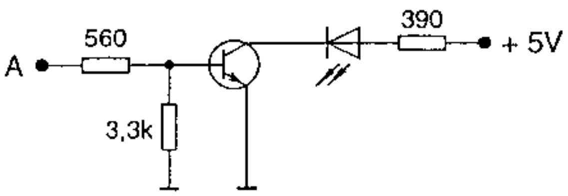
Required: Circuit diagram AUDIO BOARD II- Drawing No. 97 Sa B 2.155.37
AF signal generator, oscilloscope, power supply unit

Test configuration: The AUDIO BOARD II is removed.
Connect power supply unit as follows:
+18 V to socket Bu B pin 24
+ 5 V to socket Bu B pin 31
earth to socket Bu B pin 1.
Connect a 4 Ohm 4 watt resistor across socket Bu C pins 3 and 4.
Connect a link across socket Bu C pins 6 and 5 and a 10 kOhm resistor across pins 6 and 4.

Testing the speaker amplifier
Connect AF signal generator to socket Bu B pin 21 A 1 and oscilloscope to socket Bu C pin 2.
Set AF signal generator to f = 1 kHz $U_{OUT} = 0.63\ V_{pp}$.
Test values:
Output voltage $U_{OUT} = 8\ V_{pp} \pm 0.8\ V_{pp}$.
Vary output frequency of AF signal generator from 30 Hz to 3 kHz.
Test values:
Variations in output voltage should be < 5 %.

Testing the AUDIO LEVEL RECTIFIER

Make up auxiliary circuit as shown:



Connect terminal A to socket Bu A pin 6.
Test values:
Functional test: when an input signal of $0.63\ V_{pp}$ is applied to AF 1, the LED should go on. If the voltage is reduced, the LED should go out.

Testing speaker muting
Apply 0 V to socket Bu A pin 19 (MUTE signal).
Test values:

Functional test:	No AF signal shall be present on socket Bu C pin 2. Connect oscilloscope to socket Bu C pin 1; an AF signal should be present here (headphone output).

Apply 0 V to socket Bu A pin 20 (DUPLEX signal).
Test values:

Functional test:	as above.

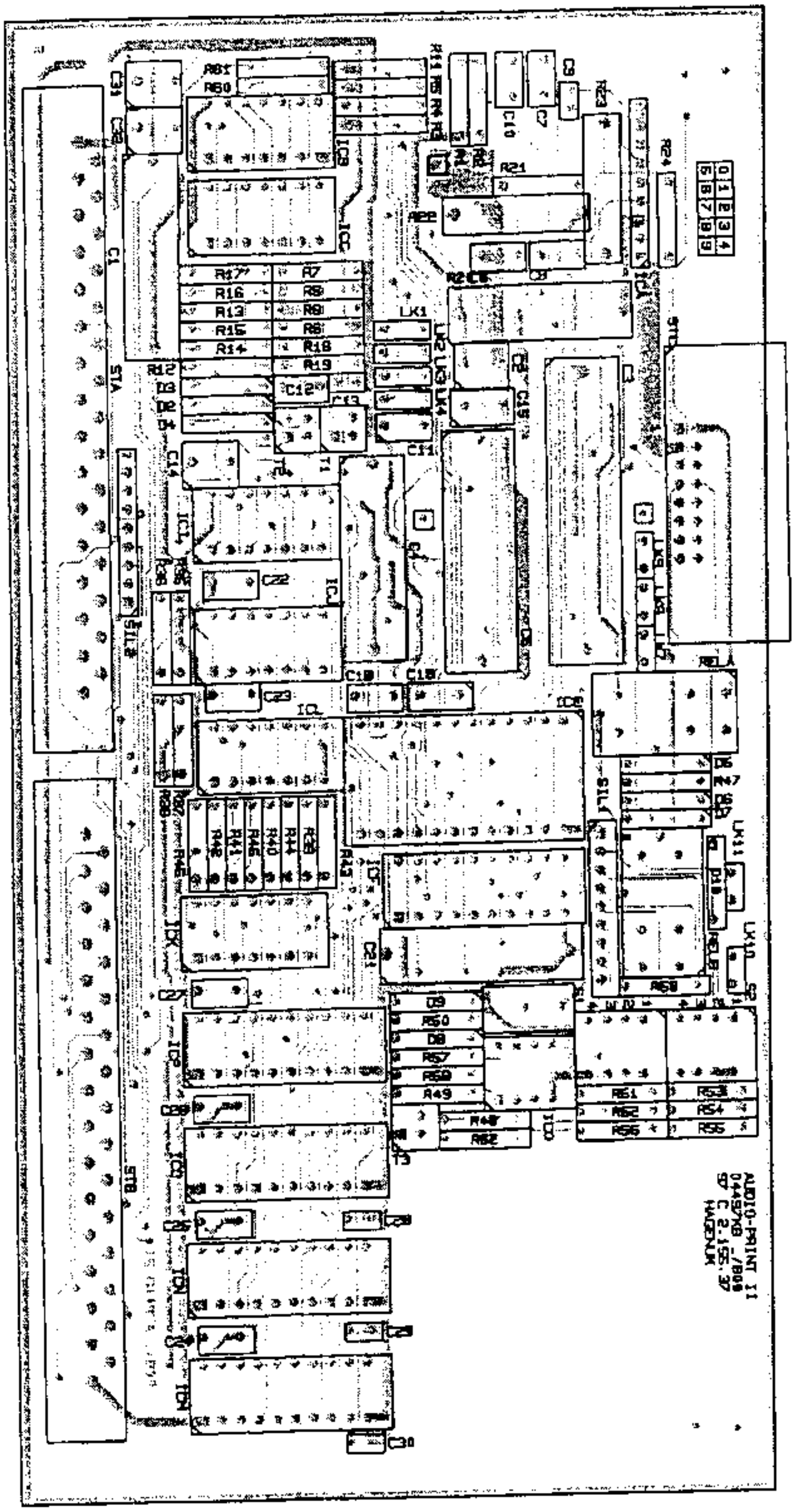
Internal settings for remote or local controlled receiver

Audio PCB II

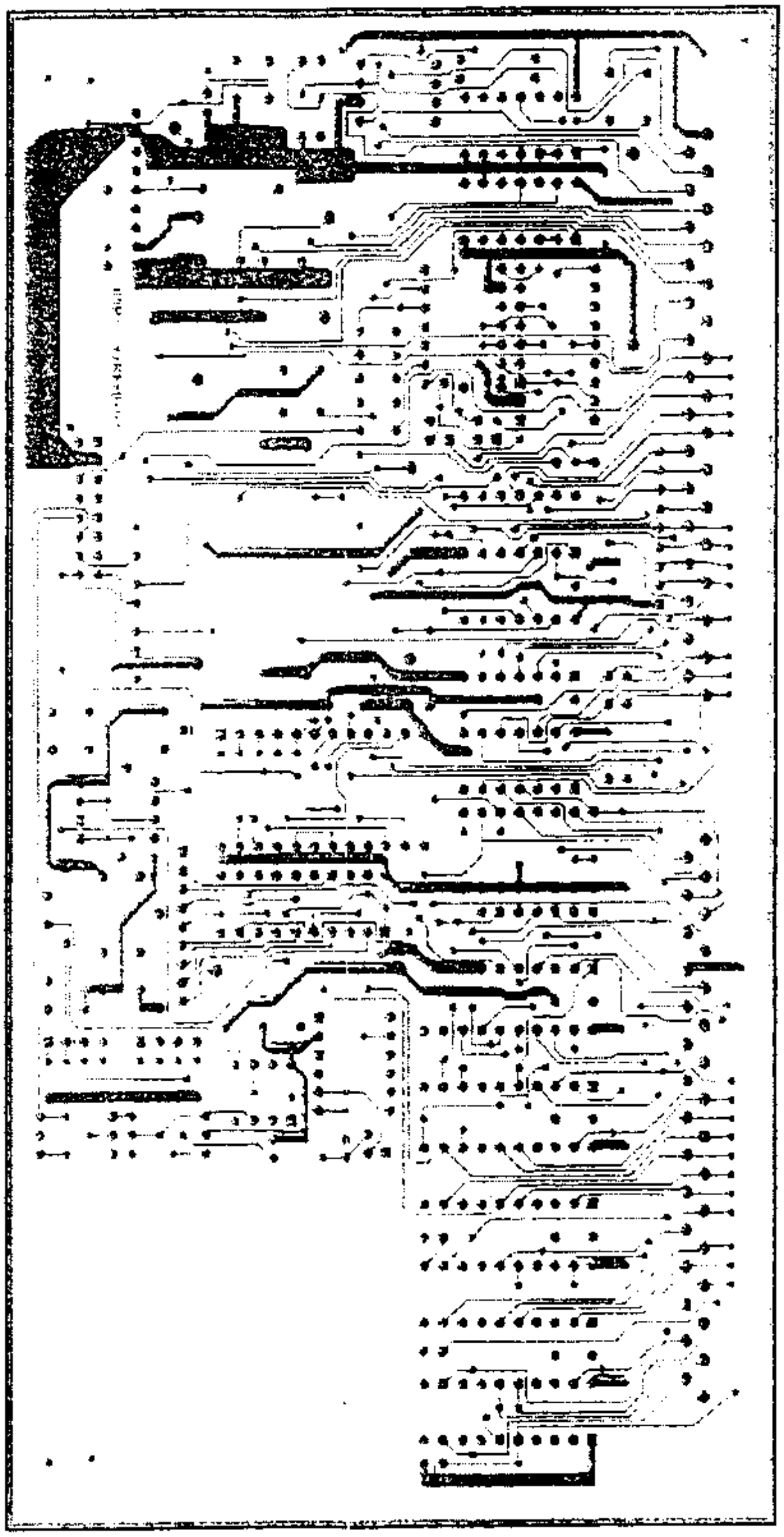
S 1:		available operations
S 1.1	ON:	Mode CHANNEL SCAN (45, 46, 41)
	OFF:	Mode SCAN CH + CH (41)
S 1.2	* ON:	MGC via remote control in 6.5 dB steps
	OFF:	MGC via remote control in 10 dB steps
S 1.3	ON:	Mode ISB; if ISB-Demodulator module is fitted
	OFF:	Mode ISB is blocked module IF out is fitted (Both options S 1.3 only possible if S 2.1 is in "OFF" position)
S 1.4	ON:	Mode SWEEP is possible (43, 44, 42)
	OFF:	Mode SWEEP is blocked
S 2:		
S 2.1	ON:	None of the options IF/OUT or ISB have been fitted
	OFF:	Option ISB or IF/OUT have been fitted
S 2.2		Not used
S 2.3		Not used
S 2.4		Not used

* IF 6.5 dB steps are selected resistor R6 on the time clock PCB fitted in the receiver RX 1001 MVB or RX 5001 and fitted in the remote control RX 1001 F or RX 5001 RC has to be 3.3 kΩ.
In case of 10 dB steps this resistor has to be 1 kΩ.

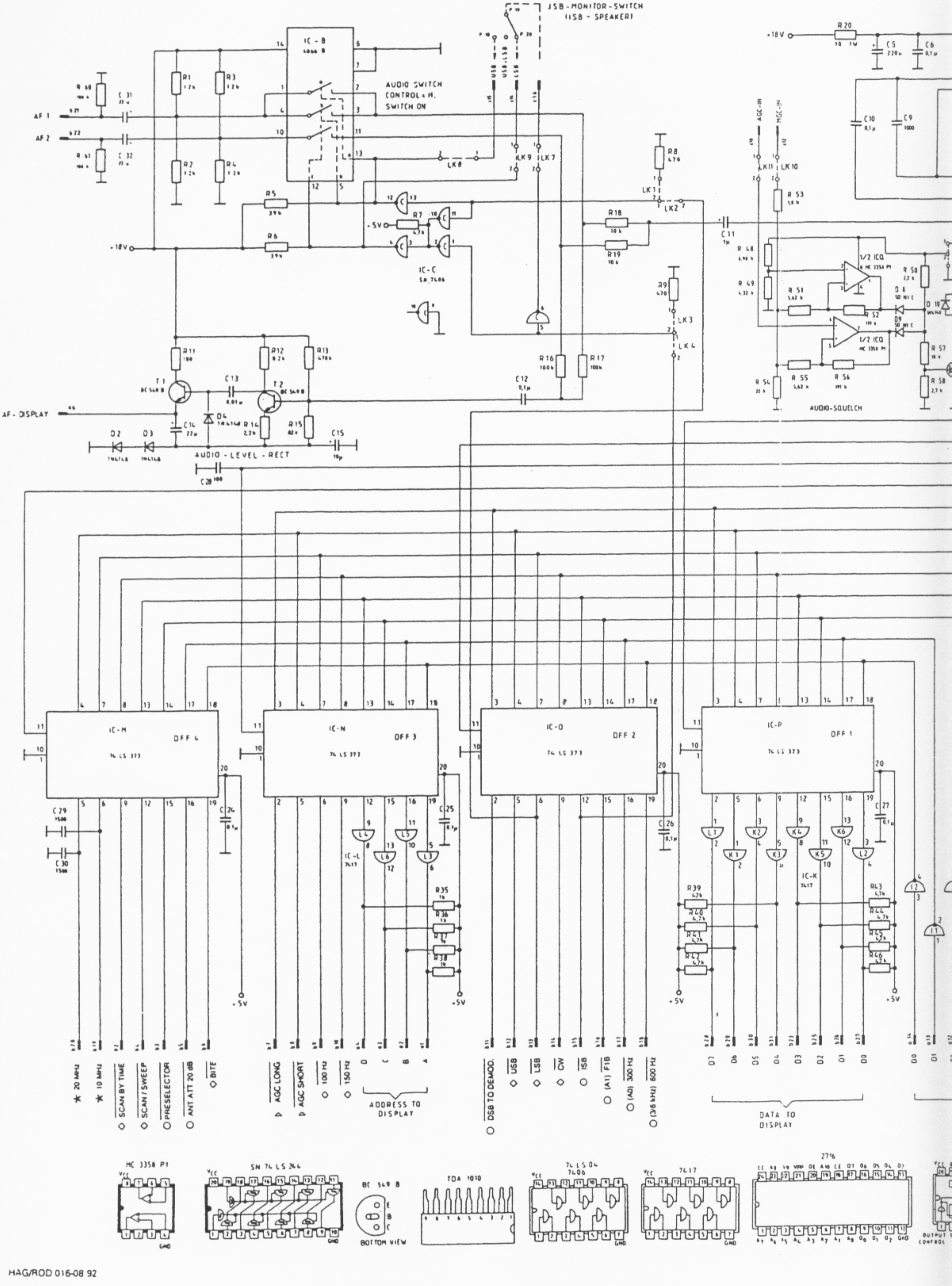
see cir

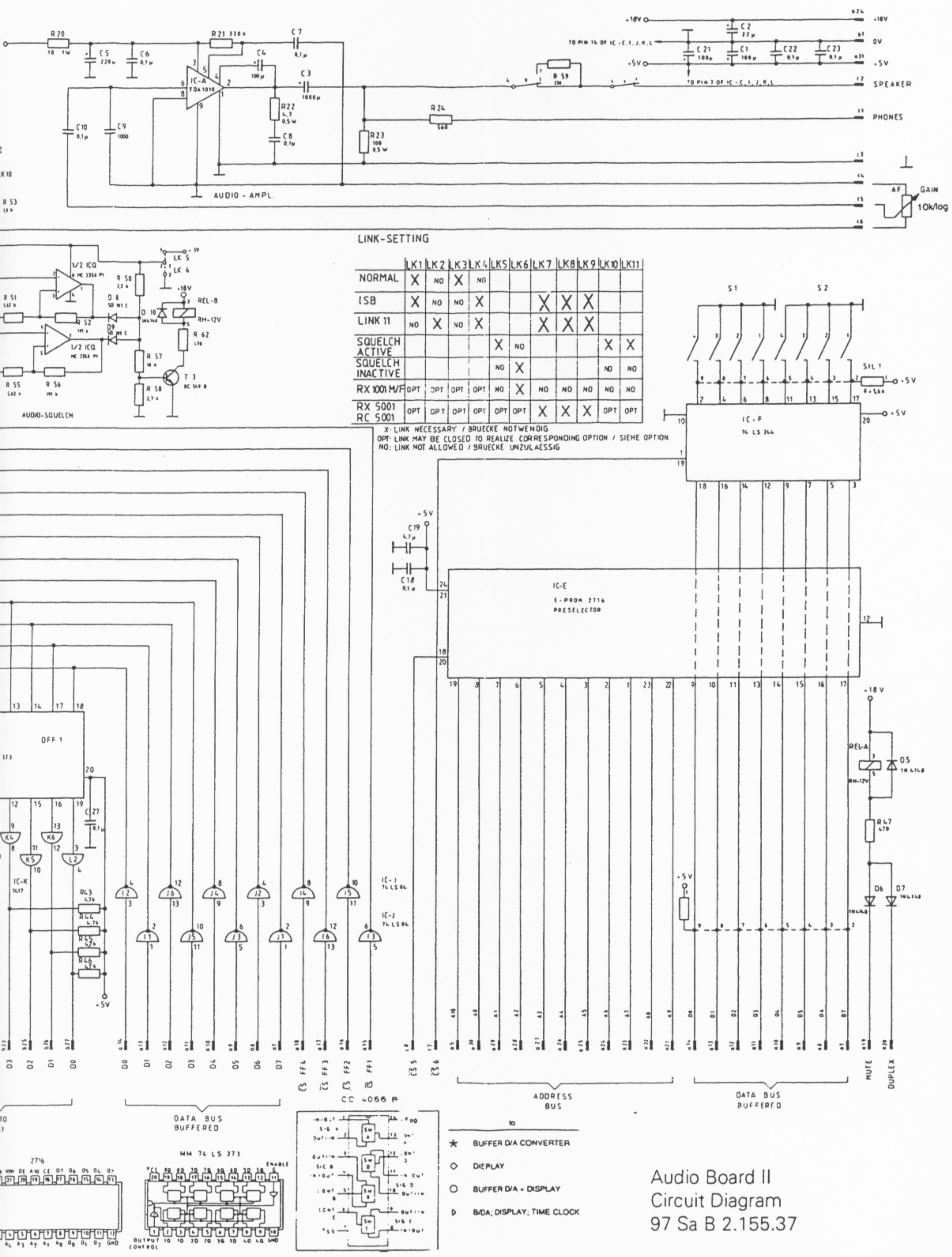


see circuit diagram - AUDIO BOARD II 97 Sa B 2.155.37



Printed Circuit Board
Audio Board II
97 B 2.155.37


JSB-MONITOR-SWITCH
(ISB-SPEAKER)
AUDIO SWITCH
CONTROL = H,
SWITCH ON
AF 1
AF 2
AF-DISPLAY
AUDIO-LEVEL-RECT
AUDIO-SQUELCH
IC-M
74 LS 373
OFF 4
IC-N
74 LS 373
OFF 3
IC-O
74 LS 373
OFF 2
IC-P
74 LS 373
OFF 1
20 MHz
10 MHz
SCAN BY TIME
SCAN/SWEEP
PRESELECTOR
ANT.ATT 20 dB
BITE
AGC LONG
AGC SHORT
100 Hz
150 Hz
ADDRESS TO
DISPLAY
DSB TO DEMOD.
USB
LSB
CW
ISB
(A1) F1B
(A0) 300 Hz
(3,6 kHz) 600 Hz
DATA TO
DISPLAY
MC 3358 P1
SN 74 LS 244
BC 549 B
BOTTOM VIEW
TDA 1010
74 LS 04
7406
7417
2716



LINK-SETTING

	LK1	LK2	LK3	LK4	LK5	LK6	LK7	LK8	LK9	LK10	LK11
NORMAL	X	NO	X	NO							
ISB	X	NO	NO	X			X	X	X		
LINK 11	NO	X	NO	X			X	X	X		
SQUELCH ACTIVE					X	NO				X	X
SQUELCH INACTIVE					NO	X				NO	NO
RX 1001 M/F	OPT	OPT	OPT	OPT	NO	X	NO	NO	NO	NO	NO
RX 5001 RC 5001	OPT	OPT	OPT	OPT	OPT	OPT	X	X	X	OPT	OPT

X: LINK NECESSARY / BRUECKE NOTWENDIG
OPT: LINK MAY BE CLOSED TO REALIZE CORRESPONDING OPTION / SIEHE OPTION
NO: LINK NOT ALLOWED / BRUECKE UNZULAESSIG

Audio Board II
Circuit Diagram
97 Sa B 2.155.37

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Capacitors:				
1423.010	C1	100-10	GPF DIN 41316-G	ROE
1189.441	C2	22/20/35 V	ETQ 5	ROE
0988.308	C3	1000/50/10/40 V	B41010-C7108T	SIEMENS
1116.274	C4	100/50/10/25 V	B41283-B51 07T	SIEMENS
1067.923	C5	220-25	GPF DIN 41316-G	SIEMENS
1423.037	C6	0,1/20/63 V	MKS 2	WIMA
1423.037	C7	0,1/20/63 V	MKS 2	WIMA
1423.037	C8	0,1/20/63 V	MKS 2	WIMA
0944.971	C9	1000pF/10/63 V	K2000 EDPU/0,6	VALVO
1423.037	C10	0,1/20/63 V	MKS 2	WIMA
1134.027	C11	1/10/25 V	ETQ 1-S	ROE
1423.037	C12	0,1/20/63 V	MKS 2	WIMA
0904.988	C13	0,01/100/20/40 V	EDPU 0,6 K10000	VALVO
1189.441	C14	22/20/35 V	ETQ 5	ROE
1423.304	C15	10/20/25 V	SAL 2222 122 56109	VALVO
1423.037	C18	01/20/63 V	MKS 2	WIMA
1390.376	C19	4,7/20/10 V	2222 122 54478	VALVO
1423.037	C22	0,1/20/63 V	MKS 2	WIMA
1423.037	C23	0,1/20/63 V	MKS 2	WIMA
1423.037	C24	0,1/20/63 V	MKS 2	WIMA
1423.037	C25	0,1/20/63 V	MKS 2	WIMA
1423.037	C26	0,1/20/63 V	MKS 2	WIMA
1423 037	C27	0,1/20/63 V	MKS 2	WIMA
1423.037	C28	0,1/20/63 V	MKS 2	WIMA
0945.005	C29	1500pF/10/63 V	K2000 EDPU 0,6	
0945.005	C30	1500pF/10/63 V	K2000 EDPU 0,6	
1189.441	C31	22/20/35 V	ETQ 5	ROE
1189.441	C32	22/20/35 V	ETQ 5	ROE
Diodes:				
0745.677	D2		1 N 4148	ITT, FAIRCHILD, SIEMENS, VALVO AEG-Telefunken
0745.677	D3		1 N 4148	ITT, FAIRCHILD, SIEMENS, VALVO AEGTelefunken
0745.677	D4		1 N 4148	ITT, FAIRCHILD, SIEMENS, VALVO AEG-Telefunken

-Audio Board II-

Parts lists No.
97 Sa 2.155.37

Ident-No.	Mark	Electr. value	Identity	Manufacturer
0745.677	D5		1 N 4148	ITT, FAIRCHILD, SIEMENS, VALVO AEG-Telefunken
0745.677	D6		1 N 4148	ITT, FAIRCHILD, SIEMENS, VALVO AEG-Telefunken
0745.677	D7		1 N 4148	ITT, FAIRCHILD, SIEMENS, VALVO AEG-Telefunken
1465.740	D8		SD 101 C	ITT
1465.740	D9		SD 101 C	ITT
0745.677	D10		1 N 4148	ITT, FAIRCHILD, SIEMENS, VALVO AEG-Telefunken

Resistors:

0745.804	R1	12 K-5-0,6-0207	DIN 44052-G
0745.804	R2	12 K-5-0,6-0207	DIN 44052-G
0745.804	R3	12 K-5-0,6-0207	DIN 44052-G
0745.804	R4	12 K-5-0,6-0207	DIN 44052-G
0799.300	R5	39 K-5-0,6-0207	DIN 44052-G
0799.300	R6	39 K-5-0,6-0207	DIN 44052-G
0767.212	R7	4,7 K-5-0,6-0207	DIN 44052-G
0554.898	R8	470-5-0,6-0207	DIN 44052-G
0554.898	R9	470-5-0,6-0207	DIN 44052-G
0744.883	R11	180-5-0,6-0207	DIN 44052-G
0542.814	R12	8,2 K-5-0,6-0207	DIN 44052-G
0837.075	R13	470 K-5-0,6-0207	DIN 44052-G
0744.808	R14	2,2 K-5-0,6-0207	DIN 44052-G
0744.875	R15	82 K-5-0,6-0207	DIN 44052-G
0767.190	R16	100 K-5-0,6-0207	DIN 44052-G
0767.190	R17	100 K-5-0,6-0207	DIN 44052-G
0179.701	R18	10 K-5-0,6-0207	DIN 44052-G
0179.701	R19	10 K-5-0,6-0207	DIN 44052-G
0528.315	R20	10-5-0,8-0719	DIN 44052-G
0744.778	R21	33 K-5-0,6-0207	DIN 44052-G
0180.726	R22	4,7-5-0,8-0414	DIN 44052-G
0751.294	R23	100-5-0,8-0414	DIN 44052-G
0542.857	R24	560-5-0,6-0207	DIN 44052-G
0179.698	R35	1 K-5-0,6-0207	DIN 44052-G
0179.698	R36	1 K-5-0,6-0207	DIN 44052-G
0179.698	R37	1 K-5-0,6-0207	DIN 44052-G

Parts lists No.
97 Sa 2.155.37

-Audio Board II-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
0179.698	R38	1 K-5-0,6-0207	DIN 44052-G	
0767.212	R39	4,7 K-5-0,6-0207	DIN 44052-G	
0767.212	R40	4,7 K-5-0,6-0207	DIN 44052-G	
0767.212	R41	4,7 K-5-0,6-0207	DIN 44052-G	
0767.212	R42	4,7 K-5-0,6-0207	DIN 44052-G	
0767.212	R43	4,7 K-5-0,6-0207	DIN 44052-G	
0767.212	R44	4,7 K-5-0,6-0207	DIN 44052-G	
0767.212	R45	4,7 K-5-0,6-0207	DIN 44052-G	
0767.212	R46	4,7 K-5-0,6-0207	DIN 44052-G	
0554.898	R47	470-5-0,6-0207	DIN 44052-G	
1465.430	R48	6,98 K-1-50-0207	DIN 44061-G	
1405.365	R49	4,32 K-1-50-0207	DIN 44061-G	
0744.808	R50	2,2 K-5-0,6-0207	DIN 44052-G	
1501.135	R51	5,62 K-1-50-0,6-0207	DIN 44061-G	
1414.917	R52	191 K-1-50-0207	DIN 44061-G	
0745.782	R53	1,8 K-5-0,6-0207	DIN 44052-G	
0767.204	R54	22 K-5-0,6-0207	DIN 44052-G	
1501.135	R55	5,62 K-1-50-0,6-0207	DIN 44061-G	
1414.917	R56	191 K-1-50-0207	DIN 44061-G	
0179.701	R57	10 K-5-0,6-0207	DIN 44052-G	
0745.820	R58	2,7 K-5-0,6-0207	DIN 44052-G	
0744.859	R59	330-5-0,6-0207	DIN 44052-G	
0767.190	R60	100 K-5-0,6-0207	DIN 44052-G	
0767.190	R61	100K-5-0,6-0207	DIN 44052-G	
0554.898	R62	470-5-0,6-0207	DIN 44052-G	

Integrated circuits:

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1423.312	IC A		TDA 1010	VALVO
1410.245	IC B		4066 B	
1076.051	IC C		SN 7406 N	TEXAS
1898.159	IC E			97 E 2.155.301
1398.296	IC F		74 LS 244 N	
1186.841	IC I		SN 74 LS 04 N	TEXAS
			DM 74 LS 04 N	NATIONAL
1186.841	IC J		SN 74 LS 04 N	TEXAS
			DM 74 LS 04 N	NATIONAL
1423.320	IC K		7417	
1423.320	IC L		7417	
1422.855	IC M		74 LS 373	TEXAS
1422.855	IC N		74 LS 373	TEXAS
1422.855	IC O		74 LS 373	TEXAS
1422.855	IC P		74 LS 373	TEXAS
1422.715	IC Q		MC 3358 P 1	MOTOROLA

Parts lists No.
97 Sa 2.155.37

-Audio Board II-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Transistors:				
1291.033	T1		BC 549 B	ROE, INTERMET,Valvo
1291.033	T2		BC 549 B	ROE, INTERMET,Valvo
1291	T3		BC 549 B	ROE, INTERMET,Valvo
Supplements:				
1076.280	REL A	RH 12 V		NATIONAL
1076.280	REL B	RH 12 V		NATIONAL
1977.261	S1	4-quad	2442212700173	VALVO
1977.261	S2	4-quad	2442212700173	VALVO
1572.938	SIL1		NW SIL 008 562J	ROE
0681.296	ST A		DIN 41617	
0681.296	ST B		DIN 41617	
1423.290	ST C	16-pins	3408-1002	3M

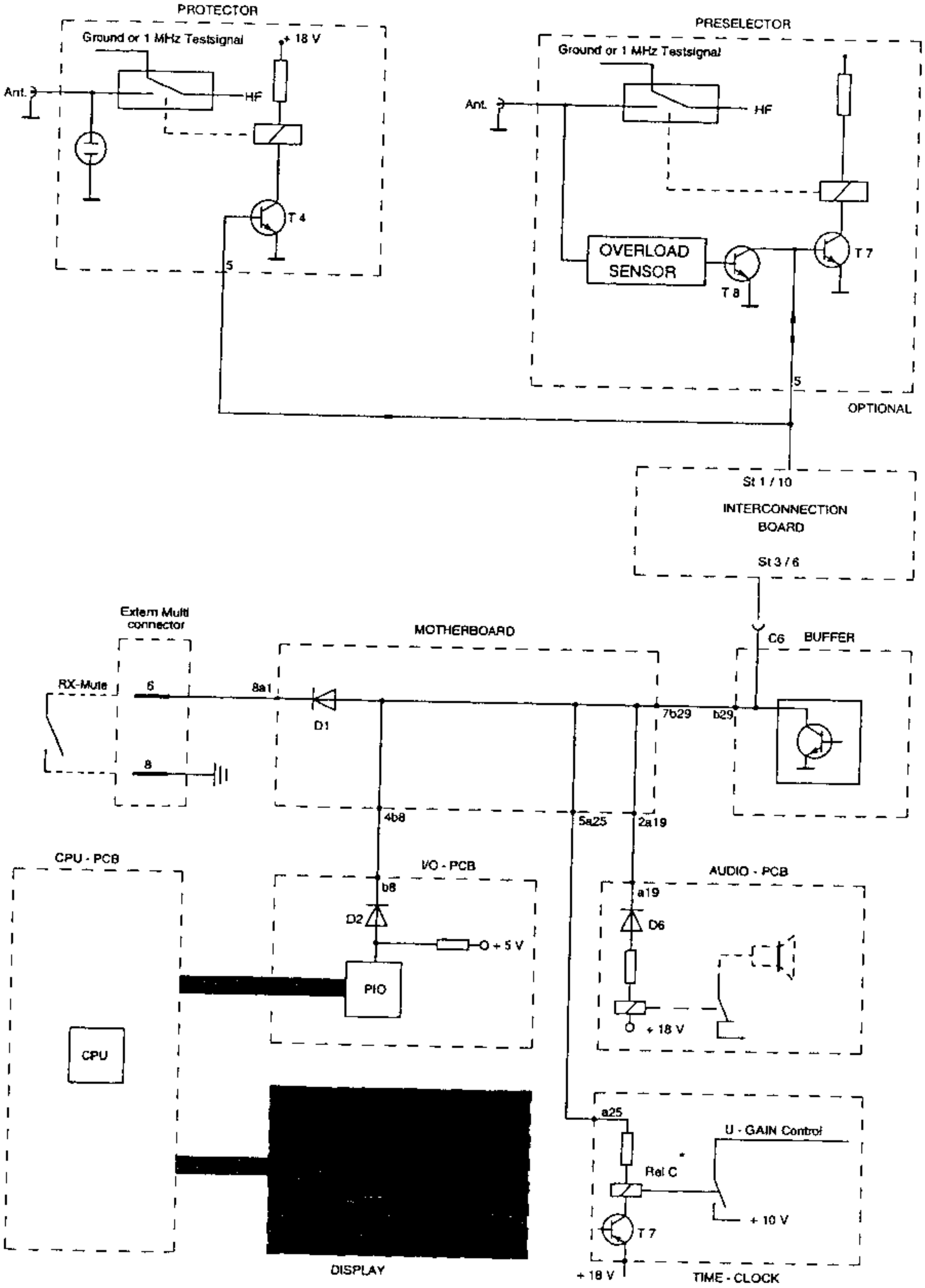
-Display-

Technical description

The display module comprises not only the LED displays themselves but also the associated driver and memory chips. The display and memory chips can process and display the figures 0 - 9, the - symbol and the wording **H E L P**. The indication **H E L P** is required for the BITE test sequence. The last place in the frequency display (10 Hz) has separate driver and memory chips (IC - R and IC - S). This makes is possible to display special characters. For instance, if the code 70 "FLYWHEEL LOCKED" is entered, the display shows "**L O c**" with the **c** in the 10 Hz positon (**L o c** stands for "locked"). In addition to the seven-segment display, a number of individual LEDs are also driven, e. g., for RF level, AF level, bandwitdth, mode etc. The RF level display (D 1 to D 12) is controlled directly by the microprocessor via memory circuit IC - V and IC - W. IC - Y controls the AF level display in accordance with the AF LEVEL (from the AUDIO LEVEL RECTIFIER on the AUDIO BOARD), etc. LED D 55 is present for special purposes (between CHANNEL and FREQUENCY display) and can be driven externally (see EXTERNAL CONNECTOR).

The brightness of all LED displays is controlled by reducing the +5 V supply with transistor T 1, the BRIGHTNESS control is mounted on the front panel.

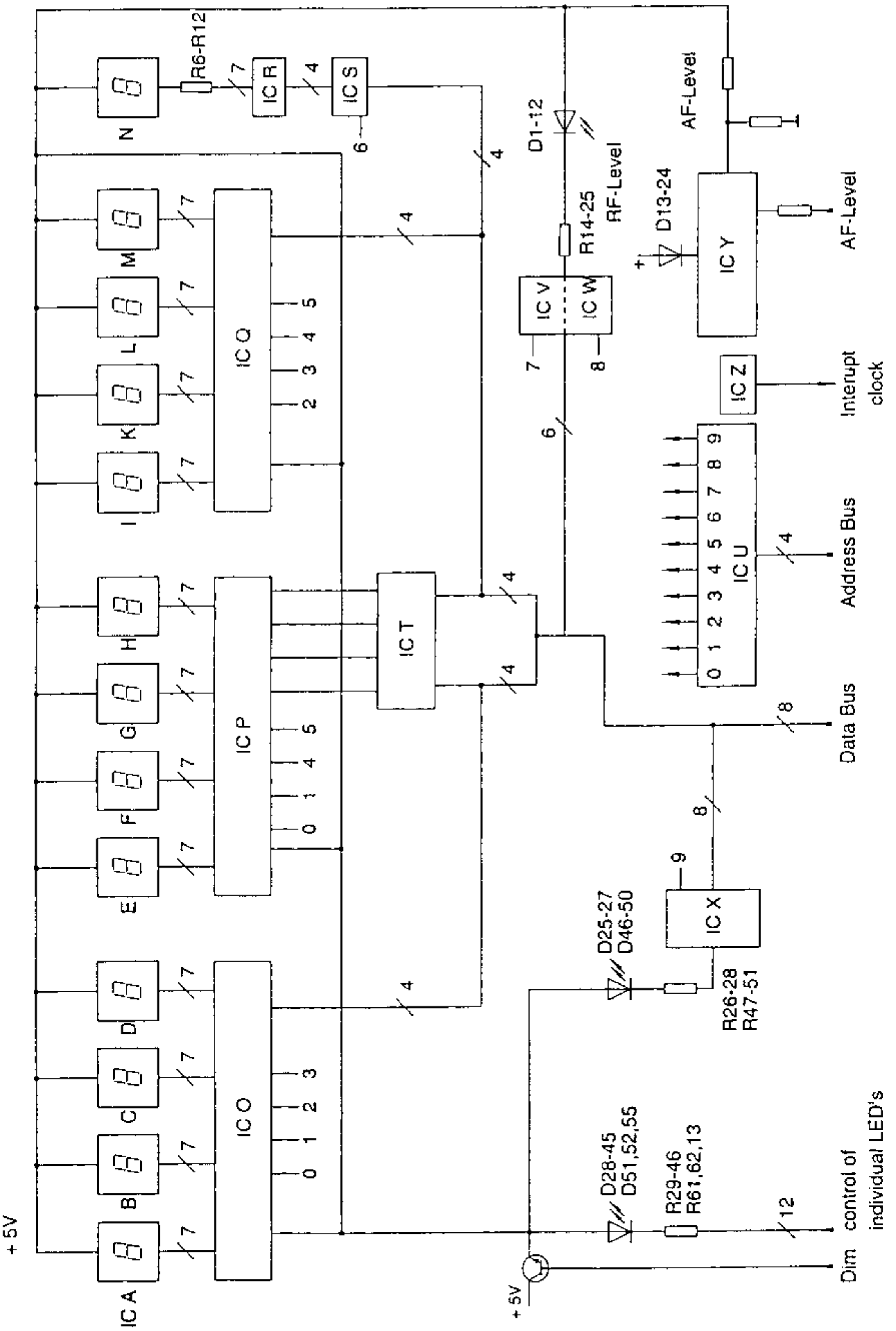
-Display-



* REL C is disengaged during BITE TEST

Mute Interconnection

-Display-



Blockdiagram Display

-Display-

Test and alignment instructions

Required: Circuit diagram DISPLAY - Hagenuk Drawing No. 97 Sa B 2.155.25
DVM, service adapter.

Test configuration: The display module is removed and reconnected to the receiver via the service adapter.

Testing the display LEDs

The LEDs can be driven by entering the appropriate signal.

Test values:

Functional test: The relevant diode should illuminate when a 0 V signal is applied to the relevant pin of plug ST A or plug ST B.

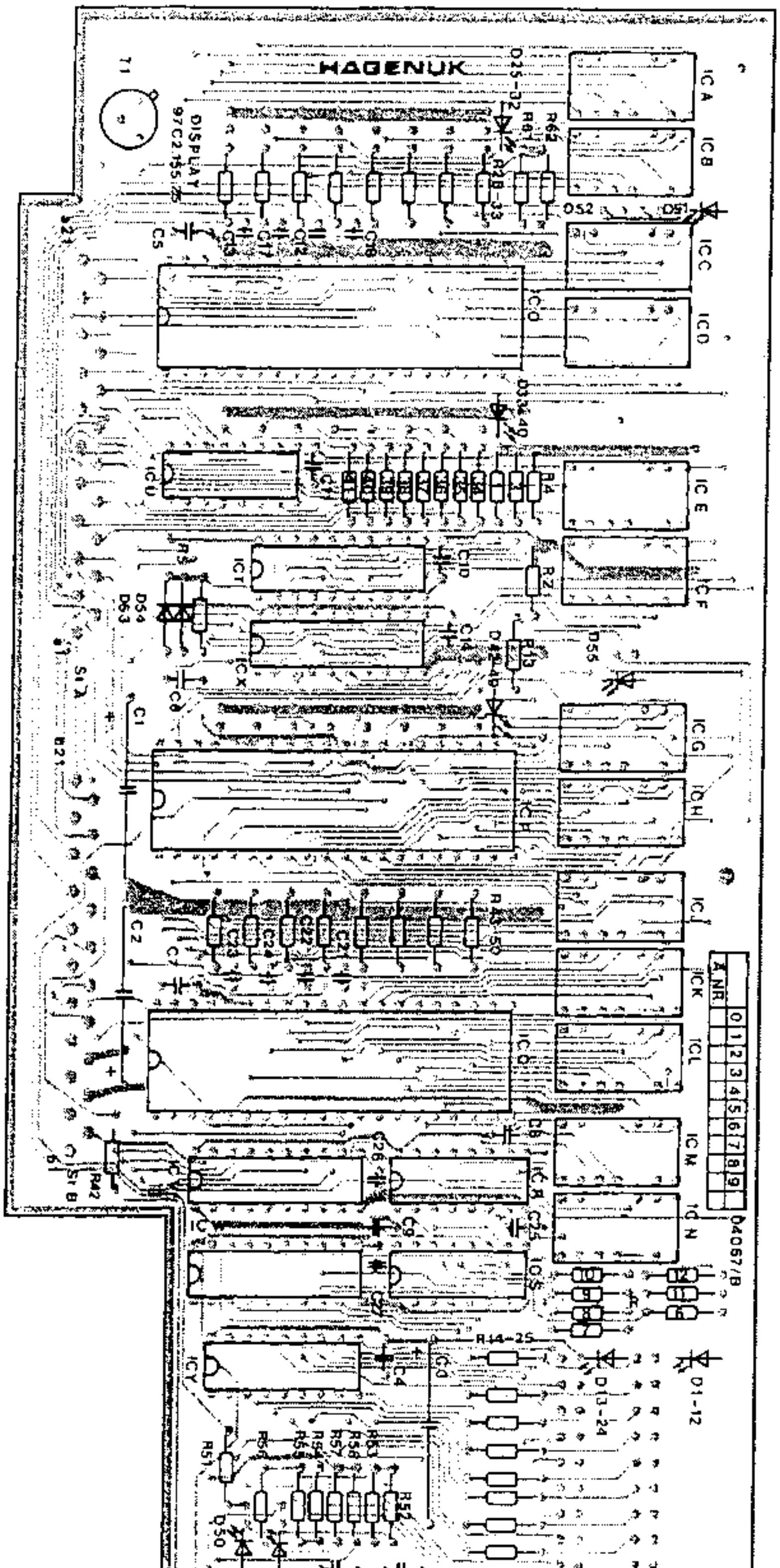
Testing the seven-segment displays

The 7-segment displays are controlled via the DATA BUS.

Test values:

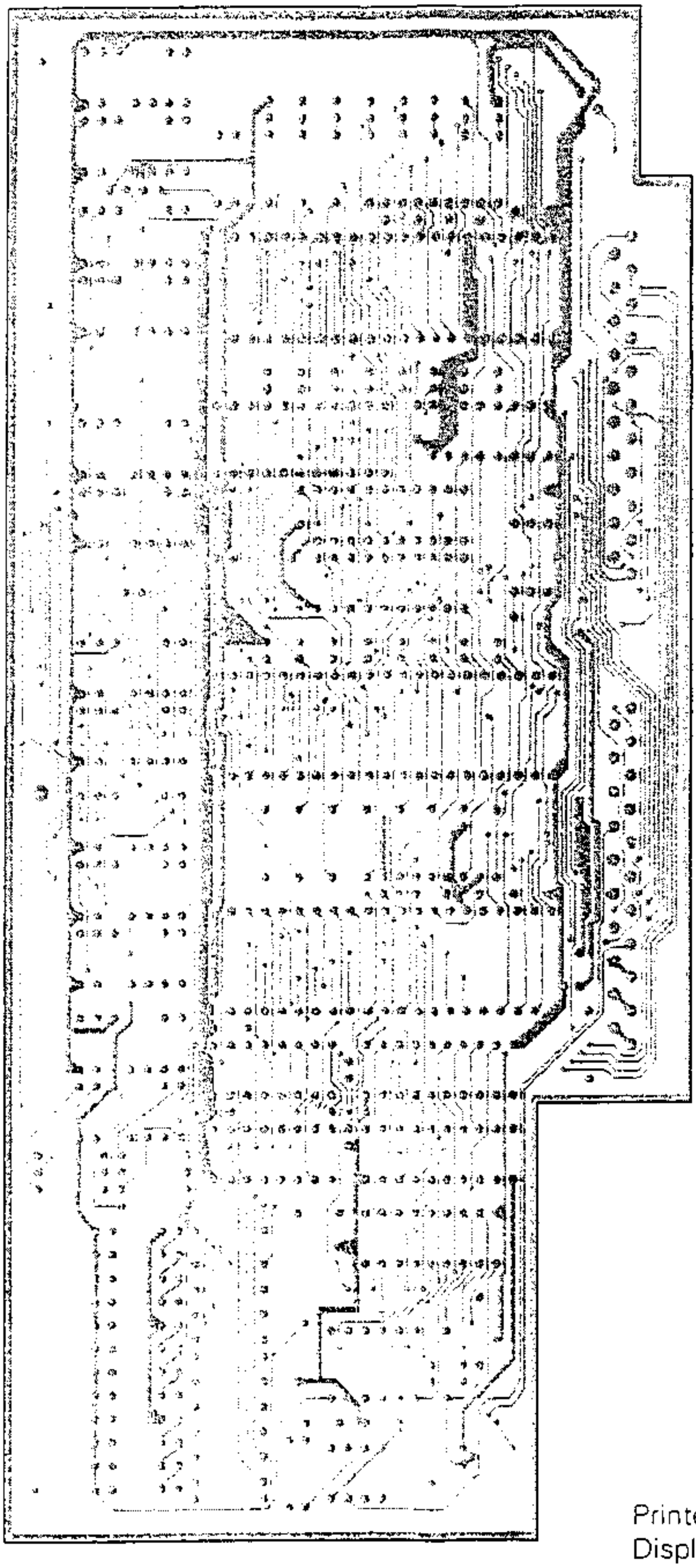
Functional test: DATA BUS D0 and D3 controls displays IC - G to N (test by entering various frequencies). DATA BUS D4 to D7 controls displays IC - A to F (test by entering, for instance, clock time or channel number).

see ci

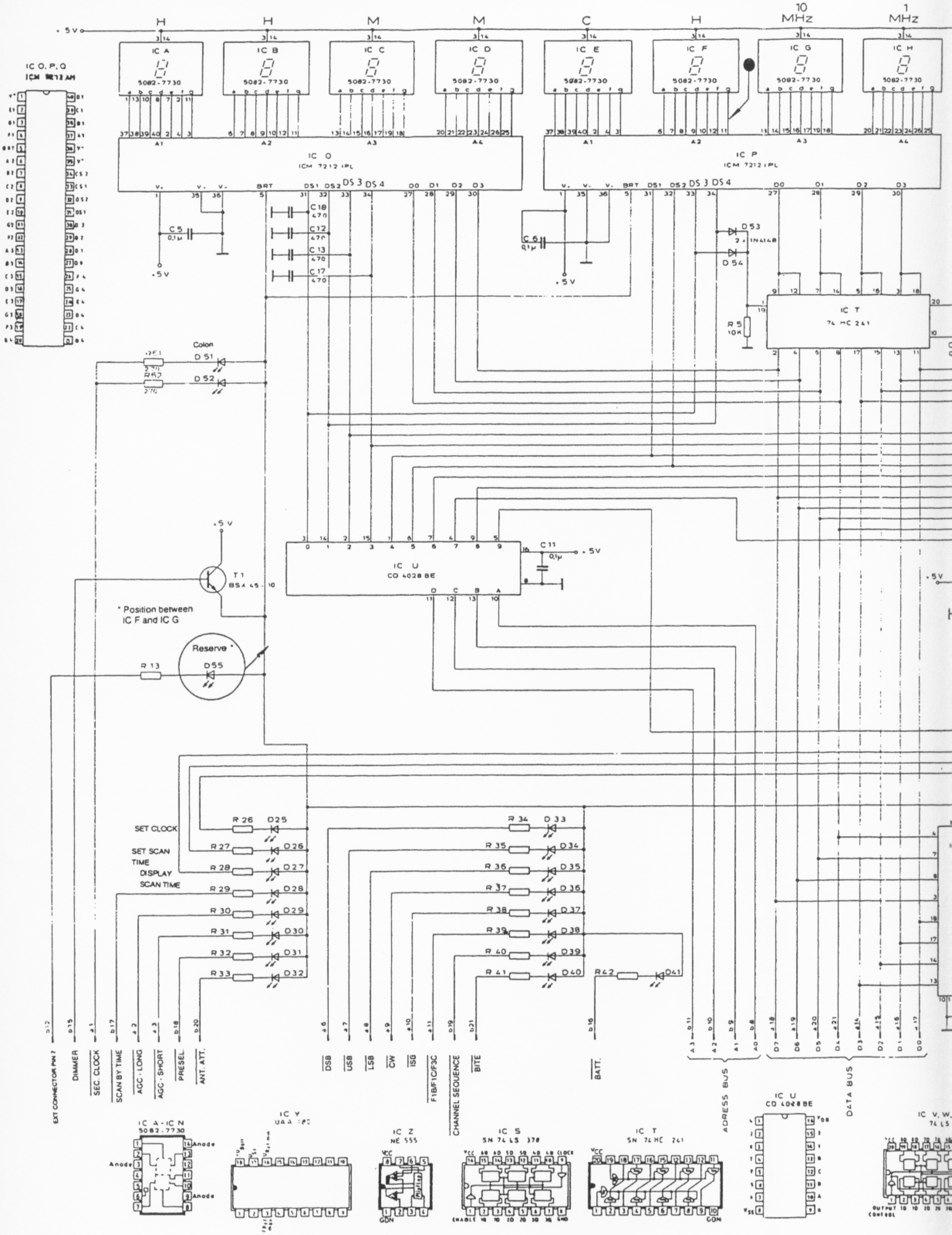


ROD 016-08.92

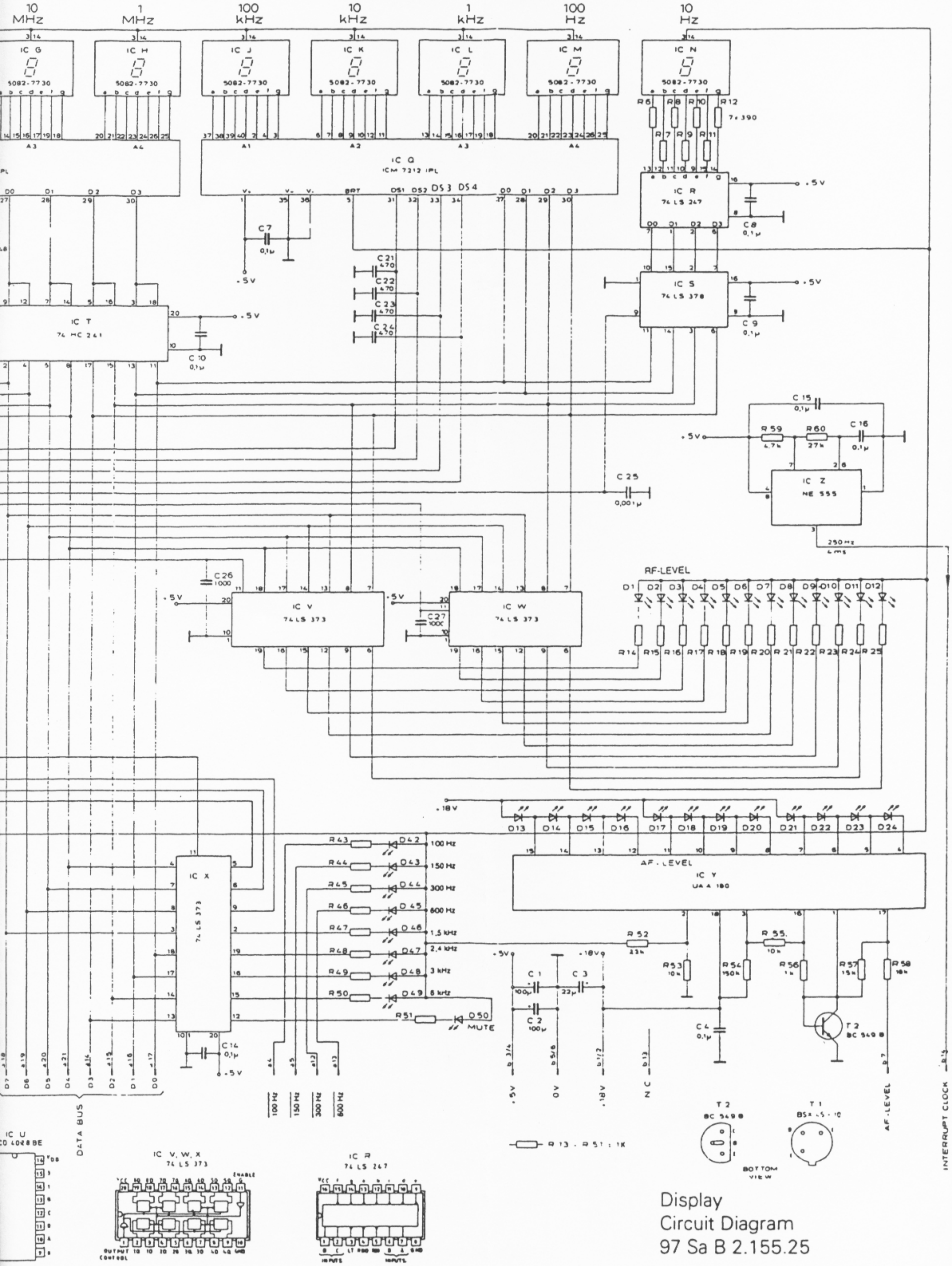
see circuit diagram - DISPLAY 97 Sa B 2.155.25



Printed Circuit Board
Display
97 C 2.155.25



HAG/ROD 016-08 92



Display
Circuit Diagram
97 Sa B 2.155.25

Parts lists No.
97 Sa 2.155.25

-Display-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Capacitors:				
1423.010	C1	100 µF/10 V	EB	ROE
1423.010	C2	100 µF/10 V	EB	ROE
1423.029	C3	22 µF/25 V	EB	ROE
1423.037	C4	0,1 µF/63 V	MKS 2	WIMA
1423.037	C5	0,1 µF/63 V	MKS 2	WIMA
1423.037	C6	0,1 µF/63 V	MKS 2	WIMA
1423.037	C7	0,1 µF/63 V	MKS 2	WIMA
1423.037	C8	0,1 µF/63 V	MKS 2	WIMA
1423.037	C9	0,1 µF/63 V	MKS 2	WIMA
1423.037	C10	0,1 µF/63 V	MKS 2	WIMA
1423.037	C11	0,1 µF/63 V	MKS 2	WIMA
1061.070	C12	470 pF/10/63 V	EDPU/0,6 K2000	VALVO
1061.070	C13	470 pF/10/63 V	EDPU/0,6 K2000	VALVO
1423.037	C14	0,1 µF/63 V	MKS 2	WIMA
1423.037	C15	0,1 µF/63 V	MKS 2	WIMA
1307.053	C16	0,1 µF/50 V	CK 05 BX 104 K	SEC
1061.070	C17	470 pF/10/63 V	EDPU/0,6 K2000	VALVO
1061.070	C18	470 pF/10/63 V	EDPU/0,6 K2000	VALVO
1061.070	C21	470 pF/10/63 V	EDPU/0,6 K2000	VALVO
1061.070	C22	470 pF/10/63 V	EDPU/0,6 K2000	VALVO
1061.070	C23	470 pF/10/63 V	EDPU/0,6 K2000	VALVO
1061.070	C24	470 pF/10/63 V	EDPU/0,6 K2000	VALVO
0944.971	C25	1000 pF/10/63 V	EDPU/0,6 K2000	VALVO
0944.971	C26	1000 pF/10/63 V	EDPU/0,6 K2000	VALVO
0944.971	C27	1000 pF/10/63 V	EDPU/0,6 K2000	VALVO
Diodes:				
1649.981	D1		SLP 181 B 50	SANYO
1649.981	D2		SLP 181 B 50	SANYO
1649.981	D3		SLP 181 B 50	SANYO
1649.981	D4		SLP 181 B 50	SANYO
1649.981	D5		SLP 181 B 50	SANYO
1649.981	D6		SLP 181 B 50	SANYO
1649.981	D7		SLP 181 B 50	SANYO
1649.981	D8		SLP 181 B 50	SANYO
1649.981	D9		SLP 181 B 50	SANYO
1649.981	D10		SLP 181 B 50	SANYO
1649.981	D11		SLP 181 B 50	SANYO
1649.981	D12		SLP 181 B 50	SANYO
1649.981	D13		SLP 181 B 50	SANYO

-Display-

Parts lists No.
97 Sa 2.155.25

Ident-No.	Mark	Electr. value	Identity	Manufacturer
1649.981	D14		SLP 181 B 50	SANYO
1649.981	D15		SLP 181 B 50	SANYO
1649.981	D16		SLP 181 B 50	SANYO
1649.981	D17		SLP 181 B 50	SANYO
1649.981	D18		SLP 181 B 50	SANYO
1649.981	D19		SLP 181 B 50	SANYO
1649.981	D20		SLP 181 B 50	SANYO
1649.981	D21		SLP 181 B 50	SANYO
1649.981	D22		SLP 181 B 50	SANYO
1649.981	D23		SLP 181 B 50	SANYO
1649.981	D24		SLP 181 B 50	SANYO
1649.981	D25		SLP 181 B 50	SANYO
1649.981	D26		SLP 181 B 50	SANYO
1649.981	D27		SLP 181 B 50	SANYO
1649.981	D28		SLP 181 B 50	SANYO
1649.981	D29		SLP 181 B 50	SANYO
1649.981	D30		SLP 181 B 50	SANYO
1649.981	D31		SLP 181 B 50	SANYO
1649.981	D32		SLP 181 B 50	SANYO
1649.981	D33		SLP 181 B 50	SANYO
1649.981	D34		SLP 181 B 50	SANYO
1649.981	D35		SLP 181 B 50	SANYO
1649.981	D36		SLP 181 B 50	SANYO
1649.981	D37		SLP 181 B 50	SANYO
1649.981	D38		SLP 181 B 50	SANYO
1649.981	D39		SLP 181 B 50	SANYO
1649.981	D40		SLP 181 B 50	SANYO
1649.981	D41		SLP 181 B 50	SANYO
1649.981	D42		SLP 181 B 50	SANYO
1649.981	D43		SLP 181 B 50	SANYO
1649.981	D44		SLP 181 B 50	SANYO
1649.981	D45		SLP 181 B 50	SANYO
1649.981	D46		SLP 181 B 50	SANYO
1649.981	D47		SLP 181 B 50	SANYO
1649.981	D48		SLP 181 B 50	SANYO
1649.981	D49		SLP 181 B 50	SANYO
1649.981	D50		SLP 181 B 50	SANYO
1649.981	D51		SLP 181 B 50	SANYO
1649.981	D52		SLP 181 B 50	SANYO
0745.677	D53		1 N 4148	ITT
0745.677	D54		1 N 4148	ITT
1649.981	D55		SLP 181 B 50	SANYO

Parts lists No.
97 Sa 2.155.25

-Display-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Integrated circuits:				
1026.232	IC A		5082-7730	HP
1026.232	IC B		5082-7730	HP
1026.232	IC C		5082-7730	HP
1026.232	IC D		5082-7730	HP
1026.232	IC E		5082-7730	HP
1026.232	IC F		5082-7730	HP
1026.232	IC G		5082-7730	HP
1026.232	IC H		5082-7730	HP
1026.232	IC J		5082-7730	HP
1026.232	IC K		5082-7730	HP
1026.232	IC L		5082-7730	HP
1026.232	IC M		5082-7730	HP
1026.232	IC N		5082-7730	HP
1422.812	IC O		ICM 7212 AIPL	INTERSIL
1422.812	IC P		ICM 7212 AIPL	INTERSIL
1422.812	IC Q		ICM 7212 AIPL	INTERSIL
1422.820	IC R		74 LS 247	TI
1422.839	IC S		74 LS 378	TI
1770.594	IC T		74 HC 241	TI
1648.373	IC U		CD 4028 BE	RCA
1422.855	IC V		74 LS 373	TI
1422.855	IC W		74 LS 373	TI
1422.855	IC X		74 LS 373	TI
1422.863	IC Y		UAA 180	SIEMENS
1158.937	IC Z		NE 555 V	SIGNETICS
Resistors:				
0179.701	R5	10 k 5 % 1/8 W	DIN 44052	
0744.751	R6	390 5 % 1/8 W	DIN 44052	
0744.751	R7	390 5 % 1/8 W	DIN 44052	
0744.751	R8	390 5 % 1/8 W	DIN 44052	
0744.751	R9	390 5 % 1/8 W	DIN 44052	
0744.751	R10	390 5 % 1/8 W	DIN 44052	
0744.751	R11	390 5 % 1/8 W	DIN 44052	
0744.751	R12	390 5 % 1/8 W	DIN 44052	
0179.698	R13	1 K 5 % 1/8 W	DIN 44052	
0179.698	R14	1 K 5 % 1/8 W	DIN 44052	
0179.698	R15	1 K 5 % 1/8 W	DIN 44052	
0179.698	R16	1 K 5 % 1/8 W	DIN 44052	
0179.688	R17	1 K 5 % 1/8 W	DIN 44052	

-Display-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
0179.698	R18	1 K 5 % 1/8 W	DIN 44052	
0179.698	R19	1 K 5 % 1/8 W	DIN 44052	
0179.698	R20	1 K 5 % 1/8 W	DIN 44052	
0179.698	R21	1 K 5 % 1/8 W	DIN 44052	
0179.698	R22	1 K 5 % 1/8 W	DIN 44052	
0179.698	R23	1 K 5 % 1/8 W	DIN 44052	
0179.698	R24	1 K 5 % 1/8 W	DIN 44052	
0179.698	R25	1 K 5 % 1/8 W	DIN 44052	
0179.698	R26	1 K 5 % 1/8 W	DIN 44052	
0179.698	R27	1 K 5 % 1/8 W	DIN 44052	
0179.698	R28	1 K 5 % 1/8 W	DIN 44052	
0179.698	R29	1 K 5 % 1/8 W	DIN 44052	
0179.698	R30	1 K 5 % 1/8 W	DIN 44052	
0179.698	R31	1 K 5 % 1/8 W	DIN 44052	
0179.698	R32	1 K 5 % 1/8 W	DIN 44052	
0179.698	R33	1 K 5 % 1/8 W	DIN 44052	
0179.698	R34	1 K 5 % 1/8 W	DIN 44052	
0179.698	R35	1 K 5 % 1/8 W	DIN 44052	
0179.698	R36	1 K 5 % 1/8 W	DIN 44052	
0179.698	R37	1 K 5 % 1/8 W	DIN 44052	
0179.698	R38	1 K 5 % 1/8 W	DIN 44052	
0179.698	R39	1 K 5 % 1/8 W	DIN 44052	
0179.698	R40	1 K 5 % 1/8 W	DIN 44052	
0179.698	R41	1 K 5 % 1/8 W	DIN 44052	
0179.698	R42	1 K 5 % 1/8 W	DIN 44052	
0179.698	R43	1 K 5 % 1/8 W	DIN 44052	
0179.698	R44	1 K 5 % 1/8 W	DIN 44052	
0179.698	R45	1 K 5 % 1/8 W	DIN 44052	
0179.698	R46	1 K 5 % 1/8 W	DIN 44052	
0179.698	R47	1 K 5 % 1/8 W	DIN 44052	
0179.698	R48	1 K 5 % 1/8 W	DIN 44052	
0179.698	R49	1 K 5 % 1/8 W	DIN 44052	
0179.698	R50	1 K 5 % 1/8 W	DIN 44052	
0179.698	R51	1 K 5 % 1/8 W	DIN 44052	
0744.786	R52	18 K 5 % 1/8 W	DIN 44052	
0179.701	R53	10 K 5 % 1/8 W	DIN 44052	
0830.089	R54	150 K 5 % 1/8 W	DIN 44052	
0179.701	R55	10 K 5 % 1/8 W	DIN 44052	
0179.698	R56	1 K 5 % 1/8 W	DIN 44052	
0791.733	R57	15 K 5 % 1/8 W	DIN 44052	
0744.786	R58	18 K 5 % 1/8 W	DIN 44052	
0767.212	R59	4,7 K 5 % 1/8 W	DIN 44052	
0542.830	R60	27 K 5 % 1/8 W	DIN 44052	
0179.663	R61	1K 5 % 1/8 W	DIN 44052	
0179.663	R62	1K 5 % 1/8 W	DIN 44052	

Parts lists No.
97 Sa 2.155.25

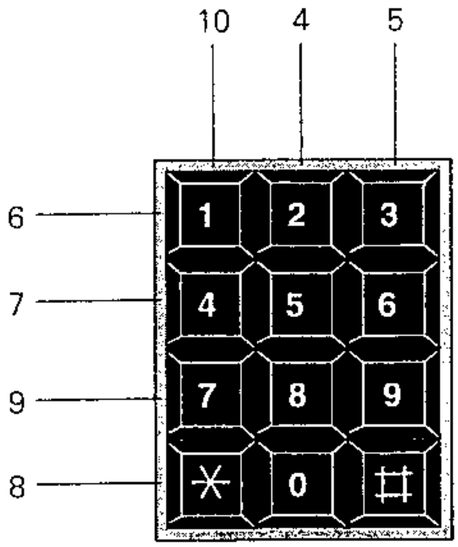
-Display-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Connectors:				
0690.678	St A	21 pins	DIN 41617	
0690.678	St B	21 pins	DIN 41617	
Transistor:				
0756.164	T1		BSX 45-10	SIEMENS
1291.033	T2		BC 549 B	

-Tuning-

Technical description
The TUNING module forms the link between the frequency knob and keyboard to the INPUT/OUTPUT module.
When the knob is turned, a bit generator generates pulses which are processed in an up/down counter IC - B. The direction of rotation is recognised by the chronological sequence of the pulses. Before counting begins, IC - B is set by the microprocessor to the initial value 8. If the microprocessor now reads a 9 in the counter, this means that the frequency knob has been turned and that the frequency should be increased by 100 Hz or 10 Hz (depending on the position of TUNING STEPS switch). If it reads a 7, this means that the frequency must be reduced. The microprocessor's program constantly scans data outputs A to D of IC - B. If the frequeney knob is turned very fast, the counter can count down to 0 or up to 16 before the overflow output CO blocks the clock input CK of the counter via IC - D. The resolution (100 Hz/10 Hz steps) is determined by the switch on the front panel, which is constantly scanned by the microprocessor.

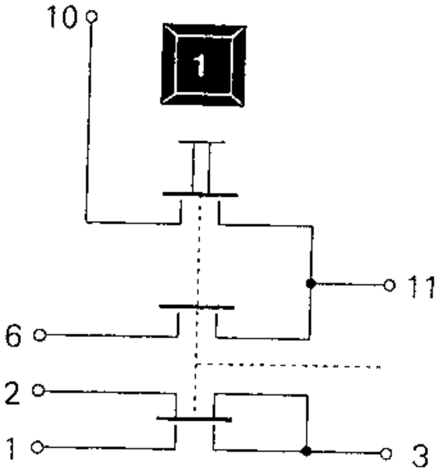
- Input via keyboard
  Seven lines are coded by pressing any key on the keyboard. The lines on pins 10,4 and 5 are assigned to the columns and lines 6, 7, 8 and 9 to the rows on the keyboard.



Division of keyboard into columns and rows

-Tuning-

EXAMPLE: press key 1
Pressing key 1 connects line 10 to line 6 and to +5 V (pin 11).



In addition to the code lines, contacts 1-3 and 2-3 are activated by each key. These are debounce contacts which operate via the TIME DELAY circuit IC - F, which feeds a KEYBOARD STROBE pulse to the I/O board via output Q and the gates of IC - E and triggers an INTERRUPT in PIO 2 (IC - C on the I/O board). The microprocessor reads the data on lines (pins) 4-10 into the buffer memory of PIO 2 IC - C. When IC - C has accepted the data it returns a READY signal (handshake).

NOTE
The lines for the DIMMER and RF potentiometers are also routed via the board.

Test and alignment instructions

Required:	Circuit diagram TUNING- Hagenuk Drawing No. 97 Sa C 2.155.28 DVM, two-channel oscilloscope
Test configuration:	The module is removed and then reconnected to the receiver via the service adapter.

-Tuning-

Testing the counter output
Connect the oscilloscope (channel 1) to plug ST A pin 5.
Test values:
The counter RESET pulse is displayed.
Connect the oscilloscope (channel 2) to plug ST A pin A.
Test values:
Bit 1 of the BCD-coded counter output is displayed.
Functional test: as soon as the frequency knob is turned, a sequence of pulses appears.

NOTE
If the RESET pulse is suppressed, the counter is decreasing or increasing its content, depending on the direction of rotation, from "8" to "0" or from "8" to "16".

Testing the keyboard
Disconnect ribbon cable from keyboard.

Functional test: When an individual key on the keyboard is pressed, 0 Ohm must be measured:

- Connect ohmmeter to pins 2 and 3.
- When the keys on the keyboard are pressed, 0 Ohm must be measured in each case:

Connect ohmmeter to the following pins of plug ST b:

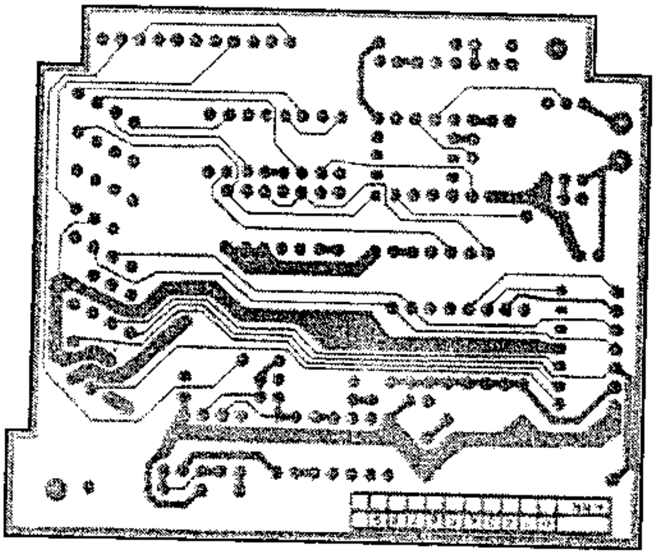
"1" pin 10/pin 6	"8" pin 4/pin 9
"4" pin 10/pin 7	"0" pin 4/pin 8
"7" pin 10/pin 9	"3" pin 5/pin 6
"*" pin 10/pin 8	"6" pin 5/pin 7
"2" pin 4/pin 6	"9" pin 5/pin 9
"5" pin 4/pin 7	"#" pin 5/pin 8

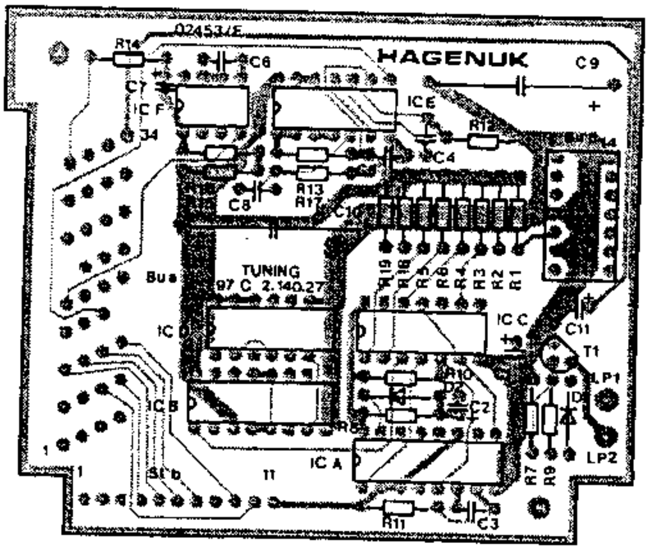
Interrupt pulse (KEYBOARD STROBE)

- Supply voltage on
- Oscilloscope channel 1 connected to plug ST A pin 15
- Oscilloscope channel 2 connected to plug ST A pin 16
- When a key is operated, channel 2 should show a negative pulse (KEYBOARD STROBE).
- Channel 2 should also show a negative pulse after a short delay (READY). (The microprocessor has accepted the data).

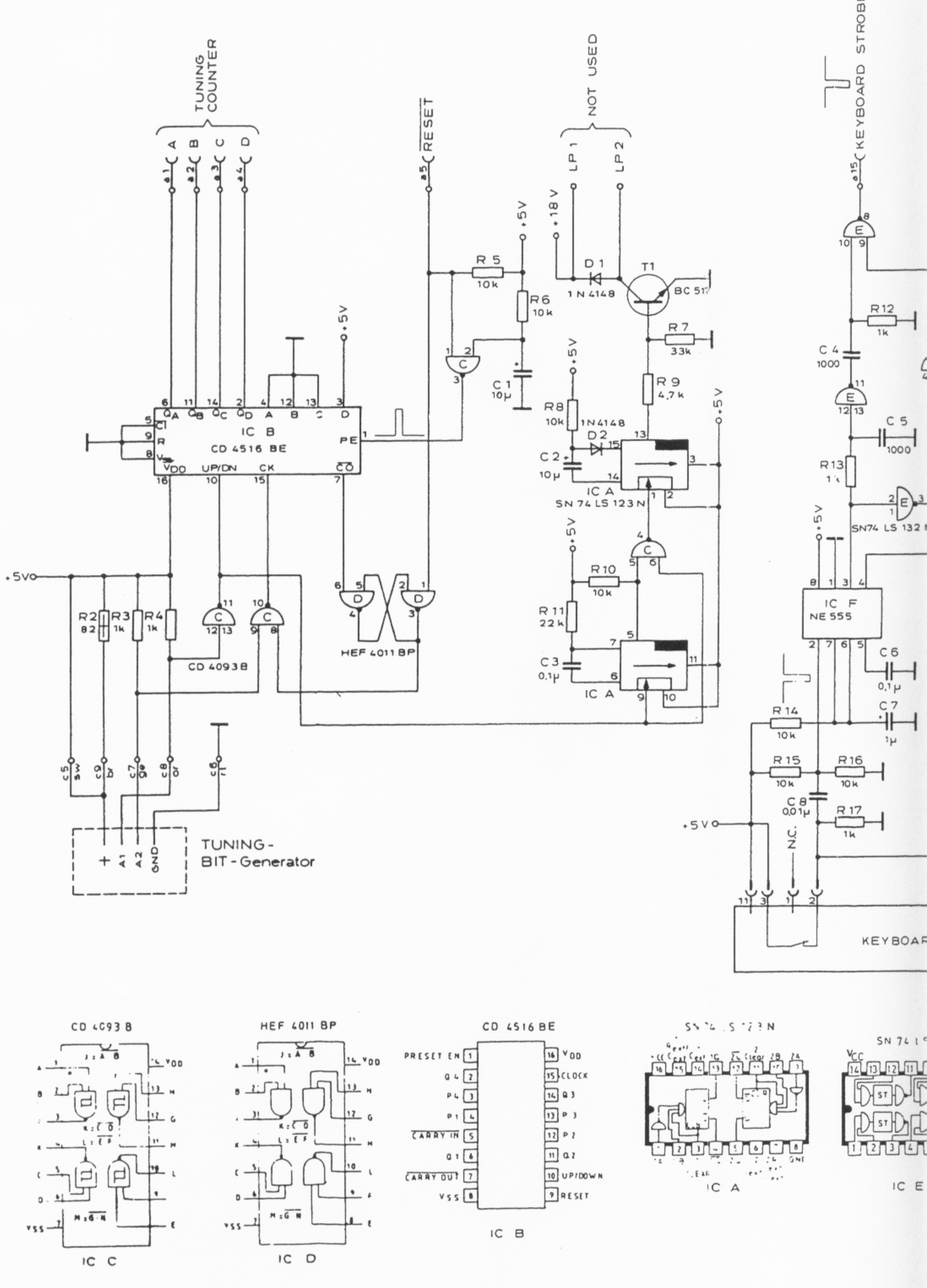
-Tuning-

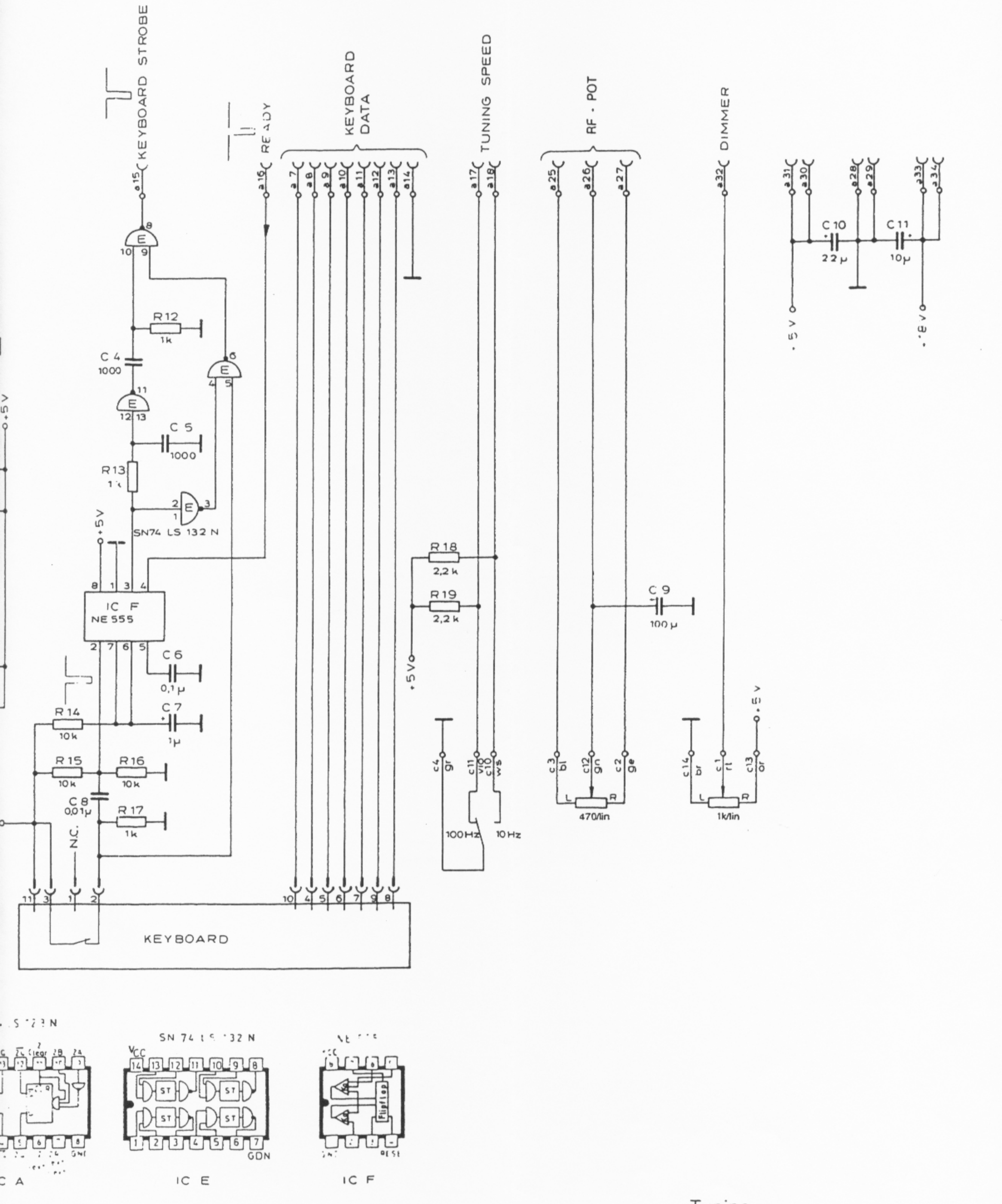
see circuit diagram - TUNING 97 Sa C 2.155.28





Tuning - 97 D 2.155.28


TUNING COUNTER
RESET
NOT USED
LP 1
LP 2
KEYBOARD STROBE
+18 V
+5V
D 1
1 N 4148
T1
BC 517
R 5
10k
R6
10k
R 7
33k
R 9
4,7 k
C 1
10µ
R8
10k
1N4148
D2
C 2
10µ
IC A
SN 74 LS 123 N
R 10
10k
R 11
22 k
C 3
0,1µ
IC B
CD 4516 BE
PE
UP/DN
CK
HEF 4011 BP
CD 4093 B
R2
82
R3
1k
R4
1k
TUNING -
BIT - Generator
R 12
1k
C 4
1000
C 5
1000
R13
SN74 LS 132
IC F
NE 555
C 6
0,1µ
R 14
10k
C 7
1µ
R 15
10k
R16
10k
C 8
0,01µ
R 17
1k
N.C.
KEYBOAR
CD 4093 B
HEF 4011 BP
CD 4516 BE
PRESET EN
Q 4
P 4
P 1
CARRY IN
Q 1
CARRY OUT
VSS
VDD
CLOCK
Q 3
P 3
P 2
Q 2
UP/DOWN
RESET
IC C
IC D
IC B
IC A
IC E



Tuning
Circuit Diagram
97 Sa B 2.155.28

Parts lists No.
97 Sa 2.155.28

-Tuning-

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Capacitors:				
1204.521	C1	10 µF/35 V	ETQ 4	ROE
1204.521	C2	10 µF/35 V	ETQ 4	ROE
1423.037	C3	0,1 µF/63 V	MKS 2	WIMA
1116.282	C4	1000 pF/200 V	CK 05 BX 102 M	SEC
1116.282	C5	1000 pF/200 V	CK 05 BX 102 M	SEC
1423.037	C6	0,1 µF/63 V	MKS 2	WIMA
1118.013	C7	1 µF/35 V	ETQ 2 1/35	ROE
1425.196	C8	0,01 µF/63 V	MKS 2	WIMA
1423.010	C9	10 µF/10 V	EB DIN 41316-G	ROE
0986.992	C10	22 µF/35 V	ETS C	ROE
1204.521	C11	10 µF/35 V	ETQ 4	ROE
Diodes:				
0745.677	D1		1 N 4148	ITT
0745.677	D2		1 N 4148	
Resistors:				
0989.290	R2	82 5 % 1/4 W	DIN 44052	
0179.698	R3	1 K 5 % 1/8 W	DIN 44052	
0179.698	R4	1 K 5 % 1/8 W	DIN 44052	
0179.701	R5	10 K 5% 1/8 W	DIN 44052	
0179.701	R6	10 K 5% 1/8 W	DIN 44052	
0627.895	R7	33 K 5 % 1/8 W	DIN 44052	
0179.701	R8	10 K 5 % 1/8 W	DIN 44052	
0767.212	R9	4,7 K 5% 1/8 W	DIN 44052	
0179.701	R10	10 K 5 % 1/8 W	DIN 44052	
0767.204	R11	22 K 5% 1/8 W	DIN 44052	
0179.698	R12	1 K 5 % 1/8 W	DIN 44052	
0179.698	R13	1 K 5% 1/8 W	DIN 44052	
0179.701	R14	10 K 5% 1/8 W	DIN 44052	
0179.701	R15	10 K 5% 1/8 W	DIN 44052	
0179.701	R16	10 K 5 % 1/8 W	DIN 44052	
0179.698	R17	1 K 5 % 1/8 W	DIN 44052	
0744.808	R18	2,2 K 5 % 1/8 W	DIN 44052	
0744.808	R19	2,2 K 5% 1/8 W	DIN 44052	

-Tuning-

Parts lists No.
97 Sa 2.155.28

Ident-No.	Mark	Electr. value	Identity	Manufacturer
Integrated circiuts:				
1285.521	IC A		SN 74 LS 123 N	TEXAS
1428.071	IC B		CD 4516 BE	RCA
1331.876	IC C		CD 4093 B	
1303.422	IC D		HEF4011 BP	VALVO
1090.933	IC E		SN 74 LS 132 N	TEXAS
1158.937	IC F		NE 555 V	SIGNETICS
Transistors:				
1067.451	T1		BC 517	
Connectors:				
1428.004	Bu A	34 pins	97 E 2.140.28	HAGENUK
1288.814	St B	11 pins	5.11.021.007.011.00	DUNKEL
	Bu C	14 pins	97 E 2.140.29	HAGENUK

-Remote Control PCBs-

For remote control the receiver RX 1001 M / RX 5001 is equipped with a serial interface (USART) on the CPU board.
To adapt the inputs and outputs of this serial interface to the outside world, a special slot is provided on the motherboard for PCBs to convert the TTL (remote control) Data from the CPU board to the level required by the connected remote control peripherals and vice versa. Audio may be routed via this PCB as well.
Conversion to RS 232, Mil 188 C, RS 422 and RS 485 will be possible.
Currently 3 different kinds of RS 232 interface PCBs are available. (Refer to following block diagrams). The difference between RS 232 C and RS 232 C II is that the latter PCB uses more modern RS 232 interface ICs, which do not have to use a separate ± 12 V power supply.
Apart from mainly dealing with data conversion, the most recent RS 232 mod PCB can also amplify and filter AF on two different channels, to cater for possible line losses (For more information about these PCBs refer to Part 5 of this Manual. Part 5 should be included if the receiver is fitted with the RS 232 option).
Two different Receiver remote control protocols are possible depending on the setting of S 2/3 on the input/output PCB.

LSV 2 Protocol (S 2/3 off)

The LSV 2 Protocol is used in conjunction with an RX 1001 F or RX 5001 RC remote control unit or with a PC with special software. One remote control can address up to 10 receivers. If demodulators TG 1001 M / TC 5001 are used in the system these can be remote controlled as well in different modes (refer to TG 1001 M / TC 5001 Manual). The LSV 2 Protocol uses protected code, using parity- and blockparity bits, and should be used for long distances or when data modems have to be used.
With the LSV 2 Protocol set the remote control continuously interrogates the selected receiver, sends its status of all the controls which can be manipulated by the operator, and receives in turn the status of the receiver display. If connected accordingly, the audio of the selected receiver is connected through to the remote control.

Computer Remote Control Protocol (S 2/3 on)

If the computer protocol is selected, up to ten receivers can be selected by a PC with appropriate software, or by a Hagenuk remote control UT 1002.

The Computer remote control protocol uses simple unprotected code (a series of ASCII characters), which may be implemented into their own remote control equipment by customers themselves if they use an RX 1001 M / RX 5001.
Single or multiple commands may be transmitted to set certain receiver parameters. The receiver does not answer with a status message.

-Remote Control PCBs-

Single or multiple question commands may be transmitted. The receiver will now answer the required question for a status message.
Possible connected demodulators TG 1001 M / TC 5001 may be remote controlled as well.

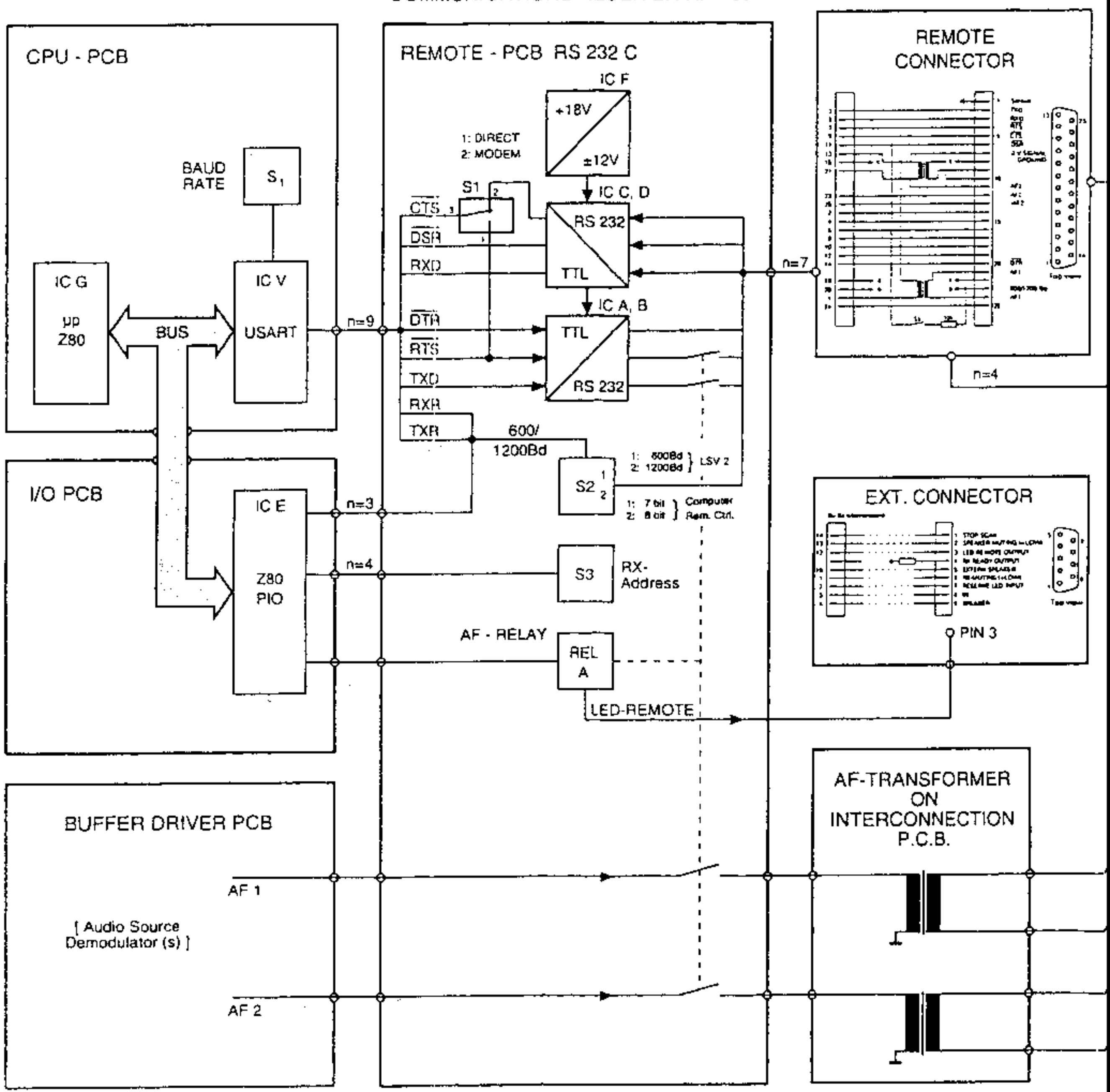
For more information about remote control unit RX 1001 F / RX 5001 RC, LSV 2 Protocol and Computer remote control protocol, refer to Part 5 of this Manual, which should be included, if the receiver is fitted with the RS 232 option.

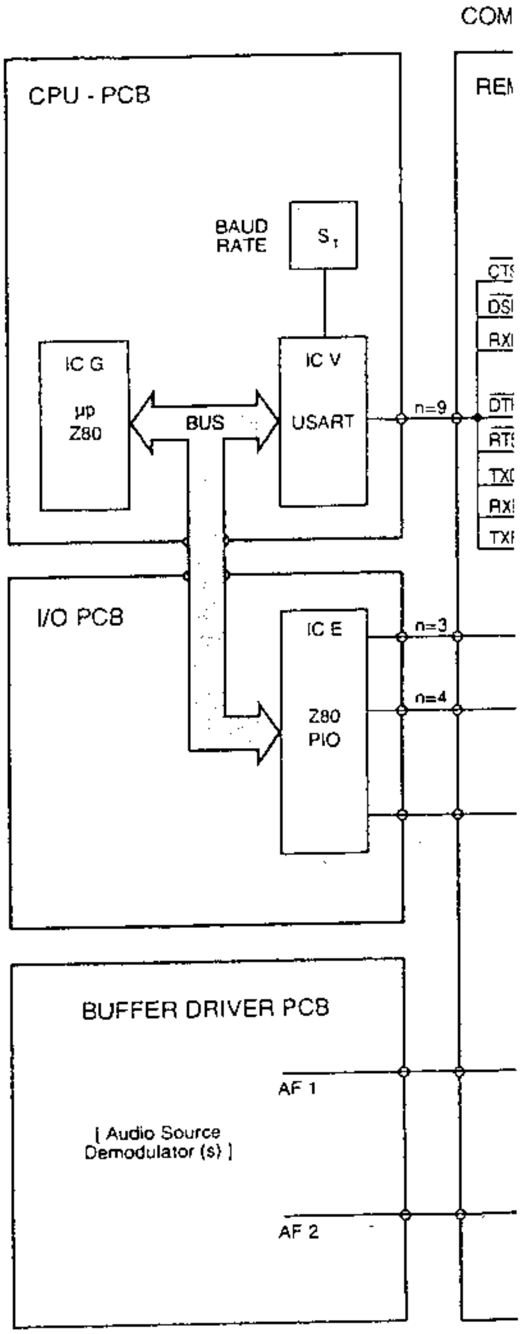
If a customer wants to implement the GO/NOGO test, as described in chapter 3.1.5, page 3-26, a RS 232-board is required.

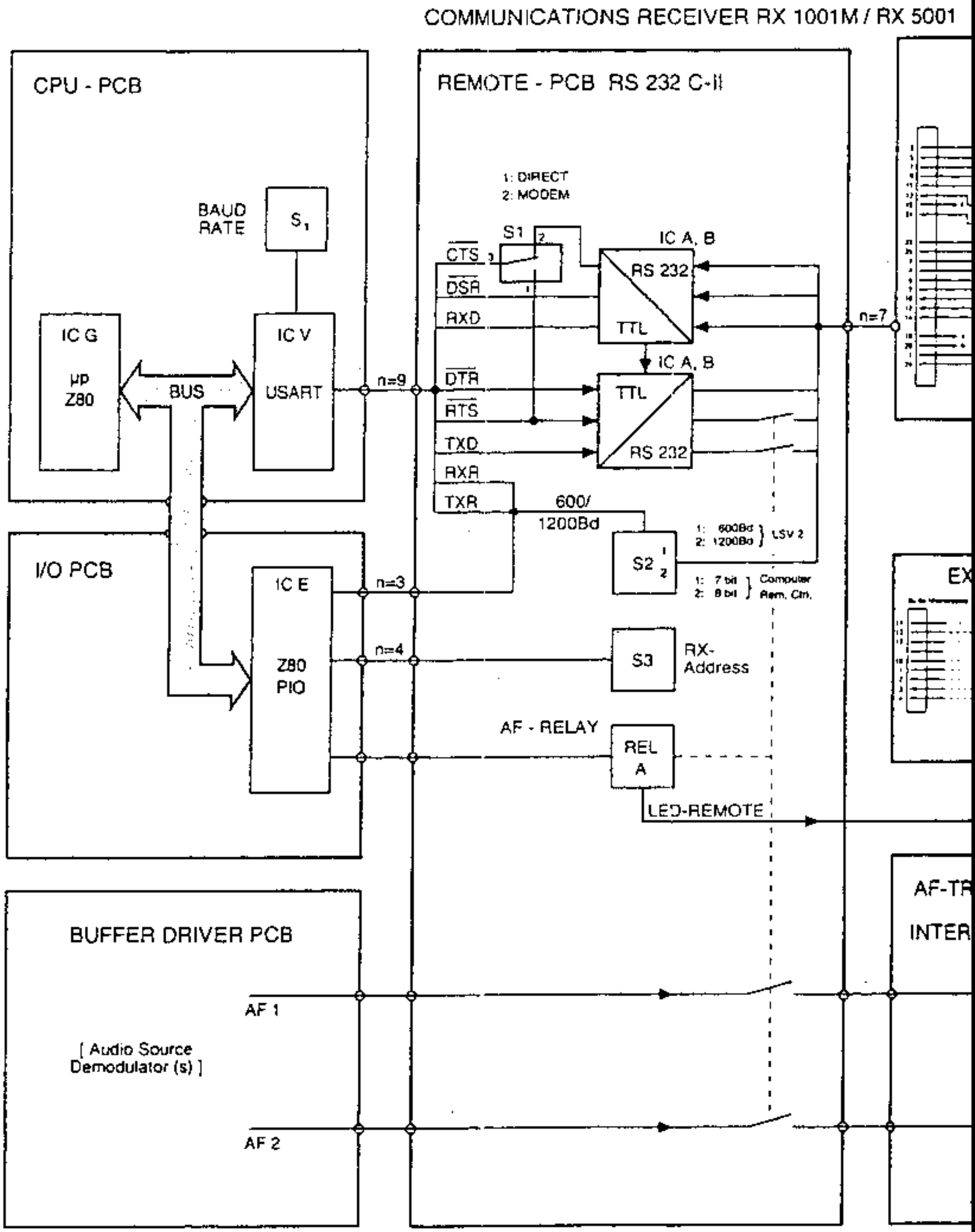
Switch settings on Remote Control PCBs when fitted in the receiver RX 1001M / RX 5001.

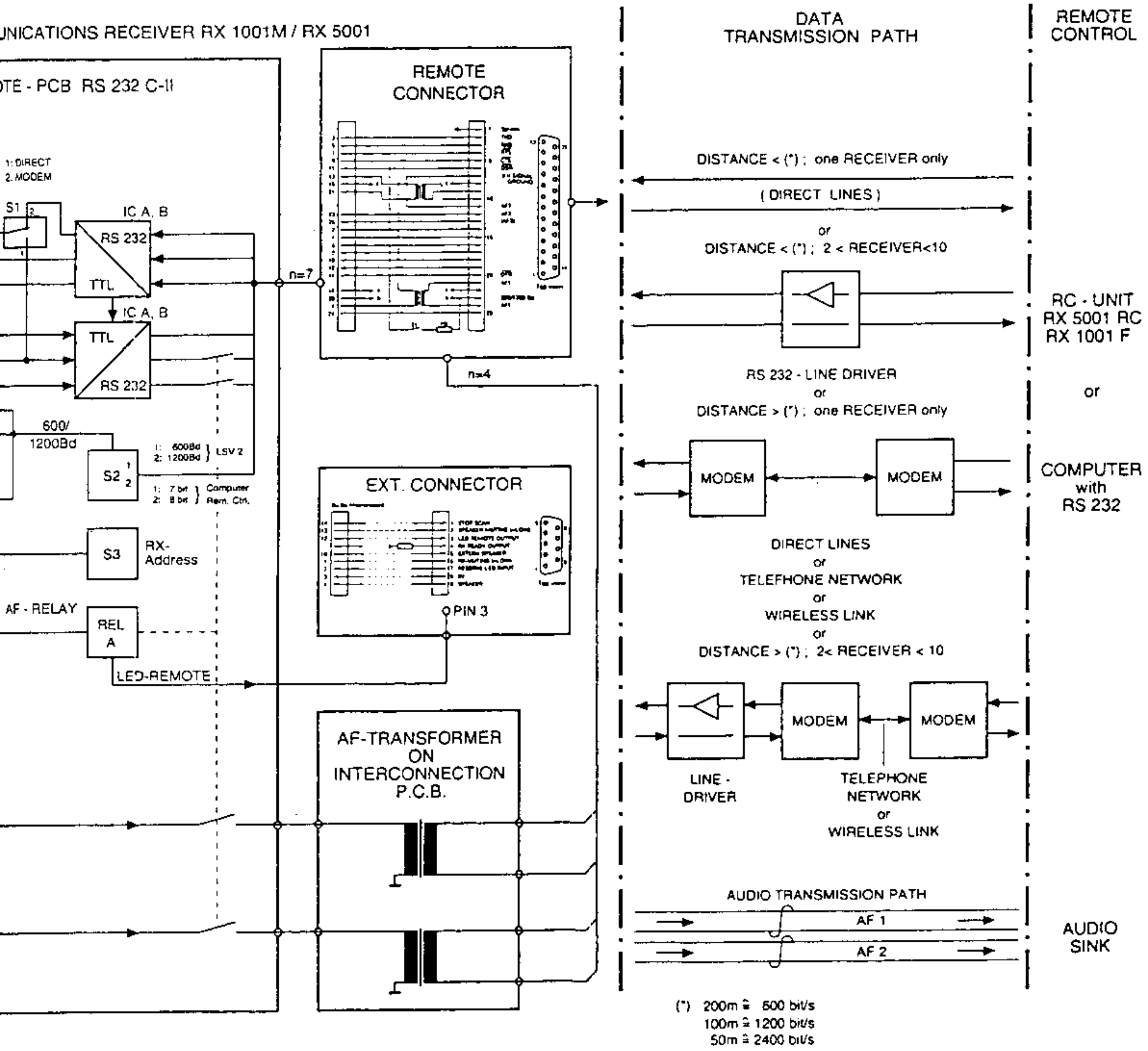
Switch S1:	RS 232 - C / V24:	With modem signals DSR, DTR, RTS and CTS are used.
	TXD / RXD only:	Without modem only signals TXD and RXD are used (jumper between RTS and CTS).
Switch S2:	(600 Bd) low baudrate (1200 Bd) high baudrate	
Switch S3:	RX address 0-9	
Switches S4-S7:	position RX (only on PCB RS 232 MOD)	

COMMUNICATIONS RECEIVER RX 1001M / RX 5001



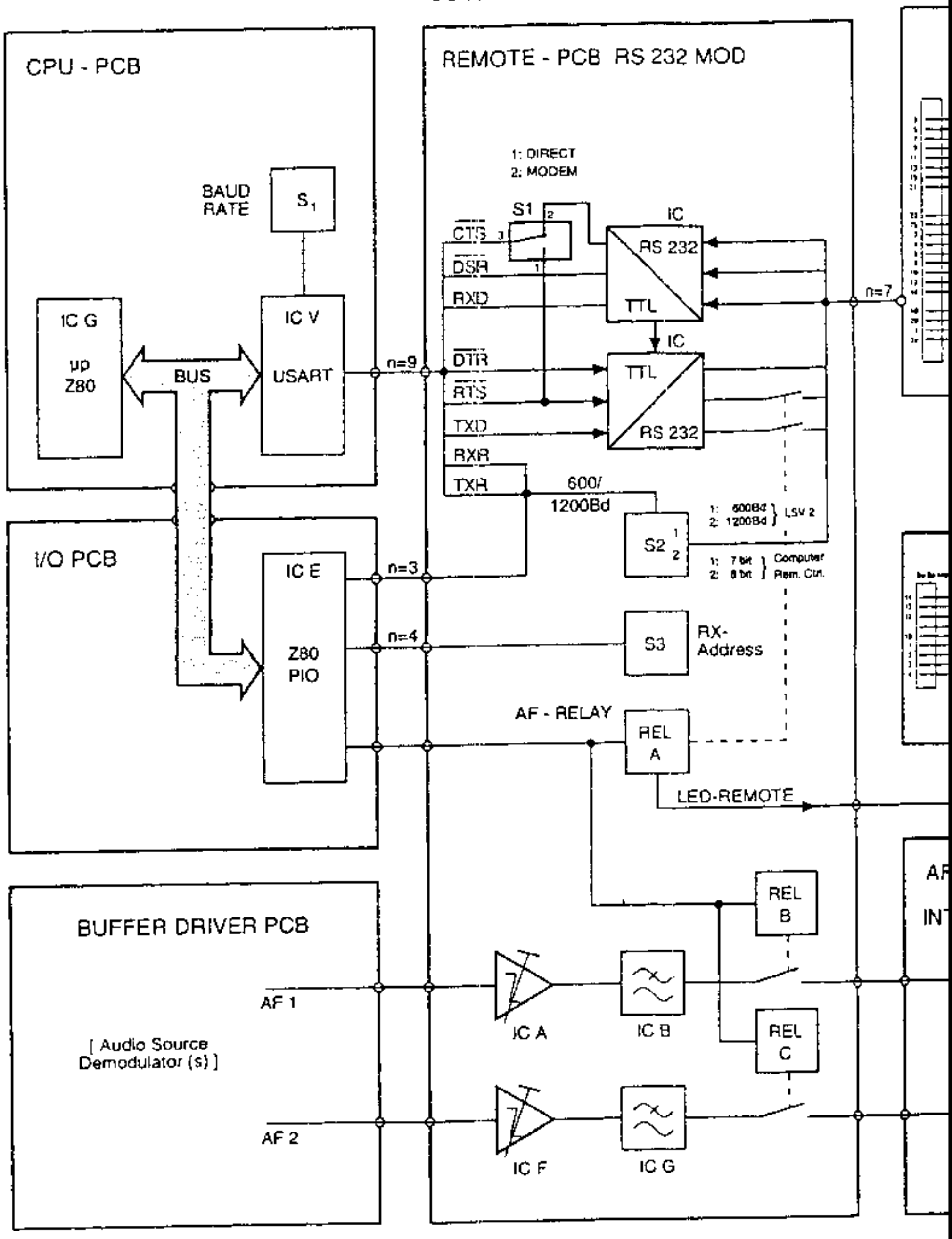

COM
CPU - PCB
REM
BAUD RATE
S_1
IC G
µp Z80
BUS
IC V
USART
n=9
I/O PCB
IC E
Z80 PIO
n=3
n=4
BUFFER DRIVER PCB
AF 1
[Audio Source Demodulator (s)]
AF 2

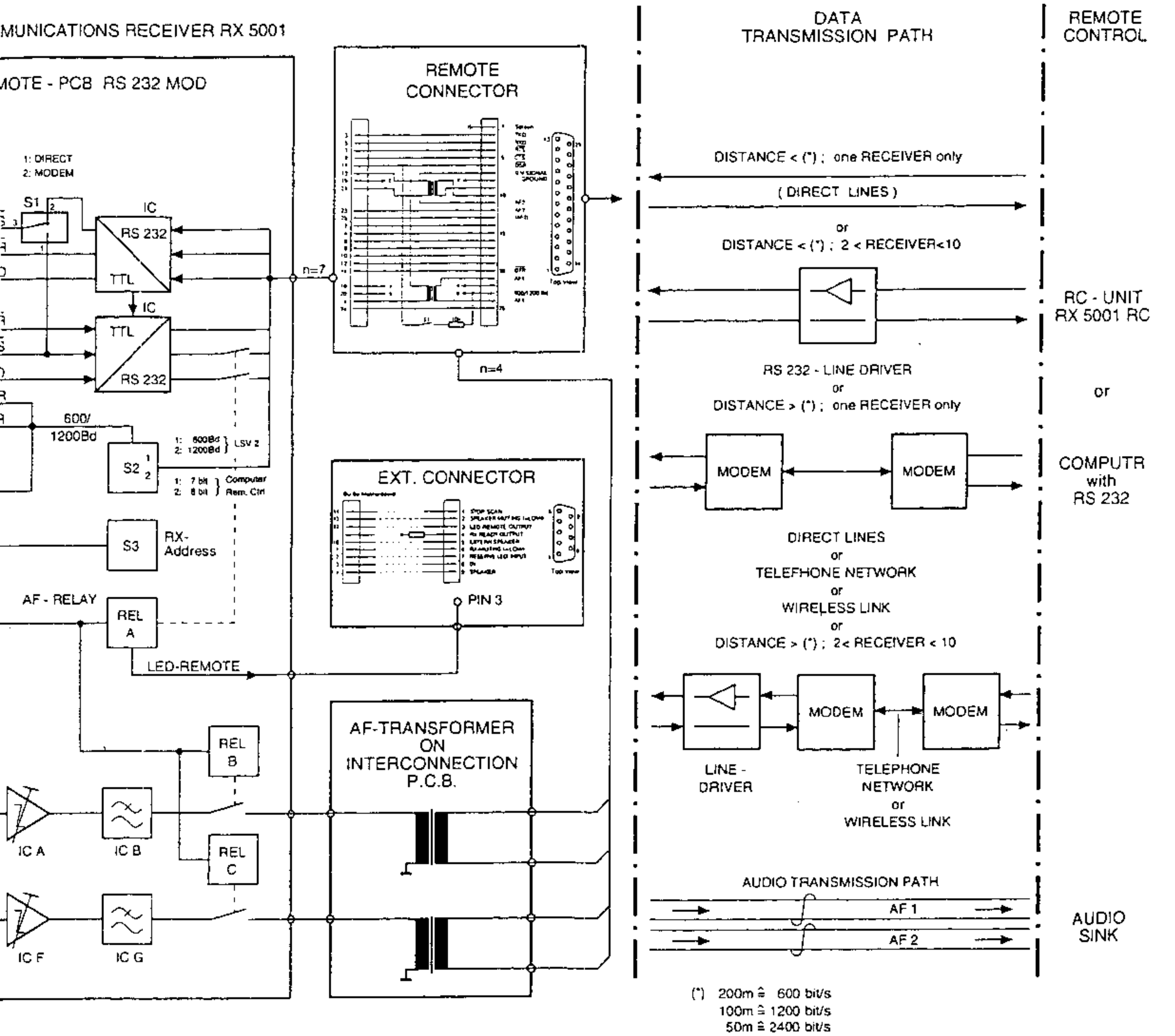

COMMUNICATIONS RECEIVER RX 1001M / RX 5001
CPU - PCB
BAUD RATE
S1
IC G
µP Z80
BUS
IC V
USART
REMOTE - PCB RS 232 C-II
1: DIRECT
2: MODEM
S1
IC A, B
CTS
DSR
RXD
RS 232
TTL
n=9
n=7
DTR
RTS
TXD
RXR
TXR
600/ 1200Bd
1: 600Bd
2: 1200Bd
LSV 2
1: 7 bit
2: 8 bit
Computer Rem. Ctrl.
S2
I/O PCB
IC E
Z80 PIO
n=3
n=4
S3
RX-Address
AF - RELAY
REL A
LED-REMOTE
BUFFER DRIVER PCB
AF 1
AF 2
[Audio Source Demodulator (s)]
EX
AF-TR
INTER



Schematic Diagram
Remote Control
RX 1001 M / RX 5001
with Serial Interface RS 232 C II

COMMUNICATIONS RECEIVER RX 5001





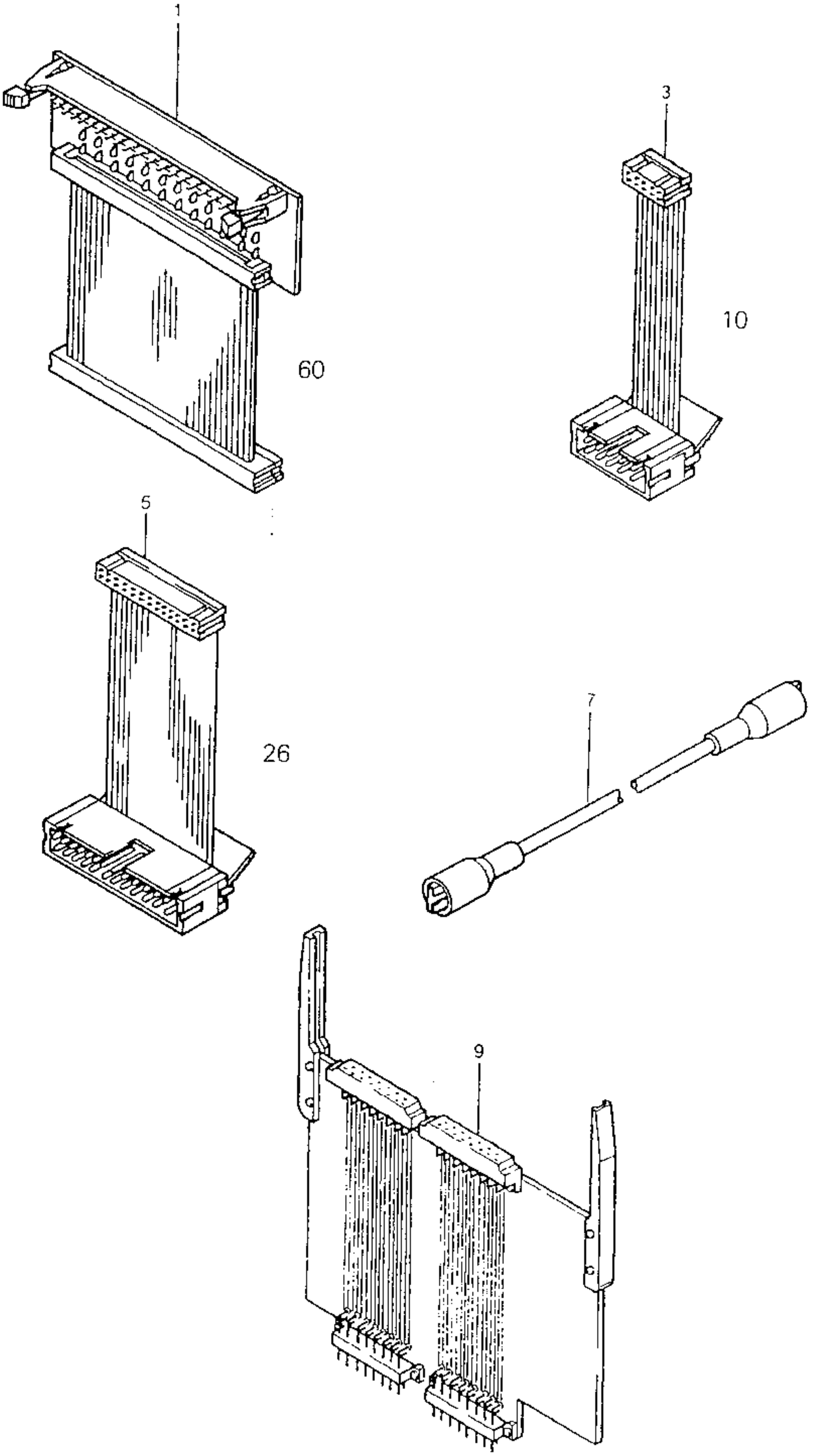
Schematic Diagram
Receiver RX 1001 M / RX 5001
with Serial Interface RS 232 MOD

-Service Adapter-

Pos.			
1	1 St.	Adapter PCB 60 pins	97 E 9.902.01
3	1 St.	Flat cable 10 pins	97 E 9.902.04
5	1 St.	Flat cable 26 pins	97 E 9.902.06
7	1 St.	Cable 1 pins	97 E 9.902.08
8	1 St.	Test EPROM	97 E 9.902-10
9	1 St.	Adapter PCB 2x21 pins	97 E 9.848.03
10	1 St.	Adapter PCB 2x31 pins	97 D 9.848.01
11	1 St.	Adapter PCB 31 pins	97 D 9.848.02
12	2 St.	Flat cable 34 pins	97 E 9.848.04
13	1 St.	Flat cable 16 pins	97 E 9.848.05
14	1 St.	Flat cable 14 pins	97 E 9.848.06
15	1 St.	Mounting Lever	97 E 9.902-1
16	4 St.	Coaxial cable	97 E 9.848.08
17	1 St.	Coaxial cable	97 E 9.848.09
18	1 St.	Coaxial cable	97 E 9.848.10

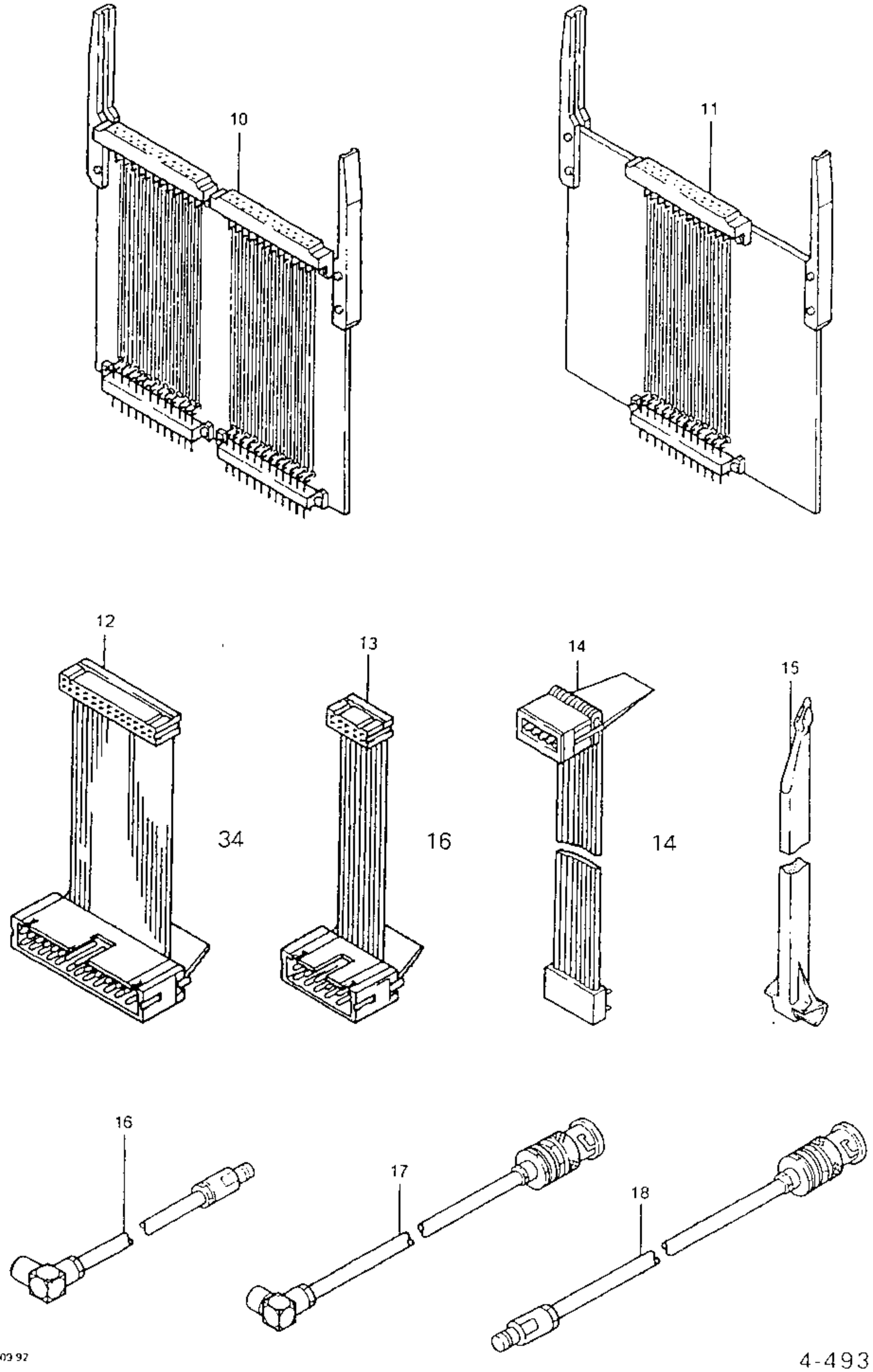
Service Adapter-Selection

TIME-CLOCK	97 C 2.155.33	Pos. 11,2x12
I/O	97 C 2.155.34	Pos. 3, 5, 10, 2x12
CPU	97 C 2.155.35	Pos. 10
AUDIO	97 C 2.155.36	Pos. 10, 13
BUFFER	97 C 2.155.30	Pos. 1, 10
DISPLAY	97 C 2.155.25	Pos. 9
BFO	97 D 2.155.50	Pos. 13,4x16
VCO-A	97 D 2.155.55	Pos. 13,3x16
VCO-B	97 D 2.155.63	Pos. 13,3x16
DEMODULATOR	97 D 2.155.70	Pos. 13,2x16
FILTER	97 D 2.155.76	Pos. 3,2x16
1. MIXER	97 D 2.155.83	Pos. 13,3x16
2. MIXER	97 D 2.155.90	Pos. 13,3x16
PROTECTOR	97 D 2.155.95	Pos. 14,2x16
IF-OUT	97 D 2.155.100	Pos. 3
PRESELECTOR	97 D 2.140.150 B	Pos. 7, 14, 16



HAG/ROD 016-09 92

-Service Adapter-



-Electromechanical Components-

1. Components

Pos.	Ident-No.	Identity	Designation	Manufacturer
1	1798.065	1803.0102	Switch	Marquard
2	1794.299	9533	Key	APR
3	1794.337	614	Blower	Papst
4	1799.673	BG 40-D-35	Bitgenerator	ITT
5	0200.735	49.1679	Socket	Kluxen
6	1433.660	AD 337/Y8	Loudspeaker	Valvo
7	1798.065	1803.0102	Switch	Marquard
8	1794.299	9533	Key	APR
9	1816.187	97 E 2.155.03-3	Switch	HAG
10	1526.790	97 E 2.140.03-14	Potentiometer 10 kΩ/log	Preh
11	1794.299	9533	Key	APR
12	1799.665	BF 40-D-30	Bitgenerator	ITT
13	1798.065	1803.0102	Switch	Marquard
14	1526.782	97 E 2.140.03-13	Potentiometer 470 Ω/lin	Preh
15	1526.774	97 E 2.140.03-12	Potentiometer 1 kΩ/lin	Preh
16	2033.860	97 E 2.172.05-3	Switch 3 pos.	HAG

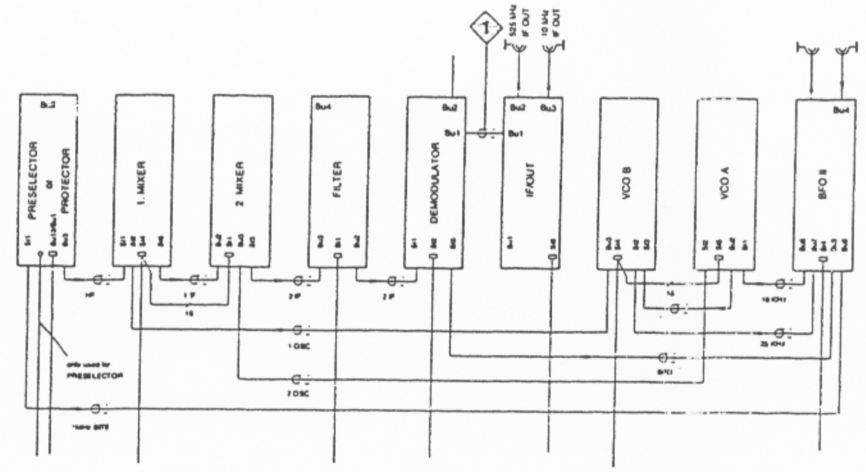
2. Control cable subassemblies

Pos.	Ident-No.	Identity	Designation	Manufacturer
1	1933.434	97 E 2.155.310	Cable 1 wire	Hagenuk
2	1841.068	97 E 2.155.117	Ribbon cable assy. 14 wire	Hagenuk
3	1810.340	97 E 2.155.111	Ribbon cable assy. 34 wire	Hagenuk
4	1810.464	97 E 2.155.121	Ribbon cable assy. 26 wire	Hagenuk
5	1810.456	97 E 2.155.120	Ribbon cable assy. 10 wire	Hagenuk
6	1768.328	97 E 2.155.09	Ribbon cable assy. 25 wire	Hagenuk
7	1768.336	97 E 2.155.12	Ribbon cable assy. 10 wire	Hagenuk

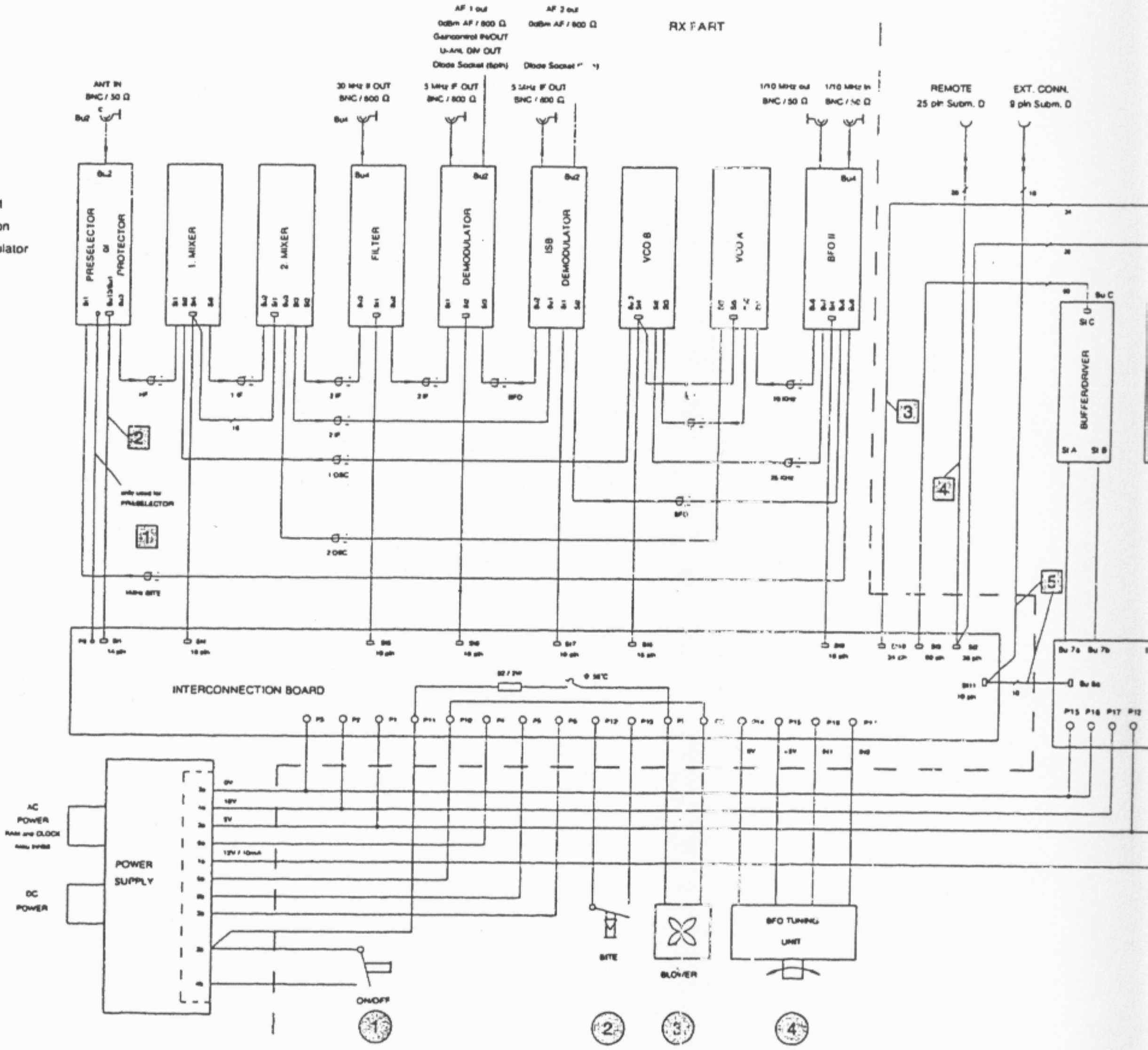
3. Coaxial cable subassembly

Pos.	Ident-No.	Identity	Designation	Manufacturer
1	2022.109	97 E 2.155.133	Coax cable assy.	Hagenuk

RX 1001 M
or
RX 5001
with option
IF / OUT



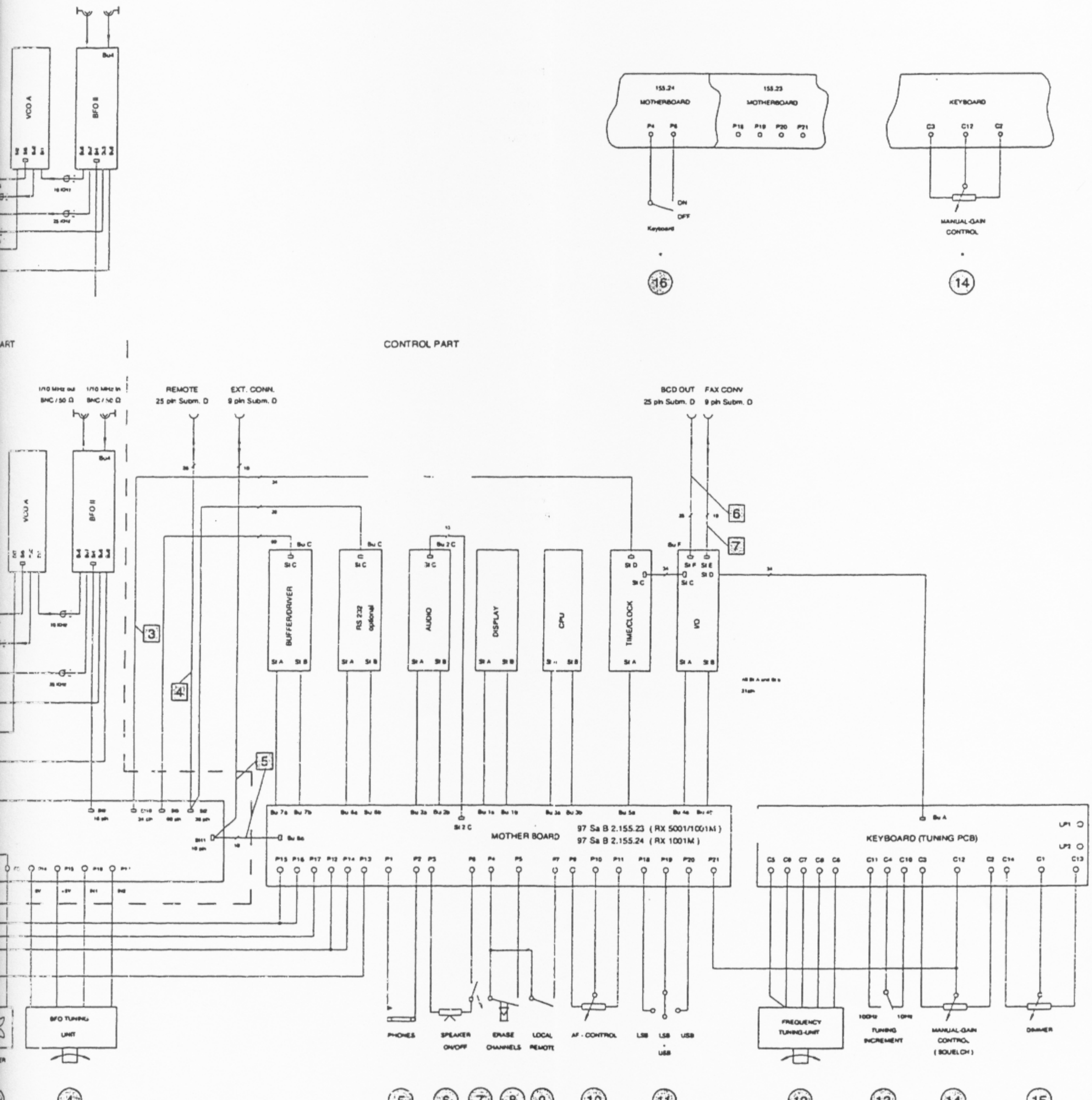
RX 5001
with option
ISB Demodulator



component designation

control cable assy. designat

coaxial cable assy. designat



component designation

control cable assy. designation

coaxial cable assy. designation

Electromechanical Components
RX 1001 M / RX 5001
* RX 1001 M only

5 REMOTE CONTROL

5.1 General

The RX 1001 M / RX 5001 can be remote controlled by the Remote Control RX 1001F / RX 5001 RC. This Remote Control resembles a normal receiver with a missing HF-Part. This remote control uses a protected code using Parity and Block parity bits for fault detection (LSV 2).
If TTY - Converters TG 1001M / TC 5001 have to be remote controlled as well, various modes and parameters can be set in the receiver and the receiver remote control (refer also to TG 1001 M manual).

A different kind of receiver remote control is possible by using a simple unprotected protocol (computer protocol).
This protocol is used by the user terminal UT 1002 or can be implemented into any Personal Computer.
What ever protocol is being used, each remote control can address up to ten individual receivers.

5.2 RX 1001 F / RX 5001 RC

5.2.1 Technical Data

Powersupply	AC	110 - 120V ± 10%
		220 - 240 V ± 10%
		45 - 64 Hz
		50 VA
	DC	21 - 32
		40 W

Audio outputs	
Built-in loudspeaker	1,5 W
External loudspeaker	3 W/4 Ohm
Earphone	10 mW, 600 ohms
Audio distortion	< 5% at SSB/DSB
Dimensions	19 standard
Height	132,5 mm
Depth	285 mm
Width	483 mm
Climate conditions	
operational temperature	-15°C to +55°C
Storage	-40°C to +85°C
Humidity	95% up to 40°C
Vibration without	0 - 12,5 Hz 3,2 mm
shockmounts	12,5 - 25Hz 0,7 mm
	25 - 50 Hz 0,4 mm
Weight	8,5 kp

RS 232 C electrical specifications

AA	chassis ground	
AB	signal ground	GND
BA	transmitted data	TXD
BB	received data	RXD
CA	request- to - send	RTS
CB	clear to - send	CTS
CC	data set ready	DSR
CD	data terminal ready	DTR
CH	data signalling rate sel.	SEL

Transmission speed	typ. 1200 bit/s
internally switchable	600/1200/1800/2400
Recommended maximum cable length	400 m (200 m typically) = 600 bit/s 200 m (100 m typically) = 1200 bit/s 100 m (50 m typically) = 2400 bit/s

Transmission time for receiver status message after entering the receiver No.,at 1200 bit/s = appr. 500 ms

Data protection:
Complementation for odd parity and generating/checking of a block-check-character. If data transmission is interrupted, interrogation or data block transmission is repeated, largely in accordance with the LSV 2 basic-mode-procedure.

5.2.2 Controls and indicators

MAINS ON/OFF- BATT.
In the MAINS position, the remote control is switched on and supplied with power.

NOTE
If the DIMMER is not completely turned down the display will show the time of day, the frequency last set on switch-off, all operating modes, and in certain cases the CHANNEL No.

SPEAKER ON/OFF
This switch is used to switch the speaker on or off.

AF
This control is used to set the AF volume for the earphone and the loudspeaker.

TUNING 100 Hz STEPS/10 Hz STEPS
The rotary TUNING knob can be used to vary the receive frequency in 100 Hz or 10 Hz steps, depending on the setting of the 100 Hz - 10 Hz - STEPS switch.

RF
If the automatic gain control (AGC) is switched off (enter 60 on keyboard), this control can be used to control the RF gain manually. In case of RX 5001 RC this knob is used to set a squelch threshold in AGC-modes if so selected on the Audio II PCB.

DIMMER
The light intensity of the LED display can be varied in order to match the brightness to the environmental light conditions.

BFO
In mode CW (A1A) this control allows the operation to vary the BFO frequency in increments of 10 Hz; the range is ± 5 kHz. This frequency offset is displayed in the time display.

DISPLAY

H
Displays the selected receiver (Receiver No.) and the hours intermittently.

H MIN
Displays current time of day in hours and minutes. Also displays switch-on and switch-off times if programmed accordingly.

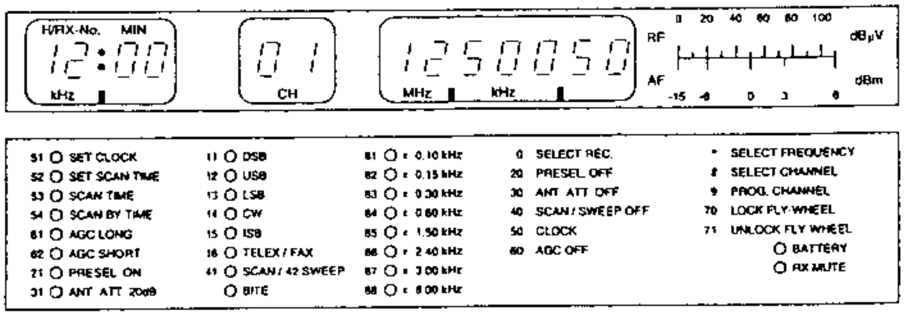
CH
The CHANNEL display shows the channel number (01-99) set.

MHz kHz
This panel displays the receive frequency. This is the carrier frequency in all receive modes and the center frequency in the case of F1 transmissions received in TELEX mode. In mode F1, it is possible to set an internal offset, e. g., 2 kHz.

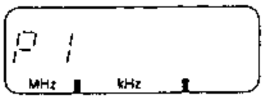
RF - dBμV AF - dBm
The upper row of LEDs indicates the input voltage in dBμV. The lower row of LEDs indicates the AF output voltage in dBm.

KEYBOARD
It is possible to enter all necessary data such as frequency, operating modes, time of day and programming via only a single keyboard. All entries are indicated on the display and the various operational parameters of the selected receiver are indicated by LEDs.

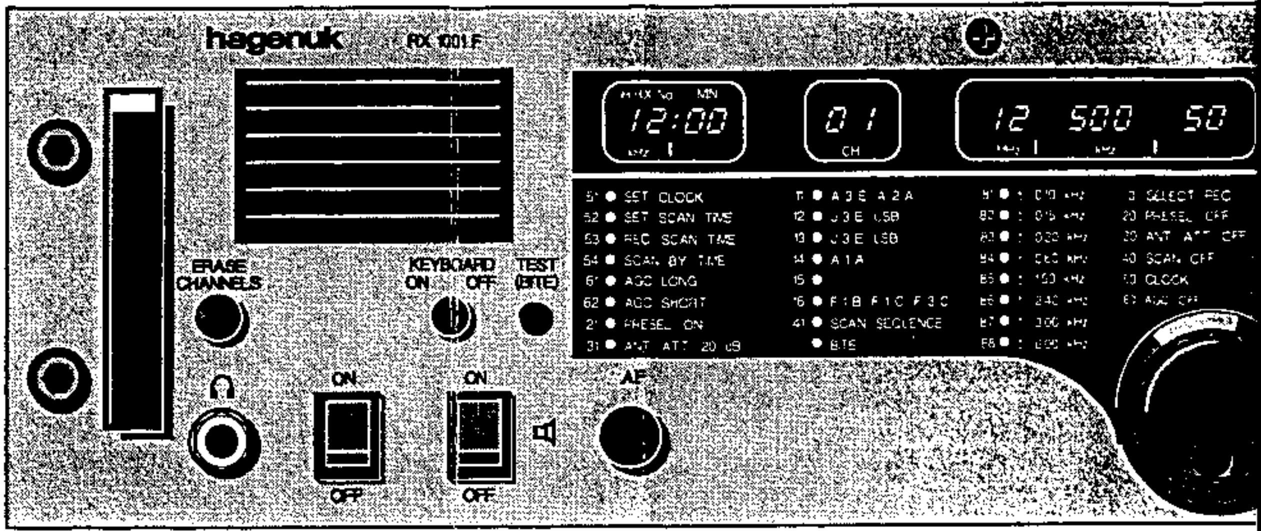
Display panel with list of entries

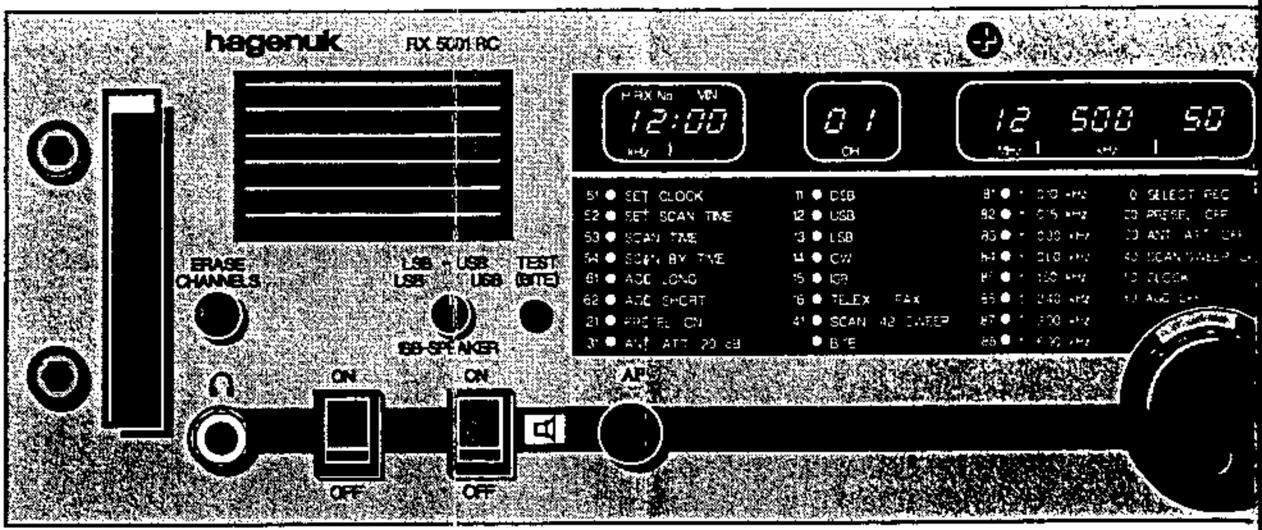


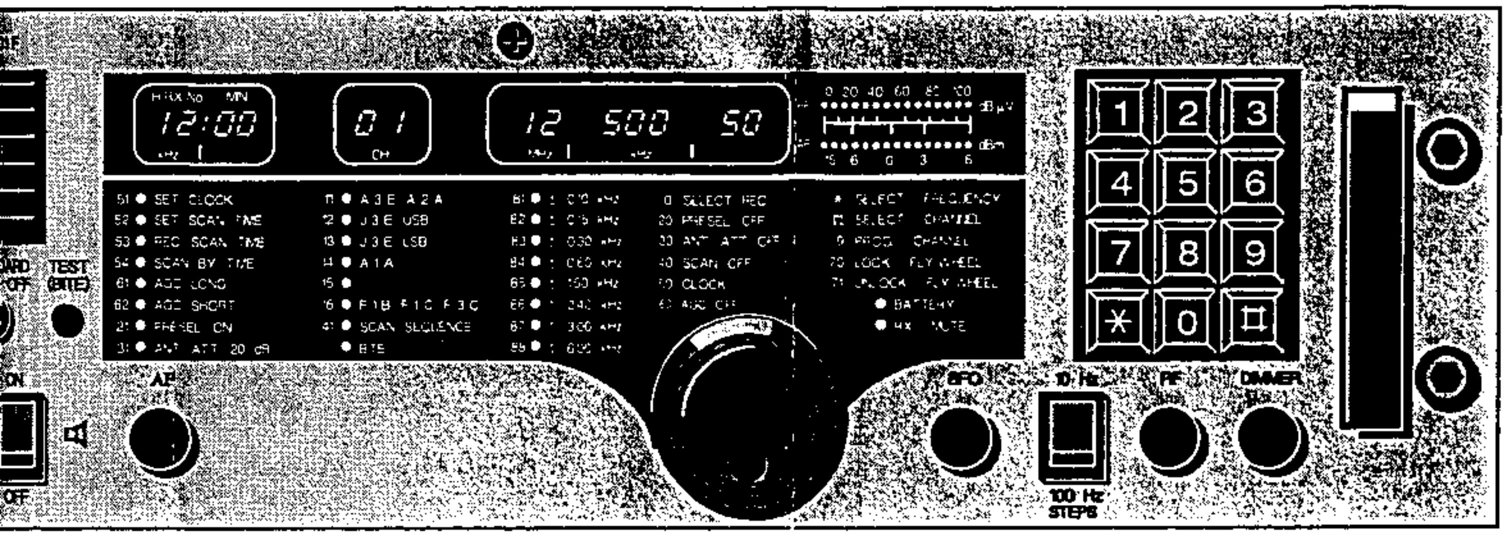
For changing, e. g., the operating mode, a "1" is entered through the keyboard. The frequency display will then no longer show the frequency but the following:



For further operating procedures refer to part 2 of this manual. For receiver selection continue reading.


hagenuk
RX 1001 F
12:00
01
CH
12 500 50
SET CLOCK
SET SCAN TIME
SCAN BY TIME
AGC LONG
AGC SHORT
PRESEL ON
ANT ATT 20 dB
SCAN SEQUENCE
BITE
ERASE CHANNELS
KEYBOARD
ON OFF
TEST (BITE)
ON
OFF
ON
OFF
AF


hagenuk
RX 5001 RC
12:00
01
CH
12 500 50
SET CLOCK
SET SCAN TIME
SCAN TIME
SCAN BY TIME
AGC LONG
AGC SHORT
ANT ATT 20 dB
DSB
USB
LSB
CW
TELEX
FAX
BITE
ERASE CHANNELS
LSB USB
TEST (BITE)
ON
OFF
ON
OFF
AF



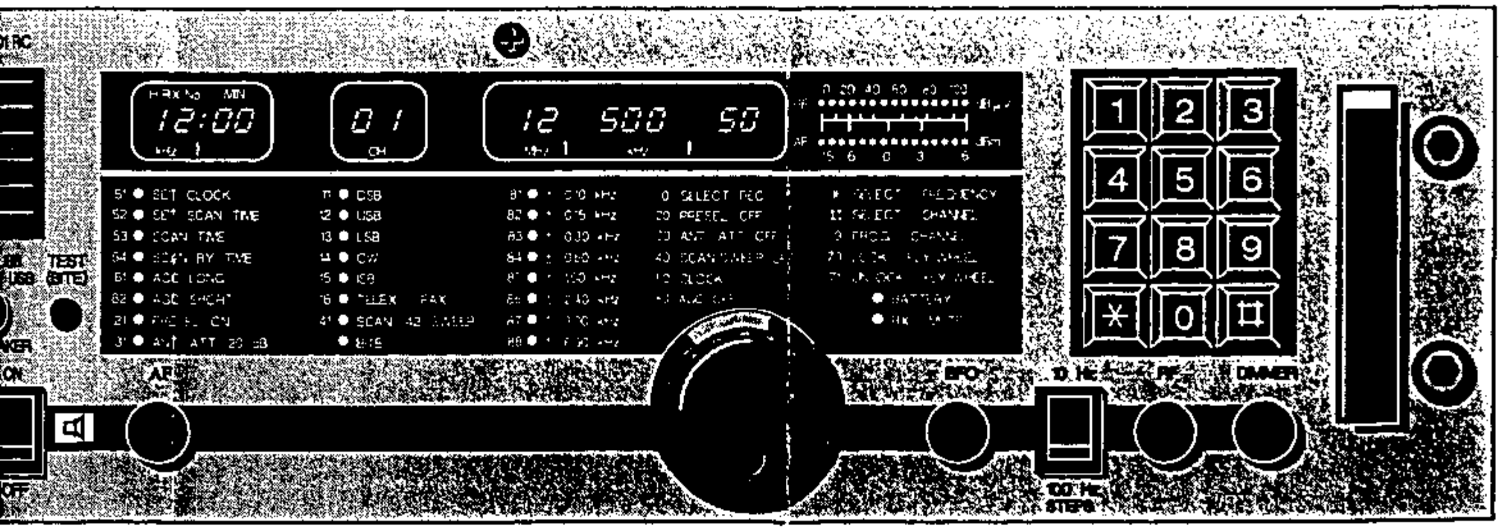


Fig. 5-1
Remote Control Unit RX 1001 F
Remote Control Unit RX 5001 RC

5.2.3 Operating and programming

Basic principle:
Once an operating procedure has been started it has to be finalized even if it is found in the meantime that an error has been made.

5.2.3.1 Operating instructions for the Remote Control Unit

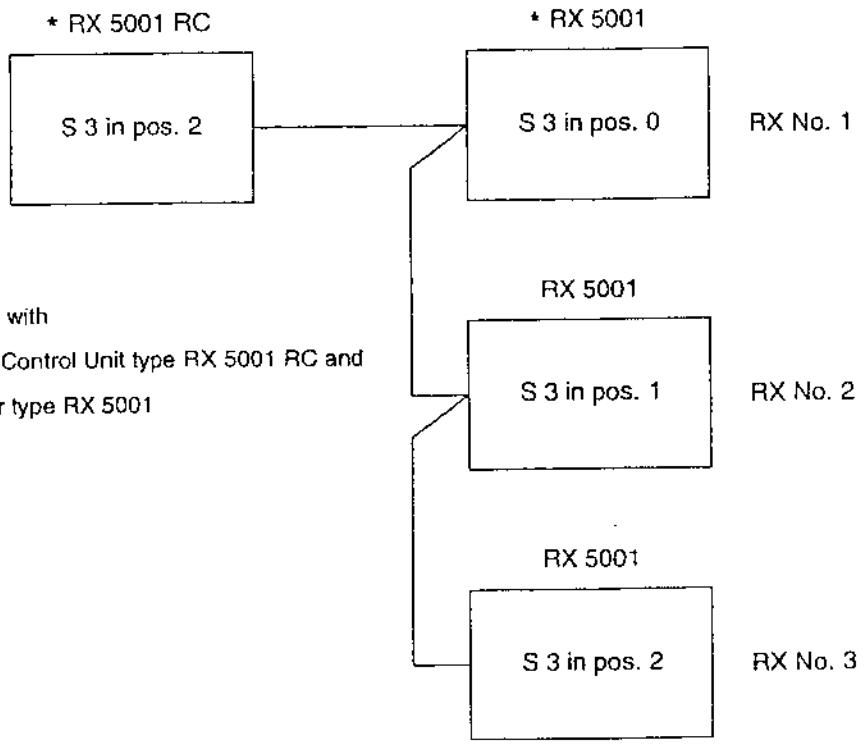
Before continuing the following has to be understood:

1. The switch S 3 on the SERIAL INTERFACE pcb which is fitted in the Remote Control Unit (RX 5001 RC or RX 1001 F) is set to the number of receivers which are allowed to be remote controlled. S 3 can be set from 0 to 9.

   e.g. If S 3 is set to position 0 (zero) only one receiver is allowed to be remote controlled. Address of this receiver must be 0 (zero); if S 3 is set to position 2, three receivers are allowed to be remote controlled with addresses 0,1 and 2.

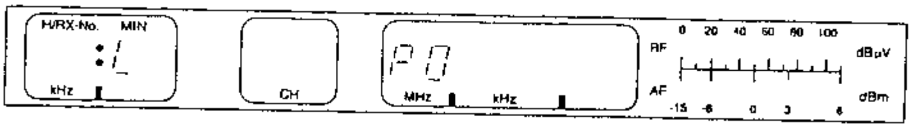
2. The switch S 3 on the SERIAL INTERFACE pcb which is fitted in the receiver (RX 5001, RX 1001 M series) is set to the address of this specific receiver. Addresses 0 to 9 are possible.

Example for a possible remote control installation setup:
One remote control unit has to control three receivers.

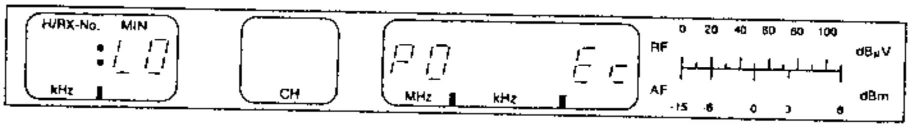


* example with
Remote Control Unit type RX 5001 RC and
Receiver type RX 5001

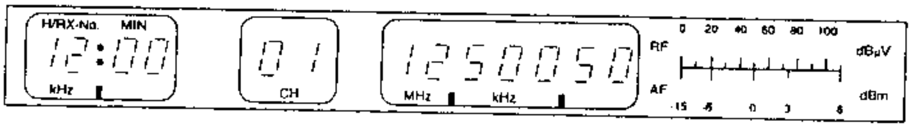
After the remote control unit and the associated receivers are switched on, the following appears on the remote control unit's display:



The above display indicates the select mode. The next step is to enter the address of the receiver, the remote control unit is to communicate with. Address 0 to 9 are possible if permitted by S 3 on the SERIAL INTERFACE pcb.
If address 0 (zero) is selected, the display briefly changes to:

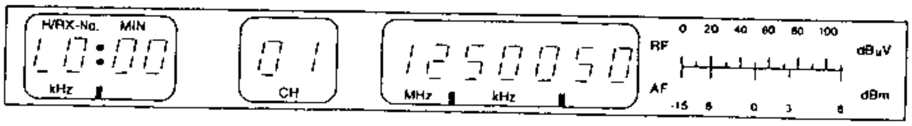


and then changes to



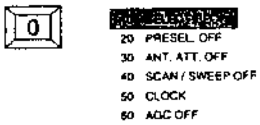
if the connection to the desired receiver is established.

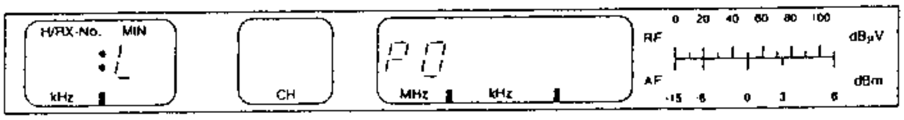
Intermittently the hour display changes to L O, indicating that the remote control is connected to receiver 0 (zero).



If the receiver No. 1 was selected the hour display would show L 1 intermittently.

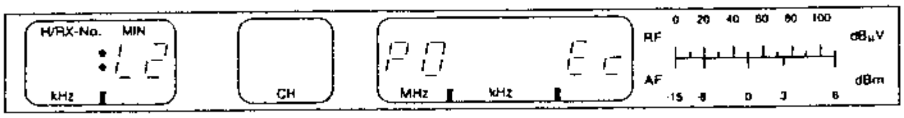
From the current display use the following procedure to change to a different receiver:
Key 0 (zero) to get select mode



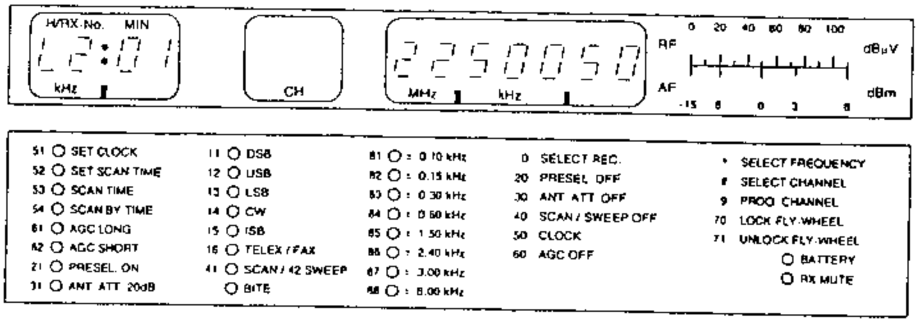


Key receiver address e.g. 2 

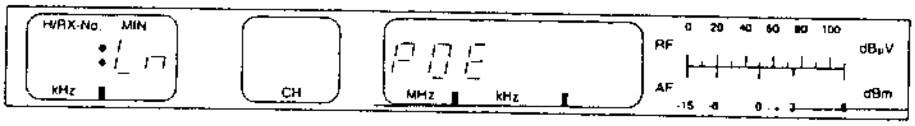
During the establishing of the connection the following display appears briefly:



and then the status of the receiver No. 2 appears with alternating hour display.



If a disallowed RX address is selected, the following display will appear.



n possible RX Addresses	n´ disallowed RX Addresses	Number of remote controlled receivers
0	1 to 9	1
0 to 1	2 to 9	2
0 to 2	3 to 9	3
.	.	.
.	.	.

This error condition can be corrected by:

1. Keying in  now the following display appears

and now key an allowed receiver address(n) (refer to table)

2. Keying in allowed receiver address(n) (refer to table)

If the connection between remote control unit and receiver is interrupted, after a while the remote control unit display will end up with

After the interruption has been repaired the connection is automatically established again after about 15 seconds or

1. Key in  and an allowed receiver address

or

2. Key in an allowed receiver address

5.2.4 Installation

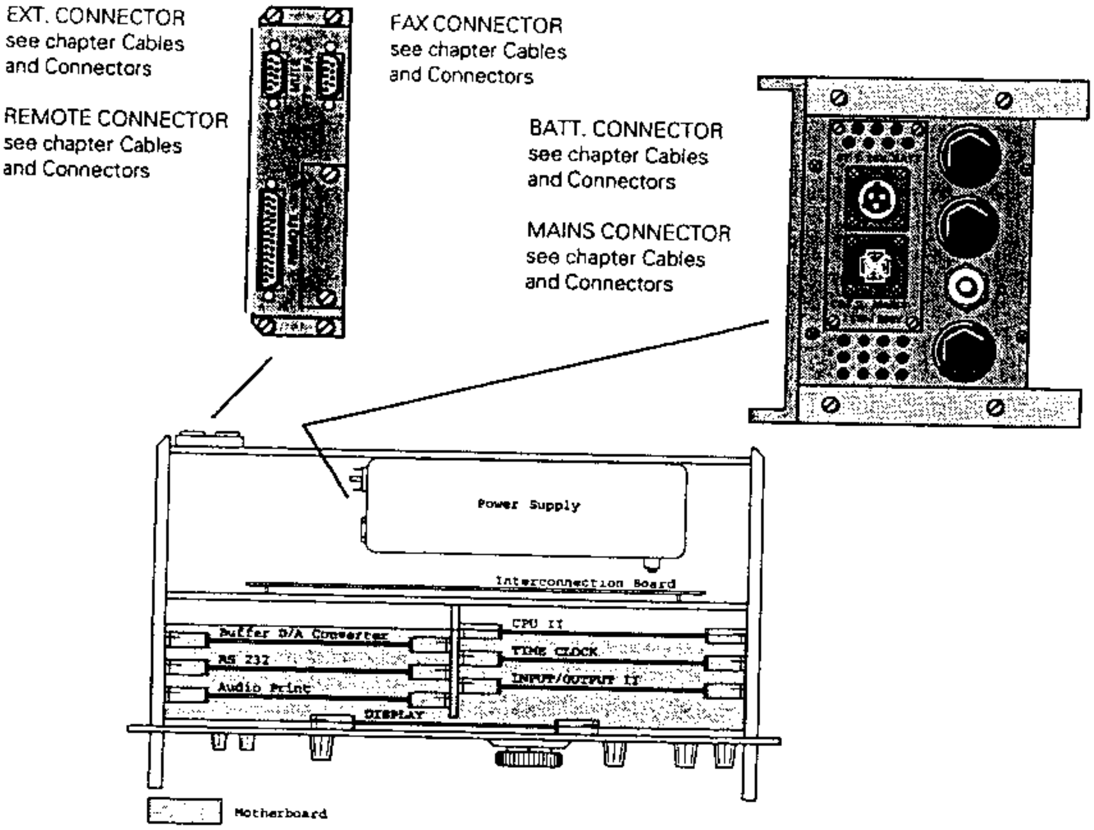


Fig. 5-2 RX 1001 F / RX 5001 RC - Rear Side and Top View

1. Unpack the Remote Control Unit
2. Does the voltage specified on the fuse label correspond to the available supply voltage?
3.

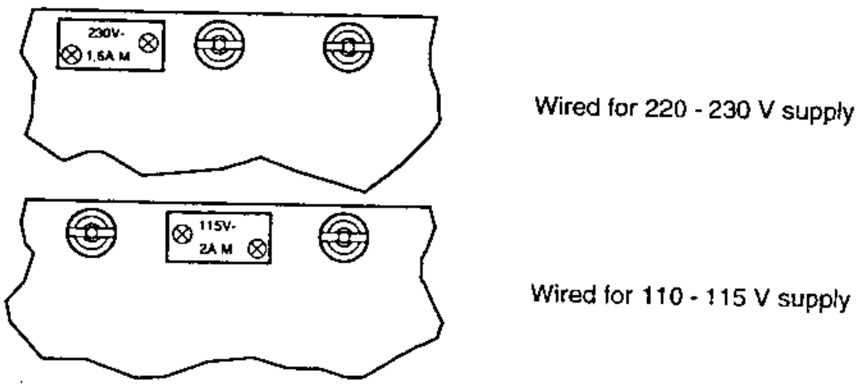


Fig. 5-3 Fuses for 115/230 V

Conversion to 115 V supply voltage:

Unscrew fuse cap (B)
Remove fuse label (A) covering the fuse switch tor 115 V
Turn label over and use to cover 230 V fuse
Replace fuse insert (use 2.0 A, from spares bag if necessary) and screw fuse cap into the new fuse holder.

4. Connect ground cable

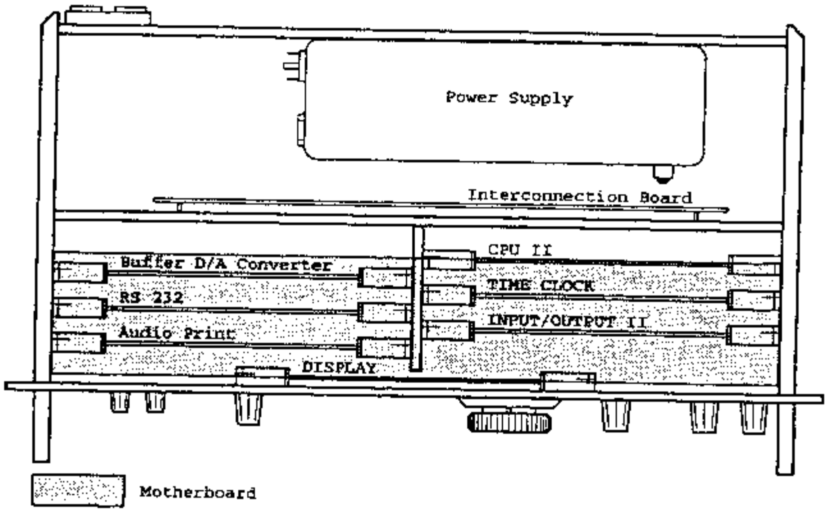
5. Switch-on charging of the built-in accumulator (although not used in RX 1001 F / RX 5001 RC) refer to page 3-25

6. Connect mains and battery cable

7. IMPORTANT:
   Observe battery charging time; 10-12 hours max.

5.2.5 Motherboard and Connections

The Receiver RX 1001 M / RX 5001 and the Remote Control Unit RX 1001 F / RX 5001 RC use same electronic components i.e. printed circuit boards. (For exceptions refer to bottom of this page)



Remote Control Unit RX 1001 F/ RX 5001 RC -component layout-

List of printed circuit boards of the Remote Control Unit RX 1001 F / RX 5001 RC:

INTERCONNECTION BOARD Drawing-No. 97-2.154.10
MOTHERBOARD Drawing-No. 97-2.155.24/23 *
REMOTE RS 232 C Drawing-No. 97-2.140.190A or
REMOTE RS 232 C II Drawing-No. 97-2.156.20 or
REMOTE RS 232 MOD Drawing-No. 97-2.156.25
– see this chapter

BUFFER D/A Converter Drawing-No. 97-2.155.30
DISPLAY Drawing No. 97-2.155.25
TIME CLOCK Drawing-No. 97-2.155.25
INPUT/OUTPUT II Drawing-No. 97-2.155.38
CPU II Drawing-No. 97-2.155.35C
AUDIO or AUDIO II Drawing-No. 97-2.155.36B or ...37 **
POWER SUPPLY Drawing-No. 97-2.155.21
– see Chapter 4

* Motherboard 155.24 for RX 1001 F only
Motherboard 155.23 for RX 1001 F or RX 5001 RC

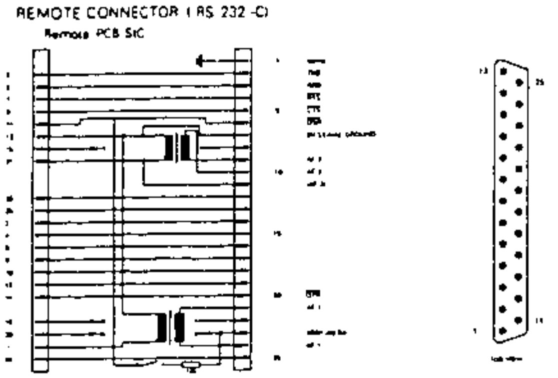
** AUDIO for RX 1001 F
AUDIO II for RX 1001 F or RX 5001 RC

HAG/ROD 016-04.93

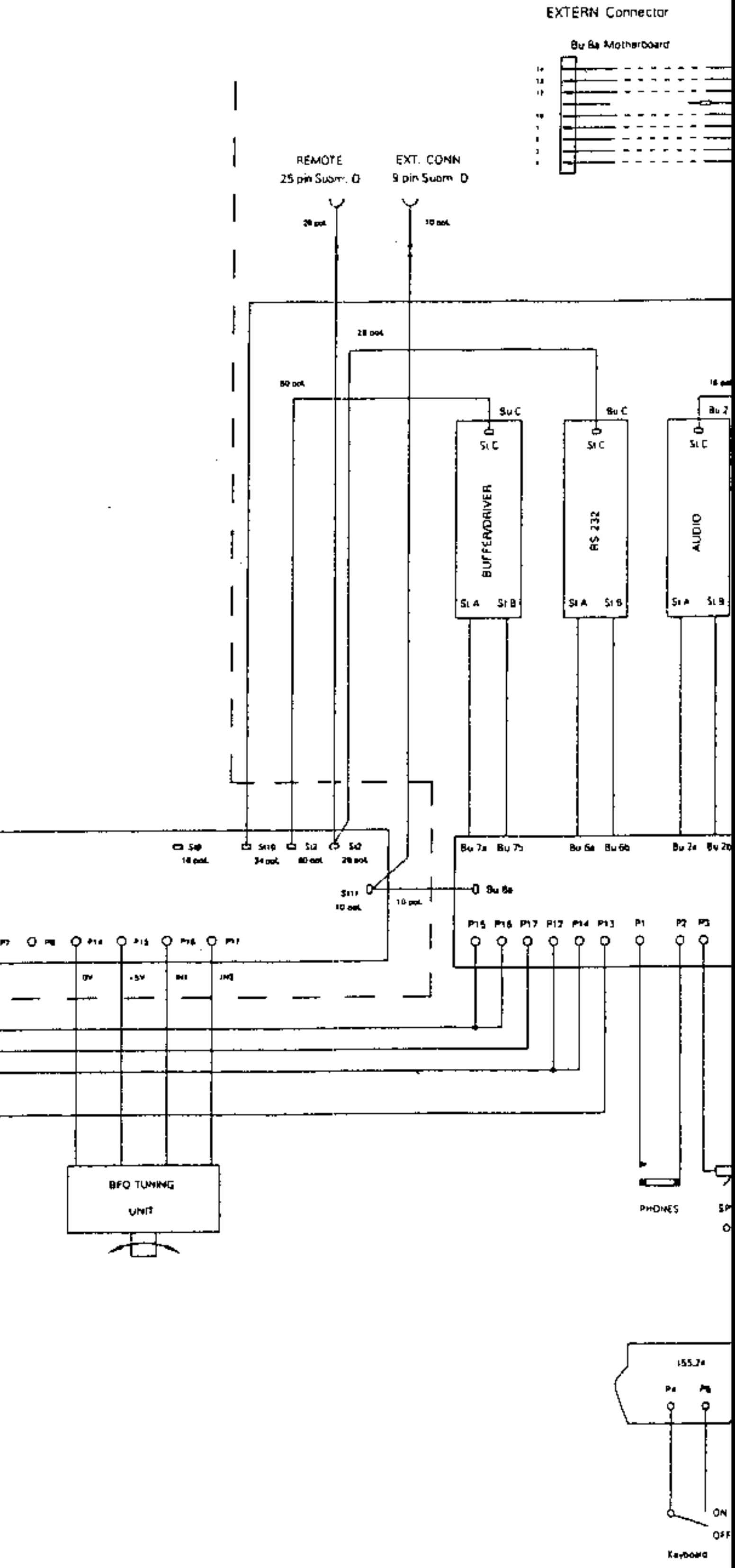
With the Remote Control Unit (RX 1001 F or RX 5001-RC) it is possible to remote control up to 10 HAGENUK- Communication receivers (RX 1001 MFB, RX 1001 MFVB or RX 5001). Remote control of the receivers can be done via direct connection or via a telephone line. Remote control via direct connection depends on the length of the line and the transmission speed (refer to technical data).
If a telephone line is used modems for this data transmission are needed. This makes it possible to provide the receiver with remote control of all functions with the exception of:

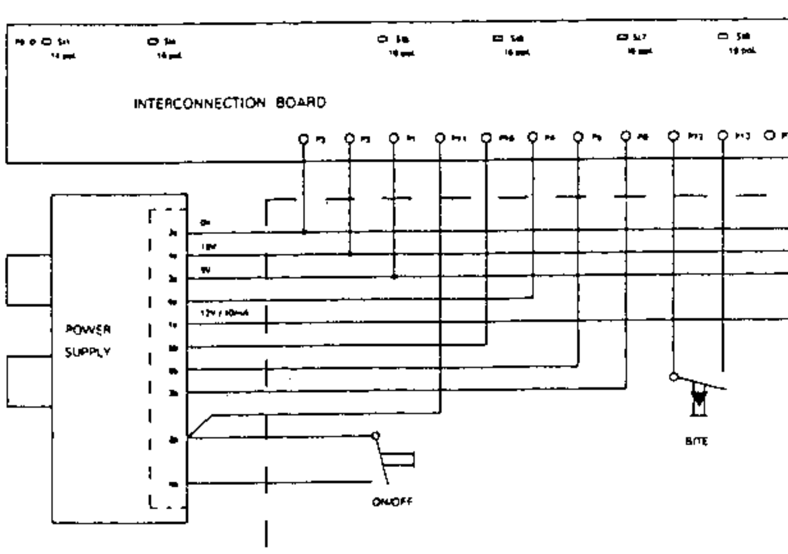
the mains	on/off switch
the loudspeaker	on/off switch
dimmer	control
loudspeaker	control

Apart from meeting the electrical specifications, the remote control is capable of processing the following data transmission formats:
50 bits/s - 9600 bit/s asynchronous 8 bits with parity bit and 2 stop bits for increased data protection, in addition to parity checking also generating and checking of block parity.



refer also to Chapter 5.4





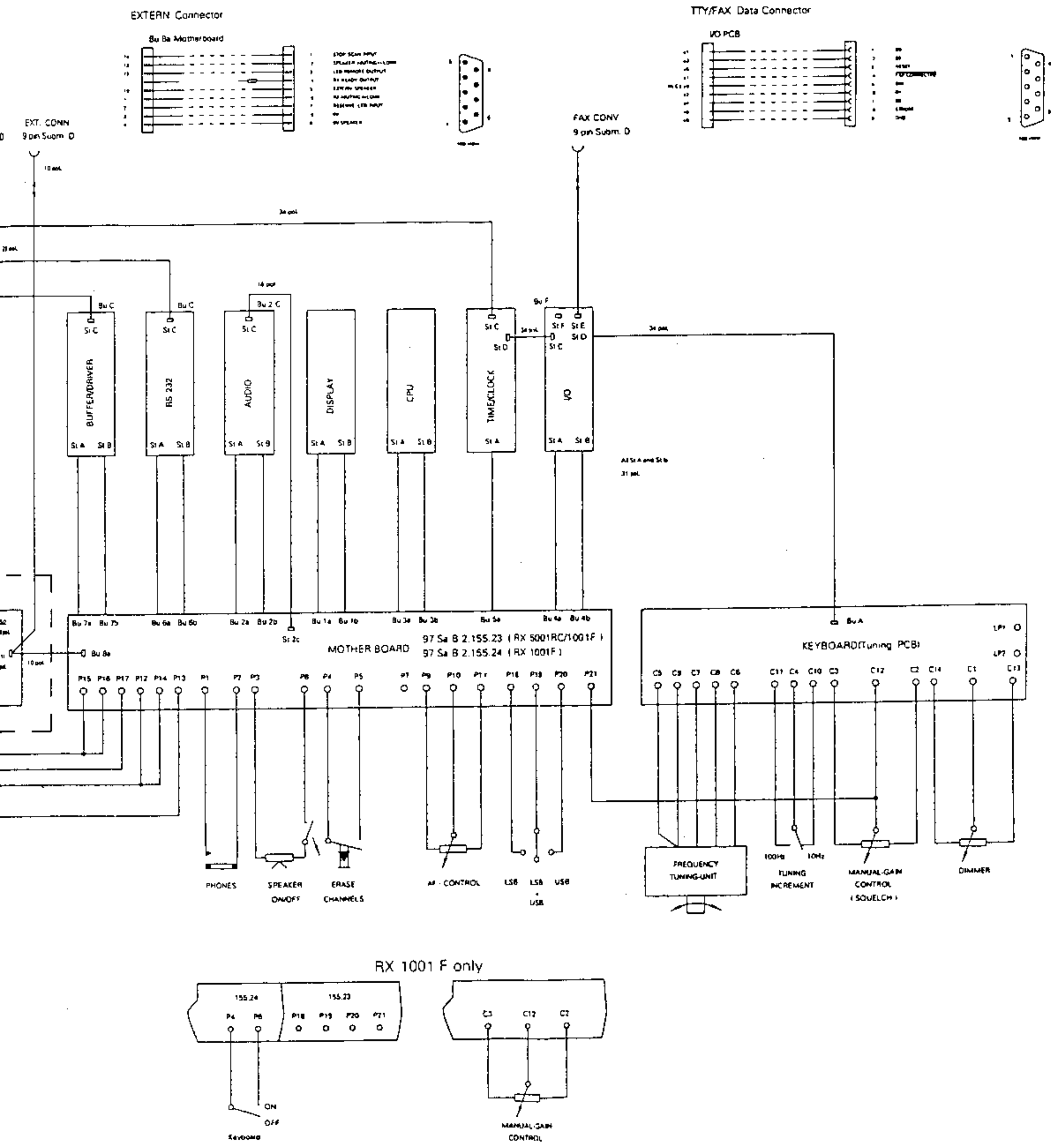
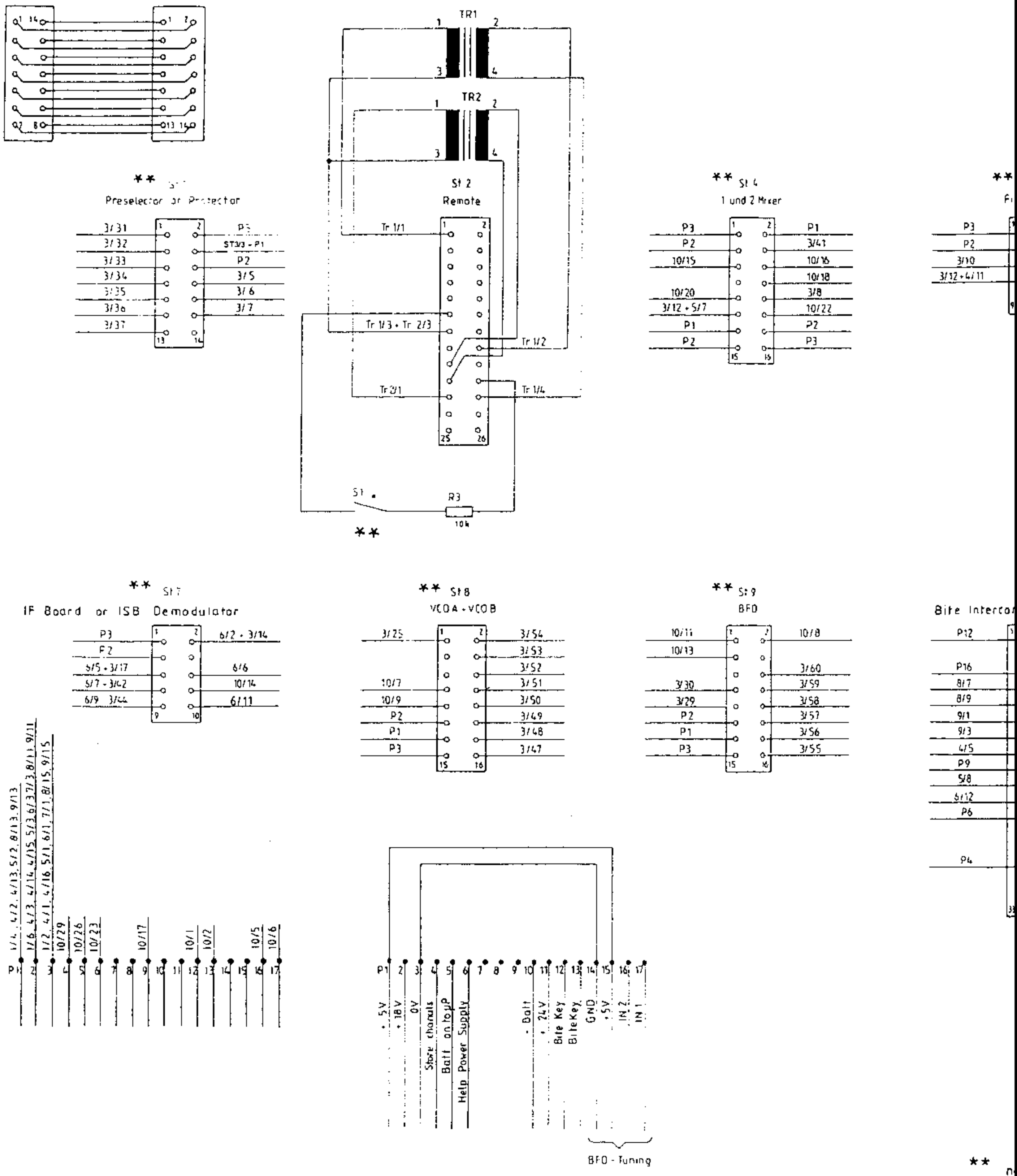
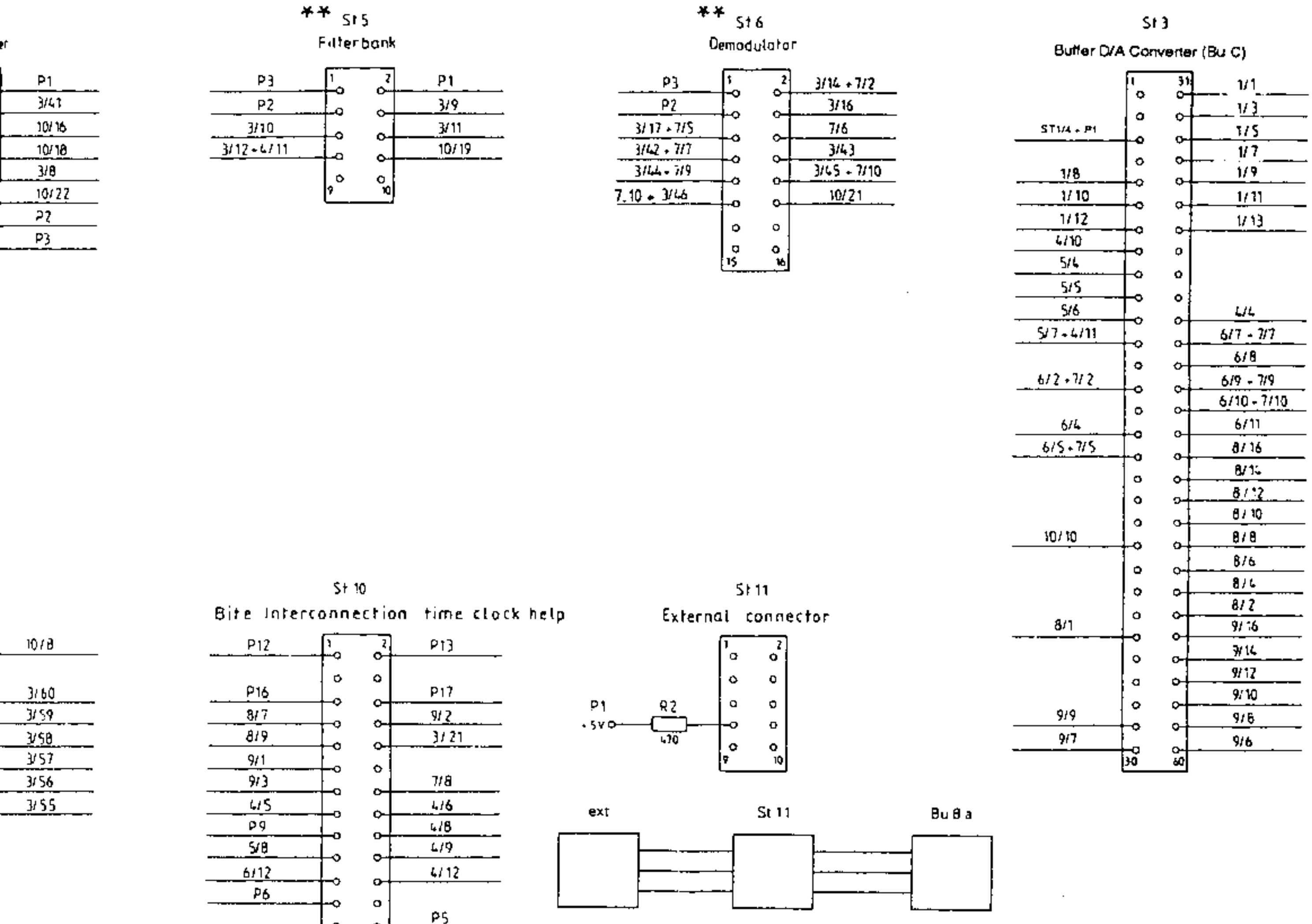
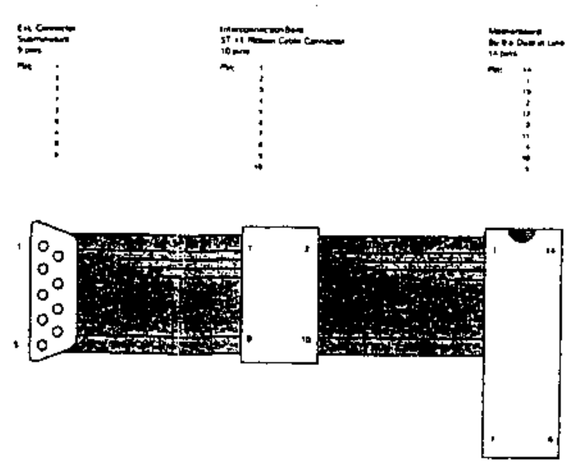


Fig. 5-4
Interconnection -Mainframe-
RX 1001 F / RX 5001 RC


TR1
TR2
St 2
Remote
Tr 1/1
Tr 1/3 + Tr 2/3
Tr 1/2
Tr 2/1
Tr 1/4
S1
R3
10k
Preselector or Protector
St 4
1 und 2 Mixer
St 7
IF Board or ISB Demodulator
St 8
VCOA + VCOB
St 9
BFO
Bite Interco
+ 5V
+ 18V
0V
Store chanals
Batt on to µP
Help Power Supply
- Batt
+ 24V
Bite Key
Bite Key.
GND
+5V
IN 2
IN 1
BFO - Tuning

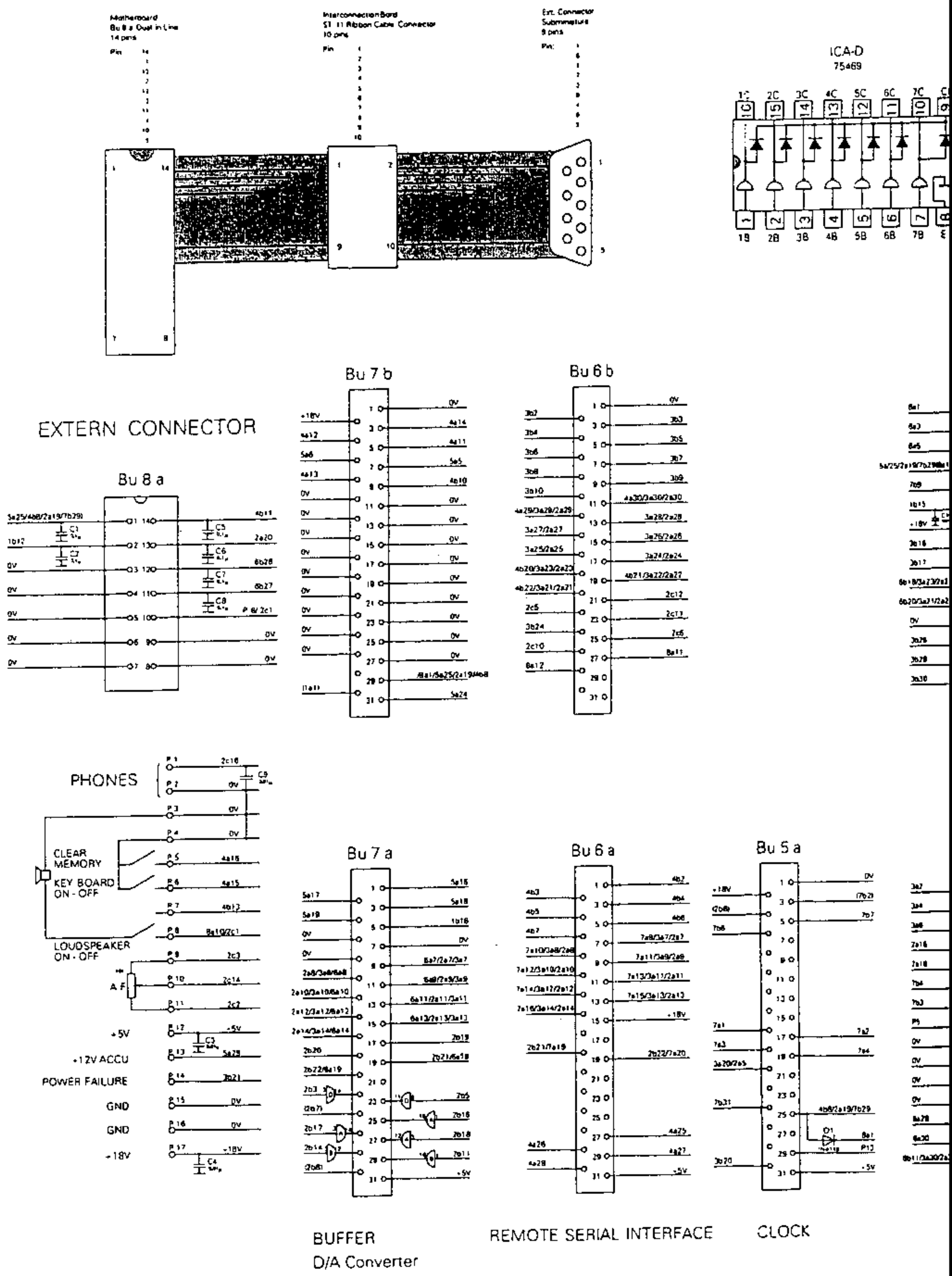




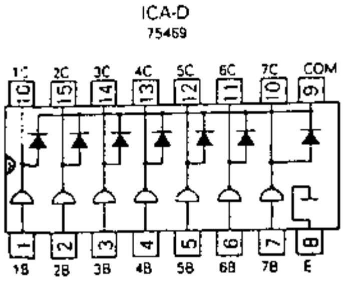
* S1 has to be switched ON to enable Go/No Go check via V24 interface (DTR/DSR)
In addition S2/2 on I/O p.c.b. has to be O the switch 600/1200 Baud on the RS 232 p.c.b. has to be set to 600 Baud.
For remote control operation S1 has to be switched OFF.

** not used in RX 1001 F and RX 5001 RC

Interconnection Board
Circuit Diagram
97 Sa C 2.155.19

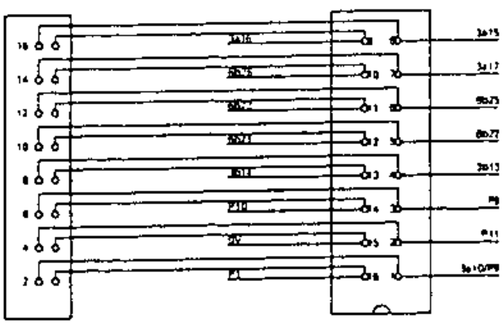


To be fitted in RX 1001 F only



Note:

Reference to the Audio PCB connector C are made to the DIL connector St 2 c. Pin numbers indicated to in this drawing referring to Audio PCB C connector do not match with pin numbers on the actual Audio PCB drawing 97 2.155.37.



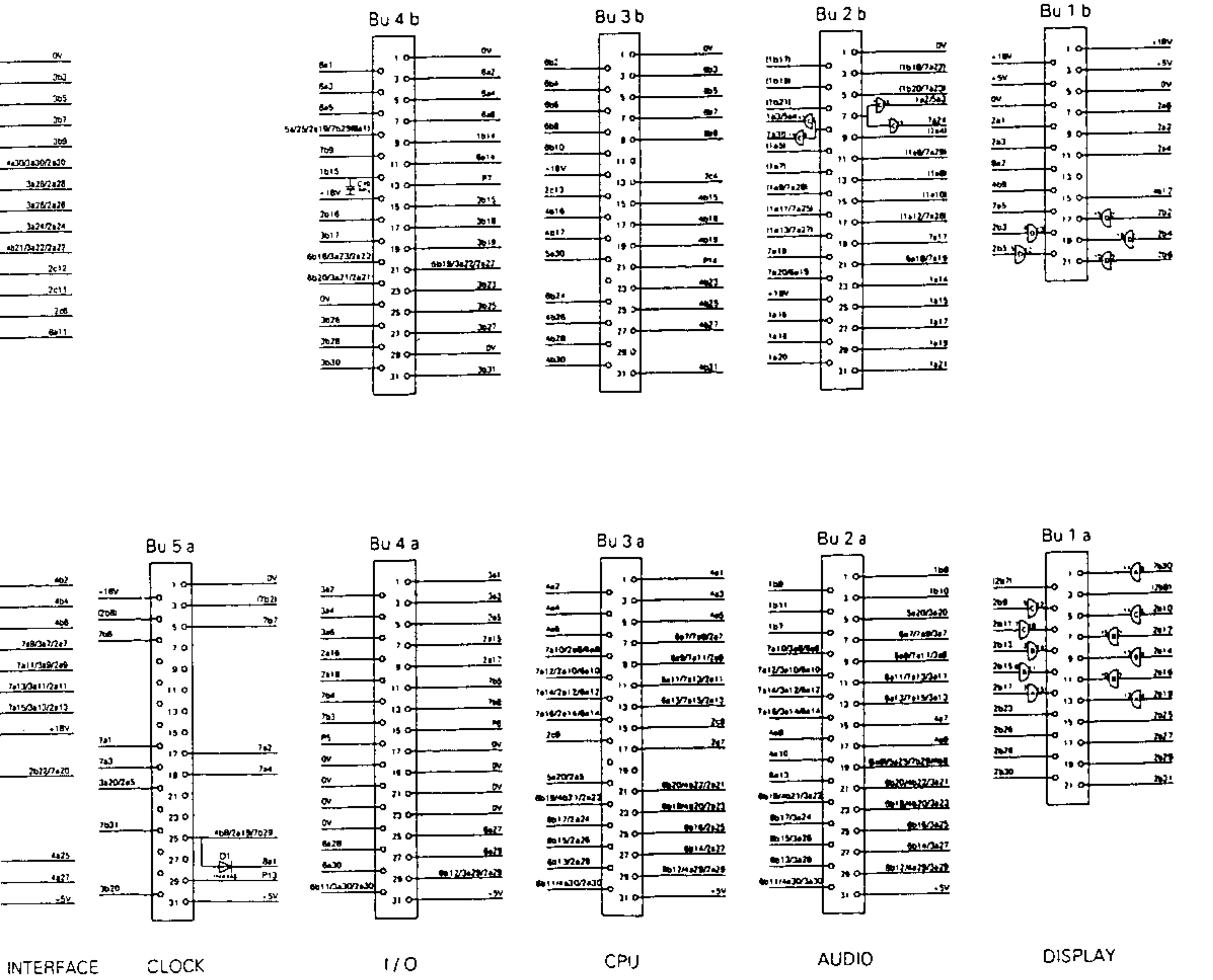
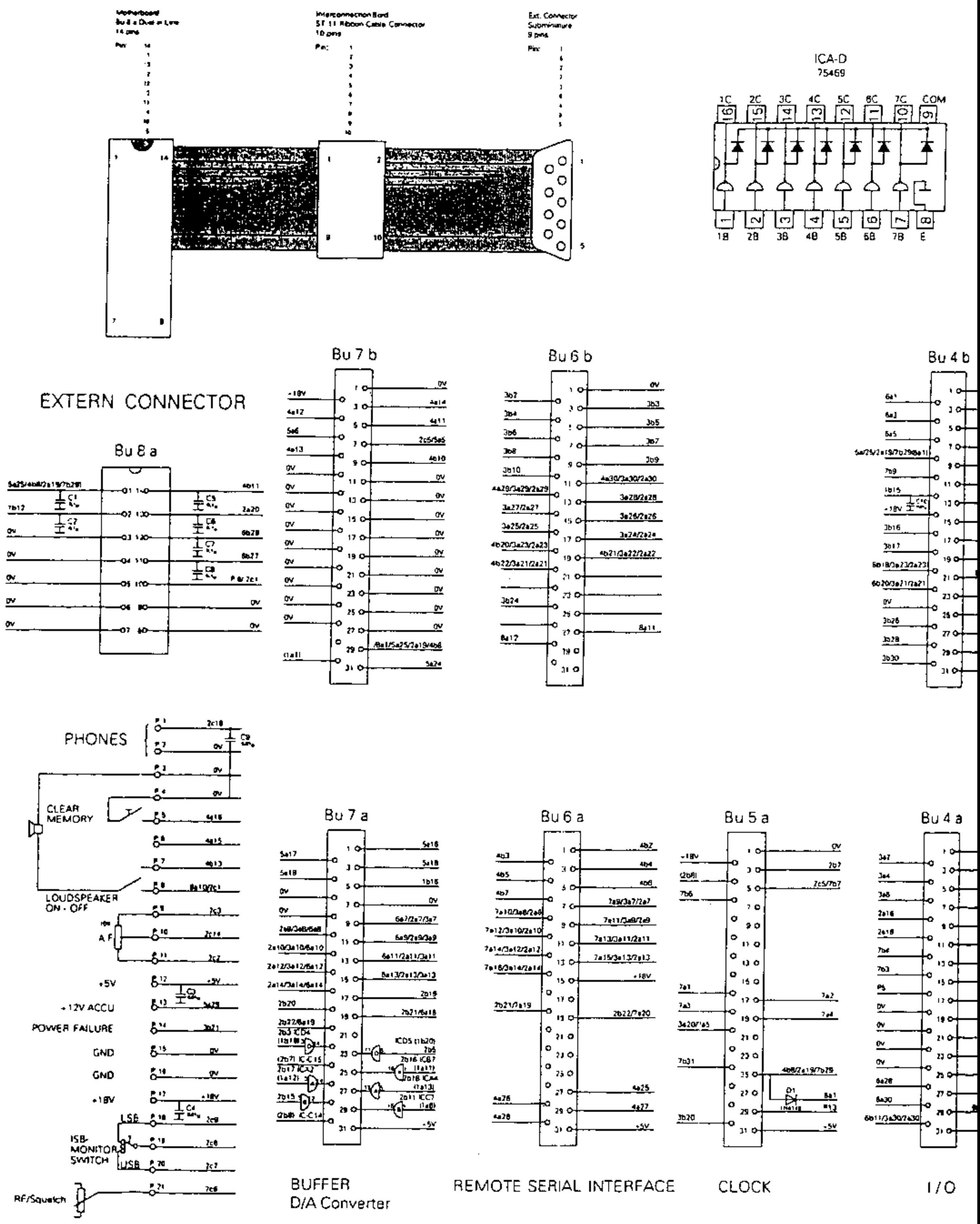
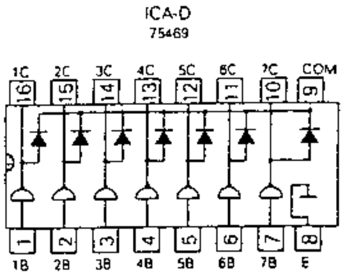


Fig. 5-6
Motherboard
97 Sa B 2.155.24

)01 F only

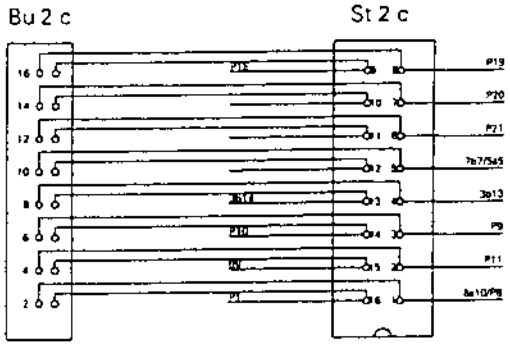


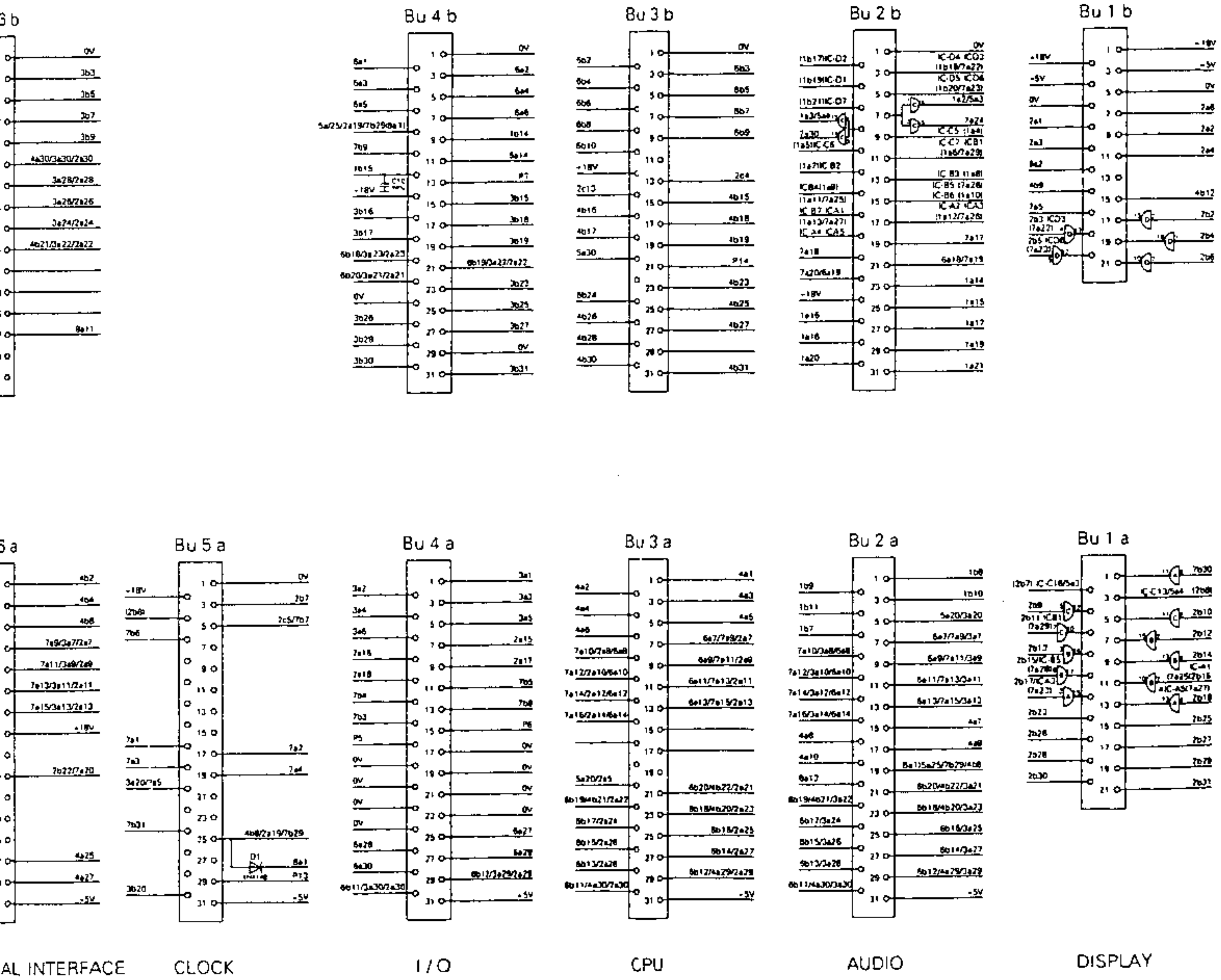
To be fitted in RX 5001 RC / RX 1001 F



Note:

Reference to the Audio PCB connector C are made to the DIL connector St 2 c. Pin numbers indicated to in this drawing referring to Audio PCB C connector do not match withpin numbers on the actual Audio PCB drawing 97 2.155.37.





fitted in RX 5001 RC / RX 1001 F

Fig. 5-7
Motherboard
97 Sa B 2.155.23

5.2.5.1 Switch settings

1 CPU - Printed circuit board

Switch S 1: Baud rate selector for Serial Interface

Baud	S 1.1	S 1.2	S 1.3	S 1.4
50	ON	ON	OFF	ON
75	ON	ON	OFF	OFF
110	OFF	OFF	OFF	OFF
134,5	ON	OFF	ON	ON
150	OFF	OFF	OFF	ON
200	ON	OFF	ON	OFF
300	OFF	OFF	ON	OFF
600	ON	OFF	OFF	ON
1200	OFF	ON	OFF	OFF
1800	OFF	ON	OFF	ON
2400	ON	OFF	OFF	OFF
2400	OFF	OFF	ON	ON
4800	OFF	ON	ON	OFF
9600	OFF	ON	ON	ON

2 INPUT/OUTPUT II Printed circuit board

Switch S 1: Highest address of connected demodulator or (number of connected demodulators in Mode 2)

Switch S 2: Configuration of remote controlled demodulator (for BITE)

Mode 1: One demodulator is connected to the Remote Control RX 5001 RC / RX 1001 F

Mode 2: Up to ten demodulators are connected to the Remote Control RX 5001 RC / RX 1001 F

Mode 3: One demodulator connected to the Remote Control RX 5001 RC / RX 1001 F and one demodulator is connected to the remote controlled receiver each.

Mode	S 2.1	S 2.2	S 2.3
1	ON	OFF	OFF
2	OFF	ON	OFF
3	OFF	OFF	ON

3 Remote Printed circuit board

Switch S 1: RS-232-C/V 24: With modem (signals DSR, DTR, RTS and CTS are used)
TXD/RXD only: Without modem only signals TXD and RXD are used (jumper between RTS and CTS)

Switch S 2: Transmission speed (modem)
(600 Bd) low baud rate
(1200 Bd) high baud rate

Switch S 3: Highest selectable receiver number

Switch S 4-S7: Position RC (only on PCB RS 232 Mod)

4 Audio Board II

Switch S 1: Options
S 1.1 ON Extended status message for request of receiver conditions, condition MUTE-EXT and SCAN STOP EXT of remote control are transmitted as well
(available for receiver software version 5.1 and updates)
S 1.1 OFF Normal status message request
S 1.2 ON Digits of the keyed-in frequency are displayed immediately after keying in.
S 1.2 OFF The keyed-in frequency is displayed after the acknowledgment from the receiver
S 1.3 Not used
S 1.4 Not used

Switch S 2: Status message request from receiver
S 2.1 ON Continuous status message request
S 2.2 ON ONE-SHOT-MODE. Status message request immedietly after connection set up and after adjusting the Controls.
S 2.3 ON Automatic status message request every 10 minutes $\pm$ 2 minutes
S 2.4 ON Not used

Remark:
Only one switch in position ON is permitted! Otherwise the mode according to position S 2.1 = ON is selected.

5 Time Clock Board

Switch S 1: Accumulator
No function, because no data protection in the Remote Control is necessary.

HAG/ROD 016-04 93

5.3 Detailed technical description test and alignment instructions, PCBs circuit diagrams, and parts list.

Technical description SERIAL INTERFACE RS-232-C, RS-232-C II and RS-232 MOD

The data flow is from/and to the microprocessor via a USART and via a parallel Input/Output (PIO) module to the SERIAL INTERFACE. The USART converts the parallel data from the microprocessor into serial data and vice versa and also generates the signals necessary for controlling a modem. These signals are converted on the SERIAL INTERFACE from TTL level to RS-232-C level/and vice versa.

5.3.1 Remote RS 232 C

The pcb contains two integrated circuits (IC-A and IC-B), each containing two level converters from TTL to RS 232 level and (IC-C and IC-D) each containing two level converters from RS 232 to TTL level. They are operated by a ±12 V supply generated by an integrated Power Supply module IC-F. The RS 232 level for logical H is approx. -3 V ... -15 V and for logical L approx. +3 V ... +15 V.

If an external modem is not used, e.g., in the case of computer control, only the lines TXD Transmit Data) and RXD (Receive Data) are used. The remaining lines DTR (Data Terminal Ready), RTS (Request To Send), DSR (Data Set Ready), CTS (Clear To Send) and "600/1200 baud" are used for modem control.
The transmit data lines RTS and TXD are connected for the duration of transmission by Rel A, as all transmit data lines are paralleled when several receivers are controlled simultaneously.
Switch S1 must be set to 1 for non-modem operation, as the USART on the CPU board requires a CTS signal.
Switch S2 determines high or low transmission speed of the modem.

NOTE
To change Baud rates see circuit diagram CPU II Hagenuk Drawing-No. 97 SaB 2.155.35.

Test and alignment instructions

Required:	Circuit diagram REMOTE RS 232 C Hagenuk Drawing-No. 97 SaC 2.140.190A
Test configuration:	The module is removed and reconnected to the receiver via the service adapter. The ribbon cable is not connected.

1. First transmitter test TXD/DTR/RTS

Set switch S1 to position V.24 RS 232 C on the board.
Disconnect connections to plug ST B pins 2, 4 and 10 and connect to 0 V.
Test values:
Voltage on plug ST C pin 3 (TXD) should be +3 to +12 V.
Voltage on plug ST C pin 14 (DTR) should be +3 to +12 V.
Voltage on plug ST C pin 7 (RTS) should be +3 to +12 V.

2. Testing the BAUD RATE switch

Set switch S2 on the board to the position 1200 BAUD
Test values:
Voltage on plug ST C pin 20 BAUD RATE should be +3 to +12 V.
Set switch S2 on the board to the position 600 BAUD.
Voltage on plug ST C pin 20 BAUD RATE should be -3 to -12 V.

3. Second transmitter test TXD/DTR/RTS

Remove the O V connection from plug ST B pins 2, 4 and 10.
Disconnect connections to plug ST B pins 7 and 8 and connect to +5 V.
Test values:
Voltages on plug ST C pin 3 (TXD), 14 (DTR) and 7 (RTS) should be -3 to -12 V.

4. Receiver test RXD

Apply +5 V to plug ST C pins 5, 9 and 11.
Test values:
Measure voltage on plug ST B pin 5.
Specified: O V to +O.8 V.
Apply -5 V to plug ST V pins 5, 9 and 11.
Measure voltage on plug ST B pin 5.
Specified: +2.0 to +5.25 V.

5. Receiver test DSR

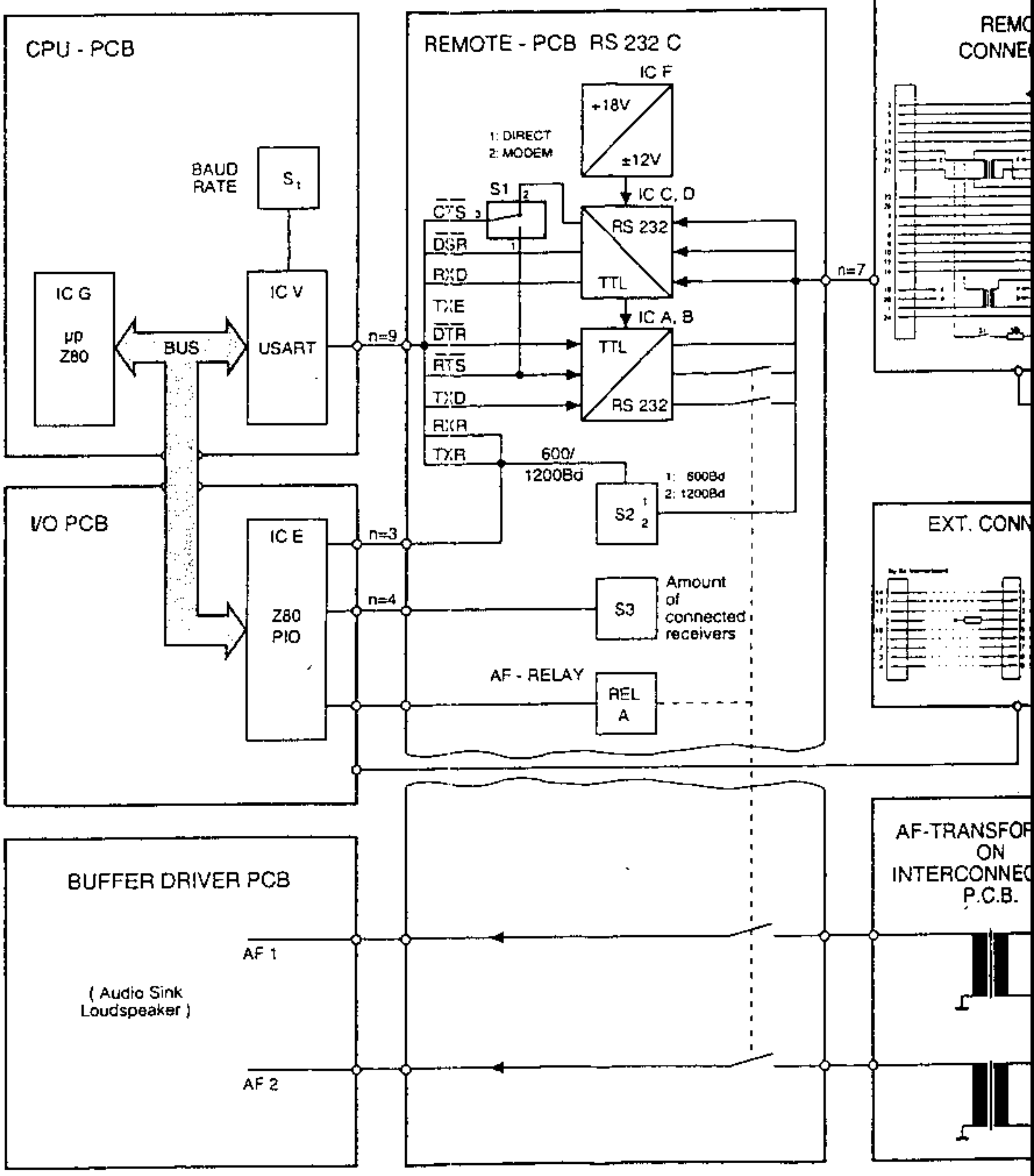
Apply -5 V to plug ST C pins 5, 9 and 11.
Test values:
Measure voltage on plug ST B pin 6.
Specified: +2.4 V to +5.25 V.
Apply +5 V to ST C pins 5, 9 and 11.
Test values:
Measure voltage on plug ST B pin 6.
Specified: O V to +O.8 V.

6. Receiver test CTS

Apply +5 V to plug ST C pins 5, 9 and 11.
Test values:
Measure voltage on plug ST B pin 3.
Specified: 0 V to +0.8 V.
Apply -5 V to plug ST C pins 5, 9 and 11.
Test values:
Measure voltage on plug ST B pin 3.
Specified: +2.4 V to +5.25 V.

Set switch S1 on board to position ONLY TXD + RXD.
Apply 0 V to plug ST B pins 2, 4 and 10.
Test values:
Measure voltage on plug ST B pin 3.
Specified: 0 V
Disconnect 0 V from plug ST B pins 2, 4 and 10.
Apply +5 V to plug ST B pins 7 and 8.
Test values:
Measure voltage on plug ST B pin 3.
Specified: +5 V.

REMOTE CONTROL RX 1001 F/RX 5001 RC



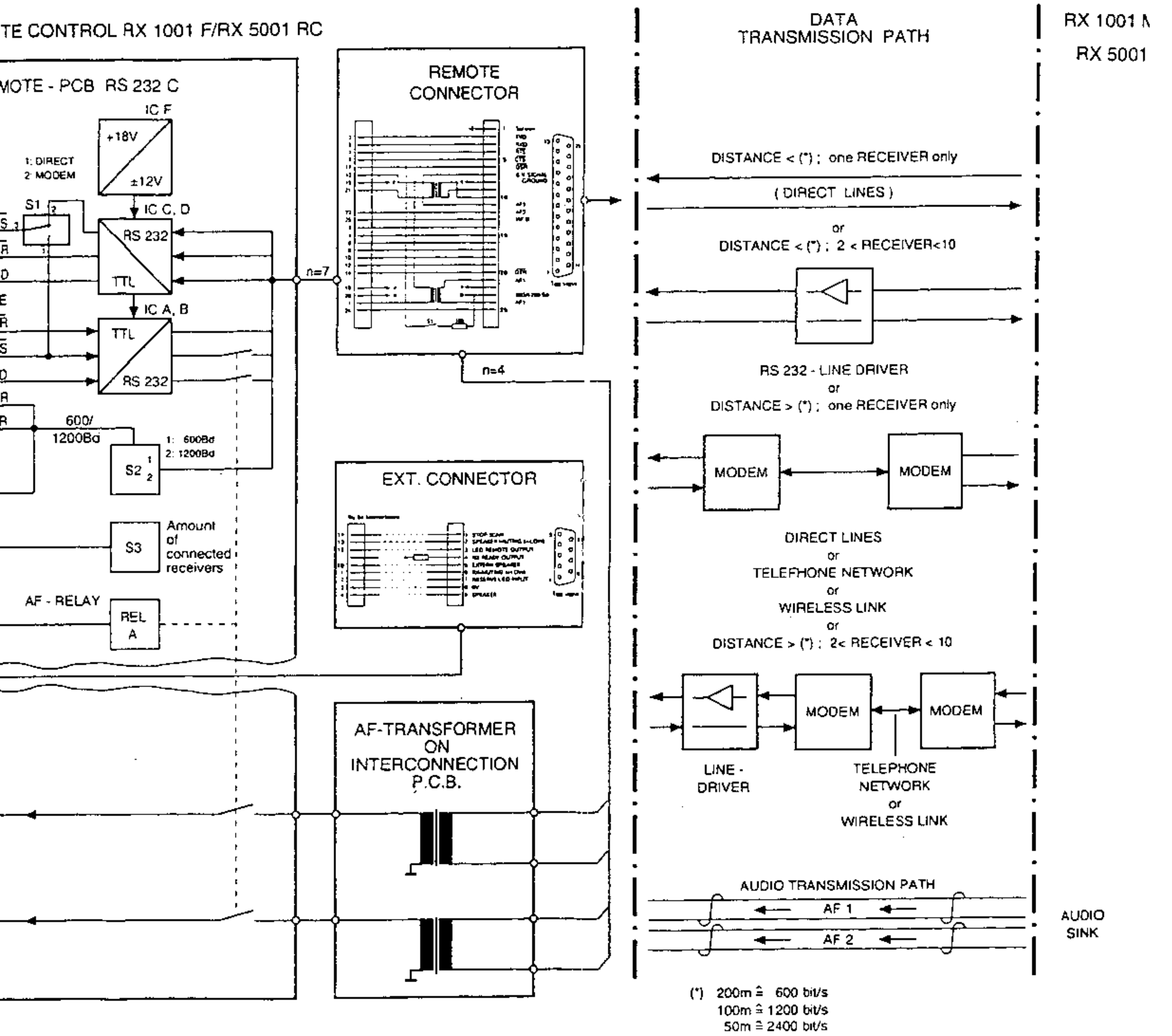
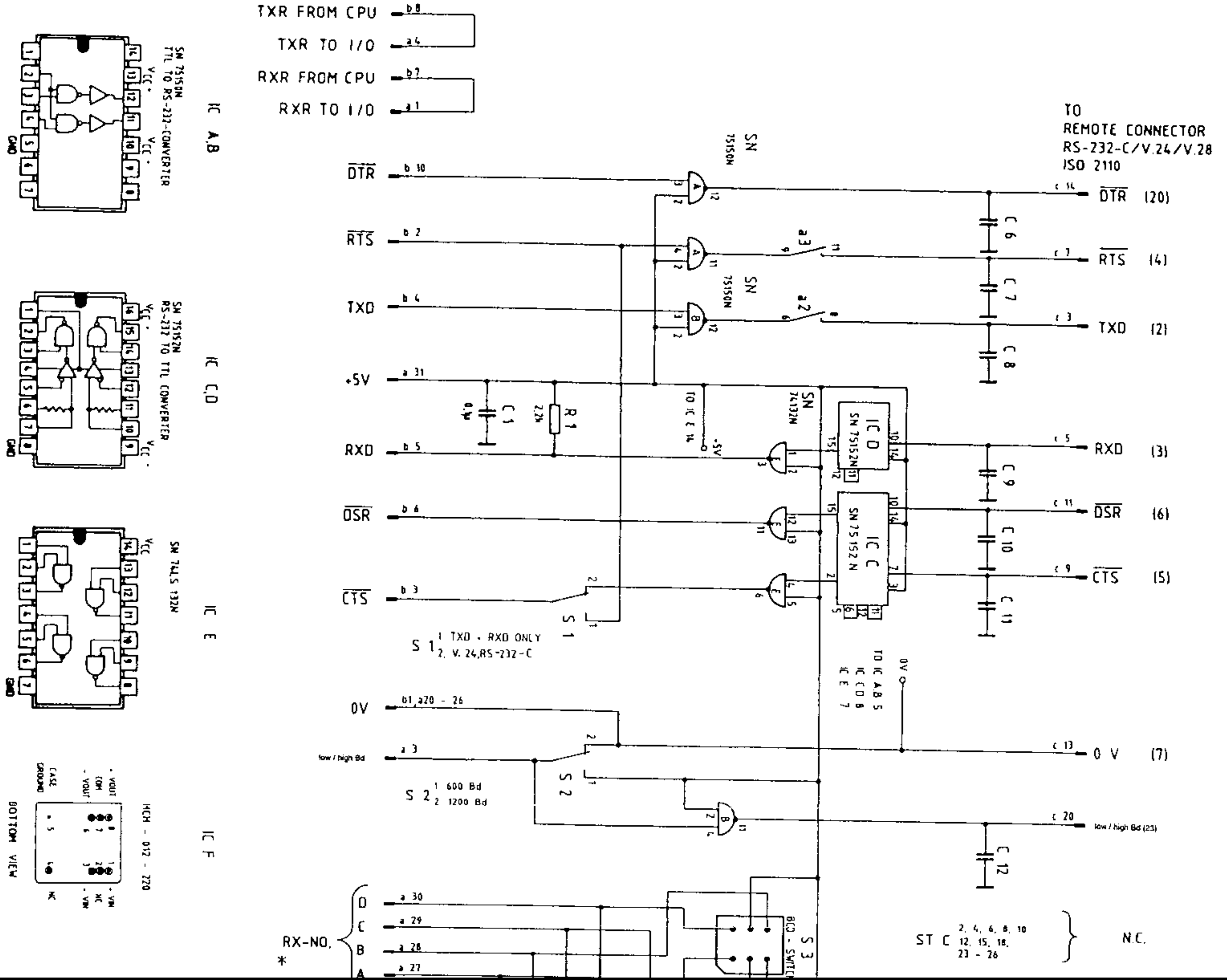


Fig. 5-8
Schematic Diagram
Remote Control
RX 1001 M / RX 5001
with Serial Interface RS 232 C



TXR FROM CPU
TXR TO I/O
RXR FROM CPU
RXR TO I/O
TO
REMOTE CONNECTOR
RS-232-C/V.24/V.28
ISO 2110
DTR (20)
RTS (4)
TXD (2)
RXD (3)
DSR (6)
CTS (5)
0 V (7)
low / high Bd (23)
DTR
RTS
TXD
+5V
RXD
DSR
CTS
0V
low / high Bd
SN 75150N
SN 74132N
IC D SN 75152N
IC C SN 75 152 N
TO IC E 14
R 1 2,2k
C 1 0,1µ
C 6
C 7
C 8
C 9
C 10
C 11
C 12
S 1 1 TXD + RXD ONLY 2, V. 24,RS-232-C
S 2 1 600 Bd 2 1200 Bd
0V
TO IC A,B 5
IC C,D 8
IC E 7
S 3
BCD - SWITCH
RX-NO.
*
D
C
B
A
ST C 2, 4, 6, 8, 10 12, 15, 18, 23 - 26
N.C.
IC A,B
SN 75150N
TTL TO RS-232-CONVERTER
IC C,D
SN 75152N
RS-232 TO TTL CONVERTER
IC E
SN 74LS 132N
IC F
HCH - 012 - 220
+ VOUT
COM
- VOUT
CASE GROUND
+ VIN
NC
- VIN
NC
BOTTOM VIEW
GND

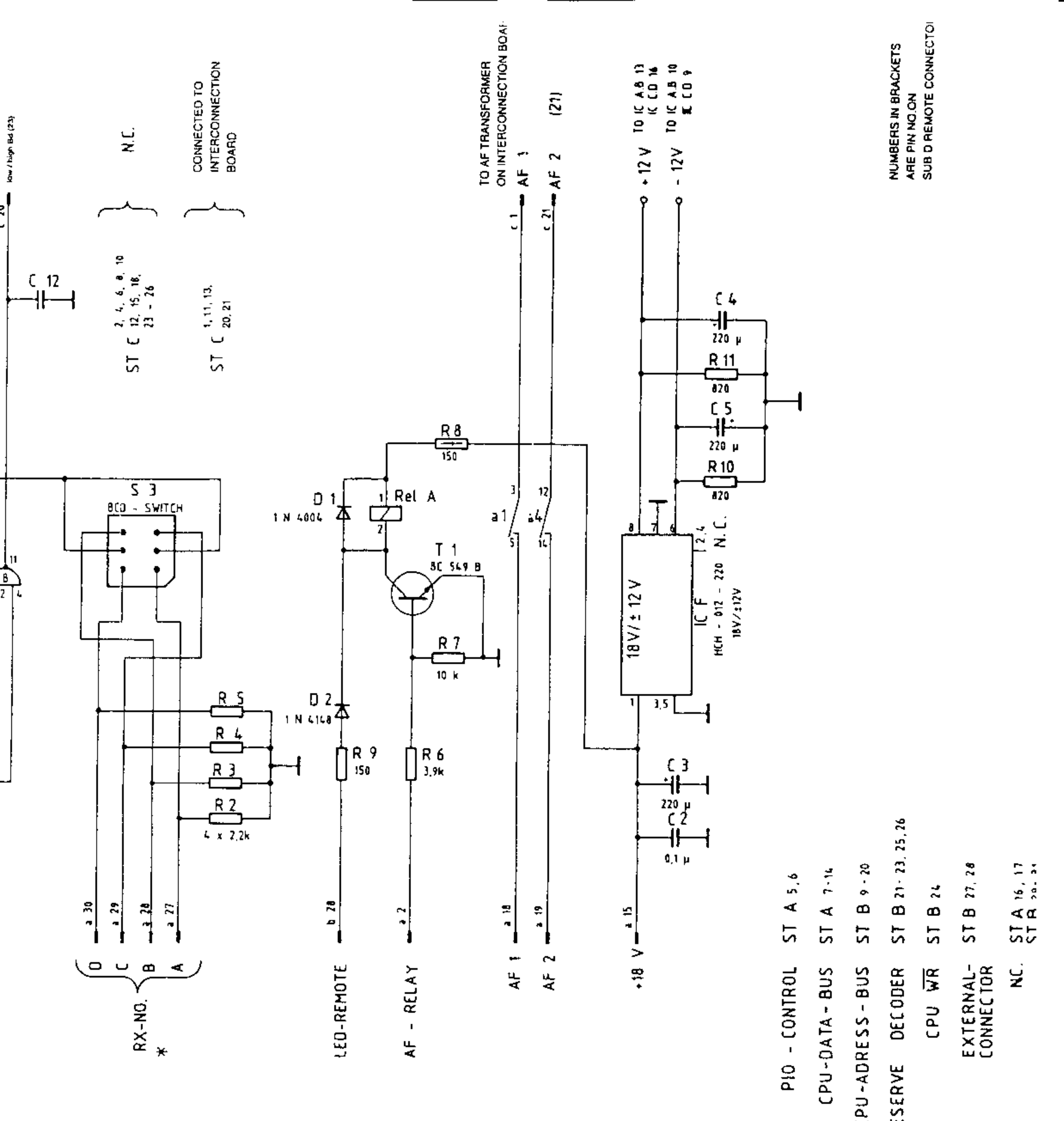


Fig. 5-10
SERIAL INTERFACE
Circuit Diagram RS 232 C
97 Sa C 2.140.190 A

Parts lists No.
97 D 2.140.190 A

-Remote RS 232 C-

Mark	Ident No.	Electr. Value	Type	Manufacturer
Capacitors:				
C1	1423.037	0,1F/2O/63V	MKS 2	WIMA
C2	1423.037	0,1F/2O/63V	MKS 2	WIMA
C3	1067.923	Elko 220F/20		SIEMENS
C4	1190.474	Elko 220F/16	DIN 41316-G	
C5	1190.474	Elko 220F/16	DIN 41316-G	
Diodes:				
D1	0763.764		1 N 4004	
D2	0745.677		1 N 4148	
Resistors:				
R1	0744.808	2,2k-5-0,6-0207	DIN 44052-G	
R2	0744.808	2,2k-5-0,6-0207	DIN 44052-G	
R3	0744.808	2,2k-5-0,6-0207	DIN 44052-G	
R4	0744.808	2,2k-5-0,6-0207	DIN 44052-G	
R5	0744.808	2,2k-5-0,6-0207	DIN 44052-G	
R6	0744.905	3,9k-5-0,6-0207	DIN 44052-G	
R7	0179.701	10k-5-0,6-0207	DIN 44052-G	
R8	0977.780	150k-5-0,7-0309	DIN 44052-G	
R9	0977.780	150k-5-0,7-0309	DIN 44052-G	
R10	0725.854	820-5-0,7-0309	DIN 44052-G	
R11	0725.854	820-5-0,7-0309	DIN 44052-G	
Integrated Circuits:				
IC-A	1398.334	SN 75150 N		TEXAS
IC-B	1398.334	SN 75150 N		TEXAS
IC-C	1398.342	SN 75152 N		TEXAS
IC-D	1398.342	SN 75152 N		TEXAS
IC-E	1090.933	SN 74 LS 132 N		TEXAS
IC-F		DC-DC converter HCHR-012-220		
Transistors:				
T1	1291.033	BC 549 B		ROE

Parts lists No.
97 D 2.140.190 A

-Remote RS 232 C-

Mark	Ident No.	Electr. Value	Type	Manufacturer
Supplements:				
Rel. A		Relay NF-4E-12 V SDS		
S1	1422.944	Micro switch TS 1		Jeanrenaud
S2	1422.944	Micro switch TS 1		Jeanrenaud
S3	1417.835	BCD-micro-switch	Typ 230002G	EECO
STA	0681.296	Multi point conn.31 pins	DIN 41617	
STA	0681.296	Multi point conn.31 pins	DIN 41617	
STC	1118.943	Edge conn. 26 pins Scotchflex 3429-1002		3M