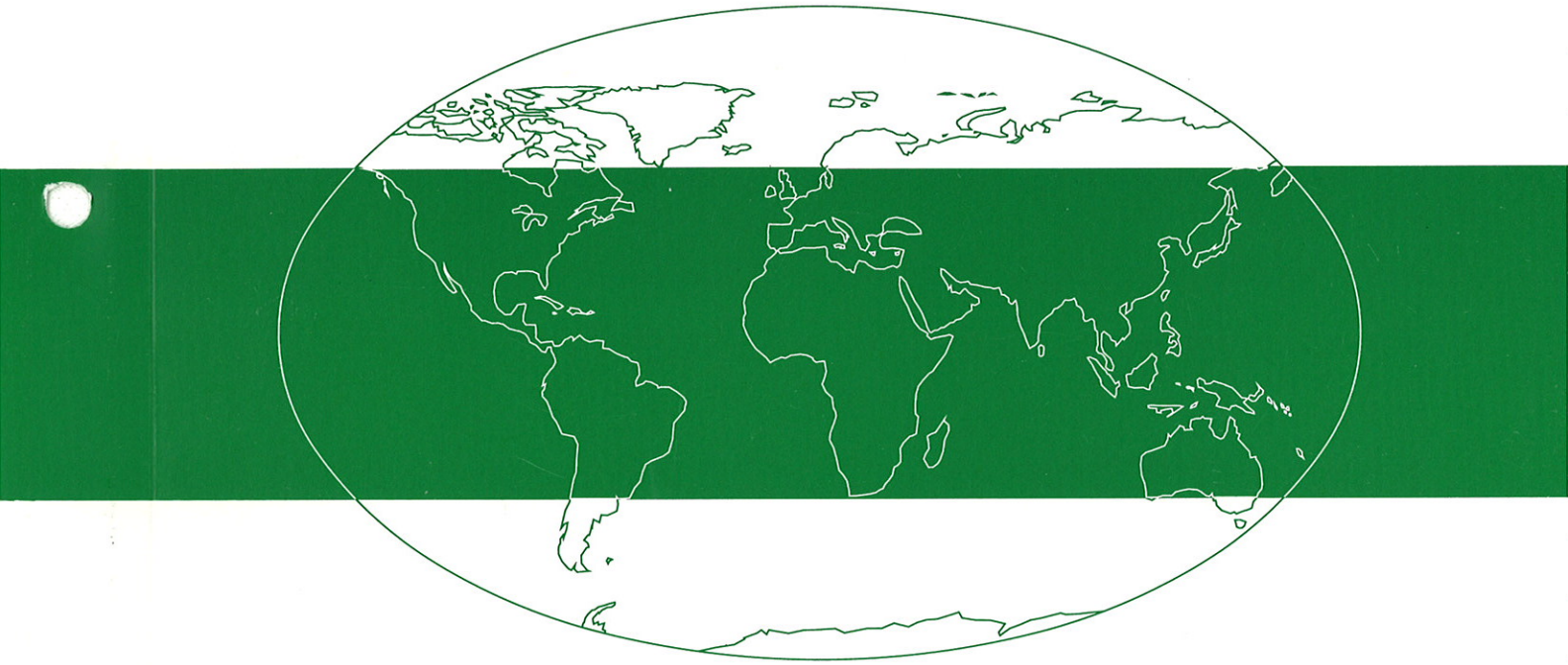
RT 146 model juni 1996

SAILOR



INSTRUCTION BOOK FOR SAILOR MULTI-REMOTE VHF-SYSTEM

PART I
INSTALLATION OF VHF AND CONTROL UNITS

PART II
INSTRUCTION BOOK FOR VHF RT146

PART III
INSTRUCTION BOOK FOR VHF CONTROL UNITS C401, C402, C403 AND REMOTE CONTROL BOX H410.

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1.1 INTRODUCTION TO SAILOR VHF PROGRAMME

SAILOR VHF PROGRAMME is comprising of a series of units which give a greater flexibility as regards installation and operation.

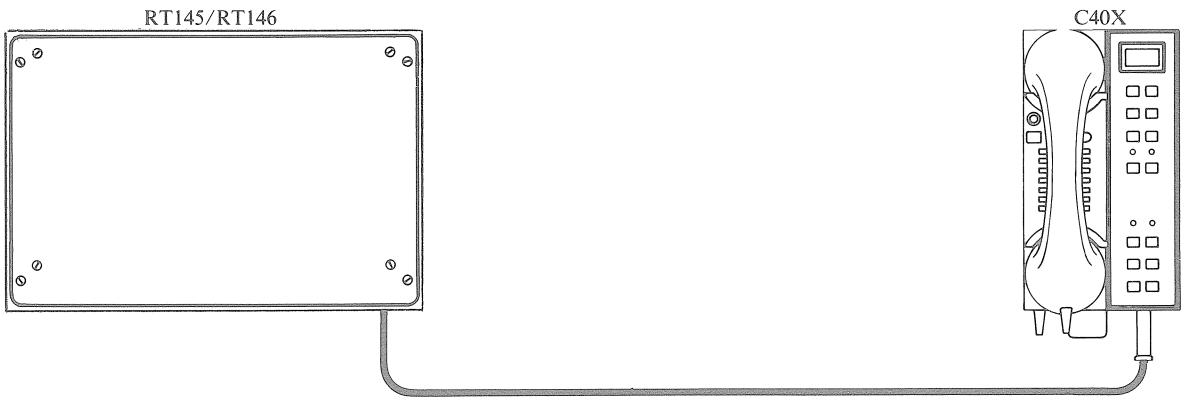
The most simple combination comprises of e.g. the SAILOR VHF RT145/RT146, which can be mounted hidden away close to the aerial feed-through or the batteries. A 16 lead multicable is installed from the RT145/RT146 to the most suitable operational point where the SAILOR CONTROL UNIT e.g. C401 easily can be mounted because of its small dimensions.

The most comprehensive installation with an unlimited number of operation points also consists as mentioned above of one SAILOR VHF RT145/RT146 and a number of SAILOR CONTROL UNITS e.g. C401 and a corresponding number of SAILOR REMOTE CONTROL BOXES. H410.

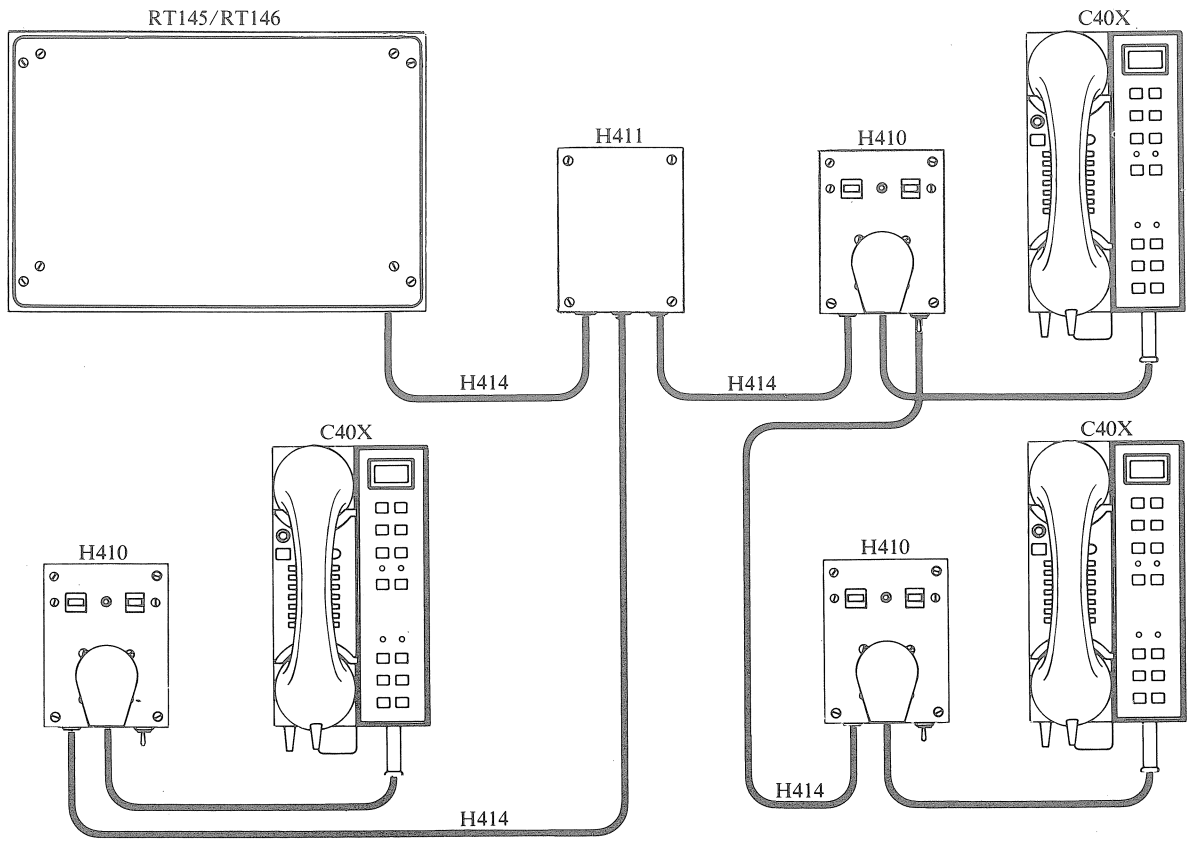
All operation points have full-function on the station. Only one operation point at a time can be in operation, and all Remote Control Boxes will show »IN USE«.

One or more operation points can have preference so that they at all times can have the full function of the station which is suitable for the Control Unit on the bridge. If there is more than one operation point on the bridge, they can all have preference.

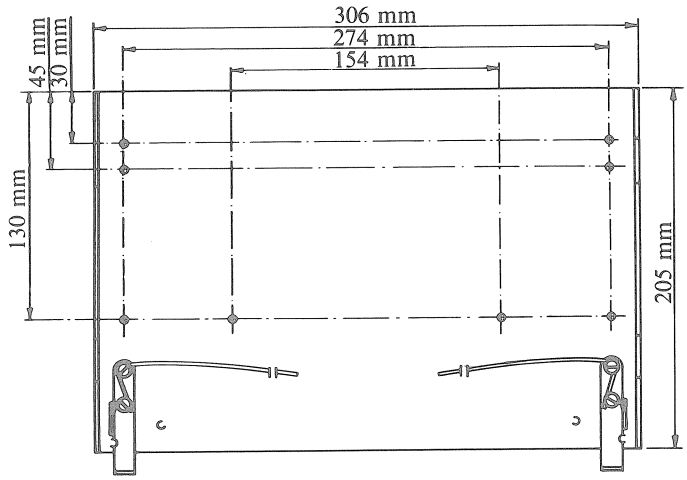
1.2 NORMAL INSTALLATION



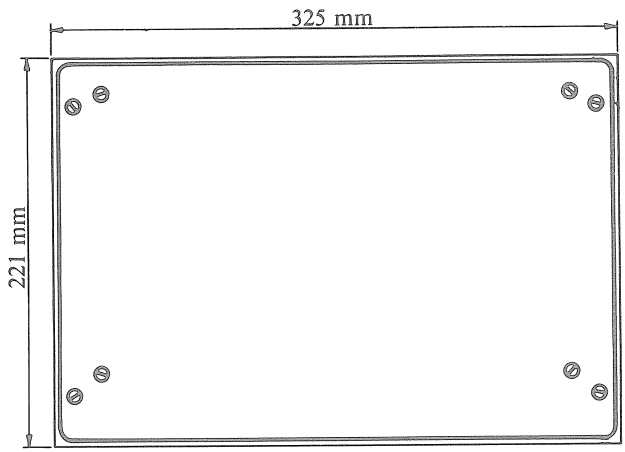
1.3 FULL REMOTE CONTROL INSTALLATION

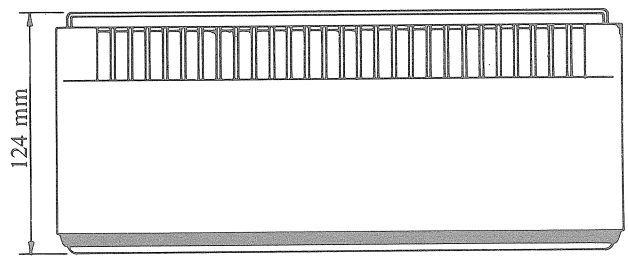


2. INSTALLATION OF SAILOR VHF RT145/RT146



Mounting panel





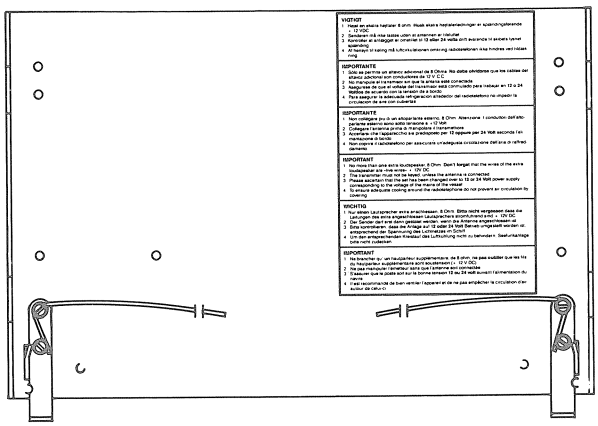
2.1 MOUNTING

The SAILOR VHF RT145/RT146 radiotelephone can easily be installed anywhere in the radio room or hidden away close to the antenna feed-through or the batteries. The mounting panel is fixed to the bulkhead by means of 4 screws. The set is hung up on this, there is 4 hooks on the mounting panel matching 4 slots at the rear side of the set. Two spring loaded locks prevent the set from becoming loose from this mounting panel. If the set has to be taken down, the locks must be pushed in the direction of the arrows, lifting the set simultaneously.

2.2 POWER SUPPLY RT145/146

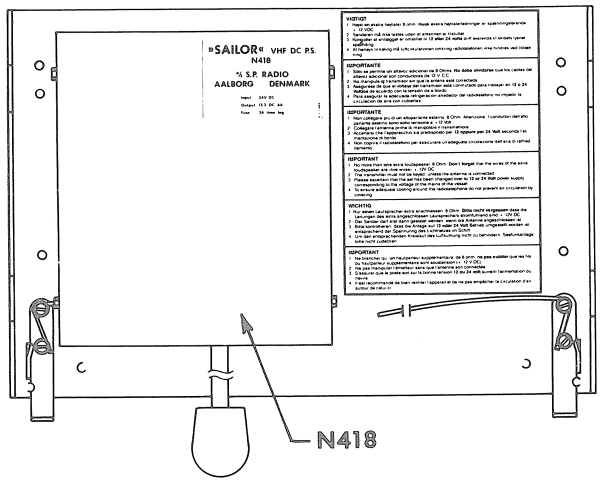
The SAILOR VHF RT145/146 can be delivered in two versions: for 12V DC supply and for 24V DC supply voltage.
For 110V AC - 127V AC, 220V AC or 237V AC supply voltage an external power supply N163 can be used. In that case SAILOR VHF RT145/146 has to be a 24V DC version.
Please ascertain that the SAILOR VHF RT145/146 is set to 12V or 24V corresponding to the voltage of the mains of the vessel.
SAILOR VHF RT145/146 can easily be changed from 24V power supply to 12V power supply or vice versa.

2.2.1 12V VERSION



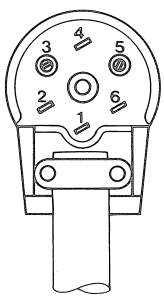
SAILOR VHF RT146 is as standard set delivered for 12V DC supply complete with power connector.
Change from 12V DC supply to 24V DC supply is done by mounting the VHF supply N418 on the mounting panel.

2.2.2 24V VERSION



Change from 24V DC to 12V DC supply is done by removing the VHF power supply N418 from the mounting panel and connect a new 12V DC power connector directly to the set.

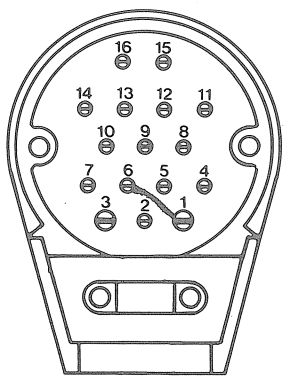
2.2.3 POWER CONNECTOR



View from mounting side.

Pin 1.	Connected to channel
Pin 2.	Controlled relay contacts in special versions. E.g. for muting purposes.
Pin 3.	+ 12/24V power supply.
Pin 4.	ON/OFF
Pin 5.	-12/24V power supply.
Pin 6.	No connection.

2.2.4 CONTROL-UNIT CONNECTOR



Pin no.	Colour	
1.	Black-Violet	-12V supply
2.	White/Green	Key
3.	White-Grey	+12V supply
4.	Blue	AF from RX
5.	Green	AF to TX
6.		No connection
7.	White/Grey	ON/OFF
8.	Brown	A^1
9.	Red	B^1
10.	Pink	C^1
11.	Yellow	D^1
12.	Yellow/Brown	A^{10}
13.	Green/Brown	B^{10}
14.	Grey/Brown	C^{10}
15.	White/Yellow	US-Mode
16.	Red/Blue	1W

2.3 ANTENNAS

All common 50 ohm antennas, which cover the used frequency range with a reasonable standing wave ratio, maximum, 1:1.5, are applicable.

The antenna is connected to the set by means of a 50 ohm coaxial cable with low loss, e.g. RG8U. At the cable end a PL259 plug is mounted.

To ensure maximum operating range, the antenna should be mounted as high as possible, and the maximum distance to other metal parts must be at least 1 metre.

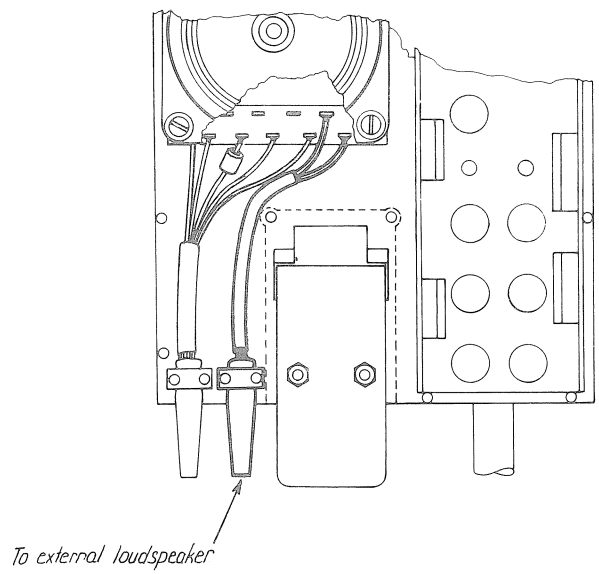
An antenna offering the necessary specifications can be delivered from S. P. Radio. This antenna is characterized by small external dimensions. For further particulars see special brochure: VHF AERIALS.

2.4 INSTALLATION OF AUXILIARY LOUDSPEAKER

If needed an 4 ohm external loudspeaker can be connected to a control unit. The external loudspeaker is coupled in parallel with the internal loudspeaker in the control unit by soldering the two wires for the ext. L.S. to the same two soldering lugs on the mounting panel as the internal loudspeaker is connected to.

The two wires for the ext. L.S. is taken through the plastic case covering the control unit in a hole which has to be made by the technician making the installation. The hole is made by biting off the thin par of the wall in the recess beside the feed-through for the cable to the microtelephone handset.

Precaution must be taken to avoid short-circuits between the two wires for the ext. L.S. and other wires, including ground. (DC on the wires).



3. INSTALLATION OF CONTROL UNITS

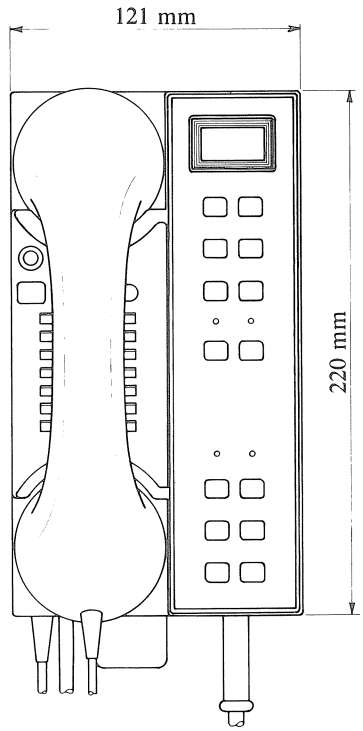
Because of its small dimensions the VHF control units can be placed on the most convenient place for operation.

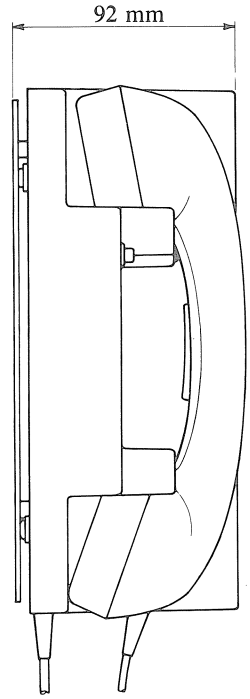
The SAILOR MOUNTING PLATE H413 is fixed to the bulkhead by means of 4 screws.

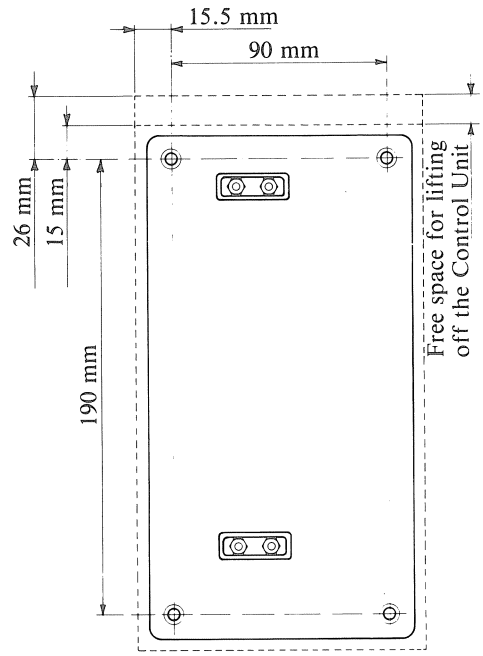
The control unit is placed at the mounting plate with the two hooks placed in the matching slots on the rear side of the control unit, and the control unit is pressed downwards until the spring loaded lock snaps in. The control unit is easily released from the mounting plate. The spring-lock arm is depressed and the control unit is pushed upwards.

When mounted, the 16-pole plug on the cable from the control unit can be connected to the SAILOR VHF RT145 in either of the following three manners:

1. Directly to the 16-pole receptacle on the rear side of the transceiver.
2. To SAILOR CONNECTION BOX H412, when only one control unit is used and the multicable between RT145 and control unit has to be extended.
3. To SAILOR REMOTE CONTROL BOX H410, when more than one control unit has to be connected to the same SAILOR VHF RT145.

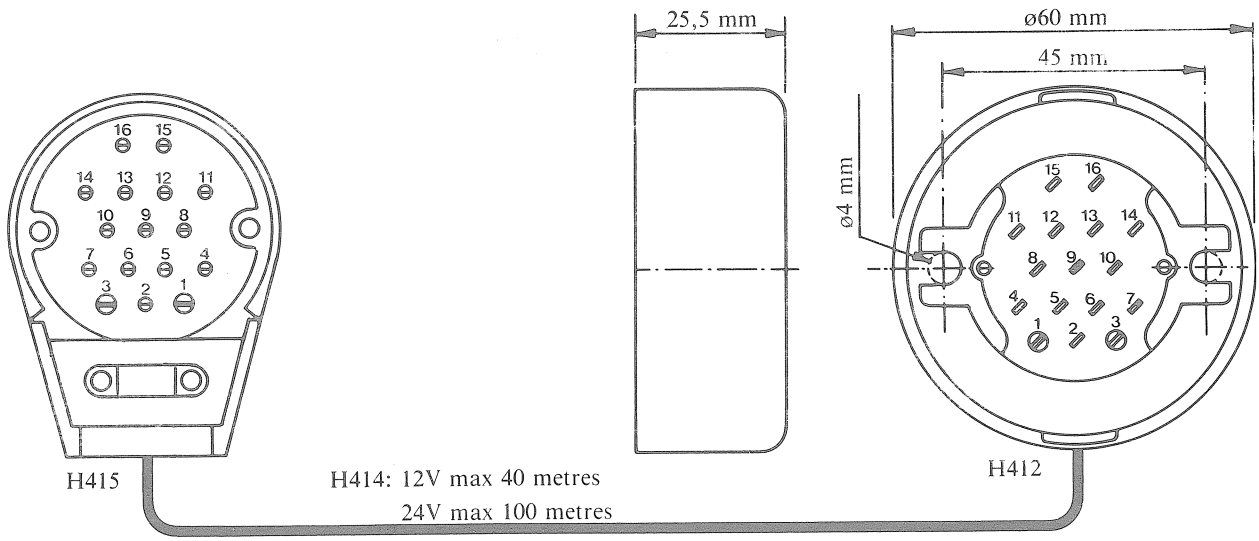






3.1 INSTALLATION OF SAILOR CONNECTION BOX H412

When the control unit has to be placed more than 1.5 metre away from the transceiver max. 100 metres with 24V supply, max. 40 metres with 12V supply, the multicable has to be extended by means of a 16-pole plug H415, SAILOR CONNECTION BOX H412 and the needed length of SAILOR MULTICABLE H414. The individual wires are soldered to the plug H415, respectively the receptacle (H412) in the manner shown on the figure below.



Pin no. Colour
1. Black no. 1 (0,75 mm²)
1. Screen for White
1. Screen for Brown
2. White/Green
3. Black no. 3 (0,75 mm²)
4. Brown
5. White
6. No connection
7. Black no. 2 (0,75 mm²)
8. Black (0,25 mm²)
9. Red
10. Pink
11. Yellow
12. Green
13. Blue
14. Grey
15. White/Yellow
16. Blue/Red

The following cores are open ended in plug:
Brown/Green
Violet
Grey/pink

Pin no. Colour
1. Black no. 1 (0,75 mm²)
2. White/Green
3. Black no. 3 (0,75 mm²)
4. Brown
5. White
6. No connection
7. Black no. 2 (0,75 mm²)
8. Black (0,25 mm²)
9. Red
10. Pink
11. Yellow
12. Green
13. Blue
14. Grey
15. White/Yellow
16. Blue/Red

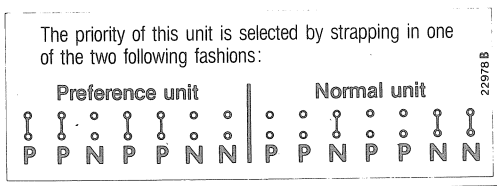
The following cores are left open ended in receptacle:
Brown/Green
Violet
Grey/Pink
Screen for White
Screen for Brown

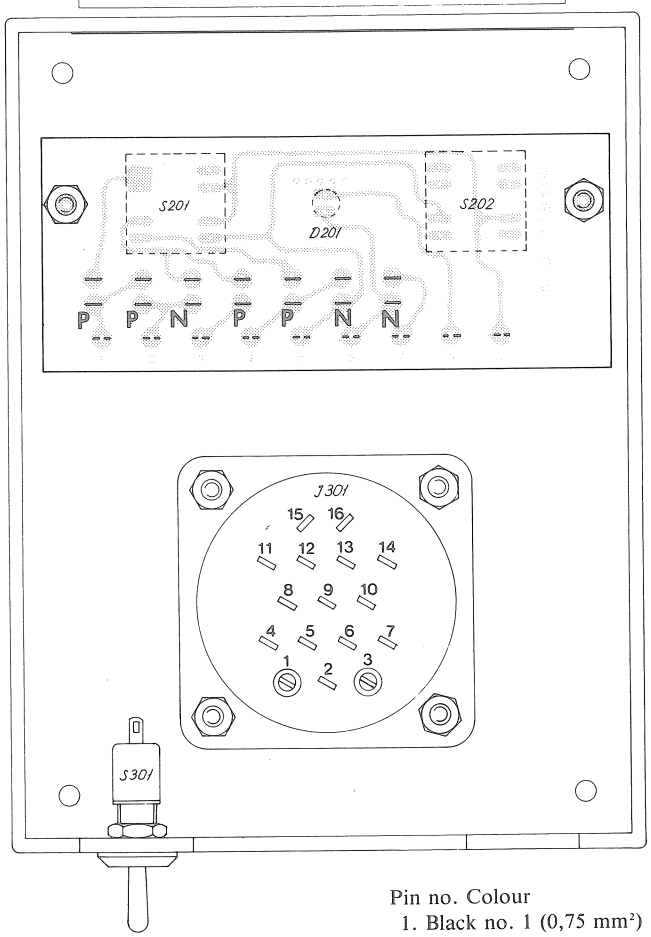
3.2 INSTALLATION OF REMOTE CONTROL BOX H410

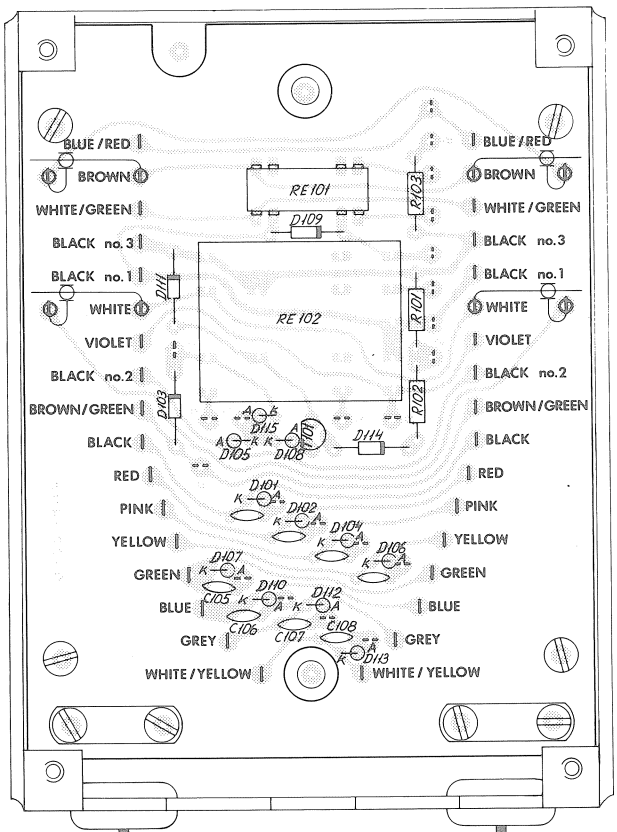
When more than one control unit has to be connected to SAILOR VHF RT145, the installation must be made by means of SAILOR REMOTE CONTROL BOX H410 and SAILOR MULTICABLE H414.

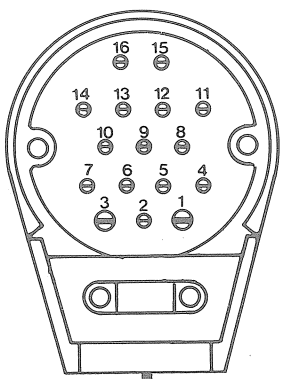
The individual wires in the multicable are soldered to the plug H415, respectively the REMOTE CONTROL BOX H410 in the manner shown below.

The distance between the VHF set and a CONTROL UNIT must not exceed 100 metres with 24V supply and 40 metres with 12V supply.









H415

Pin no. Colour
1. Black no. 1 (0,75 mm²)
1. Screen for White
1. Screen for Brown
2. White/Green
3. Black no. 3 (0,75 mm²)
4. Brown
5. White
6. No connection
7. Black no. 2 (0,75 mm²)
8. Black (0,25 mm²)
9. Red
10. Pink
11. Yellow
12. Green
13. Blue
14. Grey
15. White/Yellow
16. Blue/Red

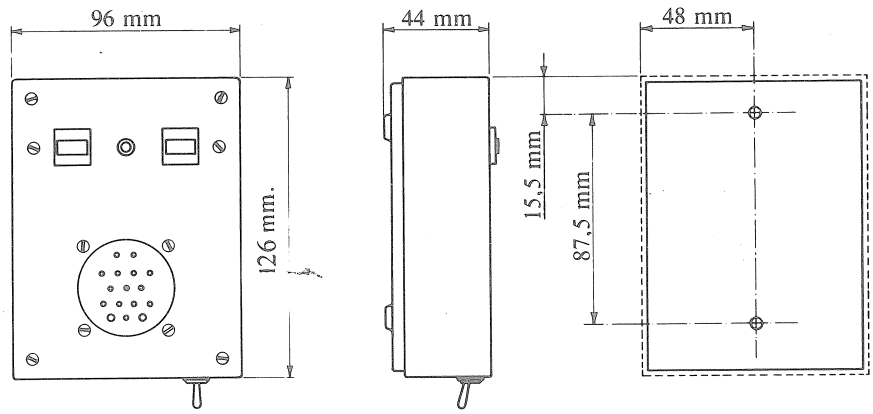
The following cores are left open ended in plug:
Brown/Green
Violet
Grey/Pink

To next REMOTE CONTROL BOX H410 or SPLITTER BOX H411

H414: 12V max. 40 metres
24V max. 100 metres

When soldering the wires in H410, care must be taken to prevent a short-circuit between the screens around the white and brown wires. Therefore the two shielded wires are passed through the sleevings – delivered with the remote control box – before the plastic insulation is cut off and the stripped wires and the screens are soldered to the appropriate soldering lugs in H410. The REMOTE CONTROL UNIT H410 is just fixed to the bulkhead by means of the two screws delivered with the unit.

DIMENSIONS:
REMOTE CONTROL BOX H410
SPLITTER BOX H411



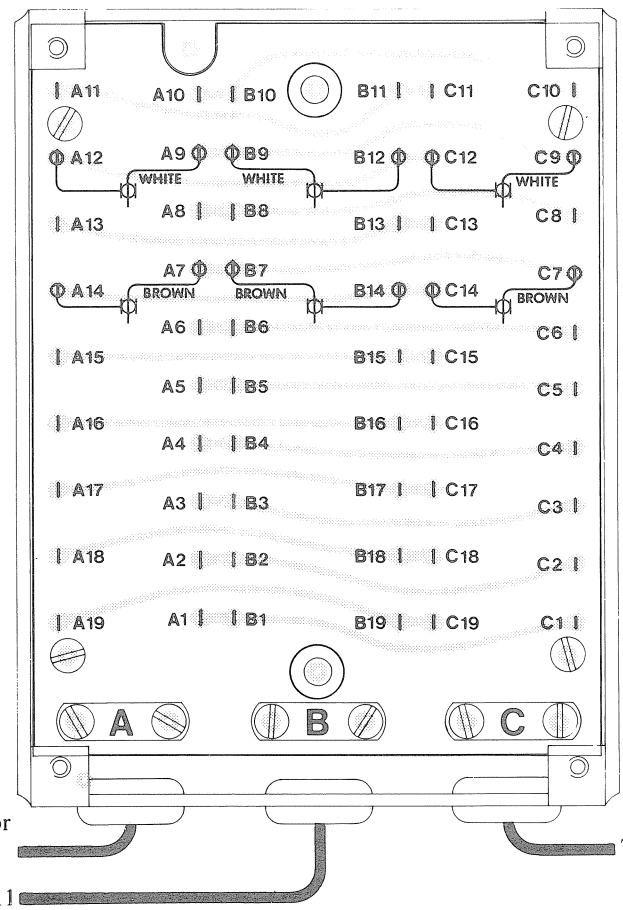
3.3 INSTALLATION OF SPLITTER BOX H411

If a branch point is needed in the installation, the MULTICABLE H414 can be split up into two branches by means of SAILOR SPLITTER BOX H411.

The total length of cables in the installation must not exceed 200 metres.

The distance between the VHF set and a control-unit must not exceed 100 metres with 24V supply and 40 metres with 12V supply.

The installation of H411 is sketched and described below.



From H410 or H411 or Plug H415

To H410 or H411

To H410 or H411

The screened wires in the three cables are soldered to the following lugs, as indicated on the printed circuit board:

A7: Brown in A.
A14: Screen for brown in A.
A9: White in A.
A12: Screen for white in A.

B7: Brown in B.
B14: Screen for brown in B.
B9: White in B.
B12: Screen for white in B.

C7: Brown in C.
C14: Screen for brown in C.
C9: White in C.
C12: Screen for white in C.

To prevent a short-circuit between the screens around the white and brown wires, the two shielded wires are passed through the sleevings – delivered with the splitter box – before the plastic insulation is cut off and the stripped wires and the screens are soldered to the appropriate soldering lugs in H411.

The remaining 15 wires can be soldered to the lugs as desired, the only demand is that the individual colours in the three cables are soldered to a set of lugs belonging together.

Ex. Blue in A to A3, blue in B to B3, blue in C to C3.

The grey/pink wire is not used and therefore just left open ended.

The splitter box is fixed to the bulkhead by means of two screws, delivered with the unit.

This page is valid from serial no. 285.644.

4. OPERATING FREQUENCIES FOR SAILOR RT144AC/RT145/RT146

CHANNEL	TRANSMITTING FREQUENCY (MHz)	RECEIVING FREQUENCY (MHz)	
		US MODE (A.-CHANNELS)	INT'L MODE (INT.-CHANNELS)
01	156.050	156.050	160.650
02	156.100	160.700	
03	156.150	160.750	
04	156.200	160.800	
05	156.250	156.250	160.850
06	156.300	156.300	
07	156.350	156.350	160.950
08	156.400	156.400	
09	156.450	156.450	
10	156.500	156.500	
11	156.550	156.550	
12	156.600	156.600	
13	156.650	156.650	
14	156.700	156.700	
15	156.750	156.750	
16	156.800	156.800	
17	156.850	156.850	
18	156.900	156.900	161.500
19	156.950	156.950	161.550
20	157.000	161.600	
21	157.050	157.050	161.650
22	157.100	157.100	161.700
23	157.150	157.150	161.750
24	157.200	161.800	
25	157.250	161.850	
26	157.300	161.900	
27	157.350	161.950	
28	157.400	162.000	
60	156.025	160.625	
61	156.075	160.675	
62	156.125	160.725	
63	156.175	156.175	160.775
64	156.225	160.825	
65	156.275	156.275	160.875
66	156.325	156.325	160.925
67	156.375	156.375	
68	156.425	156.425	
69	156.475	156.475	
70	156.525	156.525	
71	156.575	156.575	
72	156.625	156.625	
73	156.675	156.675	
74	156.725	156.725	
77	156.875	156.875	
78	156.925	156.925	161.525
79	156.975	156.975	161.575
80	157.025	157.025	161.625
81	157.075	157.075	161.675
82	157.125	157.125	161.725
83	157.175	157.175	161.775
84	157.225	161.825	
85	157.275	161.875	
86	157.325	161.925	
87	157.375	161.975	
88	157.425	157.425	162.025
WX1	Inhibit	162.550	
WX2	Inhibit	162.400	
WX3	Inhibit	162.475	
WX4	Inhibit	161.650	

5.1 CHANGE OF PREFERENCE CHANNEL C40X

When CH. 16 is not wanted as preference channel by dual watching or quick selection of a special wanted channel a modification has to be done on the channel selector unit. The coding on the data selectors IC106 and IC111 has to be changed.

Also the channel to which the set is preset when it is switched »ON«, normally CH. 16, can be changed by changing the code for the counters IC107 and IC110.

The preset inputs are coded as the inverted code for the address code for the PROM's, see the ADDRESS-TABLE in the section about programming of private channels:

Example: Address code for CH. 16:	Binary coded (international mode)							
	A7	A6	A5	A4	A3	A2	A1	A0
	1	1	1	0	1	0	0	1

The MSB, A7 is used for US mode.

Code for counters and data selectors		»10«			»1«			
		C^{10}	B^{10}	A^{10}	D^{1}	C^{1}	B^{1}	A^{1}
	1	0	0	1	0	1	1	0

If the preference channel is changed to e.g. CH. 10 instead of CH. 16 only the IC's 106 and 107 controlling the »1« has to be changed from a 6 to a 0. The code has to be changed from {0, 1, 1, 0} to {0, 0, 0, 0,}.

IC 107
MC14510B

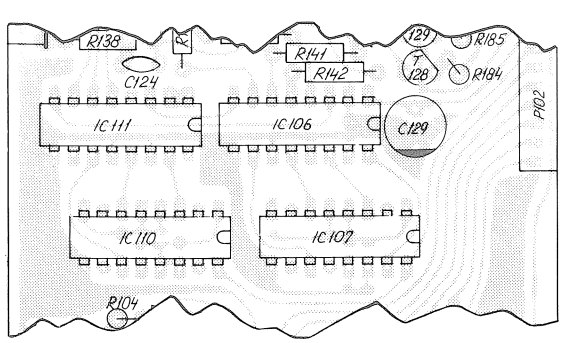
Preset	P3	P2	P1	Po
Pin	3	13	12	4
Code	0	0	0	0

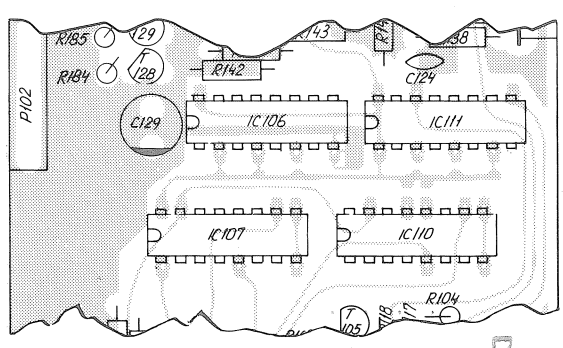
Soldering side:
Cut the connection to pin 16 (+).
Connect pin 4 to pin 13 and all inputs are grounded.

IC106
MC14519B

X input	X3	X2	X1	X0
Pin	15	2	4	6
Code	0	0	0	0

Component side:
Cut the lines to pin 2 and 4 from the + line.
Soldering side:
Pin 2 and 4 has to be grounded.





5.2 CHANGE OF VOLUME START-UP LEVEL

When the control-unit C40X is switched on a start-up level is set for the volume control.
The volume start-up level is a binary code on the preset inputs PO to P4 on the counter IC307.
From the factory the start-up level is set to level 9.
In some of the earliest produced control-units the start-up level was set to 5, please see SAILOR service information No. 84.
The start-up level can be changed in accordance with the below table.

		IC307			
	No.	Pin 3 P3	Pin 13 P2	Pin 12 P1	Pin 4 PO
Min. level	0	L	L	L	L
	1	L	L	L	H
	2	L	L	H	L
	3	L	L	H	H
	4	L	H	L	L
	5	L	H	L	H
	6	L	H	H	L
	7	L	H	H	H
	8	H	L	L	L
	9	H	L	L	H
	10	H	L	H	L
	11	H	L	H	H
	12	H	H	L	L
	13	H	H	L	H
Max. level	14	H	H	H	L
	15	H	H	H	H

»L« means connected to ground.
»H« means connected to +8V.

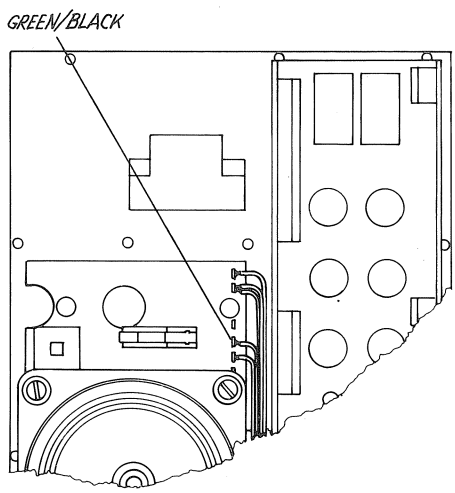
5.3 CHANGE OF DIMMER CIRCUIT C40X

Display extinguished in the fourth position: remove R103.
Filament lamps extinguished in the fourth position: remove R361.

5.4 MODIFICATION TO STOP DUAL WATCH FACILITY C40X

Solder the green/black wire from its soldering point and isolate it from ground.

If the soldering point beside is not in use, the wire can be soldered to this point.

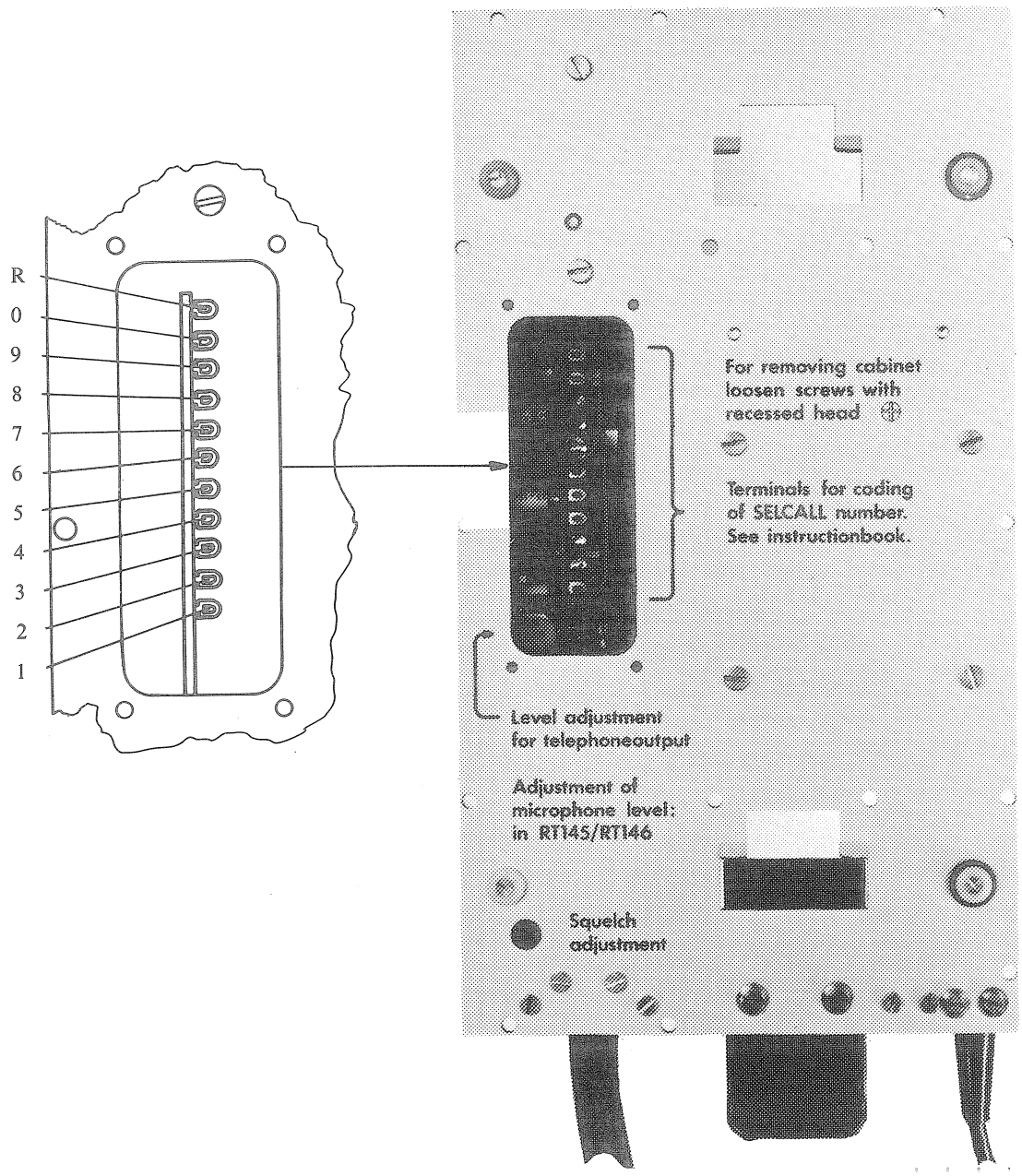


5.5 CODING OF SELCALL NUMBER C40X

ex: 7 2 3 8 9

- 1st figure - brown (most important figure)
- 2nd figure - red
- 3rd figure - orange
- 4th figure - yellow
- 5th figure - green (least important figure)

The five wires are soldered to the terminals carrying the numbers, which correspond to the figures of the call number, see photo.
If there are two identical figures in succession, the latter of them is to be soldered to (R).



Multi-remote VHF SYSTEM

PART II INSTRUCTION BOOK FOR VHF RT146

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1. GENERAL DESCRIPTON FOR SAILOR VHF RT146

SAILOR VHF RT146 is an all solid state constructed marine VHF radiotelephone, intended for ship/ship and ship/shore communication.

SAILOR RT146 can operate in duplex and simplex mode.

SAILOR RT146 is provided with built in duplex-filter for duplex communication on one antenna.

SAILOR RT146 includes all 55 international and U.S. VHF marine channels, and is prepared for up to 20 private channels to be selected as simplex or semiduplex channels.

SAILOR RT146 receiver section is a double-conversion superheterodyne system, which makes use of af phase-locked digital frequency synthesizer for frequency generation based on a single crystal to provide all channels and the 20 private channels.

SAILOR RT146 transmitter section is a phase-locked phase-modulated signal generator with a solid state RF power amplifier.

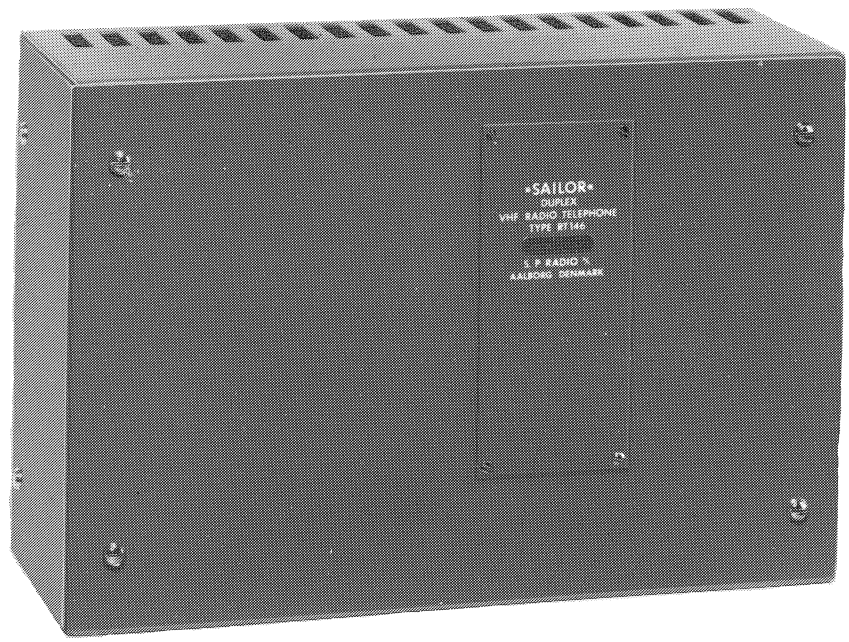
SAILOR RT146 is provided with a microprocessor for control of the frequency synthesizer.

SAILOR RT146 is for 12Volt DC supply. Voltage change-over from 24V to 12V is done by the switchmode power supply N418 located on the mounting panel.

SAILOR RT146 employs the most modern circuit technology, housed in a corrosion resistant all-welded steel cabinet with a green antirust nylon finish.

SAILOR RT146 is built-up of modules placed on a swing chassis, which facilities service and repair.

SAILOR RT146 in conjunction with VHF CONTROL UNITs C401, C402 or C403 and REMOTE CONTROL UNIT H410 provides the user with the most flexible VHF communication set in the world.



1.1. TECHNICAL DATA FOR SAILOR VHF RT146

GENERAL

Channel separation	25 kHz
Modulation	G3EJN (Phase)
Operation	Simplex and Duplex
Temperature range	-20°C to +55°C
Frequency stability	+-10 ppm
Antenna impedance	50 ohm
Nominal Power Supply	13.2V DC
Power Supply Variation ..... (with reduced data according to international standards)	12V DC -10% to +30%

24V DC Power Supply via VHF Power Supply N418

Power consumption	Stand by = 0.4 Amp.
	Transmit = 5.5 Amp.
Dimensions	Height = 222 mm
	Width = 326 mm
	Depth = 118 mm
Weight	8.4 kg

RECEIVER

Frequency range simplex	155.400 - 158.000 MHz
Frequency range duplex	160.000 - 162.600 MHz
Sensitivity	0.30 uV pd at 12 dB SINAD
Duplex desensitisation	Less than 1 dB
AF output	0.8V RMS/300 ohm

TRANSMITTER

Frequency range normal	155.400 - 158.000 MHz
RF output power	25 W, +0 to - 0.7 dB
Reduced RF output	0.5 - 1 W
Distortion	Less than 2%

1.2. PRINCIPLE OF OPERATION

1.2.1. FREQUENCY GENERATION

The frequencies are generated from a crystal oscillator on 21 MHz. The 21 MHz is divided in the REFERENCE DIVIDER to 2.1 MHz, which is the input to the RX-REFERENCE DIVIDER and clock-signal for the microcomputer. In the RX-REFERENCE DIVIDER the 2.1 MHz is divided with 168 to 12.5 kHz which is reference for the PHASE DETECTOR. This makes it possible to change the frequency from the RX-VCO with 12.5 kHz spacing .
The signal from the RX-VCO is divided in a PRESCALER, which divides with 33 until the A-COUNTER has reached zero, whereafter it divides with 32. The N-COUNTER divides the output from the PRESCALER, and the output is led to the PHASE-DETECTOR, where it is compared with the 12.5 kHz. If there is a difference, an error voltage will be generated. This is integrated in the LOOP-FILTER and the output of this filter controls the RX-VCO. The frequency of the RX-VCO is the receiving frequency minus the intermediate frequency.

$$f_{LO1} = f_{RX} - f_{1IF} = f_{RX} - 21.4 \text{ MHz}$$

The output from the RX-VCO is mixed with the output from the TX-VCO, which is in lock when it is 16.8 MHz above the RX-VCO. This means that the receiver always is 4.6 MHz above the transmitter, namely 21.4 - 16.8 = 4.6; and this difference is equal to the duplex-distance.
The 16.8 MHz from the MIXER is divided with 32 to 525 kHz, which is compared with the 21 MHz divided with 40 in the REFERENCE DIVIDER. The error voltage is integrated in the LOOP-FILTER, the output of this filter controls the TX-VCO.

1.2.2. RECEIVER

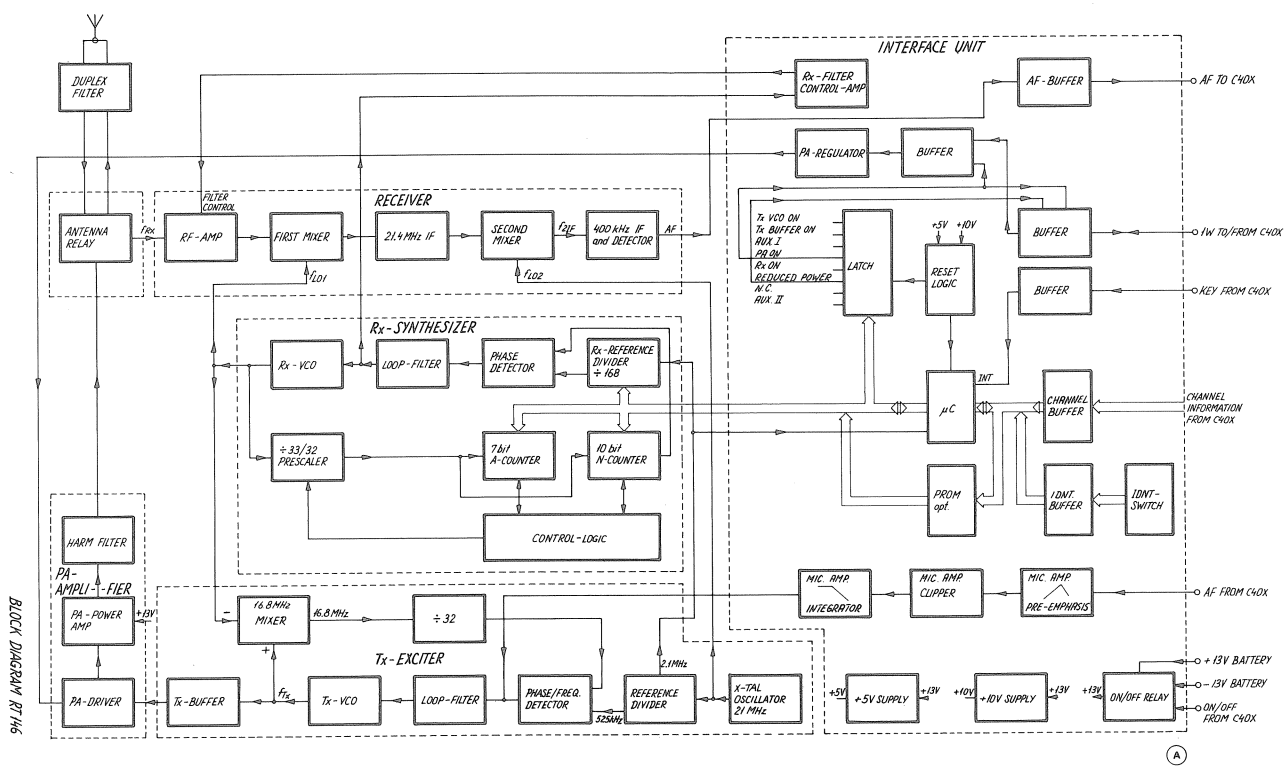
The antenne-signal is led through the duplex-filter and the antenna relay to the RF-AMPLIFIER. The bandpass filters are tuned by means of capacitor-diodes, which are controlled by means of a DC-voltage, which is derived from the control-voltage to the RX-VCO.
In the FIRST MIXER the antenna signal is mixed with the output from the RX-VCO to the intermediate frequency 21.4 MHz.
In the SECOND MIXER the 21.4 MHz is mixed with 21 MHz from the crystal-oscillator to 400 kHz, which is amplified and detected.
The audio frequency is amplified in the AF-BUFFER and led to the plug for the Control-Unit.

1.2.3. TRANSMITTER

The microphone signal from the Control-Unit is led through the MICROPHONE AMPLIFIER, where the necessary amplification limiting and filtering take place. The limiting is done by a clipper. The signal from the MICROPHONE AMPLIFIER is led to the LOOP-FILTER, where the phase-modulation of the transmitter takes place.
As the TX-VCO oscilates directly on the transmitting frequency, the signal only has to be amplified. This is done in the TX-BUFFER, PA-DRIVER and the PA-POWER AMPLIFIER. The power supply for the PA-driver is adjustable, and by means of this the output-power is adjusted. The harmonics of the output is filtered in HARM-FILTER, before it is led to the ANTENNA-RELAY and the DUPLEX-FILTER and to the antenna.

1.2.4. MICROCOMPUTER

The microcomputer (uC) performs the interface between the Control Unit and the transmitter/receiver. The microcomputer contains all the necessary information associated with each channel. Some private channels can be opened with the coding switch, but others have to be programmed in a PROM. Also some test-programmes are built into the uC.
When the set is switched on, the IDNT-switch is read once, and hereafter the channel-information from the Control Unit is read, and the dividing figure is calculated and sent to the RX-synthesizer. Also the information for the control-latch is sent. From the control-latch the output power, the antenna relay, and the supply for the receiver and transmitter, are controlled.
If the transmitter is keyed on a duplex-channel, the uC switches on the supply for the TX-VCO, TX-BUFFER, and the PA-DRIVER. If the transmitter is keyed on a simplex channel, the receiver is blocked first. The RX-synthesizer is shifted 4.6 MHz upwards, whereby the TX-VCO is moved to the transmitting frequency. Hereafter the ANTENNA-RELAY is engaged, supply is switched on to the TX-VCO, TX-buffer, and the PA-DRIVER. When the key is released it all happens again in the opposite order.



Block diagram RT146

This page is valid from serial no. 285.644.

1.3. IDENTITY SWITCH

RT146 is equipped with a switch by means of which the set can be tuned to fulfil the demands from different countries concerning permitted channels, reduced power, blocked channels etc.
It is also possible to programme a complete new function code for every channel from 0 - 29 and 60 - 89, if none of the programmed functions can be used.
The switch is also used for start of different test programmes in the microcomputer for selftest and for test of the synthesizer.
The switch consists of 8 individual switches, which are coded according to the following table.
Note that the switches are numbered in the table after their binary value. On the printed circuit board the switches are positioned in the same order, even though numbers 1 - 8 may be printed on them in the opposite direction, see fig. 1.3.

Fig. 1.3.

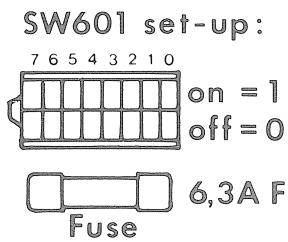


Table 1.3a.

The 3 most significant switches are coded according to the following table.

SW601

VAL. 765	Function
0XX	Channels 75 and 76 are blocked
1XX	Channels 75 and 76 are opened with reduced power
X0X	Channels 15 and 17 are opened with reduced power
X1X	Channels 15 and 17 are opened with full power
XX0	Channel 70 is opened
XX1	Channel 70 is TX-blocked

Frequency table for private channels:

1L = L1 = 155.500 MHz
2L = L2 = 155.525 MHz
L3 = 155.650 MHz

F1 = 155.625 MHz
F2 = 155.775 MHz
F3 = 155.825 MHz

WX1 = 162.550 MHz
WX2 = 162.400 MHz
WX3 = 162.475 MHz
WX4 = 161.650 MHz

37 = 157.850 MHz

22A = 157.100 MHz

This page is valid from serial no. 285.644.

Table 1.3.b. SW601 set-up:

SW601 VAL. 76543210	Dec.	Note	Programme	Private channels								AUX 2
				P0	P1	P2	P3	P4	F1	F2	F3	Note 3
XXX00000	0		Standard									16
XXX00001	1		Standard									16
XXX00010	2		Standard									16
XXX00011	3		Standard									16
XXX00100	4		Standard									16
XXX00101	5	1.	France, inland									10
XXX00110	6	1.	Germany, Rhine									10+13
XXX00111	7	1.	Belgium, pleasure									10
XXX01000	8	1.	Netherlands, inland/pleasure									10
XXX01001	9		All channels are simplex in US-mode									16
XXX01010	10		Standard									16
XXX01011	11		Standard									16
00001100	12	2.	Function coded in IC605 (PROM)									10
00001101	13	2.	Function coded in IC605 (PROM)									16
00001110	14		Function coded in IC605 (PROM)									10
00001111	15		Function coded in IC605 (PROM)									16
XXX10000	16		Standard				1L	2L				16
XXX10001	17		Standard		L1	L2	L3					16
XXX10010	18								F1	F2	F3	16
XXX10011	19		Standard		WX1	WX2	WX3	WX4				16
XXX10100	20		Standard	22A								16
XXX10101	21		Standard	22A	WX1	WX2	WX3	WX4				16
XXX10110	22		Standard		37							16
XXX10111	23	1.	Belgium, pleasure		37							10
XXX11000	24	1.	Netherlands, inland/pleasure		37							10
XXX11001	25		All channels are simplex in US-mode		WX1	WX2	WX3	WX4				16

Note 1. With the US-mode pin at a high level, the programme is shifted to standard.

Note 2. With the US-mode pin at a high level, the upper half of the PROM is used.

Note 3. AUX 2 output is high at the channel mentioned.

Table 1.3.c.

SW 601 VAL. 76543210	SW 601 Dec.	TESTPROGRAMME	
		Not keyed (key = 1)	Keyed (key = 0)
XXX11010	26	Testprogramme No. 0: Dynamic test. The standard output to synthesizer and function latch is repeated continuously.	Same as "not keyed"
XXX11011	27	Testprogramme No. 1: C40X to Port B The input from the Control Unit plug is transferred direcly to PB0-PB7 on the uC (PC3-PC0) = (0100)	IDNT to Port B The output from SW601 is transferred directly to PB0-PB7 on the uC. (PC3-PC0) = (0010).
XXX11100	28	Testprogramme No. 2: Port B to Port A PB0-PB7 is now input, and Port A is output. (PC3-PC0) = (0110). Remove the PROM if mounted!	uC to IC606 (Function latch) A square output is made on each pin in the function-latch IC606.
XXX11101	29	Testprogramme No. 3: Not used.	Not used.
XXX11110	30	Testprogramme No. 4: RX-step response The RX-VCO is stepped from 156.0 - 162.0 MHz or reverse every 25 msec. Function latch = (00100001)	TX-step response The TX-VCO is stepped from 155.4 to 157.4 MHz or reverse every 25 msec.
XXX11111	31	Testprogramme No. 5: PROM-reading. PROM-reading: SW601 serves as address set-up for the PROM, and the output of the PROM can be measured with a voltmeter. The base and emitter on T617 have to be short-circuited! (PC3-PC0) = (0010).	Same as "not keyed"

This page is valid from serial no. 285.644.

1.3.1. STANDARD FREQUENCY TABLE

CHANNEL	TRANSMITTING FREQUENCY (MHz)	RECEIVING FREQUENCY (MHz)	
		US MODE (A.-CHANNELS)	INT'L MODE (INT.-CHANNELS)
01	156.050	156.050	160.650
02	156.100	160.700	
03	156.150	160.750	
04	156.200	160.800	
05	156.250	156.250	160.850
06	156.300	156.300	
07	156.350	156.350	160.950
08	156.400	156.400	
09	156.450	156.450	
10	156.500	156.500	
11	156.550	156.550	
12	156.600	156.600	
13	156.650	156.650	
14	156.700	156.700	
15	156.750	156.750	
16	156.800	156.800	
17	156.850	156.850	
18	156.900	156.900	161.500
19	156.950	156.950	161.550
20	157.000	161.600	
21	157.050	157.050	161.650
22	157.100	157.100	161.700
23	157.150	157.150	161.750
24	157.200	161.800	
25	157.250	161.850	
26	157.300	161.900	
27	157.350	161.950	
28	157.400	162.000	
60	156.025	160.625	
61	156.075	160.675	
62	156.125	160.725	
63	156.175	156.175	160.775
64	156.225	160.825	
65	156.275	156.275	160.875
66	156.325	156.325	160.925
67	156.375	156.375	
68	156.425	156.425	
69	156.475	156.475	
70	156.525	156.525	
71	156.575	156.575	
72	156.625	156.625	
73	156.675	156.675	
74	156.725	156.725	
77	156.875	156.875	
78	156.925	156.925	161.525
79	156.975	156.975	161.575
80	157.025	157.025	161.625
81	157.075	157.075	161.675
82	157.125	157.125	161.725
83	157.175	157.175	161.775
84	157.225	161.825	
85	157.275	161.875	
86	157.325	161.925	
87	157.375	161.975	
88	157.425	157.425	162.025
WX1	Inhibit	162.550	
WX2	Inhibit	162.400	
WX3	Inhibit	162.475	
WX4	Inhibit	161.650	

1.3.2. STANDARD FUNCTION TABLE

Channel	Function code 7 6 5 4 3 2 1 0	HEX Value
0	0 0 0 0 0 0 0 0	00
1	0 0 0 0 1 0 0 0	08
2	0 0 0 0 1 0 0 0	08
3	0 0 0 0 1 0 0 0	08
4	0 0 0 0 1 0 0 0	08
5	0 0 0 0 1 0 0 0	08
6	1 1 0 0 1 0 0 0	C8
7	1 0 0 0 1 0 0 0	88
8	1 1 0 0 1 0 0 0	C8
9	1 1 0 0 1 0 0 0	C8
10	1 1 0 0 1 0 0 0	C8
11	1 1 0 0 1 0 0 0	C8
12	1 1 0 0 1 0 0 0	C8
13	1 1 0 0 1 0 0 0	C8
14	1 1 0 0 1 0 0 0	C8
15	1 1 1 0 1 0 0 0	E8
16	1 1 0 0 1 0 0 0	C8
17	1 1 1 0 1 0 0 0	E8
18	1 0 0 0 1 0 0 0	88
19	1 0 0 0 1 0 0 0	88
20	0 0 0 0 1 0 0 0	08
21	1 0 0 0 1 0 0 0	88
22	1 0 0 0 1 0 0 0	88
23	1 0 0 0 1 0 0 0	88
24	0 0 0 0 1 0 0 0	08
25	0 0 0 0 1 0 0 0	08
26	0 0 0 0 1 0 0 0	08
27	0 0 0 0 1 0 0 0	08
28	0 0 0 0 1 0 0 0	08
29	0 0 0 0 0 0 0 0	00

Channel	Function code 7 6 5 4 3 2 1 0	HEX Value
60	0 0 0 0 1 0 0 0	08
61	0 0 0 0 1 0 0 0	08
62	0 0 0 0 1 0 0 0	08
63	0 0 0 0 1 0 0 0	08
64	0 0 0 0 1 0 0 0	08
65	1 0 0 0 1 0 0 0	88
66	1 0 0 0 1 0 0 0	88
67	1 1 0 0 1 0 0 0	C8
68	1 1 0 0 1 0 0 0	C8
69	1 1 0 0 1 0 0 0	C8
70	1 1 0 0 1 0 0 0	C8
71	1 1 0 0 1 0 0 0	C8
72	1 1 0 0 1 0 0 0	C8
73	1 1 0 0 1 0 0 0	C8
74	1 1 0 0 1 0 0 0	C8
75	0 0 0 0 0 0 0 0	00
76	0 0 0 0 0 0 0 0	00
77	1 1 0 0 1 0 0 0	C8
78	1 0 0 0 1 0 0 0	88
79	1 0 0 0 1 0 0 0	88
80	1 0 0 0 1 0 0 0	88
81	1 0 0 0 1 0 0 0	88
82	1 0 0 0 1 0 0 0	88
83	1 0 0 0 1 0 0 0	88
84	0 0 0 0 1 0 0 0	08
85	0 0 0 0 1 0 0 0	08
86	0 0 0 0 1 0 0 0	08
87	0 0 0 0 1 0 0 0	08
88	1 0 0 0 1 0 0 0	88
89	0 0 0 0 0 0 0 0	00

The bits have the following functions:

Bit No.	Function	"0"	"1"
LSB 0	12.5 kHz spacing	+0 kHz	+12.5 kHz
1	NK (see frequency coding in PROM)	Standard	NK in PROM
2	AUX 1	Spare	Spare
3	Opening of RX/TX	1)	1)
4	Opening of RX only	1)	1)
5	Reduced power	25W	1W
6	Simplex in INT-mode	Duplex	Simplex
MSB 7	Simplex in US-mode	Duplex	Simplex

1) Function	Bit No. 4	Bit No. 3
Block RX/TX	0	0
RX/TX open	0	1
RX open	1	0
Block RX/TX	1	1

1.4 PROGRAMMING OF FREQUENCY CODE FOR PRIVATE CHANNELS IN THE PROM.

Divide figures for private channels:

F_{TX}	N_{HEX}	N_{BINARY} 7 6 5 4 3 2 1 0	F_{RX} DUPLEX
155.4	E8	1 1 1 0 1 0 0 0	160
155,425	E9	1 1 1 0 1 0 0 1	160,025
155,450	EA	1 1 1 0 1 0 1 0	160,050
155,475	EB	1 1 1 0 1 0 1 1	160,075
155,500	EC	1 1 1 0 1 1 0 0	160,100
155,525	ED	1 1 1 0 1 1 0 1	160,125
155,550	EE	1 1 1 0 1 1 1 0	160,150
155,575	EF	1 1 1 0 1 1 1 1	160,175
155,600	F0	1 1 1 1 0 0 0 0	160,200
155,625	F1	1 1 1 1 0 0 0 1	160,225
155,650	F2	1 1 1 1 0 0 1 0	160,250
155,675	F3	1 1 1 1 0 0 1 1	160,275
155,700	F4	1 1 1 1 0 1 0 0	160,300
155,725	F5	1 1 1 1 0 1 0 1	160,325
155,750	F6	1 1 1 1 0 1 1 0	160,350
155,775	F7	1 1 1 1 0 1 1 1	160,375
155,800	F8	1 1 1 1 1 0 0 0	160,400
155,825	F9	1 1 1 1 1 0 0 1	160,425
155,850	FA	1 1 1 1 1 0 1 0	160,450
155,875	FB	1 1 1 1 1 0 1 1	160,475
155,900	FC	1 1 1 1 1 1 0 0	160,500
155,925	FD	1 1 1 1 1 1 0 1	160,525
155,950	FE	1 1 1 1 1 1 1 0	160,550
155,975	FF	1 1 1 1 1 1 1 1	160,575
157,450	3A	0 0 1 1 1 0 1 0	162,050
157,475	3B	0 0 1 1 1 0 1 1	162,075
157,500	3C	0 0 1 1 1 1 0 0	162,100
157,525	3D	0 0 1 1 1 1 0 1	162,125
157,550	3E	0 0 1 1 1 1 1 0	162,150
157,575	3F	0 0 1 1 1 1 1 1	162,175
157,600	40	0 1 0 0 0 0 0 0	162,200
157,625	41	0 1 0 0 0 0 0 1	162,225
157,650	42	0 1 0 0 0 0 1 0	162,250
157,675	43	0 1 0 0 0 0 1 1	162,275
157,700	44	0 1 0 0 0 1 0 0	162,300
157,725	45	0 1 0 0 0 1 0 1	162,325
157,750	46	0 1 0 0 0 1 1 0	162,350
157,775	47	0 1 0 0 0 1 1 1	162,375
157,800	48	0 1 0 0 1 0 0 0	162,400
157,825	49	0 1 0 0 1 0 0 1	162,425
157,850	4A	0 1 0 0 1 0 1 0	162,450
157,875	4B	0 1 0 0 1 0 1 1	162,475
157,900	4C	0 1 0 0 1 1 0 0	162,500
157,925	4D	0 1 0 0 1 1 0 1	162,525
157,950	4E	0 1 0 0 1 1 1 0	162,550
157,975	4F	0 1 0 0 1 1 1 1	162,575
158,000	50	0 1 0 1 0 0 0 0	162,600

The programming value for the standard frequency range is given in the table below. They shall be programmed at the address for the frequency code for P0 to F9. The divide figure can also be calculated from the following formula:

$F = 156.0 + CH \times 0.050$

$N = \left(\frac{F - 16.8}{0.0125} - NK\right) : 2$

CH = Channel number

F = transmitting frequency in MHz

NK = constant for the divide figure

NK(TX) = 11136 (decimal value)

There is also a constant for simplex-receiving:
(NK(RX) = 10768 (decimal). This must always be 368 less than NK(TX) to maintain a duplex distance of 4.6 MHz.

1.4.1. PROGRAMMING OF FUNCTION CODE IN PROM

The function code consists of 8-bits with the following functions:

Bit No.		Function	"0"	"1"
LSB	0	12,5 kHz spacing	+0 kHz	+12,5 kHz
	1	NK (TX) and NK (RX) coded in PROM	Standard	NK in PROM *
	2	AUX 1	Spare	Spare
	3	Opening of RX/TX	1)	1)
	4	Opening of RX only	1)	1)
	5	Reduced power	25W	1W
	6	Simplex in INT-mode	Duplex	Simplex
MSB	7	Simplex in US-mode	Duplex	Simplex

1) Function	Bit No. 4	Bit No. 3
Block RX/TX	0	0
RX/TX open	0	1
RX open	1	0
Block RX/TX	1	1

A function code must be programmed for each private channel.
By the identity-codes from 12 - 15 a function-code for each of the channels 0 - 29 and 60 to 89 must be programmed in the PROM.

* Factory used

1.4.1. continued

If it is necessary to convert the binary value into hex-code for the PROM-programmer use the following table:

bit. No.:

7 6 5 4	3 2 1 0

Split-up the 8-bits into two groups of 4-bits as shown. Then convert each group according to the following table:

0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	A
1011	B
1100	C
1101	D
1110	E
1111	F

Example:

Function code = 1 1 0 0 1 0 0 0 (binary notation)

- 0 — Standard channel spacing selected
- 0 — Standard constant for the dividing figure selected.
- 0 — AUX1 equals zero at this channel
- 1 — RX/TX open
- 0 — 25W selected
- 0 — Simplex in INT-mode
- 1 — Simplex in US-mode

This figure is converted as follows:

1100 = C

1000 = 8

The result is then C8 in hexadecimal notation.

1.4.2. ADDRESS TABLE FOR THE PROM

Only those addresses for which a function is wanted, need to be programmed.

If some of the private channels programmed in the microprocessor is opened according to the identity-switch, the corresponding addresses in the PROM cannot be used.

Lower half section of the PROM.

	CH	ADR HEX	FUNCTION BIT 76543210	HEX VAL
FUNCTION CODE FOR STANDARD CHANNELS	00	00		
	01	01		
	02	02		
	03	03		
	04	04		
	05	05		
	06	06		
	07	07		
	08	08		
	09	09		
	10	0A		
	11	0B		
	12	0C		
	13	0D		
	14	0E		
	15	0F		
	16	10		
	17	11		
	18	12		
	19	13		
	20	14		
	21	15		
	22	16		
	23	17		
	24	18		
	25	19		
	26	1A		
	27	1B		
	28	1C		
	29	1D		
	60	1E		
	61	1F		
	62	20		
	63	21		
	64	22		
	65	23		
	66	24		
	67	25		
	68	26		
	69	27		
	70	28		
	71	29		
	72	2A		
	73	2B		
	74	2C		
	75	2D		
	76	2E		
	77	2F		
	78	30		
	79	31		
	80	32		
	81	33		

	CH	ADR HEX	FUNCTION BIT 76543210	HEX VAL
	82	34		
	83	35		
	84	36		
	85	37		
	86	38		
	87	39		
	88	3A		
	89	3B		
FREQUENCY CODE FOR PRIVATE CHANNELS	P0	3C		
	P1	3D		
	P2	3E		
	P3	3F		
	P4	40		
	P5	41		
	P6	42		
	P7	43		
	P8	44		
	P9	45		
	F0	46		
	F1	47		
	F2	48		
	F3	49		
	F4	4A		
	F5	4B		
	F6	4C		
	F7	4D		
	F8	4E		
	F9	4F		
FUNCTION CODE FOR PRIVATE CHANNELS	P0	50		
	P1	51		
	P2	52		
	P3	53		
	P4	54		
	P5	55		
	P6	56		
	P7	57		
	P8	58		
	P9	59		
	F0	5A		
	F1	5B		
	F2	5C		
	F3	5D		
	F4	5E		
	F5	5F		
	F6	60		
	F7	61		
	F8	62		
	F9	63		
NK	NK(RX)	64		MSB
	NK(RX)	65		LSB
	NK(TX)	66		MSB
	NK(TX)	67		LSB

Upper half section of the PROM.

	CH	ADR HEX	FUNCTION BIT 76543210	HEX VAL
FUNCTION CODE FOR STANDARD CHANNELS	00	80		
	01	81		
	02	82		
	03	83		
	04	84		
	05	85		
	06	86		
	07	87		
	08	88		
	09	89		
	10	8A		
	11	8B		
	12	8C		
	13	8D		
	14	8E		
	15	8F		
	16	90		
	17	91		
	18	92		
	19	93		
	20	94		
	21	95		
	22	96		
	23	97		
	24	98		
	25	99		
	26	9A		
	27	9B		
	28	9C		
	29	9D		
	60	9E		
	61	9F		
	62	A0		
	63	A1		
	64	A2		
	65	A3		
	66	A4		
	67	A5		
	68	A6		
	69	A7		
	70	A8		
	71	A9		
	72	AA		
	73	AB		
	74	AC		
	75	AD		
	76	AE		
	77	AF		
	78	B0		
	79	B1		
	80	B2		
	81	B3		

	CH	ADR HEX	FUNCTION BIT 76543210	HEX VAL
	82	B4		
	83	B5		
	84	B6		
	85	B7		
	86	B8		
	87	B9		
	88	BA		
	89	BB		
FREQUENCY CODE FOR PRIVATE CHANNELS	P0	BC		
	P1	BD		
	P2	BE		
	P3	BF		
	P4	C0		
	P5	C1		
	P6	C2		
	P7	C3		
	P8	C4		
	P9	C5		
	F0	C6		
	F1	C7		
	F2	C8		
	F3	C9		
	F4	CA		
	F5	CB		
	F6	CC		
	F7	CD		
	F8	CE		
	F9	CF		
FUNCTION CODE FOR PRIVATE CHANNELS	P0	D0		
	P1	D1		
	P2	D2		
	P3	D3		
	P4	D4		
	P5	D5		
	P6	D6		
	P7	D7		
	P8	D8		
	P9	D9		
	F0	DA		
	F1	DB		
	F2	DC		
	F3	DD		
	F4	DE		
	F5	DF		
	F6	E0		
	F7	E1		
	F8	E2		
	F9	E3		
NK	NK(RX)	E4		MSB
	NK(RX)	E5		LSB
	NK(TX)	E6		MSB
	NK(TX)	E7		LSB

1.4.3. PROGRAMMING PROCEDURE FOR PRIVATE CHANNELS.

1) Find N_{HEX} IN SECTION 1.4.

2) Find the address for the frequency code for private channels in section 1.4.2.

3) Programme N_{HEX} at this address.

4) Set-up the function code by means of the table in section 1.4.1.

5) Find the address for the function code for private channels in section 1.4.2.

6) Programme the function code at this address.

7) Put the PROM in the radio and check that it was done correctly. (The IDNT-switch shall not be changed).

Hint: Write down the coding in the table in section 1.4.2.

1.4.4. PROGRAMMING PROCEDURE FOR STANDARD CHANNELS.

Only the function code for the standard channels can be changed. The frequency corresponding to the channel number will always be unchanged.

1) Find the function codes for each channel to be opened in section 1.4.1.

2) Set-up the IDNT-switch according to the table in section 1.3. (Use the binary code 00001111 (dec. 15) if AUX2 shall be high at channel 16 or 00001110 (dec. 14) if AUX2 shall be high at channel 10).

For special purposes it is possible to programme another function code in the upper half section of the PROM. The IDNT-switch shall be set to dec. 12 or dec. 13. Then it is possible to switch between the lower and upper half section of the PROM by means of the "US-mode" switch. In "INT.-mode" the lower half is selected and in "US-mode" the upper half is selected.

Hint: Write down the coding in the table in section 1.4.2.

2. CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMMES VHF RT146

2.1. RECEIVER UNIT (100)

The receiver unit comprises the following circuits:

2.1.1. RF-Amplifier and First Mixer

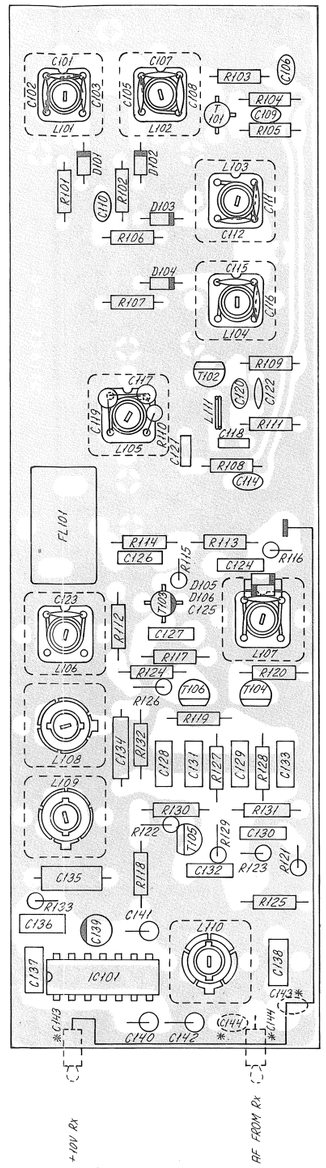
The RF-amplifier working in the frequency range 155.4 MHz to 162.4 MHz consists of the transistor T101 and the two double-tuned filters surrounding it.
From the aerial, the signal is led through the duplex-filter to the antenna switch from which the signal is fed to the receiver input-filter.
The input filter as well as the intermediate filter are variable capacitance tuned filters, controlled by a DC-voltage derived from the RX-VCO control voltage which secures an optimum filter response in the whole frequency range of the receiver.
In this way the two double-tuned filters create the necessary attenuation of signals far away from the wanted signal frequency in order to give the wanted spurious rejection of such unwanted signals.
The amplifying transistor T101 which is a large current, low noise transistor in a common-base configuration, secures by its gain the receiver overall noise figure; as well as good two-signal performance is obtained.
The RF-input to the first mixer is taken from the coil L104 in the intermediate filter.
Mixer transistor T102 is of the J-FET-type, where the first LO-signal is injecting into the source from a 50 ohm generator.
The wanted 21.4 MHz IF-output is selected by means of the tuned drain-circuit consisting of L105, C117, C119, and R110 which in the same time creates the necessary impedance matching to the IF-crystal filter.

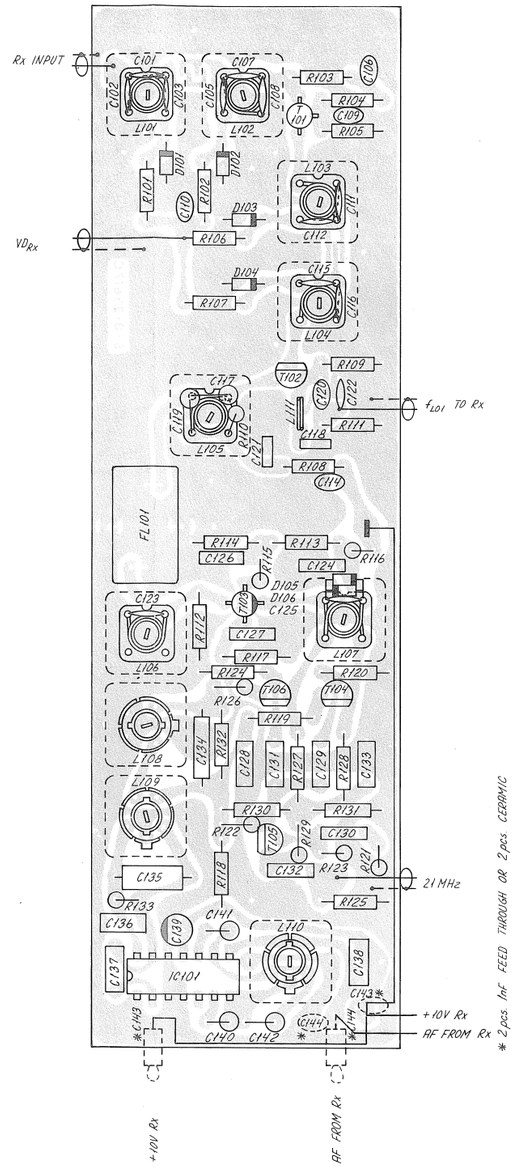
2.1.2. IF-Filter and Amplifier

The receiver adjacent channel selectivity is maintained by means of the crystal filter FL101. The output from this filter is led to the IF-amplifier with the transistor T103. L106, C123, and R112 give the appropriate impedance matching to the filter output.
The amplifier gives the needed power gain between crystal filter and second mixer and in the same time good large signal performance is obtained.
Diodes D105, and D106 in the tuned drain-circuit limit the maximum IF-voltage swing delivered to the second mixer.

2.1.3. Second Mixer, 400 kHz IF-Amplifier and Discriminator

The second mixer consists of the IF-injection transistor T105 and the two mixing transistors T104 and T106 in a balanced configuration.
The second LO-signal of 21 MHz is taken from the reference crystal oscillator.
The 400 kHz IF-signal is taken out in an unbalanced way in the tuned collector circuit of T106 and led to the integrated amplifier IC101 via transformer L109 which is a part of the above mentioned collector circuit.
This integrated circuit comprises both a large gain IF-amplifier and the discriminator circuit.
The large gain secures a voltage-limited injection to the internal discriminator, providing a very good receiver AM-rejection.
The AF-output is taken from pin 8 on IC101.





AC voltages outside frame of diagram.

▲: Measured with oscilloscope or frq. counter.

⊙⊡: Measured with test probe.

●: Connections to module.

[ ]: Approx. measurement with test probe.

Test conditions: ⊙

Voltages without brackets:

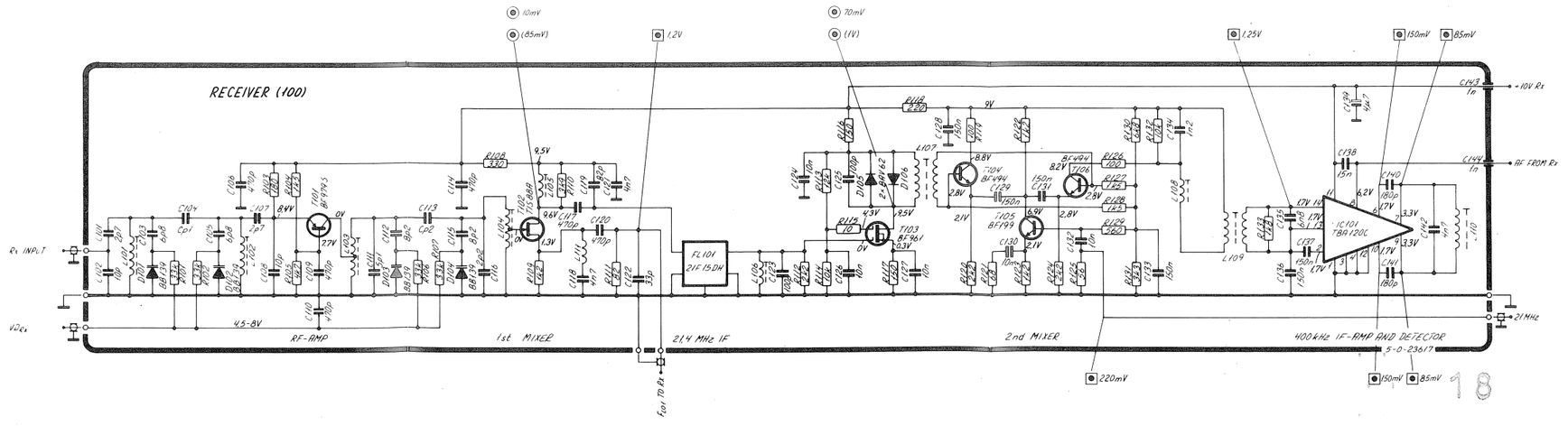
Antenna signal 1 mV pd: Δf=

±3 kHz; fm = 1 kHz

Voltages in brackets:

Antenna signal 10 mV pd; Δf =

±3 kHz; fm = 1 kHz



2.2. RX-SYNTHESIZER UNIT (200)

The RX-synthesizer unit comprises the following circuits:

2.2.1. RX-VCO and Buffer Amplifiers

The transistor T203 is producing 8.3 V supply voltage for the RX-VCO and bias for the buffer amplifiers consisting of the transistors T201 and T204.
The RX-VCO comprises a Field Effect Transistor T202 (the oscillator transistor), two coaxial coils L203, L204, two capacitors C212, C214, and a variable capacitance diode D201. The frequency is mainly determined by the components L203, L204, C214, and D201.
The RX-VCO is a voltage controlled oscillator where the control voltage from the loop filter determines the frequency by means of D201. A high control voltage to the variocap. diode D201 means a small capacitance in the diode which means a high frequency of the VCO. In the opposite way a low control voltage means a low VCO frequency.
The RX-VCO signal is passed to two buffer amplifiers via lowpass filter C209, C206, L201. The LO1 buffer transistor T201 is producing 5 mW for the 1st mixer in the receiver. The 5 mW is taken from the tuned filter L202, R202, C207, and C208. The prescaler buffer transistor T204 is producing 0.25 mW for the 16.8 MHz mixer in the TX-Exciter-Unit. It is also producing signal for 32/33 prescaler. The signal from transistor T204 is led through a lowpass filter C217, L206, and C222.
The gain in both buffers can be adjusted by the potentiometer R209.

2.2.2. 32/33 Prescaler

The integrated circuit IC201 is a two modulus prescaler based on the ECL technique.
From the control logic in the programmable divider IC202 pin 14, a high or low level is led to the prescaler IC201 pin 1. A high level at IC201 pin 1 causes the prescaler to divide by 33 and in turn a low level at pin 1 sets it up for dividing by 32.
The resistor R232 and the diode D204 work as a speed-up circuit.

2.2.3. The Programmable Divider

The programmable divider IC202 comprises two phase detectors, a lock detector, a reference divider, an A-counter, an N-counter, control logic, and 8 latches. Only phase detector B of the detectors is in use.
When the VHF is switched on the microcomputer will load dividing figures into the reference divider and into the A and N-counters. The microcomputer loads only one latch at a time.
By setting up a code at the address inputs A_0 - A_2 the microcomputer selects a latch and at the same time a code for the dividing figure is set up at the data inputs D_0 - D_3. The microcomputer sends a strobe pulse to IC202 pin 12 and the selected latch is loaded. The procedure is then repeated until all the latches are loaded.
When the channel or the function of the VHF is changed it is only the latches for the A and N-counter which change data. The reference frequency is 2.1 MHz and it is constant. Therefore it is not necessary to change the dividing figure every time.
In the beginning of a counting period the prescaler IC201 starts dividing by 33 and the A and N-counters count down. First the A-counter reaches zero and stops counting and the control logic shifts the prescaler to divide by 32. Then the N-counter reaches zero and sends a pulse to the phase detector B, and the control logic shifts the prescaler to divide by 33. The control logic also reloads the A and N-counters with data from their latches and the whole thing starts all over again.
The pulse frequency from the reference divider is 12.5 kHz. If the RX-VCO frequency is correct the pulse frequency of the N-counter is also 12.5 kHz and in phase with the pulse from the reference divider. The phase detector B compares the phase of the two pulses. If they are not in phase the detector sends correction pulses to the phase-detector-pump for correcting the frequency/phase of the RX-VCO. However, the synthesizer circuit is born with a small phase error, therefore the phase detector is sending small correction pulses to transistor T210 with a frequency of 12.5 kHz.

2.2.4. Phase Detector Pump and Loop Filter

We assume that the RX-VCO frequency has decreased from its nominal frequency. The phase-detector now sends negative correction pulses from IC202 pin 17 to T210, which goes on. A current will then flow from C225 through R225 and R229 and into T210. This current will discharge C225 forcing the output voltage from the transistors T205 and T206 to increase until the VCO reaches the correct frequency.
If the RX-VCO frequency is too high, the negative correction pulses from the detector at pin 16 of IC202 will turn transistor T209 off. The collector voltage of transistor T209 increases and a current will flow through the diode D202, the resistor R225 and into the capacitor C225 and charge this capacitor. The output voltage at the collector of the transistors T205 and T206 will decrease until the VCO reaches its right frequency.
If the phase-locked-loop is locked, both outputs of the phase-detector will be 5 V and the output voltage of the transistors T205 and T206 will have a value between 2 V and 10 V corresponding to the VCO-frequency. However, the system is working with a constant phase error and the phase detector sends small correction pulses to transistor T210, even the phase-locked-loop is locked.
The four transistors T205, T206, T207, and T208 are working as an operational amplifier with the inverting input at base of transistor T208. Non-inverting input is at transistor T207 while the transistors T205 and T206 form the output stage.

AC voltages outside frame of diagram.

▲: Measured with oscilloscope or frq. counter.

⊙ ⊡: Measured with test probe.

●: Connections to module.

[ ]: Approx. measurement with test probe.

Test conditions: ⊙

Voltages without brackets:

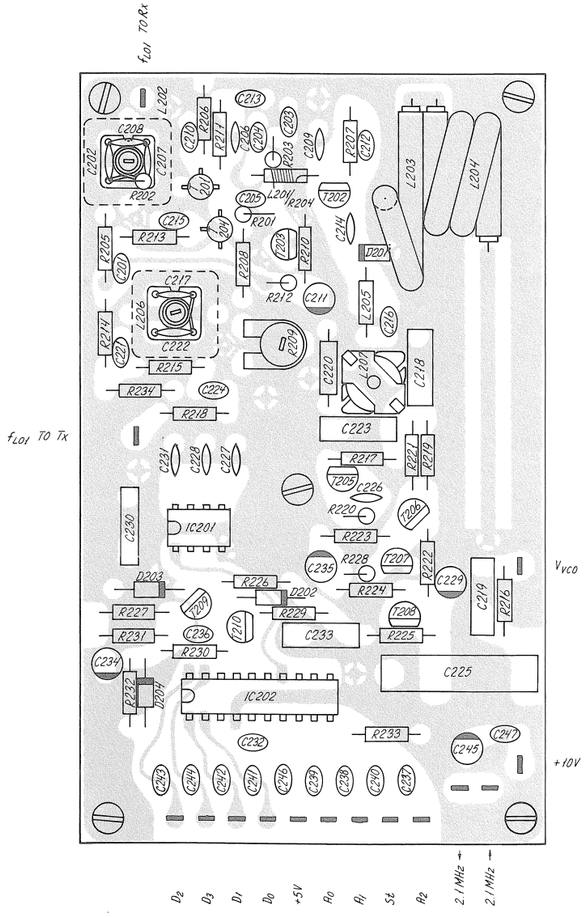
Antenna signal 1 mV pd: Δf=

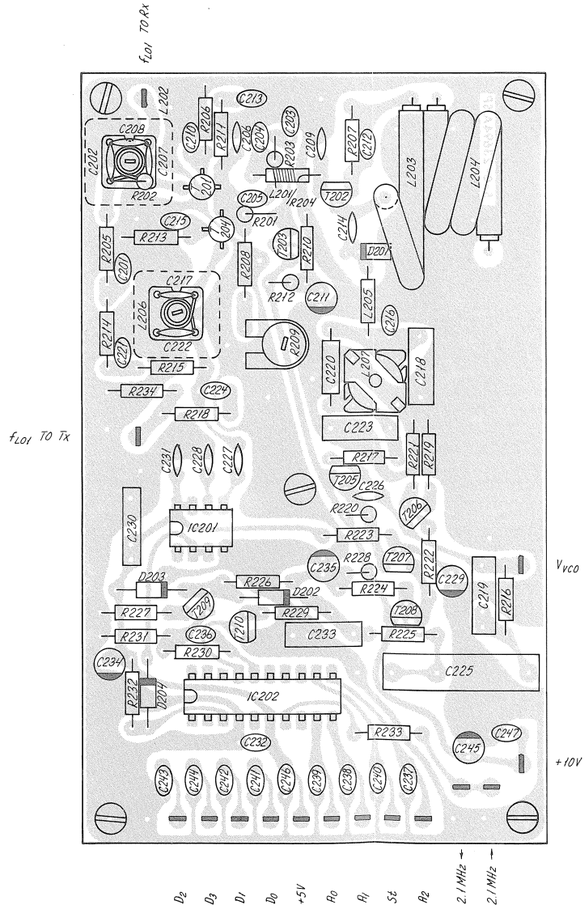
±3 kHz; fm = 1 kHz

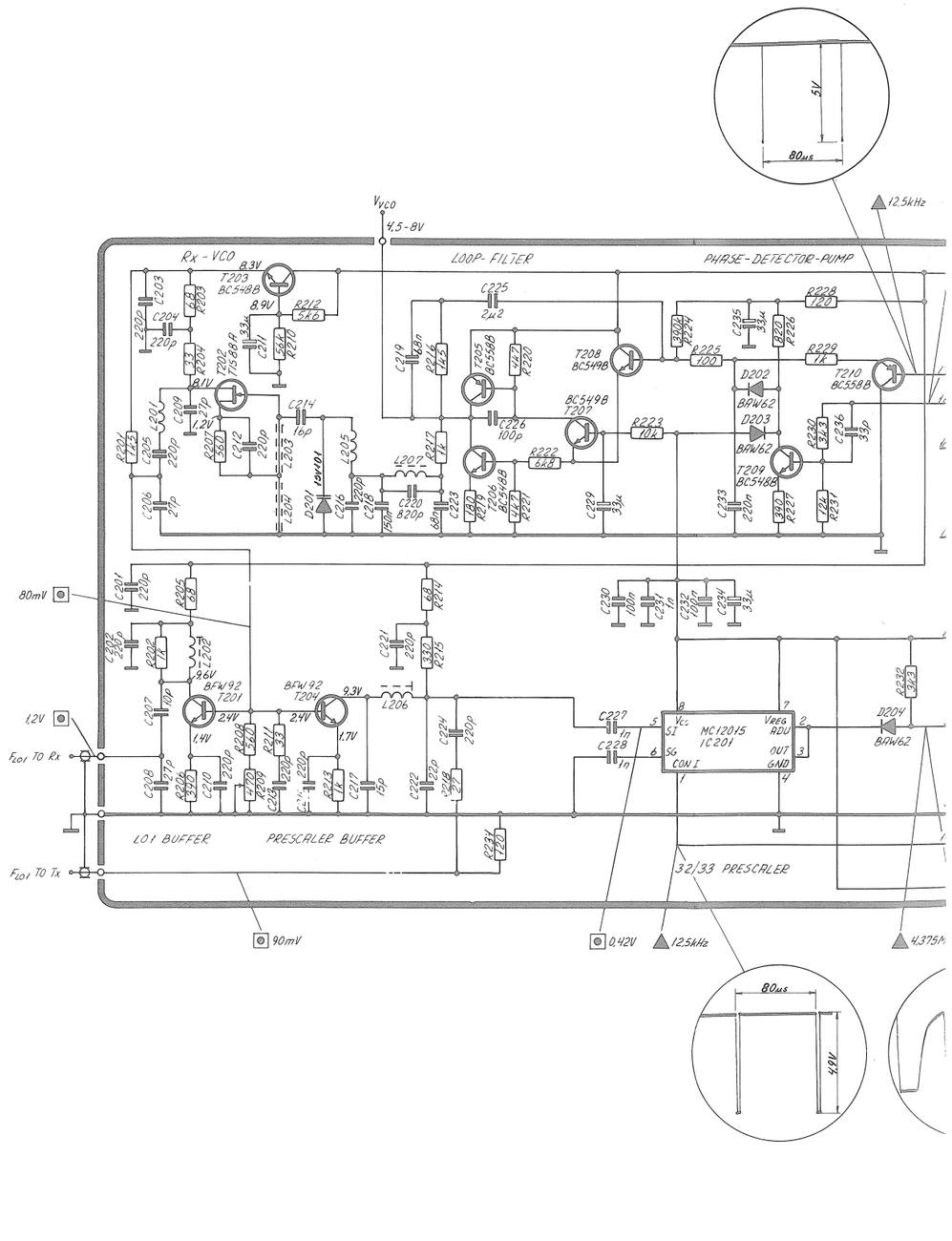
Voltages in brackets:

Antenna signal 10 mV pd; Δf =

±3 kHz; fm = 1 kHz







2.3. TX EXCITER UNIT (300)

The TX exciter unit comprises the following circuits:

2.3.1. Insulation Buffer and 16.8 MHz Mixer

From RX-VCO the signal is led to transistor T301 and from TX-VCO the signal is led to transistor T302. Both transistors which are not coupled in common base act as buffer amplifiers. The mixed signal over resistor T305 is led to the mixer amplifier T303 via capacitor C305. The differential signal which is the TX-VCO frequency minus the RX-VCO frequency is led to the amplifier transistor T304 through the low-pass filter consisting of C310, L301, and C311. In transistor T305 the signal is amplified to TTL level. The diode D301 works as a base clamp diode.

2.3.2. 21 MHz Osc.

The oscillator is a Colpitt type and the oscillator transistor T308 is oscillating by means of a 21 MHz crystal X301.
The trimmer capacitor C331 is for fine adjustment of the oscillator frequency.
RF signal for second mixer in the receiver is taken from the low-pass filter C326, L305, and C328. RF signal for the reference divider is led to transistor T307 for amplifying. In transistor T306 the signal is amplified to TTL level.

2.3.3. Phase/Frequency Detector, 32 Counter and Reference Divider

The crystal frequency is led to IC306 pin 10 which is a decade counter. From output pin 5 of this, the frequency is divided by 5. This frequency is led to flip-flop IC305a, where the frequency is divided by 2. From IC305a pin 5, the 2.1 MHz is taken and this is the clock frequency for the microcomputer and the RX synthesizer. The resistor R322 is for pull-up and the ferrit bead FP301 is blocking for higher harmonics of the clock frequency.
From IC306 pin 8, the 21 MHz is also divided by 10. The frequency is divided by 2 in flip-flop IC305b and divided by 2 in IC304a. At IC304b pin 13, the 21 MHz is then divided by 40 and the frequency is therefore 525 kHz at which the phase detector is working.
From the other side the mixed signal of 16.8 MHz is led to the binary divider IC301 pin 10 where it is divided by 16. In flip-flop IC302b the signal is divided by 2. From IC320b pin 8 the 16.8 MHz is then divided by 32 = 525 kHz.
The phase/frequency detector consists of IC302a, IC303, and IC304b. From IC304b pin 9 the detector is connected to the loop filter via the pull-up resistor R321 and the diode D303. The phase corrections pulse from the detector is active low and when the phase locked loop is in the lock the duty cycle of the correction pulse is about 30 per cent.
The correction pulses are made in this way:
After the count down of the 21 MHz the IC304b pin 9 goes low. Pin 8 goes high and this is connected to IC303 pin 2.
When the 16.8 MHz is divided by 32 the IC302a pin 6 and IC303 pin 1 go high. When IC303 pin 13 is always high the IC303 pin 8 will go low and preset IC302a and IC304b; the correction pulse will then go high and so on. The propagation delay in the two inverters IC303 determines the size of the preset pulse.

ased from its nominal fre-
correction pulses from
t will then flow from C225
rent will discharge C225
rs T205 and T206 to increase

tive correction pulses from
nsistor T209 off. The col-
nd a current will flow
into the capacitor C225
at the collector of the
the VCO reaches its right

uts of the phase-detector
nsistors T205 and T206 will
ng to the VCO-frequency.
t phase error and the phase
nsistor T210, even the

08 are working as an opera-
base of transistor T208.
le the transistors T205

AC voltages outside frame of diagram.

▲: Measured with oscilloscope or frq. counter.

◎ ◻: Measured with test probe.

●: Connections to module.

[ ]: Approx. measurement with test probe.

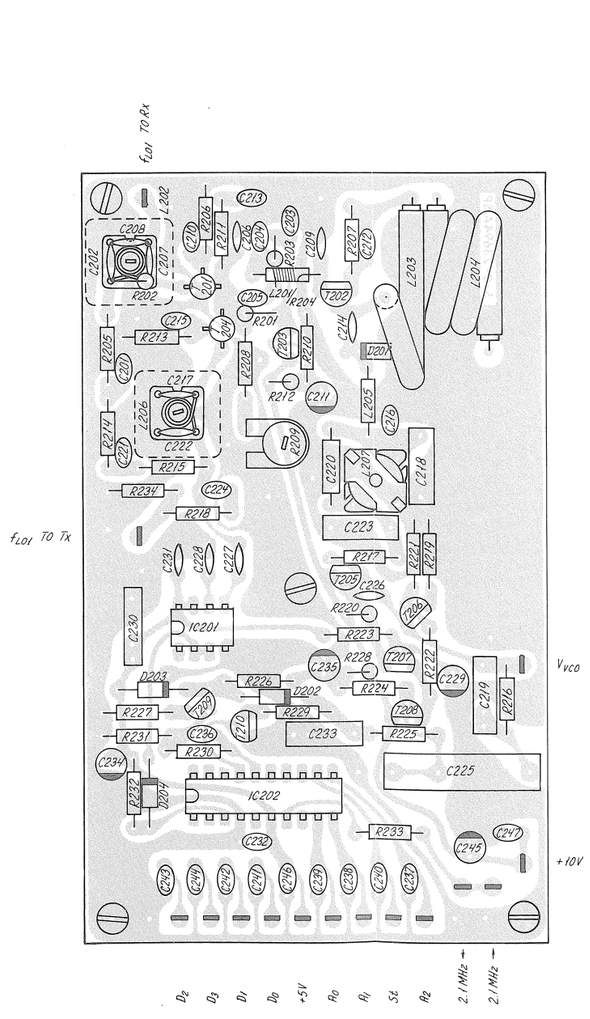
Test conditions: ◎

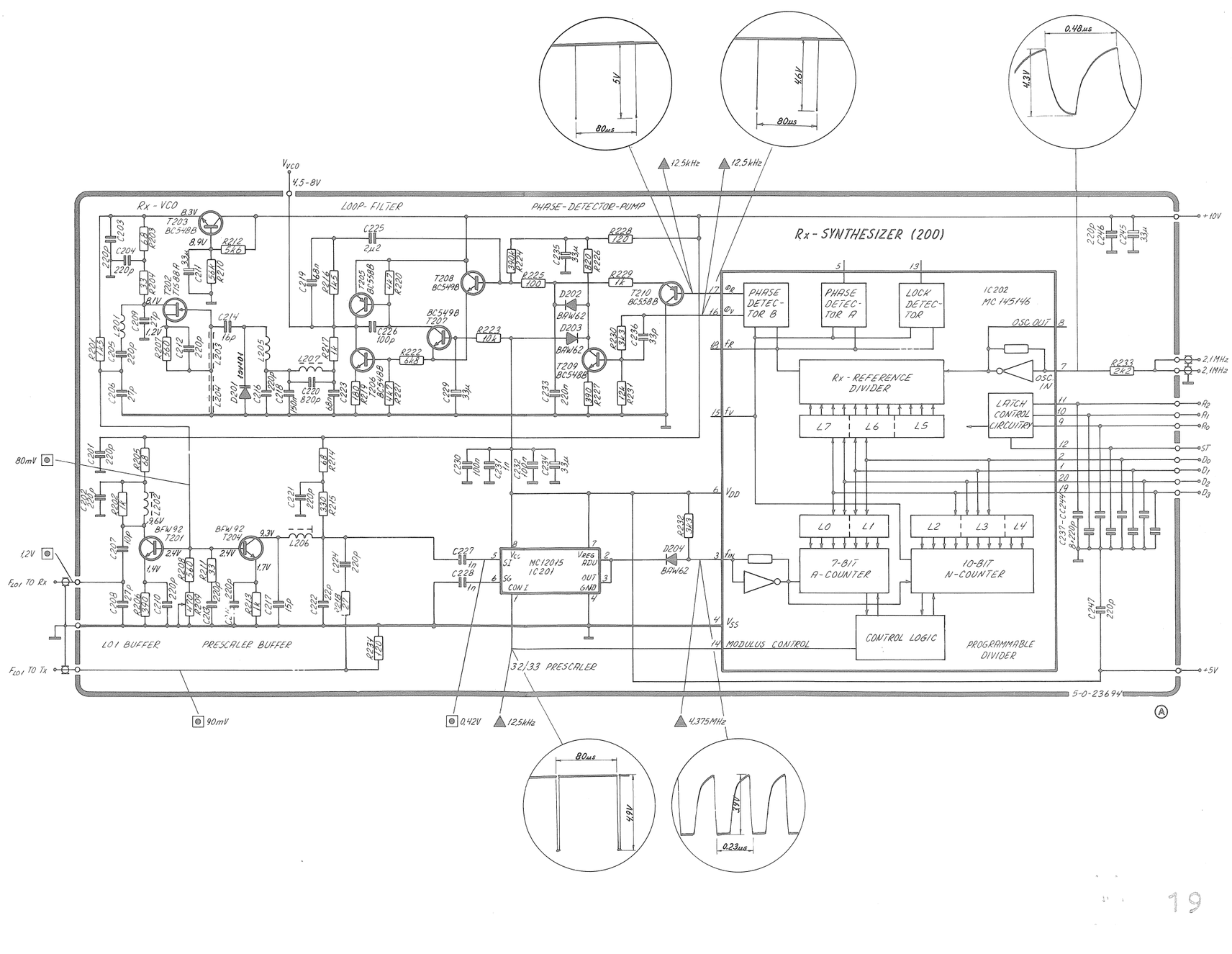
Voltages without brackets:

Antenna signal 1 mV pd: Δf= ±3 kHz; fm = 1 kHz

Voltages in brackets:

Antenna signal 10 mV pd; Δf = ±3 kHz; fm = 1 kHz





2.3. TX EXCITER UNIT (300)

The TX exciter unit comprises the following circuits:

2.3.1. Insulation Buffer and 16.8 MHz Mixer

From RX-VCO the signal is led to transistor T301 and from TX-VCO the signal is led to transistor T302. Both transistors which are not coupled in common base act as buffer amplifiers. The mixed signal over resistor T305 is led to the mixer amplifier T303 via capacitor C305. The differential signal which is the TX-VCO frequency minus the RX-VCO frequency is led to the amplifier transistor T304 through the low-pass filter consisting of C310, L301, and C311. In transistor T305 the signal is amplified to TTL level. The diode D301 works as a base clamp diode.

2.3.2. 21 MHz Osc.

The oscillator is a Colpitt type and the oscillator transistor T308 is oscillating by means of a 21 MHz crystal X301.
The trimmer capacitor C331 is for fine adjustment of the oscillator frequency.
RF signal for second mixer in the receiver is taken from the low-pass filter C326, L305, and C328. RF signal for the reference divider is led to transistor T307 for amplifying. In transistor T306 the signal is amplified to TTL level.

2.3.3. Phase/Frequency Detector, 32 Counter and Reference Divider

The crystal frequency is led to IC306 pin 10 which is a decade counter. From output pin 5 of this, the frequency is divided by 5. This frequency is led to flip-flop IC305a, where the frequency is divided by 2. From IC305a pin 5, the 2.1 MHz is taken and this is the clock frequency for the microcomputer and the RX synthesizer. The resistor R322 is for pull-up and the ferrit bead FP301 is blocking for higher harmonics of the clock frequency.
From IC306 pin 8, the 21 MHz is also divided by 10. The frequency is divided by 2 in flip-flop IC305b and divided by 2 in IC304a. At IC304b pin 13, the 21 MHz is then divided by 40 and the frequency is therefore 525 kHz at which the phase detector is working.
From the other side the mixed signal of 16.8 MHz is led to the binary divider IC301 pin 10 where it is divided by 16. In flip-flop IC302b the signal is divided by 2. From IC320b pin 8 the 16.8 MHz is then divided by 32 = 525 kHz.
The phase/frequency detector consists of IC302a, IC303, and IC304b. From IC304b pin 9 the detector is connected to the loop filter via the pull-up resistor R321 and the diode D303. The phase corrections pulse from the detector is active low and when the phase locked loop is in the lock the duty cycle of the correction pulse is about 30 per cent.
The correction pulses are made in this way:
After the count down of the 21 MHz the IC304b pin 9 goes low. Pin 8 goes high and this is connected to IC303 pin 2.
When the 16.8 MHz is divided by 32 the IC302a pin 6 and IC303 pin 1 go high. When IC303 pin 13 is always high the IC303 pin 8 will go low and preset IC302a and IC304b; the correction pulse will then go high and so on. The propagation delay in the two inverters IC303 determines the size of the preset pulse.

2.3.4. TX-VCO

The TX-VCO comprises a Field Effect Transistor T311 (oscillator transistor), two coaxial coils L309 and L310, the capacitors C343 and C345, and a variocapacitor diode D302. The frequency is mainly determined by L309, L310, C345, and D302.
The TX-VCO is a Voltage Controlled Oscillator, where the control voltage from the loop filter determines the frequency by means of the variocapacitor diode D302. A high voltage to D302 means a smaller capacitor in D302 and again a higher VCO frequency. In the opposite way a small control voltage means a smaller frequency.
From drain of transistor T311 the signal is led to a buffer amplifier T310 via a tuned filter consisting of L308, R342, and C342. The ferrit bead is blocking for UHF oscillatings. In the collector of T310 there is a tuned filter consisting of L307 and C340. From here the signal for two circuits is taken.
From an outdraw on coil L307 signal to TX-buffer is taken through capacitor C338. Here the TX-VCO signal is amplified in transistor T309. In drain of T309 there is a tuned filter consisting of L306, C332, C333, R332, and R333, which gives a 50 ohm generator for Power Amplifier Unit. The output power from TX-buffer is 25 mW and is adjusted by trimmer potentiometer R341.
Stop and start of both TX-buffer and TX-VCO are controlled from the microcomputer by controlling the supply for the transistor. That secures that the frequency is correct before the transmitter is started.
From the collector of T310 signal for the 16.8 MHz Mixer is taken via capacitor C341.

2.3.5. Loop-filter

The Loop-filter amplifier is a differential amplifier (OP-Amp.) with the inverted input at the base of transistor T314, where also the phase detector is connected. The base of transistor T313, which is the non-inverted input, is connected to +5V by means of R349 and R350.
Transistor T312 is the output stage,and the control voltage for TX-VCO is taken over the resistor R346 and is filtered in the ripple-filter consisting of R345, C348, C347, and R344. At the input R351 and C352 are working as a filter against the higher harmonics in the phase detector pulse.
We assume that the system is in lock. While the detector pulse is low a current is flowing out of the capacitor C351 and the output voltage over R346 increases. The TX-VCO frequency is also increasing until the detector pulse goes high again. Because the diode D303 is blocking,a current flows into C351 through the resistors R354 and R355. The control voltage over R346 decreases and the frequency is also decreasing. The current which is flowing in and out of C351 is equal when the system is in lock. For principal understanding accept that C353 and R352 have no influence on the current to C351.
If the TX-VCO frequency is too high, the detector pulse gets smaller and that means that more current is flowing into C351 than there is flowing out. That means again that the control voltage and the frequency will decrease until the frequency is correct again.
The opposite process will happen if the frequency is too low. Even though the system is in lock there is always a little phase error.
The AF modulation signal is led into the Loop-filter via resistor R356. The control voltage is then modulated which again will modulate the phase in the TX-VCO.

AC voltages outside frame of diagram.

▲: Measured with oscilloscope or frq. counter.

◎ ⊡: Measured with test probe.

●: Connections to module.

[ ]: Approx. measurement with test probe.

Test conditions: ◉

Voltages without brackets:

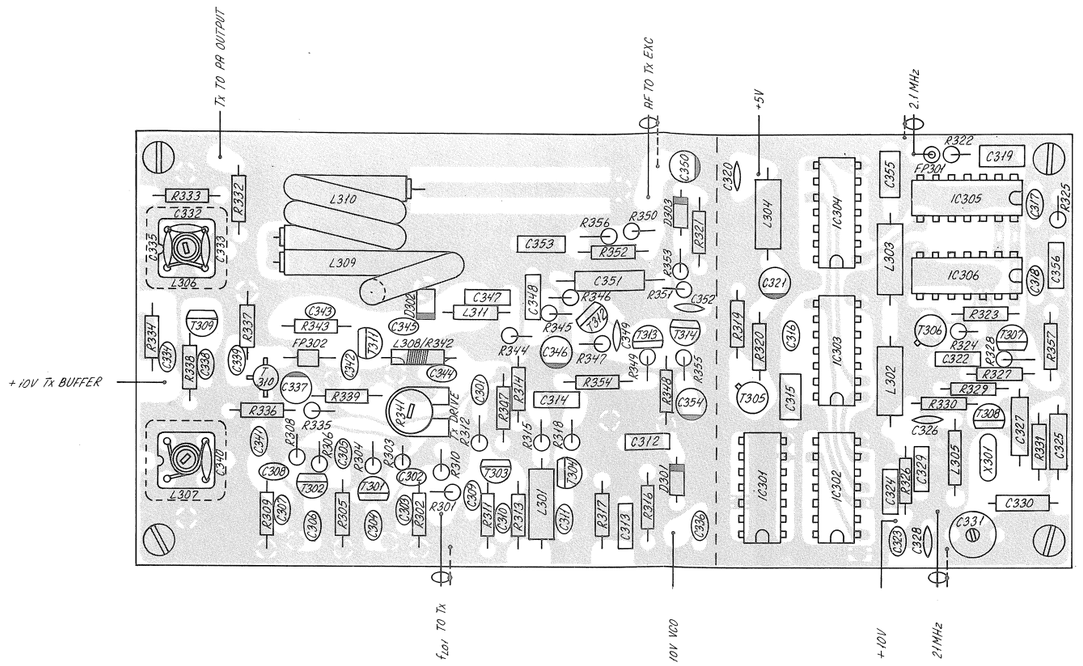
Antenna signal 1 mV pd: Δf=

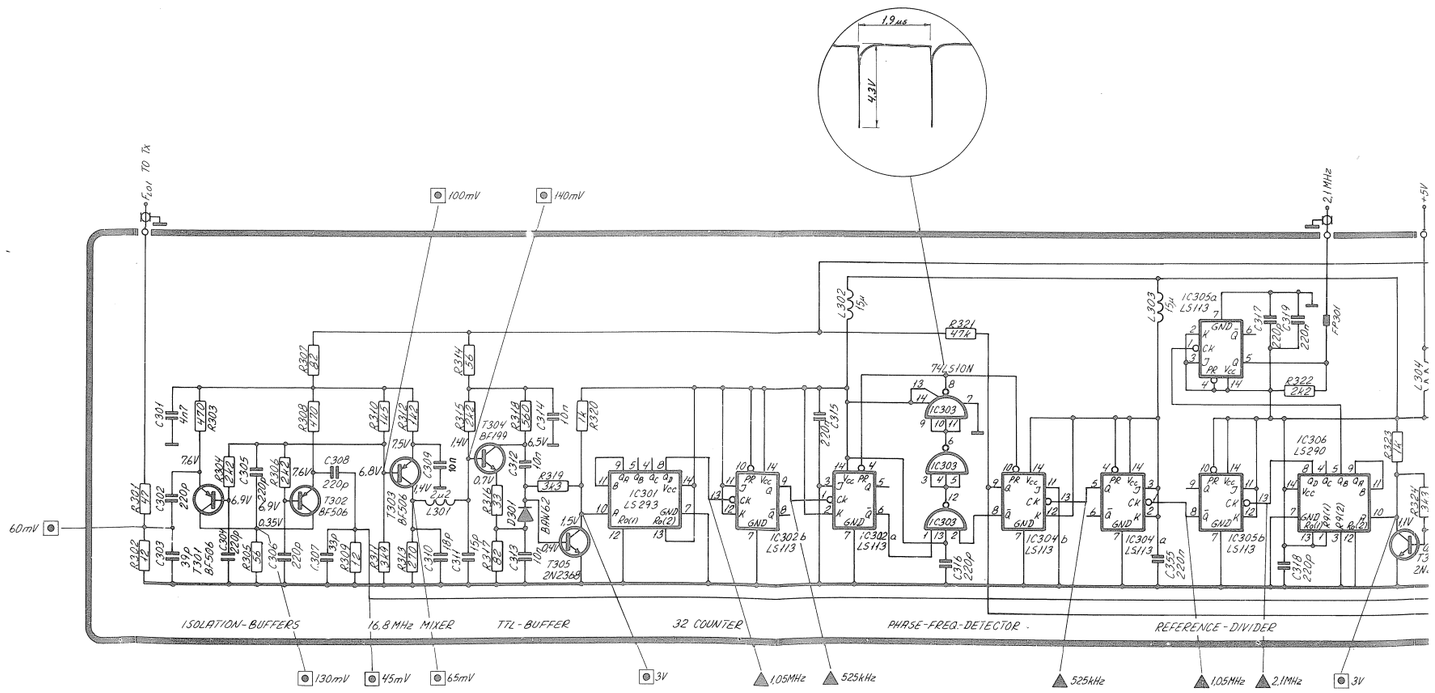
±3 kHz; fm = 1 kHz

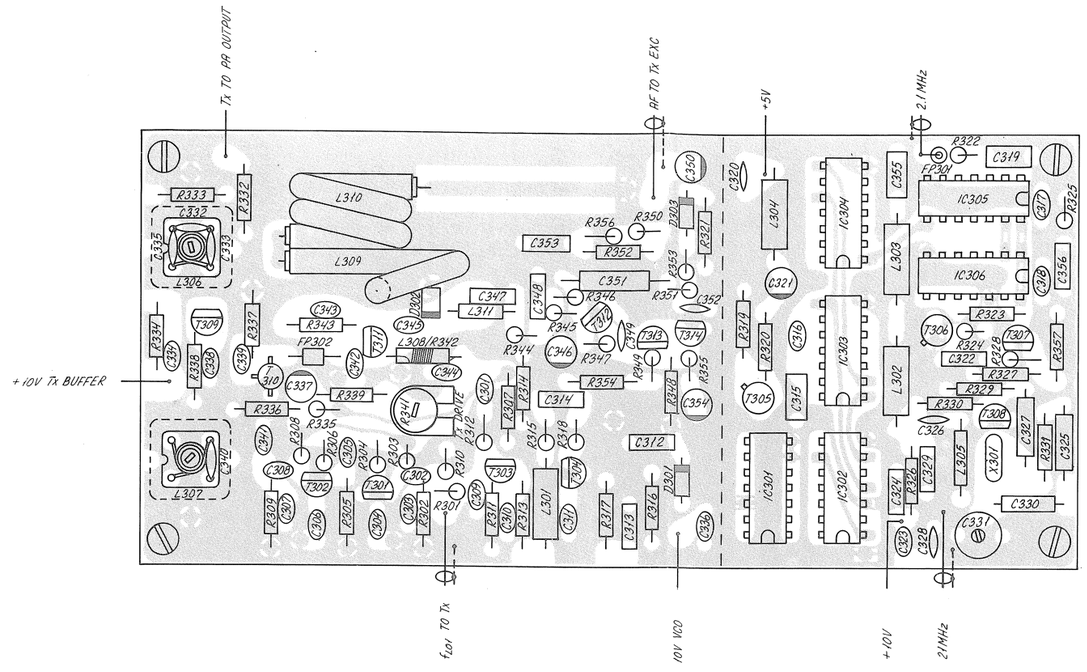
Voltages in brackets:

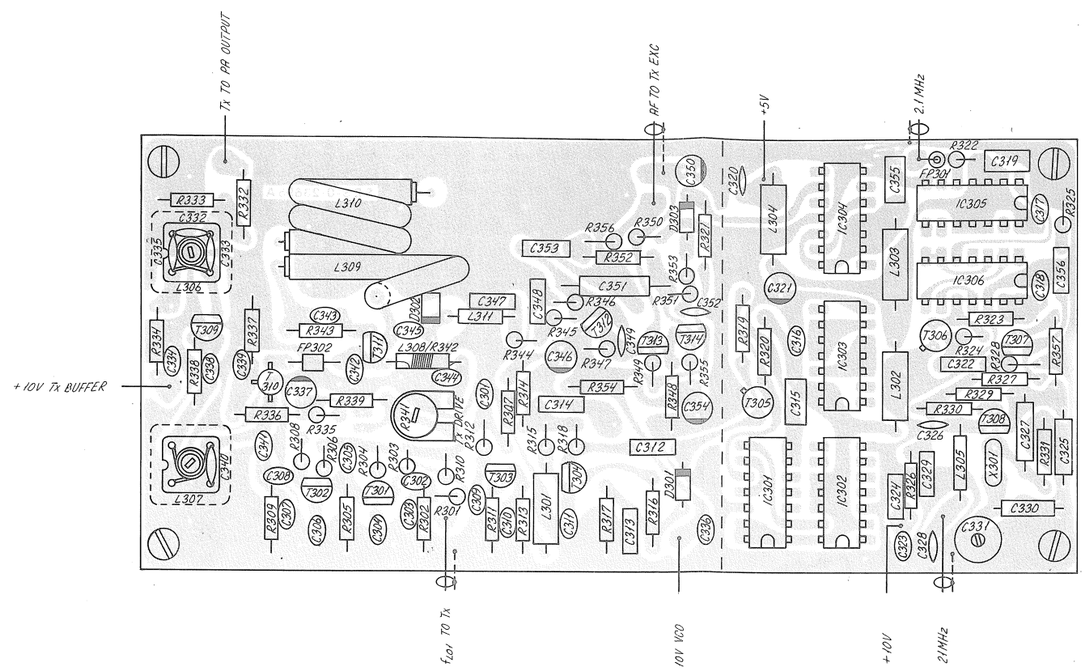
Antenna signal 10 mV pd; Δf =

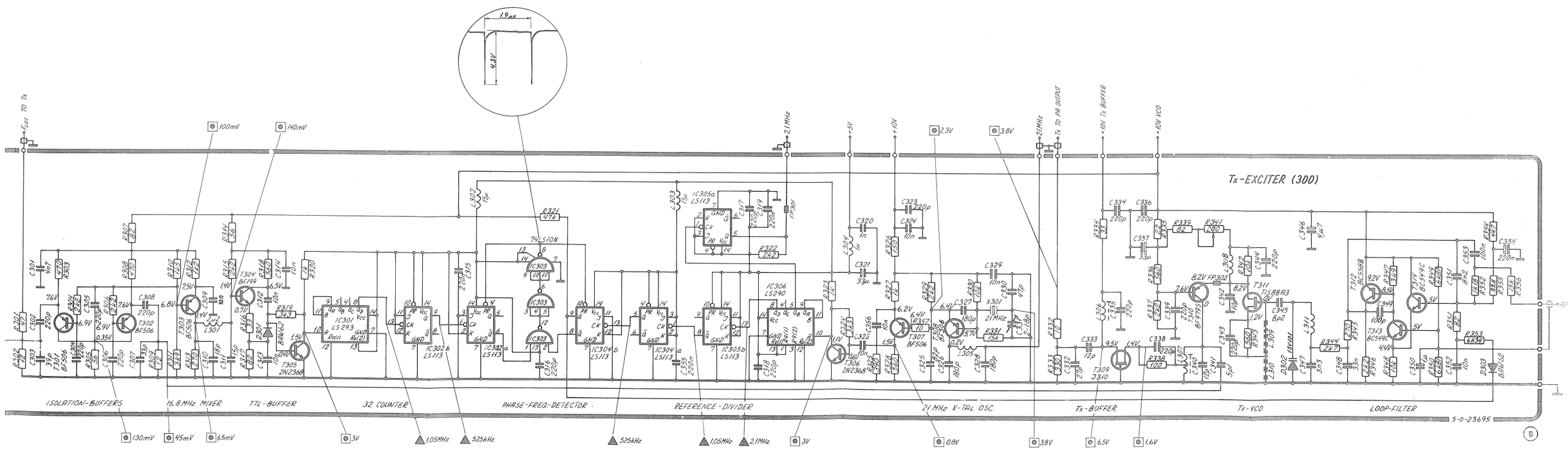
±3 kHz; fm = 1 kHz






Tx TO PA OUTPUT
RF TO Tx EXC
+5V
2.1 MHz
+10V Tx BUFFER
f LO1 TO Tx
10V VCO
+10V
21MHz


Tx TO PA OUTPUT
RF TO Tx EXC
+5V
2.1 MHz
+10V Tx BUFFER
f LO1 TO Tx
10V VCO
+10V
21MHz


1.9 ms
4.3V
f LO1 TO Tx
100mV
140mV
2.1MHz
+5V
+10V
2.3V
3.8V
21MHz
Tx TO PA OUTPUT
+10V Tx BUFFER
+10V VCO
Tx-EXCITER (300)
RF TO Tx EXC.
ISOLATION-BUFFERS
16.8 MHz MIXER
TTL-BUFFER
32 COUNTER
PHASE-FREQ-DETECTOR
REFERENCE-DIVIDER
21 MHz X-TAL OSC.
Tx-BUFFER
Tx-VCO
LOOP-FILTER
5-0-23695
130mV
45mV
65mV
3V
1,05MHz
525kHz
525kHz
1,05MHz
2,1MHz
3V
0.8V
3,8V
6.5V
1.6V

2.4. TX-POWER AMPLIFIER (400)

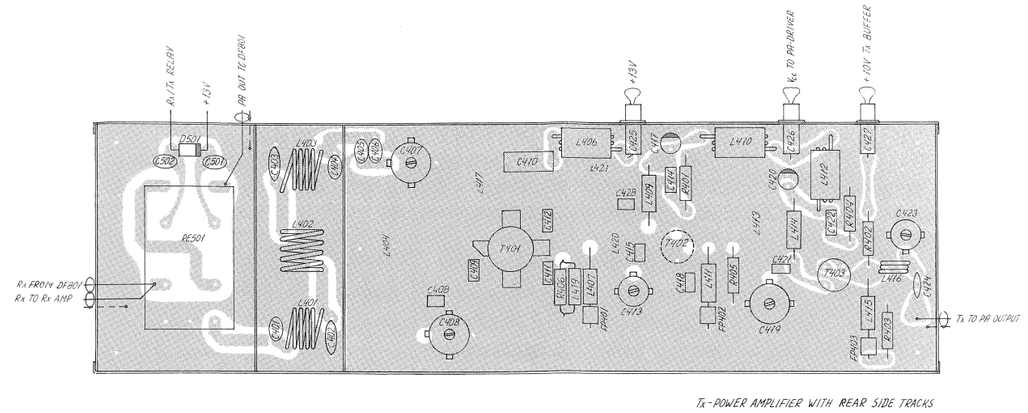
The TX-power-amplifier comprises the amplifier and a harmonic filter.

2.4.1. TX-Power-Amplifier

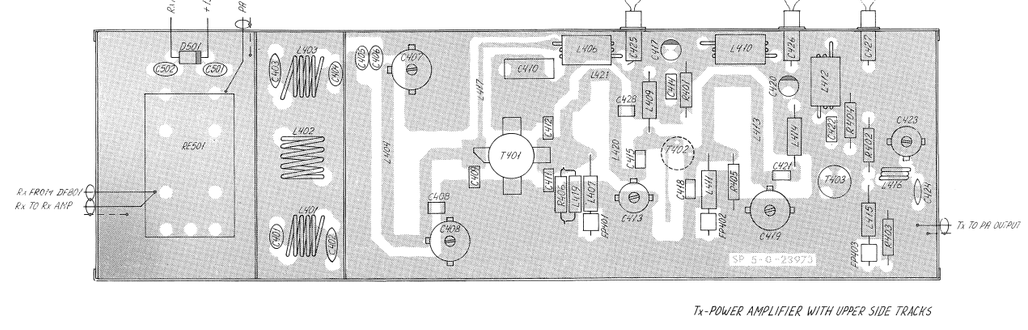
The amplifier consists of a single transistor output amplifier and a two-transistor power driver which are both tuned class-C amplifier circuits. The amplifier is made on double sided epoxy board, using microstrip technique in the tuning circuits.
The power driver is fed from a 50 ohm generator with a power level of 25 mW.
The final output power level is controlled by means of the supply voltage level fed to the power driver. In full power mode, the power driver will deliver about 4.5 - 5 W to the output transistor T401.
The output signal is fed to the harmonic filter through capacitors C405 and C406.

2.4.2. Harmonic Filter

The harmonic filter is realized as a seventh-order Chebyschev-filter, which at the same time will provide the necessary attenuation of the harmonics generated by the power amplifier and a low insertion loss at the carrier frequency.
The output from the harmonic filter is fed to the antenne relay.



Tx-POWER AMPLIFIER WITH REAR SIDE TRACKS



Tx-POWER AMPLIFIER WITH UPPER SIDE TRACKS

AC voltages outside frame of diagram.

▲: Measured with oscilloscope or frq. counter.

◎ ▣: Measured with test probe.

●: Connections to module.

[ ]: Approx. measurement with test probe.

Test conditions: ◎

Voltages without brackets:

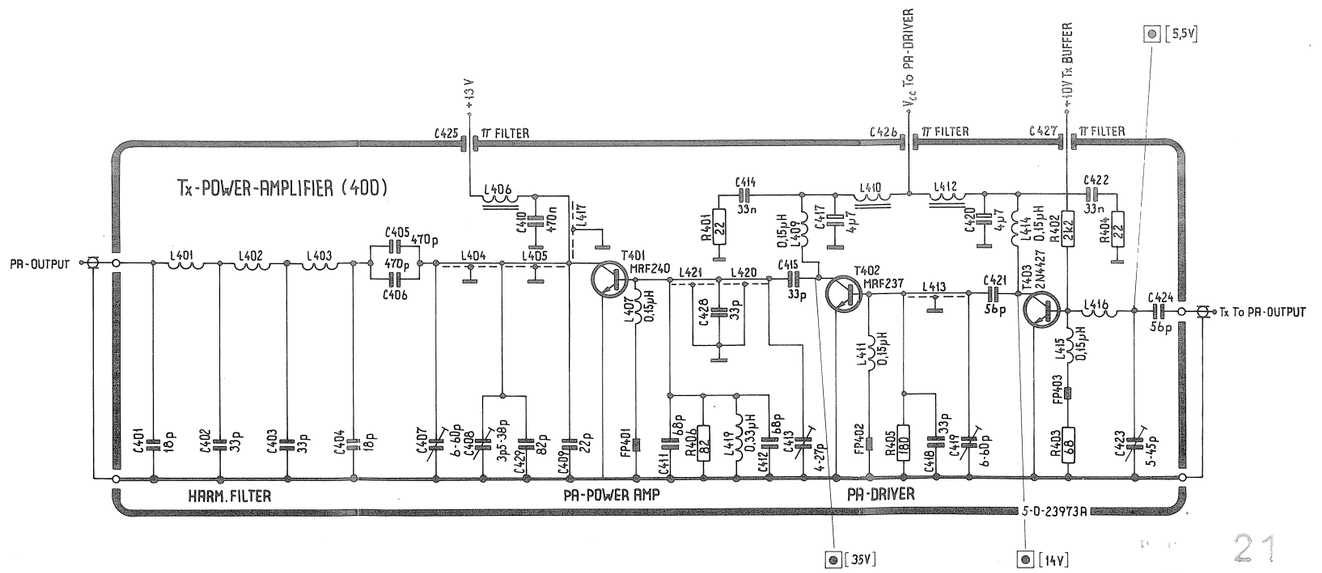
Antenna signal 1 mV pd: Δf=

±3 kHz; fm = 1 kHz

Voltages in brackets:

Antenna signal 10 mV pd; Δf =

±3 kHz; fm = 1 kHz



2.6. INTERFACE UNIT (600)

The interface unit forms the link between the control unit C40X and the receiver/transmitter. Furthermore several functions are assembled on this p.c.b.

2.6.1. ON/OFF - Relay

The relay is engaged, when the wire ON/OFF from C40X/H410 is grounded. The same wire is also led to the POWER SUPPLY plug, thus an external power supply can also be switched on.
The zenerdiode D602 protects against spikes as well as reverse polarity.

2.6.2. 5V Supply

The +5V power supply is an integrated, non-adjustable regulator.

2.6.3. +10V Supply

The +10V supply is a serial-regulator with current limiter. When it is switched on, T602 gets base current through R601 and R604. Thus T602 draws collector current, so that T603 switches on, and the output voltage rises. When T604 begins to conduct, the current in T602 is reduced. Hereby the base current to T603 is also reduced, and the output voltage stabilizes.
The current limiting starts when the voltage across R603 is big enough to turn T601 on. Hereby current flows through D604 to the emitter of T602, and by this the current in T602 and also in T603 decreases, which results in decreasing of the output voltage. The current is limited to approximately 350 mA.

2.6.4. PA-regulator

By means of the PA-regulator it is possible to adjust the output power from the transmitter.
When the output from IC607b is changed from 0V to 5V, T613 is turned off. Thus T614 is turned on and thereby also T616 and T615, and the output voltage rises. When the voltage at the base of T614 is equal to the voltage on the base of T613 the current in T614 is reduced, and thereby also in T616 and T615, and the output voltage stabilizes. The output power from the TX-POWER AMPLIFIER is adjusted by changing the output voltage of the PA-regulator on R659. When the output power is to be reduced to 1W, the reference voltage to T613 is decreased. This is done when Q5 on IC606 is turned to +5V. The reduced reference voltage is adjusted with R646, and thereby also the reduced output power.

2.6.5. RX-FILTER CONTROL AMP.

Here the control voltage from the RX-VCO is turned into a control voltage to the capacity diode in the bandpass filters in the receiver.

2.6.6. AF-BUFFER

The AF-signal from the detector is amplified. The buffer is adjusted to deliver 0.8 V_{RMS} in 330 ohm at nominal modulation. F=3 kHz, F_{mod}=1 kHz.

2.6.7. MICROPHONE AMPLIFIER

The amplifier consists of three stages. In the first stage the signal is pre-emphasized. In the next stage the signal is clipped when the input signal is big enough. In the last stage the signal is de-emphasized before it is led to the modulator on the TX-EXCITER. The de-emphasizing is necessary because it is a phase-modulator.

2.6.8. THE MICROCOMPUTER

The uC is held in reset by a low voltage on the RESET input pin. As long as the uC is in reset it is doing nothing, and all the ports are configured as input-lines.

The RESET-LOGIC measures the +5V and +10V supply voltages, so that the uC cannot go out of reset before these are all right.

When the uC goes out of reset the IDNT-switches are read once by turning the IDNT-BUFFER on. This is done when PC2 is switched to 0V. Hereafter this buffer is turned off again and the CHANNEL-BUFFER is turned on by switching PC1 to 0V. The CHANNEL-BUFFER will afterwards be on except if the uC shall read from the PROM. This means that the uC has to be forced into reset after a change in the IDNT-code either by switching off the radio or by short-circuiting the RESET pin 28 to ground.

The channel information is as follows:

Channel	C^{10}	B^{10}	A^{10}
0 - 9	0	0	0
10 - 19	0	0	1
20 - 29	0	1	0
60 - 69	0	1	1
70 - 79	1	0	0
80 - 89	1	0	1
P0 - P9	1	1	0
F0 - F9	1	1	1

Channel	D^1	C^1	B^1	A^1
0	0	0	0	0
1	0	0	0	1
2	0	0	2	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	0

Example: Channel 16 = 0010110.

Every time a new channel is selected the receiver is turned off and if the transmitter is keyed this is also turned off. If the uC is going to read from the PROM both input buffers are turned off by switching PC2 and PC1 to 5V. Hereby T617 is also turned off and the PROM is enabled. After the PROM is read the CHANNEL-BUFFER is enabled again. Hereafter the new dividing figure is sent to the RX-synthesizer and the receiver is turned on again by means of the control latch.

From the CONTROL LATCH the receiver, transmitter, antenna relay, and the two informations AUX1 and AUX2 are controlled.

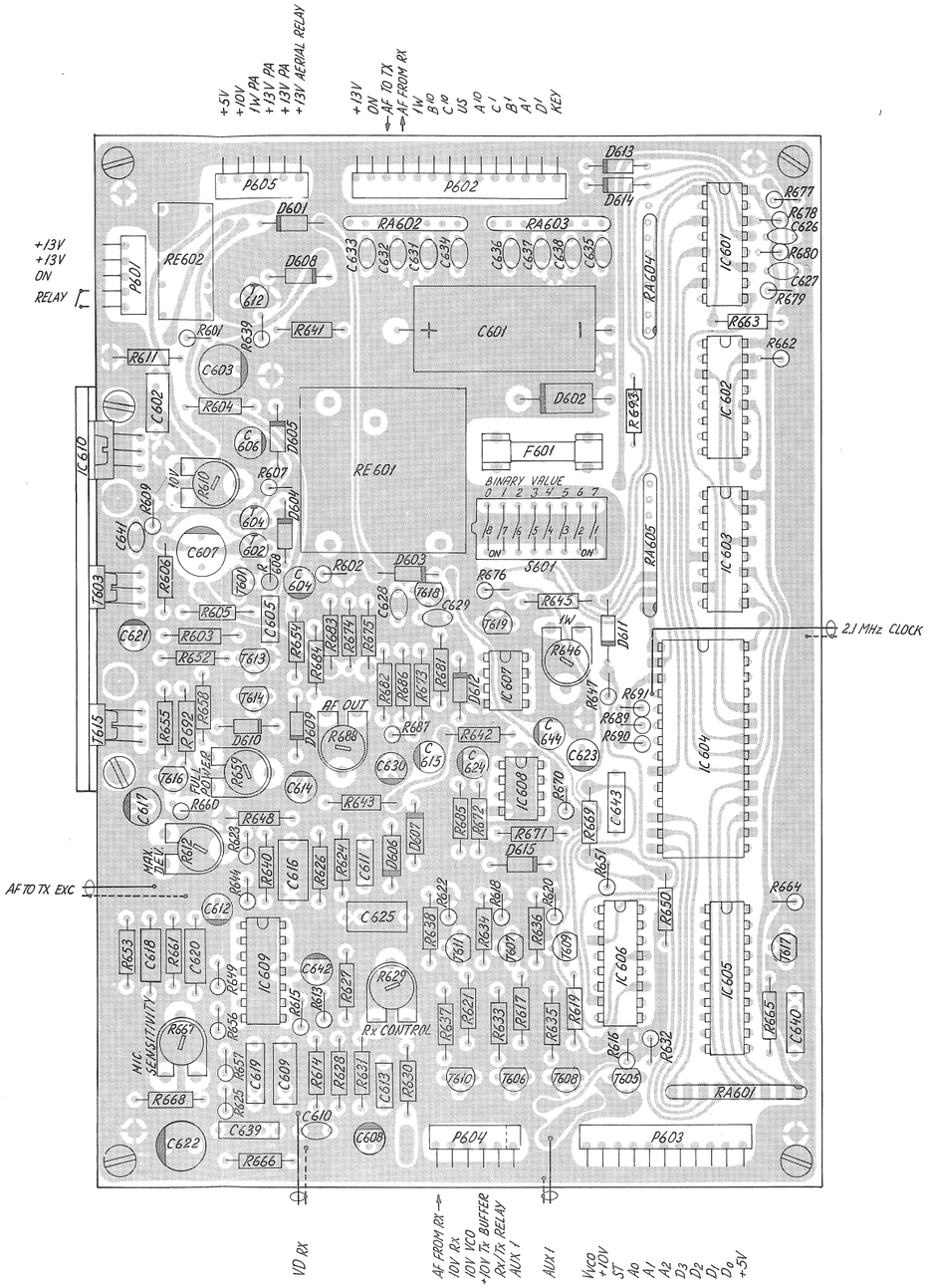
AUX2 is turned to +5V either on channel 10 or channel 16. Se table 1.3.b.

AUX1 is coded in the PROM and gets the same level as it is coded to.

When the transmitter is keyed by switching the key-wire from C40X to 0V, TX-VCO is turned on. After approx. 15 msecs the TX-BUFFER is turned on and after further 60 msecs also the PA-DRIVER is turned on by means of the PA-REGULATOR.

When the key is released the PA-DRIVER is turned off firstly. After approx. 15 msecs also the TX-BUFFER is switched off and after further 45 msecs the TX-VCO is turned off.

The PA-REGULATOR is turned on when Q3 on the CONTROL LATCH is switched to +5V. Provided that reduced power is not selected on C40X there will be +5V on both sides of the resistor array R645, R646, and R647. Hereby the reference voltage to the PA-REGULATOR will be +5V. If the 1W-wire is switched to 0V controlled from C40X also the one end of R645 is turned to 0V. Hereby the input-voltage to IC607b is reduced and thereby also the reference voltage to the regulator. The level can be adjusted with R646. The 1W-wire can also be switched to 0V if Q5 on IC606 is switched to +5V and thereby turns T619 on. Then C40X is also informed and the 1W-indicator on C40X will turn on.



is as follows:

10	A 10
0	0
0	1
1	0
1	1
0	0
0	1
1	0
1	1

:1	B 1	A 1
0	0	0
0	0	1
0	2	0
0	1	1
1	0	0
1	0	1
1	1	0
1	1	1
0	0	0
0	0	0

)10110.

. is selected the receiver is turned off and if
l this is also turned off. If the uC is going to
input buffers are turned off by switching PC2
617 is also turned off and the PROM is enabled.
:he CHANNEL-BUFFER is enabled again. Hereafter
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:ans of the control latch.

:he receiver, transmitter, antenna relay, and the
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ıther on channel 10 or channel 16. Se table 1.3.b.

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switched to 0V if Q5 on IC606 is switched to +5V
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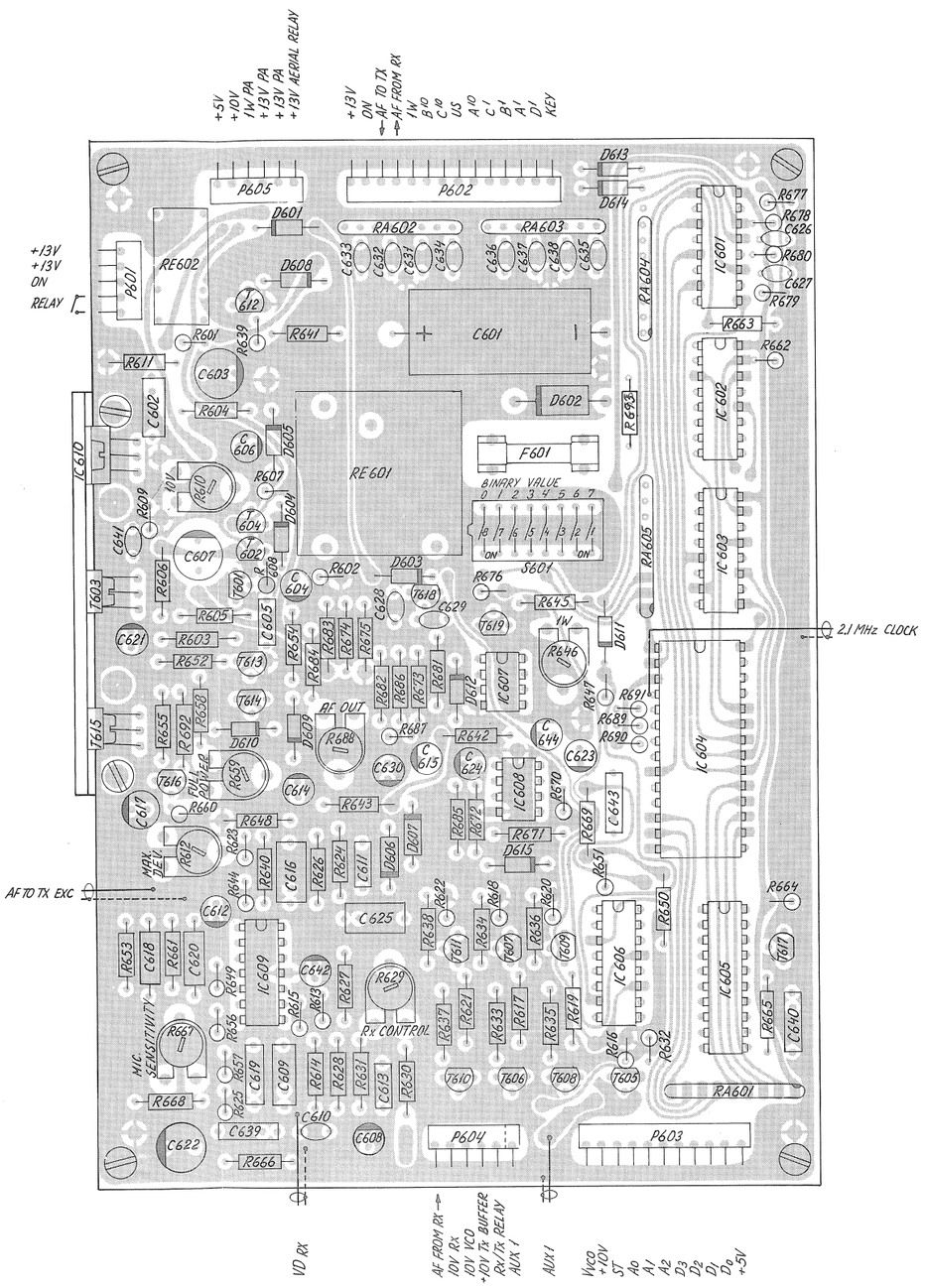
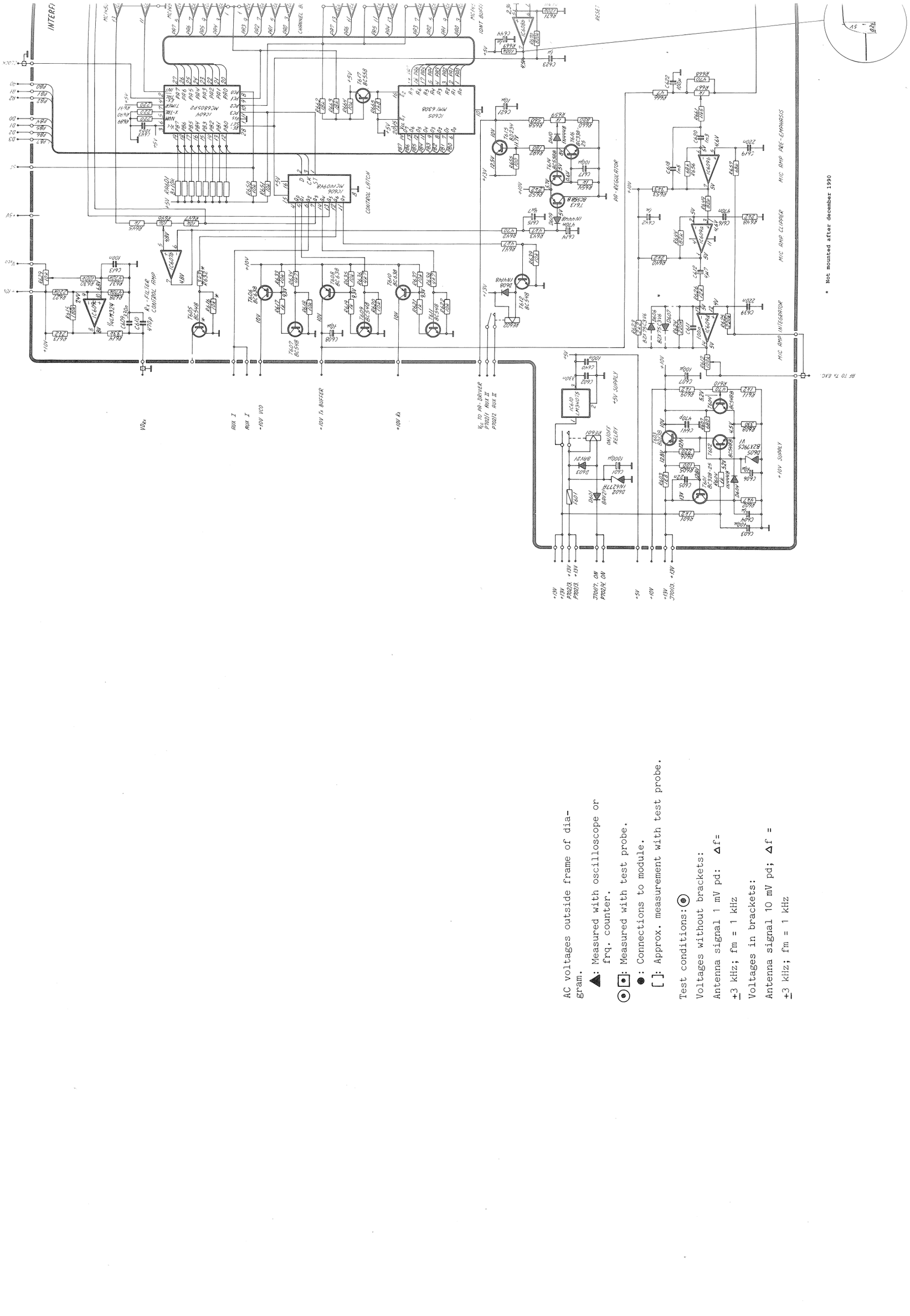
n.





AC voltages outside frame of diagram.

▲: Measured with oscilloscope or frq. counter.

⊙ ⊡: Measured with test probe.

●: Connections to module.

[ ]: Approx. measurement with test probe.

Test conditions: ⊙

Voltages without brackets:

Antenna signal 1 mV pd: Δf= ±3 kHz; fm = 1 kHz

Voltages in brackets:

Antenna signal 10 mV pd; Δf = ±3 kHz; fm = 1 kHz

AC voltages outside frame of diagram.

▲: Measured with oscilloscope or frq. counter.

⊙ ⊡: Measured with test probe.

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±3 kHz; fm = 1 kHz

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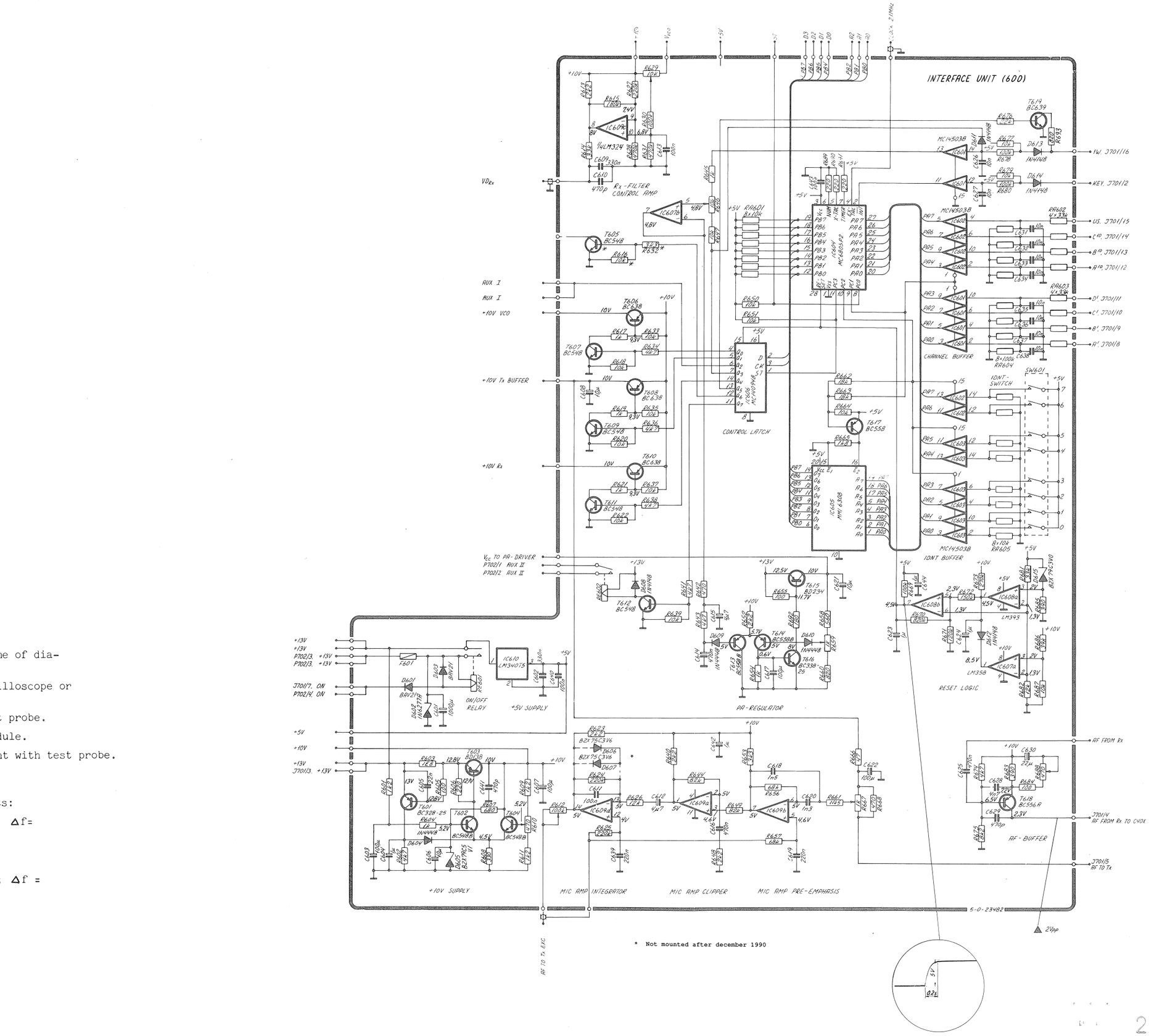
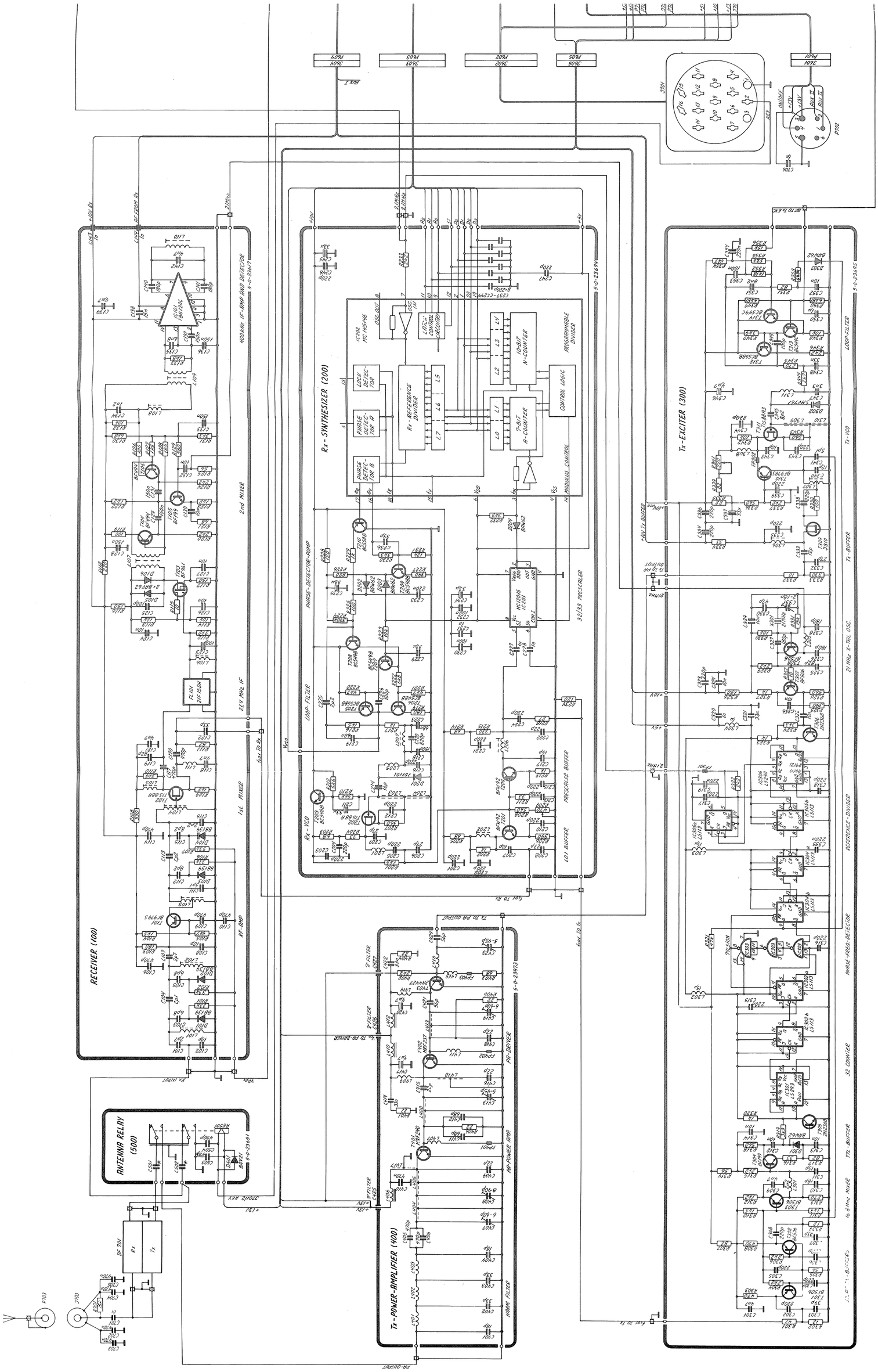




MULTI REMOTE VHF SYSTEM

4-0-23462F

2.8 MAIN DIAGRAM RT146

2.14. DC POWER SUPPLY N418

GENERAL DESCRIPTION
The power supply N418 is constructed for supply of a 13.2V VHF from a 24V DC system. In order to obtain high efficiency, the principle of regulation is the switch mode principle.

TECHNICAL DATA
The power supply N418 is on/off controlled from the connected VHF unit.

Input Voltage:	16 - 32V DC
Output Voltage:	13.2V DC
Output Current:	Max. 7A DC
Operation Temperature Range:	-15°C - +55°C
Switch Frequency:	Approx. 40 kHz

PRINCIPLE OF OPERATION
The on/off information from the connected VHF unit is controlling the N418 via pin 4 of P201.

The regulation takes place after the forward principle, which means that during the "on time" of the switching element T202, the coil L105 is connected direct from the input to the output.

When switching element T202 is turned off the stored energy in L105 maintains supply of current to the output via diode D201.

Regulation of the output voltage takes place via pulse width regulation, which means that the "on time" (duty cycle) of the switching element T202 is controlled. The regulation gives long "on time" when the input voltage is low, a further decrease of input voltage allows the T202 to be on, continuously. If the input voltage is increased the "on time" is shortened.

In order to limit the inrush current during the switching on of N418, soft start is built into N418, thus enabling a short "on time" for T202 immediately after the switching on, and afterwards the "on time" is slowly increased. Current limitation is established by sensing the voltage across the resistor R126. If the current is too high, the pulse width is shortened in order to reduce the output current.

CIRCUIT DESCRIPTION
When N418 is switched on the resistor R113 is connected to the negative terminal of the supply in the VHF and transistor T102 is on. The IC101 starts to function. The voltage level on pin 9 of IC101 controls the duty cycle and the voltage always starts from the low because C108 is discharged via transistor T101 every time the N418 is switched off.

Pin 16 of IC101 is a 5V reference voltage, which is divided down in R104, R105, and R106 and connected to pin 2 (the non-inverted input). Pin 1 of IC101 is connected to the output voltage via voltage divider R117 and R122,

the two levels are compared and the pulse width is controlled so that the output voltage stays stable. Pin 11 and 14 are outputs connected in parallel, the signal forms via T103 and T201 the drive signal for the switching element T202. The components L103, L104, R123, R124, R125, and C121 control the switching on and off of T202 and D201. D105 prevents inverse polarity across T202.

The IC102 senses the output current via the voltage across R126. If this voltage is too high - due to an overload - the pulse width and thus the output voltage is reduced.

With capacitors and coils in input and output, switching noise is suppressed so that the N418 fulfils the CISPR noise regulations.

ADJUSTMENT PROCEDURE

Adjustment of output voltage.

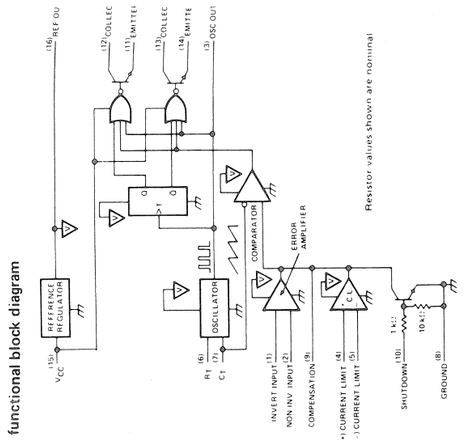
With a load equal to the consumption of a VHF unit in receive condition 0.5 - 0.8A measure the output voltage across C126, and if necessary adjust with R105 to 13.2V.

Adjustment of max. current.

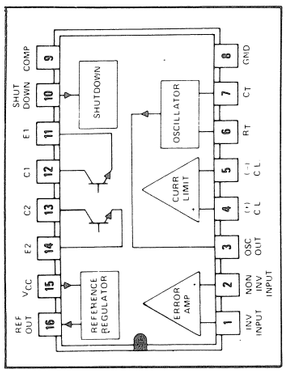
With a load of 5.8A (2.3 ohm) across the output, check that the output voltage is still 13.2V.

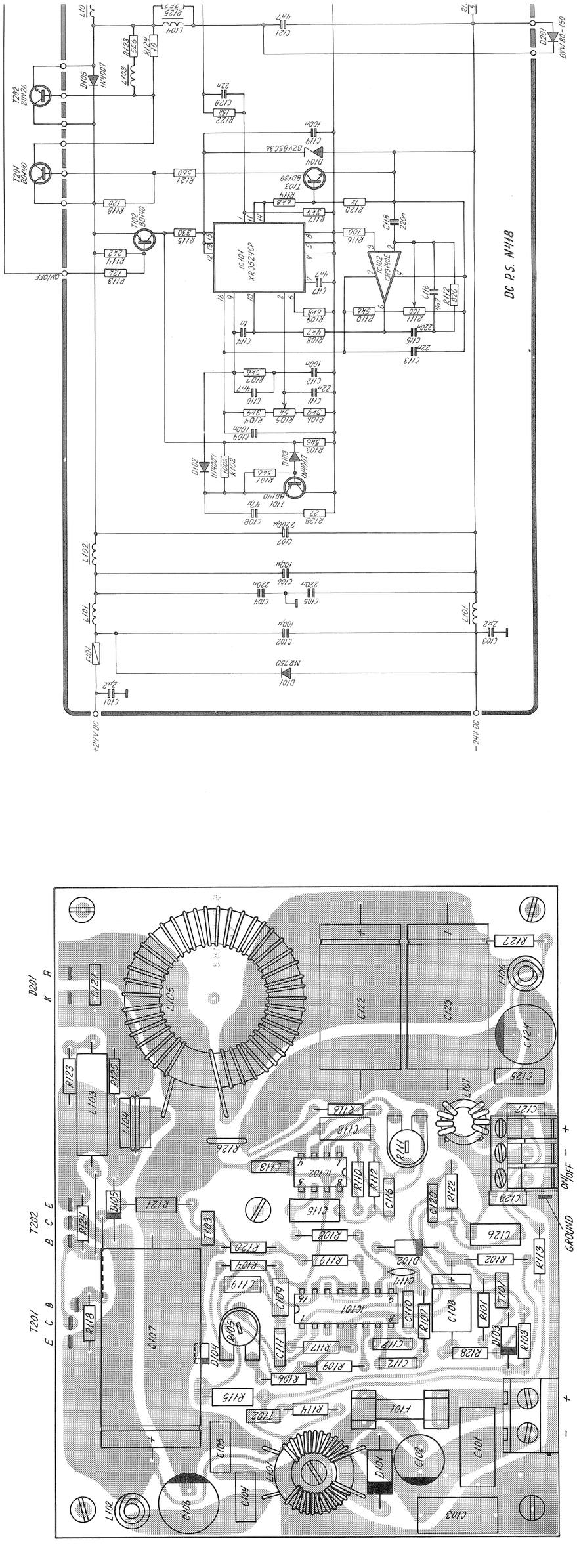
Change the load to 1,5 ohm by paralleling 4.3 ohm to the 2.3 ohm. The voltage will then be 10.5V and the output current is 7A. If necessary adjust to 10.5V with R111.

functional block diagram



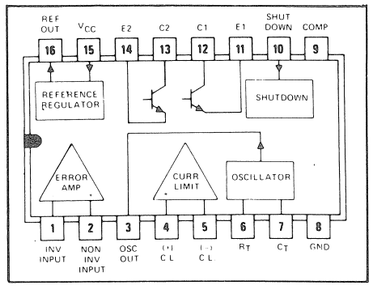
J OR N
DUAL-IN-LINE PACKAGE
(TOP VIEW)



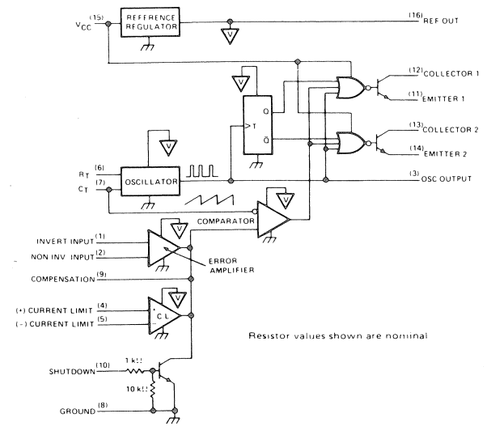


RT146-RT2047 A
4-6-23818A I II

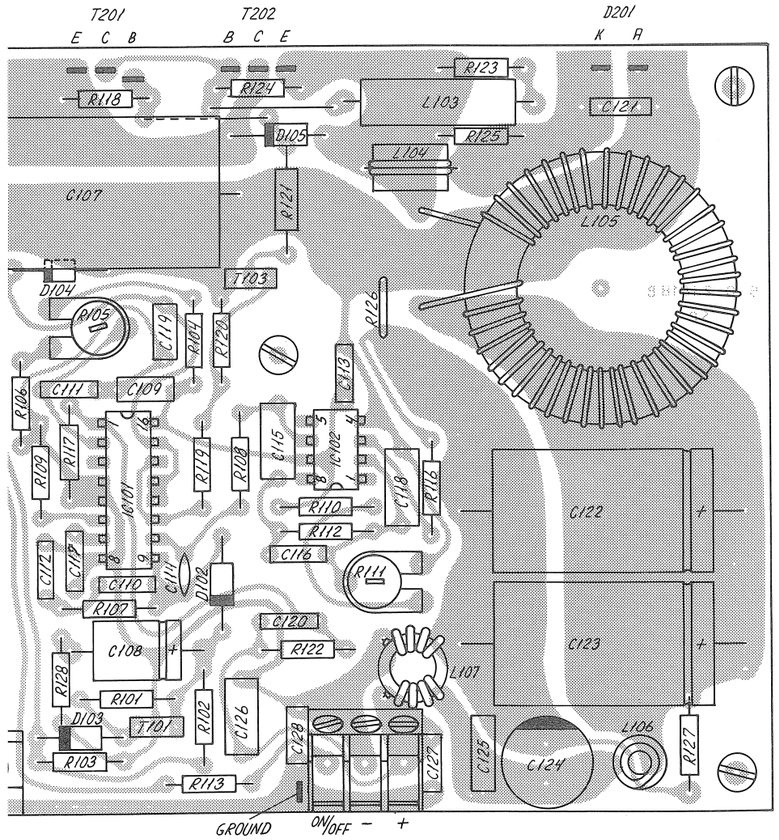
J OR N
DUAL-IN-LINE PACKAGE
(TOP VIEW)

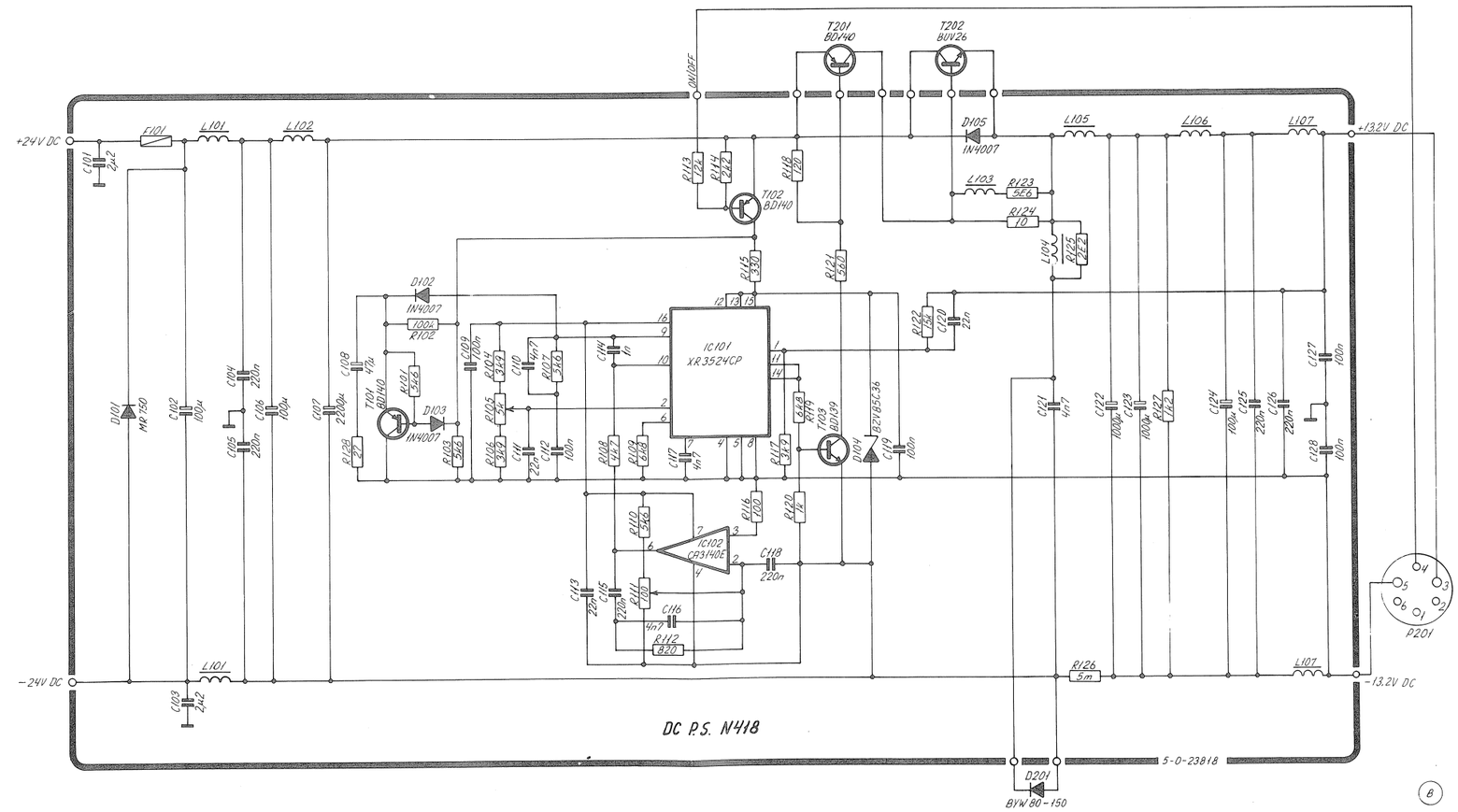


functional block diagram



Resistor values shown are nominal

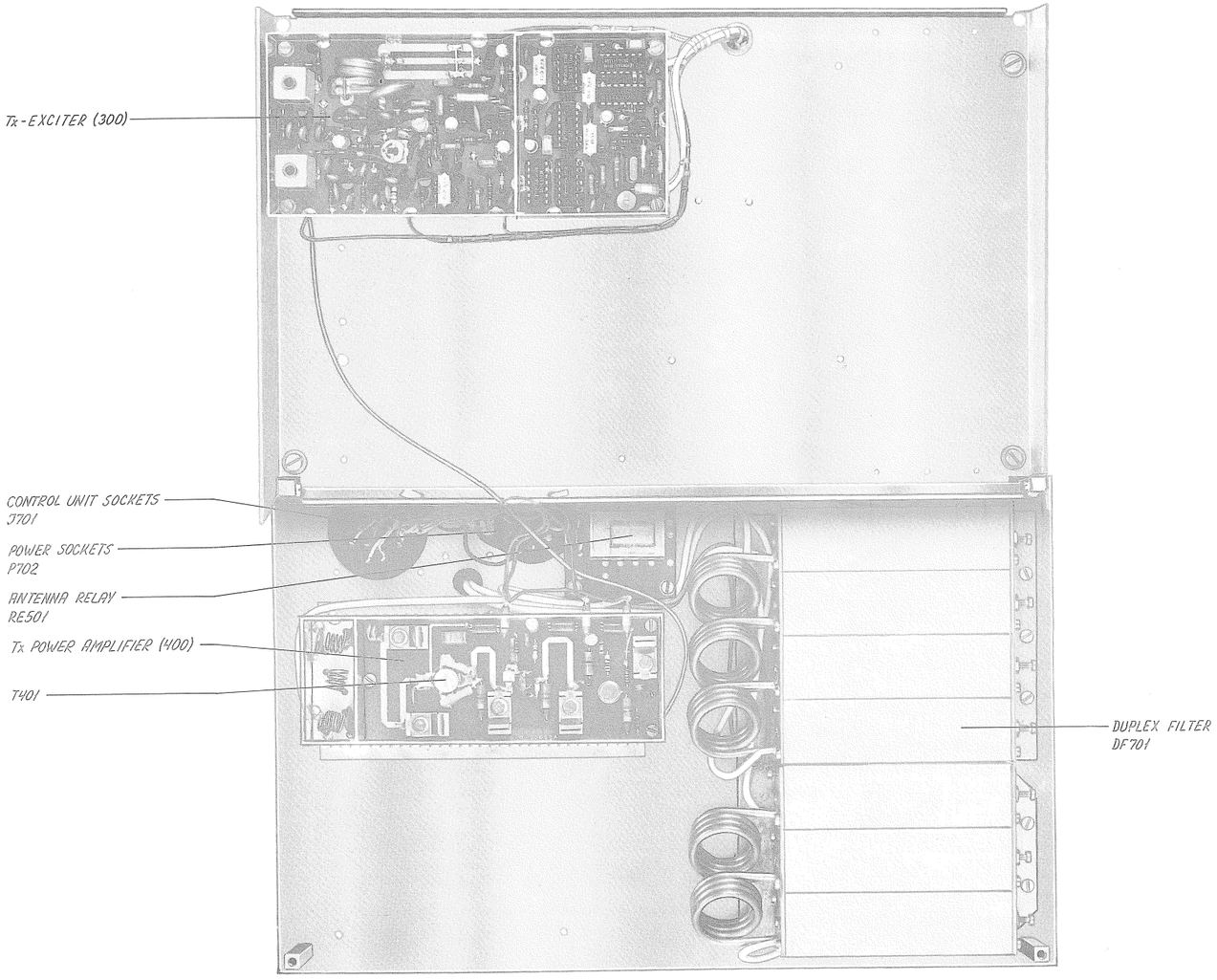


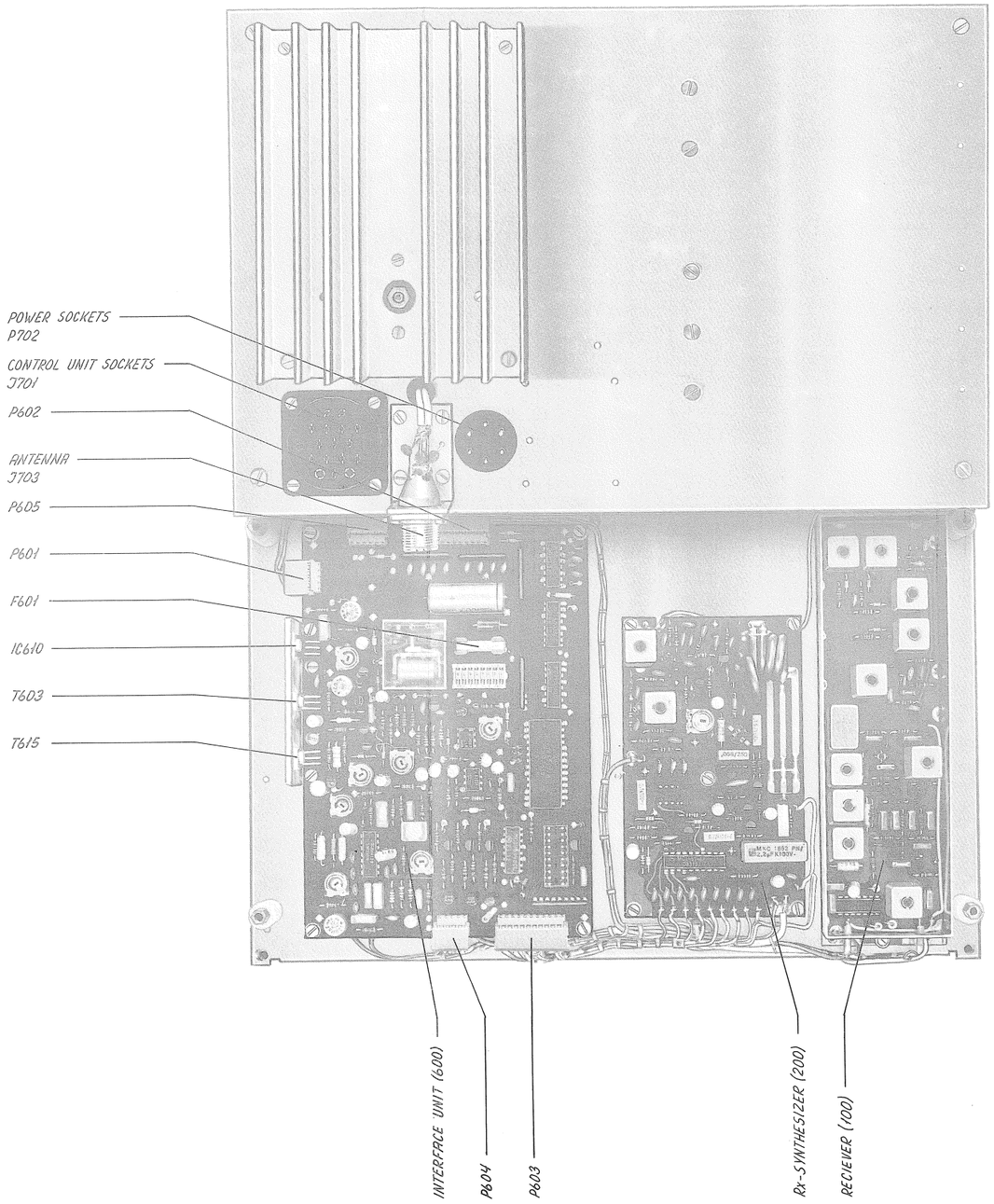


DC P.S. N418

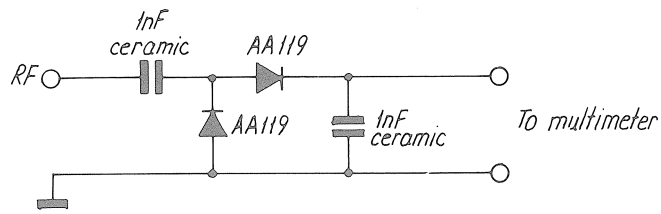
(B)

3.1 MODULE LOCATION RT146

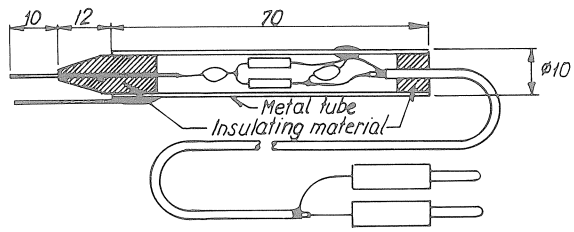




DIODE PROBE



LAYOUT OF THE PROBE



4.4. CALIBRATION OF TEST PROBE

For some test probe measurements it is necessary to use a test probe calibrated together with a specified multimeter.

Necessary equipment:

1. Diagram with space for the measuring results
2. Test probe
3. Multimeter
4. New factory adjusted RT146 and control unit

4.4.1. PROCEDURE FOR CALIBRATION

1. Switch on the set from the CONTROL UNIT.
2. Set CHANNEL to ch. 28.
3. Remove coax cable from soldering point for F_{LO1} to RX on RX-Synthesizer and replace it with a 50 ohm resistor.
4. Connect test probe to the above mentioned point and write down the measured result on the diagram.
5. Remove the resistor and solder back the coax cable.
6. Follow the above mentioned procedure by measuring the levels from F_{LO1} to TX on RX-Synthesizer and TX drive level from TX-Exciter.

All other test probe measurements are relative and ought to be measured with the same test probe and taken down on the diagram.

4.5. ADJUSTMENT PROCEDURE

4.5.1. Adjustment of INTERFACE UNIT (600)

Alignment and control of voltage regulators.

1. Switch on the set from the CONTROL UNIT.
2. Set CHANNEL to ch. 28.
3. Check 13.2V with multimeter on P702 pin 3 and J701 pin 3.
4. Check 5V ±0.2V with multimeter on IC610 pin 3.
5. Connect multimeter to collector of T603 and adjust 10V regulator with R610 to 10V ±0.2V.
6. Connect multimeter to collector of T603 and key the transmitter.
7. Adjust PA-regulator with R659 to +10V ±0.2V.
8. Connect multimeter to R614.
9. Adjust RX-control voltage (VD_{RX}) to 8V with R629.

4.5.2. Adjustment of RX-SYNTHESIZER (200)

1. Set CHANNEL to ch. 28.
2. Check the DC-control voltage on R217 with a multimeter to be 8V. If components have been changed in the VCO-circuit, it is possible that the jump wire used for adjusting the VCO frequency range has to be moved until the 8V ±0.4V is achieved.
3. Control of frequency on F_{LO1} to RX with a frequency counter to be 140.600 MHz.

Alignment of F_{LO1} to TX and F_{LO1} to RX.

1. Connect "calibrated" test probe to soldering point for F_{LO1} to TX.
2. Adjust L202 until the core is 0.5 mm over the coil form and potentiometer R209 CCW to 3/4 of the range (experience).
3. Adjust L206 to max. deflection on the Tp meter.
4. Set CHANNEL to ch. 6.
5. Check the deflection on the Tp meter to be nearly the same as ch. 28. Otherwise obtain the level on ch. 6 and ch. 28 to be nearly the same by adjusting L206.
6. Connect test probe to soldering point for F_{LO1} to RX.
7. Adjust L202 to max. deflection on Tp meter and obtain that deflection on ch. 6 and ch. 28 are nearly the same.

The levels measured with power meter (mW) and 50 ohm impedance must be:

F_{LO1} to TX: 0.25 mW

F_{LO1} to RX: 5 mW ±1.5 dB.

4.5.3. Adjustment of TX-EXCITER (300).

1. Set CHANNEL to ch. 28.
2. Connect frequency counter to the top of T306.
3. Adjust trimmer capacitor C331 until the frequency counter shows 21000000 Hz ±20 Hz.

Note! With the transmitter keyed you can measure on R332 and adjust C331 until the frequency counter shows 157400000 Hz ±150 Hz.

4. Check on FP301 the clock frequency to microprocessor to be 2.1 MHz.
5. Check the DC-control voltage on R344 to be 8V.
   If components have been changed in the VCO-circuit it is possible that the jump wire used for adjusting the VCO frequency range has to be moved until the 8V ±0.4V is achieved.

Alignment of TX-drive level.

1. Remove coax cable from TX-PA and solder a 50 ohm resistor from TX to PA output to ground.
2. Connect test probe to TX to PA output.
3. Adjust coils L306 and L307 to max. deflection on the Tp-meter and obtain that the levels on ch. 6 and ch. 28 are nearly the same.
4. Adjust R641 to the correct output about 3.8V on Tp-meter.
5. Remove the 50 ohm resistor and solder the coax cable back to the output point.

4.5.4. Adjustment of TX-POWER AMPLIFIER

Alignment of output power.

1. Set CHANNEL to ch. 20.
2. Connect RF-power meter and a 50 ohm 25 Watt load resistor to antenna connector J703.
3. Adjust trimming capacitors C423, C419, C413, C408, C407 to max. deflection on the power meter.
4. Repeat the adjustment under point 3 several times to get max. output power.
5. If the power meter shows more than 25W adjust R659 on interface unit till the power meter shows 25 Watt.
6. Set output power to 1W on control unit.
7. Adjust R646 on interface unit till the power meter shows 0.8 Watt.

4.5.5. Alignment of Modulation on Interface Unit (600)

1. Set CHANNEL to ch. 28.
2. Disconnect the wire from pin No. 5 (yellow/green) on the control unit connector J701 pin 5.
3. Connect tone generator and AF-voltmeter between the disconnected wire and pin No. 1 in connector J701.
4. Set power output level to 1W.

5. Connect modulation meter loosely to the RF-load resistor.
6. Connect distortion analyzer to the modulation meter.
7. Turn potentiometer R667 to the middle of the adjusting range.
8. Set the tone generator to a frequency of 1000 Hz and output level to 2.6 V_{RMS} (nominal level 260 mV_{RMS} + 20 dB). Read level on AF-voltmeter.
9. Key the transmitter.
10. Adjust R612 to max. deviation: F = ±5.0 kHz.
11. Set level of tone generator to nominal level: 260 mV_{RMS}.
12. Adjust R667 to nominal modulation: F = ±3.0 kHz.
13. Check that distortion is less than 5%.

4.5.6. Adjustment of RX-Amplifier Unit and AF-Buffer Amplifier

Alignment of RF and IF amplifier:

1. Set CHANNEL to ch. 28.
2. Connect signal generator to antenna connector J703.
3. Connect test probe to pin 14 if IC101.
4. Set signal generator frequency to 162,000 MHz and increase signal level until the deflection on Tp-meter reaches 30% of maximum deflection.
5. Readjust signal generator level under the alignment if necessary to keep the same deflection on the Tp-meter. You must be sure that the signal is out of compression.
6. Adjust coils L101, L102, L103, L104, L105, L106, L107, L108, and L109 to max. deflection on the Tp-meter.
7. Set CHANNEL to ch. 6.
8. Set signal generator to 156,300 MHz.
9. Adjust potentiometer R629 (interface unit) to max. deflection on Tp-meter.
10. Set CHANNEL to ch. 28.
11. Set signal generator to 162,000 MHz.
12. Adjust coils L101, L102, L103, and L104 to max. deflection on the Tp-meter.

Alignment of Detector and AF-buffer amplifier.

1. Set CHANNEL to ch. 6.
2. Connect signal generator to antenna connector J703.
3. Connect frequency counter between pin 14 of IC101 and frame through 10 uF capacitor.
4. Set signal generator level to 1 mW (no modulation).
5. Set signal generator frequency till frequency counter shows 400.0 kHz ±0.1 kHz.
6. Pin No. 4 in control unit connector J701 must be loaded with a control unit or a 330 ohm resistor.

7. Check that potentiometer R688 is in center position.
8. Connect AF voltmeter to control unit connector J701 pin No. 4.
9. Set modulation on signal generator to nominal modulation: fm = 1 kHz, F = ±3 kHz.
10. Adjust coil L110 to max. deflection on the AF voltmeter.
11. Adjust potentiometer R688 to 0.8V_{RMS} on AF voltmeter.

Alignment and control of receiver sensitivity.

1. Connect reference control unit to control unit connector J701.
2. Set CHANNEL to ch. 6.
3. Disconnect signal generator to antenna connector J703.
4. Connect distortion analyzer between the two terminals at the telephone cartridge on the control unit (+ on red wire).
5. Set signal generator to best sensitivity (12 dB SINAD).
6. Adjust potentiometer R629 (interface unit) to best sensitivity.
7. Adjust coils L101, L102, and L103 to max. signal to noise ratio (best sensitivity).
8. Check that the sensitivity on all channels is better than 0.8 uV EMF for 12 dB SINAD.

RECEIVER (100) for RT146 - RT147

Symbol	*Description*			*Manufact.*	
R101	Resistor	33 kohm ±5%	0.33W	Philips	2322 211 13333
R102	Resistor	33 kohm ±5%	0.33W	Philips	2322 211 13333
R103	Resistor	180 ohm ±5%	0.33W	Philips	2322 211 13181
R104	Resistor	1.5 kohm ±5%	0.33W	Philips	2322 211 13152
R105	Resistor	4.7 kohm ±5%	0.33W	Philips	2322 211 13472
R106	Resistor	33 kohm ±5%	0.33W	Philips	2322 211 13333
R107	Resistor	33 kohm ±5%	0.33W	Philips	2322 211 13333
R108	Resistor	330 ohm ±5%	0.33W	Philips	2322 211 13331
R109	Resistor	1.2 kohm ±5%	0.33W	Philips	2322 211 13122
R110	Resistor	3.9 kohm ±5%	0.33W	Philips	2322 106 33392
R111	Resistor	82 ohm ±5%	0.33W	Philips	2322 211 13829
R112	Resistor	2.2 kohm ±5%	0.33W	Philips	2322 211 13222
R113	Resistor	12 kohm ±5%	0.33W	Philips	2322 211 13123
R114	Resistor	10 kohm ±5%	0.33W	Philips	2322 211 13103
R115	Resistor	10 ohm ±5%	0.33W	Philips	2322 106 33109
R116	Resistor	150 ohm ±5%	0.33W	Philips	2322 106 33151
R117	Resistor	150 ohm ±5%	0.33W	Philips	2322 211 13151
R118	Resistor	220 ohm ±5%	0.33W	Philips	2322 211 13221
R119	Resistor	100 ohm ±5%	0.33W	Philips	2322 211 13101
R120	Resistor	2.2 kohm ±5%	0.33W	Philips	2322 211 13222
R121	Resistor	68 ohm ±5%	0.33W	Philips	2322 106 33689
R122	Resistor	1.2 kohm ±5%	0.33W	Philips	2322 106 33122
R123	Resistor	1.2 kohm ±5%	0.33W	Philips	2322 106 33122
R124	Resistor	2.2 kohm ±5%	0.33W	Philips	2322 211 13222
R125	Resistor	56 ohm ±5%	0.33W	Philips	2322 211 13569
R126	Resistor	100 ohm ±5%	0.33W	Philips	2322 106 33101
R127	Resistor	1.5 kohm ±5%	0.33W	Philips	2322 211 13152
R128	Resistor	1.5 kohm ±5%	0.33W	Philips	2322 211 13152
R129	Resistor	560 ohm ±5%	0.33W	Philips	2322 106 33561
R130	Resistor	6.8 kohm ±5%	0.33W	Philips	2322 211 13682
R131	Resistor	3.3 kohm ±5%	0.33W	Philips	2322 211 13332
R132	Resistor	10 kohm ±5%	0.33W	Philips	2322 211 13103
R133	Resistor	1.8 kohm ±5%	0.33W	Philips	2322 106 33182
C101	Capacitor ceramic	2.7 pF ±0.1 pF	250V	Ferroperm	9/0112.9
C102	Capacitor ceramic	10 pF ±5%	400V	Ferroperm	9/0112.9
C103	Capacitor ceramic	6.8 pF ±0.25 pF	400V	Ferroperm	9/0112.9
C104	Cp 1 capacitor printed			S.P.	
C105	Capacitor ceramic	6.8 pF ±0.25 pF	400V	Ferroperm	9/0112.9

RECEIVER (100) for RT146 - RT147

Symbol	Description		Manufact.	
C106	Capacitor ceramic 470 pF -20/+80%	400V	Ferroperm	9/0129.9
C107	Capacitor ceramic 2.7 pF +0.1 pF	250V	Ferroperm	9/0112.9
C108	Capacitor ceramic 10 pF ±5%	400V	Ferroperm	9/0112.9
C109	Capacitor ceramic 470 pF -20/+80%	400V	Ferroperm	9/0129.9
C110	Capacitor ceramic 470 pF -20/+80%	400V	Ferroperm	9/0129.9
C111	Capacitor ceramic 5.1 pF ±0.25 pF	400V	Ferroperm	9/0112.9
C112	Capacitor ceramic 8.2 pF ±0.25 pF	400V	Ferroperm	9/0112.9
C113	Cp 2 capacitor printed		S.P.	
C114	Capacitor ceramic 470 pF -20/+80%	400V	Ferroperm	9/0129.9
C115	Capacitor ceramic 8.2 pF ±0.25 pF	400V	Ferroperm	9/0112.9
C116	Capacitor ceramic 2.2 pF ±0.1 pF	400V	Ferroperm	9/0112.9
C117	Capacitor polystyrene 470 pF ±1%		Philips	2222 427 44701
C118	Capacitor MKT 4.7 nF ±10%		Siemens	B32509-A0472-K
C119	Capacitor polystyrene 82 pF ± 1%		Philips	2222 427 48209
C120	Capacitor ceramic 470 pF -20/+80%	400V	Ferroperm	9/0129.9
C121	Capacitor MKT 4.7 nF ±10%		Siemens	B32509-A0472-K
C122	Capacitor ceramic 33 pF ±5%	63V	Ferroperm	9/0116.8
C123	Capacitor ceramic 100 pF ±5%	25V	Ferroperm	9/0213.8
C124	Capacitor MKT 10 nF ±10%		Siemens	B32510-D6103-K
C125	Capacitor ceramic 100 pF ±5%	25V	Ferroperm	9/0213.8
C126	Capacitor MKT 10 nF ±10%		Siemens	B32510-D6103-K
C127	Capacitor MKT 10 nF ±10%		Siemens	B32510-D6103-K
C128	Capacitor MKT 150 nF ±10%		Siemens	B32510-D1154-K
C129	Capacitor MKT 150 nF ±10%		Siemens	B32510-D1154-K
C130	Capacitor MKT 10 nF ±10%		Siemens	B32510-D6103-K
C131	Capacitor MKT 150 nF +10%		Siemens	B32510-D1154-K
C132	Capacitor MKT 10 nF ±10%		Siemens	B32510-D6103-K
C133	Capacitor MKT 150 nF ±10%		Siemens	B32510-D1154-K
C134	Capacitor polystyrene 1.2 nF ±2%		Philips	2222 425 31202
C135	Capacitor polystyrene 6.8 nF ±2%		Philips	2222 424 36802
C136	Capacitor MKT 150 nF ±10%		Siemens	B32510-D1154-K
C137	Capacitor MKT 150 nF ±10%		Siemens	B32510-D1154-K
C138	Capacitor MKT 15 nF ±10%		Siemens	B32510-D6153-K
C139	Capacitor electrolytic 4.7 uF±20%	50V	ROE	EKI 00 AA 147H
C140	Capacitor polystyrene 180 pF ±2%		Philips	2222 427 31801
C141	Capacitor polystyrene 180 pF ±2%		Philips	2222 427 31801
C142	Capacitor polystyrene 4.7 nF ±2%		Philips	2222 424 34702
C143	Capacitor feed-through 1 nF -20/+80%	250V	Ferroperm	9/0138,58 - 250V
C144	Capacitot feed-through 1 nF -20/+80%	250V	Ferroperm	9/0138,58 - 250V

RECEIVER (100) for RT146 - RT147

Symbol	*Description*		*Manufact.*	
L101	Coil	TL355	S.P.	6-0-23627
L102	Coil	TL356	S.P.	6-0-23628
L103	Coil	TL357	S.P.	6-0-23629
L104	Coil	TL358	S.P.	6-0-23630
L105	Coil	TL360	S.P.	6-0-23632
L106	Coil	TL361	S.P.	6-0-23633
L107	Coil	TL362	S.P.	6-0-23634
L108	Coil	TL363	S.P.	6-0-23635
L109	Coil	TL364	S.P.	6-0-23636
L110	Coil	TL365	S.P.	6-0-23637
L111	Coil	TL359	S.P.	6-0-23631
T101	Transistor		Siemens	BF979S
T102	Transistor		Motorola	TIS88A 2
T103	Transistor		Siemens	BF961
T104	Transistor		Philips	BF494
T105	Transistor		Philips	BF199
T106	Transistor		Philips	BF494
IC101	Integrated circuit		Motorola	TBA120C
D101	Diode		Motorola	BB139
D102	Diode		Motorola	BB139
D103	Diode		Motorola	BB139
D104	Diode		Motorola	BB139
D105	Diode		Miniwatt	BAW62
D106	Diode		Miniwatt	BAW62
FL101	Crystal filter	21.4 MHz	N.D.K.	21F15DH

RX-SYNTHESIZER (200)	RT146	ESPERA	5-0-23694D	603718

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
C201	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C202	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C203	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C204	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C205	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C206	CAPACITOR CERAMIC	27pF 5% N150 50VDC	NKE	DT 350 758L PH 270 J 50V	15.812
C207	CAPACITOR CERAMIC	10pF 5% NPO 500VDC	NKE	DT 350 758L CH 100 J 500V	15.565
C208	CAPACITOR CERAMIC	27pF 5% N150 50VDC	NKE	DT 350 758L PH 270 J 50V	15.812
C209	CAPACITOR CERAMIC	27pF 5% N150 50VDC	NKE	DT 350 758L PH 270 J 50V	15.812
C210	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C211	CAPACITOR ELECTROLYTIC	33uF 20% 16VDC	ELNA	RJ2-16-V-330-M-T34	14.518
C212	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C213	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C214	CAPACITOR CERAMIC	16pF 5% N150 50VDC	NKE	DT340 758S PH 160 J 50V	15.057
C215	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C216	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C217	CAPACITOR CERAMIC	15pF 5% NPO 500VDC	NKE	DT 360 758L CH 150 J 500V	15.590
C218	CAPACITOR POLYESTER	150nF 10% 100VDC	PHILIPS	2222 372 21154	11.074
C219	CAPACITOR POLYESTER	68nF 10% 250V	ERO	MKT1822	11.102
C220	CAPACITOR POLYSTYRENE	820pF 1% 250VDC	PHILIPS	2222 430 88201	10.348
C221	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C222	CAPACITOR CERAMIC	22pF 5% N150 500VDC	KCK	RT-HM SK PH 220 J	15.062
C223	CAPACITOR POLYESTER	68nF 10% 250V	ERO	MKT1822	11.102
C224	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C225	CAPACITOR MKT	2u2F 10% 100VDC	PHILIPS	2222 373 90002	11.142
C226	CAPACITOR CERAMIC	100pF 5% N150 500V	#KCK	HM11SJPH101J	15.132
C227	CAPACITOR CERAMIC	1nF 10% 50VDC CL2	NKE	DT 340 758L B 102 K 50V	16.160
C228	CAPACITOR CERAMIC	1nF 10% 50VDC CL2	NKE	DT 340 758L B 102 K 50V	16.160
C229	CAPACITOR ELECTROLYTIC	33uF 20% 16VDC	ELNA	RJ2-16-V-330-M-T34	14.518
C230	CAPACITOR MKT	100nF 10% 100VDC	ERO	MKT 1822-410/01 5	11.073
C231	CAPACITOR CERAMIC	1nF 10% 50VDC CL2	NKE	DT 340 758L B 102 K 50V	16.160
C232	CAPACITOR CERAMIC	100nF 10% 50V	SIEMENS	B37987-F5104-K000	16.305
C233	CAPACITOR POLYESTER	0.22uF 10% 100V	PHILIPS*	2222 369 25224	11.075
C234	CAPACITOR ELECTROLYTIC	33uF 20% 16VDC	ELNA	RJ2-16-V-330-M-T34	14.518
C235	CAPACITOR ELECTROLYTIC	33uF 20% 16VDC	ELNA	RJ2-16-V-330-M-T34	14.518
C236	CAPACITOR CERAMIC	33pF 5% N150 400V	#KCK	HM74SJPH330J	15.083
C237	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C238	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C239	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C240	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C241	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C242	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C243	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C244	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C245	CAPACITOR ELECTROLYTIC	33uF 20% 16VDC	ELNA	RJ2-16-V-330-M-T34	14.518
C246	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C247	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
D201	DIODE CAPASITANCE	13pF/9VDC	TOSHIBA	1SV101 in matched group	26.135
D202	DIODE	BAW62 HIGH SPEED	PHILIPS	BAW62-143	25.350
D203	DIODE	BAW62 HIGH SPEED	PHILIPS	BAW62-143	25.350
D204	DIODE	BAW62 HIGH SPEED	PHILIPS	BAW62-143	25.350
IC201	INTEGRATED CIRCUIT	MC12015P	MOTOROLA*	MC12015P	32.850
IC202	INTEGRATED CIRCUIT	4BIT SER.INP.PLL SYNTHES	MOTOROLA	MC145146P1	33.490
L201	COIL	TL370	S.P.RADIO	6-0-23686	400370
L202	COIL	TL368	S.P.RADIO	6-0-23592	400368
L203	COIL	TL375	S.P.RADIO	6-0-23696B	400375
L204	COIL	TL376	S.P.RADIO	6-0-23697C	400376
L205	CHOKE	4u7H 10%	FASTRON	MICC-4R7K-02	20.137
L206	COIL	TL369	S.P.RADIO	6-0-23662	400369
L207	COIL	TL371	S.P.RADIO	6-0-23687	400371
R201	RESISTOR MF	1k5 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-1k5	01.704
R202	RESISTOR MF	1k0 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-1k0	01.700
R203	RESISTOR MF	68 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-68R	01.670
R204	RESISTOR MF	33 OHM 5% 0.4W	PHILIPS	2322 181 53339	01.162
R205	RESISTOR MF	68 OHM 5% 0.4W	PHILIPS	2322 181 53689	01.170
R206	RESISTOR MF	390 OHM 5% 0.4W	PHILIPS	2322 181 53391	01.189
R207	RESISTOR MF	560 OHM 5% 0.4W	PHILIPS	2322 181 53561	01.193
R208	RESISTOR MF	560 OHM 5% 0.4W	PHILIPS	2322 181 53561	01.193
R209	POTENTIOMETER TRIMMING	470 OHM 10% 0.5W	PHILIPS*	2322 482 22471	07.651

R210	RESISTOR MF	56k OHM 5% 0.4W	PHILIPS	2322 181 53563	01.243
R211	RESISTOR MF	33 OHM 5% 0.4W	PHILIPS	2322 181 53339	01.162
R212	RESISTOR MF	5k6 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-5k6	01.718
R213	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R214	RESISTOR MF	68 OHM 5% 0.4W	PHILIPS	2322 181 53689	01.170
R215	RESISTOR MF	330 OHM 5% 0.4W	PHILIPS	2322 181 53331	01.187
R216	RESISTOR MF	1k5 OHM 5% 0.4W	PHILIPS	2322 181 53152	01.204
R217	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R218	RESISTOR MF	27 OHM 5% 0.4W	PHILIPS	2322 181 53279	01.160
R219	RESISTOR MF	180 OHM 5% 0.4W	PHILIPS	2322 181 53181	01.181
R220	RESISTOR MF	4k7 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-4k7	01.716
R221	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R222	RESISTOR MF	6k8 OHM 5% 0.4W	PHILIPS	2322 181 53682	01.220
R223	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R224	RESISTOR MF	390k OHM 5% 0.4W	PHILIPS	2322 181 53394	01.264
R225	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
R226	RESISTOR MF	820 OHM 5% 0.4W	PHILIPS	2322 181 53821	01.197
R227	RESISTOR MF	390 OHM 5% 0.4W	PHILIPS	2322 181 53391	01.189
R228	RESISTOR MF	120 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-120R	01.677
R229	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R230	RESISTOR MF	3k3 OHM 5% 0.4W	PHILIPS	2322 181 53332	01.212
R231	RESISTOR MF	12k OHM 5% 0.4W	PHILIPS	2322 181 53123	01.227
R232	RESISTOR MF	3k3 OHM 5% 0.4W	PHILIPS	2322 181 53332	01.212
R233	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222	01.208
R234	RESISTOR MF	120 OHM 5% 0.4W	PHILIPS	2322 181 53121	01.177
T201	TRANSISTOR RF	BFW92A	TFK	BFW92A	29.160
T202	TRANSISTOR JFET	TIS88A3 TO-92	MOTORPLA	TM 00 044-3	29.737
T203	TRANSISTOR AF	BC548B NPN TO-92	PHILIPS	BC548B	28.076
T204	TRANSISTOR RF	BFW92A	TFK	BFW92A	29.160
T205	TRANSISTOR AF	BC558B	PHILIPS	BC558B	28.100
T206	TRANSISTOR AF	BC548B NPN TO-92	PHILIPS	BC548B	28.076
T207	TRANSISTOR	BC549B	PHILIPS*	BC549B	28.080
T208	TRANSISTOR	BC549B	PHILIPS*	BC549B	28.080
T209	TRANSISTOR AF	BC548B NPN TO-92	PHILIPS	BC548B	28.076
T210	TRANSISTOR AF	BC558B	PHILIPS	BC558B	28.100

TX-EXCITER — MODULE 300 — ESPERA — 5-0-23695D — 600100

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
C301	CAPACITOR CERAMIC	4n7F 20% CL2 50VDC	NKE	DT 380 758S D 472 M 50V	15.165
C302	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C303	CAPACITOR CERAMIC	39pF 5% N150 500V	#KCK	HM74SJPH390J	15.095
C304	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C305	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C306	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C307	CAPACITOR CERAMIC	33pF 5% N150 400V	#KCK	HM74SJPH330J	15.083
C308	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C309	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V	15.170
C310	CAPACITOR CERAMIC	18pF 5% NPO 500VDC	NKE	DT 360 758S CH 180 J 500V	15.060
C311	CAPACITOR CERAMIC	15pF 5% NPO 500VDC	NKE	DT 360 758L CH 150 J 500V	15.590
C312	CAPACITOR MKT	10nF 10% 400V	SIEMENS	B32510-D6103-K000	11.381
C313	CAPACITOR MKT	10nF 10% 400V	SIEMENS	B32510-D6103-K000	11.381
C314	CAPACITOR MKT	10nF 10% 400V	SIEMENS	B32510-D6103-K000	11.381
C315	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32510-D1224-K000	11.225
C316	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C317	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C318	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C319	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32510-D1224-K000	11.225
C320	CAPACITOR CERAMIC	1nF 10% 50VDC CL2	NKE	DT 340 758L B 102 K 50V	16.160
C321	CAPACITOR ELECTROLYTIC	33uF 20% 16VDC	ELNA	RJ2-16-V-330-M-T34	14.518
C322	CAPACITOR MKT	10nF 10% 400V	SIEMENS	B32510-D6103-K000	11.381
C323	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C324	CAPACITOR MKT	10nF 10% 400V	SIEMENS	B32510-D6103-K000	11.381
C325	CAPACITOR POLYSTYRENE	82pF 1% 630V	#PHILIPS	2222 431 88209	10.398
C326	CAPACITOR CERAMIC	180pF 2% N330 100VDC	PHILIPS	2222 683 46181	16.168
C327	CAPACITOR POLYSTYRENE	180pF 1% 630VDC	PHILIPS	2222 431 81801	10.407
C328	CAPACITOR CERAMIC	180pF 2% N330 100VDC	PHILIPS	2222 683 46181	16.168
C329	CAPACITOR MKT	10nF 10% 400V	SIEMENS	B32510-D6103-K000	11.381
C330	CAPACITOR STYROFLEX	47pF 2,5% 160V	SIEMENS	B31063-B1470-H000	10.168
C331	CAPACITOR TRIMMING	2-18pF PTFE	DAU	107.2901.018	17.100
C332	CAPACITOR CERAMIC	27pF 5% N150 50VDC	NKE	DT 350 758L PH 270 J 50V	15.812
C333	CAPACITOR CERAMIC	12pF 5% NPO 500VDC	NKE	DT350465 758S CH 120J 500	15.575

C334	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C335	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C336	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C337	CAPACITOR ELECTROLYTIC	33uF 20% 16VDC	ELNA	RJ2-16-V-330-M-T34	14.518
C338	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C339	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C340	CAPACITOR CERAMIC	12pF 5% NPO 500VDC	NKE	DT350465 758S CH 120J 500	15.575
C341	CAPACITOR CERAMIC	5p1F +/-0.25pF N150 500V	KCK	RT-HM60-SK PH 5R1 C	16.107
C342	CAPACITOR CERAMIC	10pF 5% N150 500VDC	NKE	DT350465 758S PH100J 500V	16.113
C343	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C344	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	NKE	DT35-0465 758S B 221K500V	16.090
C345	CAPACITOR CERAMIC	8p2F +/-0.25pF N150 500V	NKE	DT350465 758S PH8R2C500V	16.112
C346	CAPACITOR ELECTROLYTIC	4.7uF 20% 50VDC	ELNA	RJ2-50-V-4R7-M-T34	14.510
C347	CAPACITOR MKT	3n3F 5% 400V	SIEMENS	B32510-D6332-J000	11.371
C348	CAPACITOR MKT	33nF 5% 250V	SIEMENS	B32510-D3333-J000	11.497
C349	CAPACITOR CERAMIC	100pF 5% N150 500V	#KCK	HM11SJPH101J	15.132
C350	CAPACITOR ELECTROLYTIC	1uF 20% 50VDC	ELNA	RJ2-50-V-010-M-T34	14.506
C351	CAPACITOR POLYSTYRENE	8,2nF 1% 160V	#PHILIPS	2222 429 88202	10.298
C352	CAPACITOR MKT	10nF 20% 100VDC	PHILIPS	2222 370 38103	11.168
C353	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.219
C354	CAPACITOR ELECTROLYTIC	0.22uF 20% 50VDC	ELNA	RJ2-50V-R22-M-T34	14.502
C355	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32510-D1224-K000	11.225
C356	CAPACITOR MKT	10nF 10% 400V	SIEMENS	B32510-D6103-K000	11.381
D301	DIODE	BAW62 HIGH SPEED	PHILIPS	BAW62-143	25.350
D302	DIODE CAPASITANCE	13pF/9VDC	TOSHIBA	1SV101 in matched group	26.135
D303	DIODE	BAW62 HIGH SPEED	PHILIPS	BAW62-143	25.350
FP301	FERRITE BEAD	Ø3,7xØ1.2x3.5mm GRADE 3B	PHILIPS	4322 020 34400	35.180
FP302	FERRITE BEAD	Ø3.7xØ1.2x3.5mm GRADE 4B1	PHILIPS	4322 020 34420	35.181
IC301	INTEGRATED CIRCUIT	SN74LS293N	TEXAS*	74LS293N	34.260
IC302	INTEGRATED CIRCUIT	SN74LS113AN	TEXAS*	SN74LS113AN	33.841
IC303	INTEGRATED CIRCUIT	SN74LS10N	TEXAS*	74LS10N	33.534
IC304	INTEGRATED CIRCUIT	SN74LS113AN	TEXAS*	SN74LS113AN	33.841
IC305	INTEGRATED CIRCUIT	SN74LS113AN	TEXAS*	SN74LS113AN	33.841
IC306	INTEGRATED CIRCUIT	SN74LS290N	TEXAS*	SN74LS290N	34.251
L301	CHOKE	2.2uH 10%	FERROPERM	1582	20.131
L302	CHOKE	15uH 10%	FERROPERM	1582	20.152
L303	CHOKE	15uH 10%	FERROPERM	1582	20.152
L304	CHOKE	1uH 10%	FERROPERM	1582	20.115
L305	CHOKE FIXED	470nH 10%	FASTRON	MICC-R47K-02	20.075
L306	COIL	TL374	S.P.RADIO	6-0-23690	400374
L307	COIL	TL373	S.P.RADIO	6-0-23689	400373
L308	COIL	TL372	S.P.RADIO	6-0-23688	400372
L309	COIL	TL375	S.P.RADIO	6-0-23696B	400375
L310	COIL	TL376	S.P.RADIO	6-0-23697C	400376
L311	CHOKE	4u7H 10%	FASTRON	MICC-4R7K-02	20.137
R301	RESISTOR MF	47 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-47R	01.666
R302	RESISTOR MF	12 OHM 5% 0.4W	PHILIPS	2322 181 53129	01.152
R303	RESISTOR MF	470 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-470R	01.691
R304	RESISTOR MF	2k2 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-2k2	01.708
R305	RESISTOR MF	56 OHM 5% 0.4W	PHILIPS	2322 181 53569	01.168
R306	RESISTOR MF	2k2 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-2k2	01.708
R307	RESISTOR MF	82 OHM 5% 0.4W	PHILIPS	2322 181 53829	01.172
R308	RESISTOR MF	470 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-470R	01.691
R309	RESISTOR MF	12 OHM 5% 0.4W	PHILIPS	2322 181 53129	01.152
R310	RESISTOR MF	1k5 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-1k5	01.704
R311	RESISTOR MF	3k9 OHM 5% 0.4W	PHILIPS	2322 181 53392	01.214
R312	RESISTOR MF	1k2 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-1k2	01.702
R313	RESISTOR MF	270 OHM 5% 0.4W	PHILIPS	2322 181 53271	01.185
R314	RESISTOR MF	56 OHM 5% 0.4W	PHILIPS	2322 181 53569	01.168
R315	RESISTOR MF	2k2 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-2k2	01.708
R316	RESISTOR MF	33 OHM 5% 0.4W	PHILIPS	2322 181 53339	01.162
R317	RESISTOR MF	82 OHM 5% 0.4W	PHILIPS	2322 181 53829	01.172
R318	RESISTOR MF	560 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-560R	01.693
R319	RESISTOR MF	3k3 OHM 5% 0.4W	PHILIPS	2322 181 53332	01.212
R320	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R321	RESISTOR MF	47k OHM 5% 0.4W	PHILIPS	2322 181 53473	01.241
R322	RESISTOR MF	2k2 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-2k2	01.708
R323	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R324	RESISTOR MF	3k3 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-3k3	01.712
R325	RESISTOR MF	390 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-390R	01.689
R326	RESISTOR MF	150 OHM 5% 0.4W	PHILIPS	2322 181 53151	01.179
R327	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R328	RESISTOR MF	560 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-560R	01.693
R329	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222	01.208
R330	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225

R331	RESISTOR MF	15k OHM 5% 0.4W	PHILIPS	2322 181 53153	01.229
R332	RESISTOR MF	10 OHM 5% 0.4W	PHILIPS	2322 181 53109	01.150
R333	RESISTOR MF	330 OHM 5% 0.4W	PHILIPS	2322 181 53331	01.187
R334	RESISTOR MF	33 OHM 5% 0.4W	PHILIPS	2322 181 53339	01.162
R335	RESISTOR MF	22 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-22R	01.658
R336	RESISTOR MF	560 OHM 5% 0.4W	PHILIPS	2322 181 53561	01.193
R337	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222	01.208
R338	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
R339	RESISTOR MF	82 OHM 5% 0.4W	PHILIPS	2322 181 53829	01.172
R341	PRESET CERMET	200 OHM 10% 0.5W	BOURNS	3386P-1-201	07.884
R342	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R343	RESISTOR MF	560 OHM 5% 0.4W	PHILIPS	2322 181 53561	01.193
R344	RESISTOR MF	2k7 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-2k7	01.710
R345	RESISTOR MF	270 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-270R	01.685
R346	RESISTOR MF	2k2 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-2k2	01.708
R347	RESISTOR MF	3k9 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-3k9	01.714
R348	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R349	RESISTOR	6.81 KOHM 1% 0.4W	*PHILIPS	2322 156 16812	03.419
R350	RESISTOR	6.81 KOHM 1% 0.4W	*PHILIPS	2322 156 16812	03.419
R351	RESISTOR MF	82 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-82R	01.672
R352	RESISTOR MF	1k18 OHM 1% 0.6W	PHILIPS	2322 156 11182	03.226
R353	RESISTOR MF	6k34 OHM 1% 0.6W	PHILIPS	2322 156 16342	03.228
R354	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R355	RESISTOR MF	22k OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-22k	01.733
R356	RESISTOR MF	15k OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-15k	01.729
R357	RESISTOR MF	10 OHM 5% 0.4W	PHILIPS	2322 181 53109	01.150
T301	TRANSISTOR	BF 506	SIEMENS	BF506	28.202
T302	TRANSISTOR	BF 506	SIEMENS	BF506	28.202
T303	TRANSISTOR	BF 506	SIEMENS	BF506	28.202
T304	TRANSISTOR RF	BF199	PHILIPS	BF199	28.178
T305	TRANSISTOR RF SWITCH	2N2369A	MOTOROLA	2N2369A	28.315
T306	TRANSISTOR RF SWITCH	2N2369A	MOTOROLA	2N2369A	28.315
T307	TRANSISTOR	BF 506	SIEMENS	BF506	28.202
T308	TRANSISTOR	BF 506	SIEMENS	BF506	28.202
T309	TRANSISTOR	J310	SILICONIX	J310	29.725
T310	TRANSISTOR RF	LOW POWER PNP BF979/BF479	TELEFUNKEN AG	BF979	28.250
T311	TRANSISTOR JFET	TIS88A3 TO-92	MOTORPLA	TM 00 044-3	29.737
T312	TRANSISTOR AF	BC558B	PHILIPS	BC558B	28.100
T313	TRANSISTOR	BC549C	PHILIPS*	BC549C	28.082
T314	TRANSISTOR	BC549C	PHILIPS*	BC549C	28.082
X3O1	CRYSTAL	21.0 MHz NC-25B	NDK*	S1-2070-1010-30 SP SPEC.C1035	39.838

Symbol	Description				Manufact.	B
C401	Capacitor, Ceramic	18pF +-.5pF	NPO	500V	KCK	HM60SJCH180J
C402	Capacitor, Ceramic	33pF ±5%	NPO	400V	FERROPERM	9/0112.9
C403	Capacitor, Ceramic	33pF ±5%	NPO	400V	FERROPERM	9/0112.9
C404	Capacitor, Ceramic	18pF +-.5pF	NPO	500V	KCK	HM60SJCH180J
C405	Capacitor, Ceramic	470pF -20/+80%		400V	FERROPERM	9/0129.9
C406	Capacitor, Ceramic	470pF -20/+80%		400V	FERROPERM	9/0129.9
C407	Capacitor, Trimming	6-60pF	PTFE		DAU	109 4901 060
C408	Capacitor, Trimming	3.5-38pF	PTFE		DAU	109 3901 038
C409	Capacitor Multi Layer	22pF ±10%	HQ	200V	FERROPERM	1210-HQ-200V
C410	Capacitor, MKT	470nF ±10%		100V	SIEMENS	B32511-D1474-K000
C411	Capacitor Multi Layer	68pF ±10%	HQ	200V	FERROPERM	1210-HQ-200V
C412	Capacitor Multi Layer	68pF ±10%	HQ	200V	FERROPERM	1210-HQ-200V
C413	Capacitor, Trimming	3.9-27pF	PTFE		DAU	107 3901 027
C414	Capacitor, MKT	33nF ±20%		63V	SIEMENS	B32529-D333-M
C415	Capacitor Multi Layer	33pF ±10%	HQ	200V	FERROPERM	1210-HQ-200V
C417	Capacitor, Electrolytic	4,7uF ±20%		50V	ERO	EKI 00 AA 147H
C418	Capacitor Multi Layer	33pF ±10%	HQ	200V	FERROPERM	1210-HQ-200V
C419	Capacitor, Trimming	6-60pF	PTFE		DAU	109 4901 060
C420	Capacitor, Electrolytic	4,7uF ±20%		50V	ERO	EKI 00 AA 147H
C421	Capacitor Multi Layer	56pF ±10%	NPO	100V	FERROPERM	NPO-1210
C422	Capacitor, MKT	33nF ±20%		63V	SIEMENS	B32529-D333-M
C423	Capacitor, Trimming	5-45pF	PTFE		DAU	107 5901 045
C424	Capacitor, Ceramic	56pF ±5%	NPO	50V	KCK	HE60SJCH560J
C425	VHF PI-Filter				FERROPERM	9/0168,50 PI-Filter
C426	VHF PI-Filter				FERROPERM	9/0168,50 PI-Filter
C427	VHF PI-Filter				FERROPERM	9/0168,50 PI-Filter
C428	Capacitor Multi Layer	33pF ±10%	HQ	200V	FERROPERM	1210-HQ-200V
C429	Capacitor Multi Layer	82pF ±10%	HQ	200V	FERROPERM	1210-HQ-200V
FP401	Ferrit Bead	3B			PHILIPS	4322 020 34400
FP402	Ferrit Bead	3B			PHILIPS	4322 020 34400
FP403	Ferrit Bead	3B			PHILIPS	4322 020 34400

Symbol	*Description*		*Manufact.*	
L401	Coil	TL367	S.P.	6-0-23639
L402	Coil	TL367	S.P.	6-0-23639
L403	Coil	TL367	S.P.	6-0-23639
L404	Coil Printed		Cumatrix	5-0-23973A
L405	Coil Printed		Cumatrix	5-0-23973A
L406	Coil	TL067	S.P.	6-0-20854A
L407	Choke	0.15uH ±20%	Airco	4415-1M
L409	Choke	0.15uH ±20%	Airco	4415-1M
L410	Coil	TL067	S.P.	6-0-20854A
L411	Choke	0.15uH ±20%	Airco	4415-1M
L412	Coil	TL067	S.P.	6-0-20854A
L413	Coil Printed		Cumatrix	5-0-23973A
L414	Choke	0.15uH ±20%	Airco	4415-1M
L415	Choke	0.15uH ±20%	Airco	4415-1M
L416	Coil	TL366	S.P.	6-0-23638
L417	Coil Printed		S.P.	5-0-23973A
L419	Choke	0.33uH ±5%	Frontier	1303-07K
L420	Coil Printed		Cumatrix	5-0-23973A
L421	Coil Printed		Cumatrix	5-0-23973A
R401	Resistor	22 ohm ±5% 0.33W	Philips	2322 181 13229
R402	Resistor	2.2Kohm ±5% 0.33W	Philips	2322 181 13222
R403	Resistor	68 ohm ±5% 0.33W	Philips	2322 181 13689
R404	Resistor	22 ohm ±5% 0.33W	Philips	2322 181 13229
R405	Resistor	180 ohm ±5% 0.33W	Philips	2322 181 13181
R406	Resistor	82 ohm ±5% 0.33W	Philips	2322 181 13829
T401	Transistor	MRF240	Motorola	MRF240 m/møtrik
T402	Transistor	MRF237	Motorola	MRF237
T403	Transistor	2N4427	TRW	2N4427

Symbol	Description			Manufact.	B
C501	Capacitor, Ceramic	470pF -20/+80%	400V	FERROPERM	9/0129.9
C502	Capacitor, Ceramic	470pF -20/+80%	400V	FERROPERM	9/0129.9
D501	Diode	BAV21		PHILIPS	BAV21
RE501	Relay	NF2E-12V		MEW	NF2E-12V

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	INTERFACE (600)	RT146	ESPERA	5-0-23482D	603713
C601	CAPACITOR ELECTROLYTIC	1000uF -10/+50% 25V	RUBYCON*	25TTMS1000M	14.580
C602	CAPACITOR MKT	330nF 10% 63VDC	PHILIPS	2222 371 18334	11.122
C603	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E G5	14.610
C604	CAPACITOR ELECTROLYTIC	1uF 20% 50VDC	ELNA	RJ2-50-V-010-M-T12	14.506
C605	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C606	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C607	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E G5	14.610
C608	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C609	CAPACITOR MKT	330nF 10% 100V	SIEMENS	B32511-D1334-K000	11.229
C610	CAPACITOR CERAMIC	470pF 10% CL2 50VDC	NKE	DT 330 758L B 471 K 50V FLAT PACK	16.158
C611	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C612	CAPACITOR ELECTROLYTIC	4.7uF 20% 50VDC	ELNA	RJ2-50-V-4R7-M-T12	14.510
C613	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C614	CAPACITOR ELECTROLYTIC	0.47uF 20% 50VDC	ELNA	RJ2-50V-R47-M-T12	14.504
C615	CAPACITOR ELECTROLYTIC	4.7uF 20% 50VDC	ELNA	RJ2-50-V-4R7-M-T12	14.510
C616	CAPACITOR MKT	470nF 10% 100V	SIEMENS	B32511-D1474-K000	11.388
C617	CAPACITOR ELECTROLYTIC	100uF 20% 10VDC	ELNA	RJ3-10-V-101-M-T12	14.607
C618	CAPACITOR POLYSTYRENE	1.5nF 1% 160V	*PHILIPS	2222 429 81502	10.280
C619	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32511-D1224-K000	11.227
C620	CAPACITOR POLYSTYRENE	1.3nF 1% 160V	*PHILIPS	2222 429 81302	10.279
C621	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C622	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E G5	14.610
C623	CAPACITOR ELECTROLYTIC	1uF 20% 50VDC	ELNA	RJ2-50-V-010-M-T12	14.506
C624	CAPACITOR ELECTROLYTIC	1uF 20% 50VDC	ELNA	RJ2-50-V-010-M-T12	14.506
C625	CAPACITOR MKT	470nF 10% 100V	SIEMENS	B32511-D1474-K000	11.388
C626	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C627	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C628	CAPACITOR CERAMIC	4n7F 20% CL2 50VDC	NKE	DT 380 758S D 472 M 50V FLAT PACK	15.165
C629	CAPACITOR CERAMIC	470pF 10% CL2 50VDC	NKE	DT 330 758L B 471 K 50V FLAT PACK	16.158
C630	CAPACITOR ELECTROLYTIC	22uF 20% 25VDC	ELNA	RJ2-25-V-220-M-T12	14.514
C631	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C632	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C633	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
C634	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C635	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C636	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C637	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C638	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C639	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32511-D1224-K000	11.227
C640	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C641	CAPACITOR CERAMIC	470pF 10% CL2 50VDC	NKE	DT 330 758L B 471 K 50V FLAT PACK	16.158
C642	CAPACITOR ELECTROLYTIC	1uF 20% 50VDC	ELNA	RJ2-50-V-010-M-T12	14.506
C643	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C644	CAPACITOR ELECTROLYTIC	1uF 20% 50VDC	ELNA	RJ2-50-V-010-M-T12	14.506
D601	DIODE GENERAL PURPOSE	BAV21 200V/0.25A	TFK	BAV21	25.340
D602	DIODE TRANSIENT ABSORBER	18V	MOTOROLA*	1N6277A	26.765
D603	DIODE GENERAL PURPOSE	BAV21 200V/0.25A	TFK	BAV21	25.340
D604	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D605	DIODE ZENER	5.1V 5% 0.4W	PHILIPS	BZX79C5V1	26.527
D606	DIODE ZENER	3.6V	PHILIPS	BZX75C3V6	26.911
D607	DIODE ZENER	3.6V	PHILIPS	BZX75C3V6	26.911
D608	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D609	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D610	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D611	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D612	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D613	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D614	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D615	DIODE ZENER	3.0V 5% 0.4W BZX79C3V0	PHILIPS	BZX79C3V0	26.509
F601	FUSE	8AF 250V Ø5x20mm	ELU	171 100 8AF (DIN 41571/1)	45.561
IC601	INTEGRATED CIRCUIT	MC14503BCP	RCA*	CD4503	33.360
IC602	INTEGRATED CIRCUIT	MC14503BCP	RCA*	CD4503	33.360
IC603	INTEGRATED CIRCUIT	MC14503BCP	RCA*	CD4503	33.360
IC604	PROGRAMMED MIKROPROCESSOR	RT146 (C1052UV)	ESPERA	C1052 UV / 0-0-25553	725553
IC605	PROM BIPOLAR	256x8 Taa=60nSEC	NATIONAL	DM74LS471N	32.751
IC606	INTEGRATED CIRCUIT	MC14094BCP	NAT.*	CD4094BCN	33.305
IC607	DUAL OP AMP	LM358N	TEXAS	LM358P	31.100
IC608	INTEGRATED CIRCUIT	DUAL DIFF.COMPARATOR	TEXAS	LM393P	31.105
IC609	QUAD OP.AMP.	324	TEXAS	LM324N	31.065
IC610	VOLTAGE REGULATOR	FIXED 5V/1A	MOTOROLA	MC7805CT	31.250

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R601	RESISTOR MF	1k2 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-1k2	01.702
R602	RESISTOR MF	4k7 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-4k7	01.716
R603	RESISTOR	1.8 OHM 5% 0.5W	PHILIPS	2322 156 11808	03.148
R604	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R605	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
R606	RESISTOR MF	220 OHM 5% 0.4W	PHILIPS	2322 181 53221	01.183
R607	RESISTOR MF	680 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-680R	01.695
R608	RESISTOR MF	330 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-330R	01.687
R609	RESISTOR MF	1k2 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-1k2	01.702
R610	POTENTIOMETER TRIMMING	470 OHM 20% 0.05W	PHILIPS	2322 410 03353	07.568
R611	RESISTOR MF	1k2 OHM 5% 0.4W	PHILIPS	2322 181 53122	01.202
R612	POTENTIOMETER TRIMMING	100 KOHM 20% 0.05W	PHILIPS	2322 410 03361	07.588
R613	RESISTOR MF	2k2 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-2k2	01.708
R614	RESISTOR MF	33k OHM 5% 0.4W	PHILIPS	2322 181 53333	01.237
R615	RESISTOR MF	180k OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-180k	01.756
R616	RESISTOR MF	10k OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-10k	01.725
R617	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R618	RESISTOR MF	10k OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-10k	01.725
R619	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R620	RESISTOR MF	10k OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-10k	01.725
R621	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R622	RESISTOR MF	10k OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-10k	01.725
R623	RESISTOR MF	2k2 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-2k2	01.708
R624	RESISTOR MF	220k OHM 5% 0.4W	PHILIPS	2322 181 53224	01.258
R625	RESISTOR MF	220k OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-220k	01.758
R626	RESISTOR MF	12k OHM 5% 0.4W	PHILIPS	2322 181 53123	01.227
R627	RESISTOR MF	220k OHM 5% 0.4W	PHILIPS	2322 181 53224	01.258
R628	RESISTOR MF	470k OHM 5% 0.4W	PHILIPS	2322 181 53474	01.266
R629	POTENTIOMETER TRIMMING	10 KOHM 20% 0.05W	PHILIPS	2322 410 03357	07.578
R630	RESISTOR MF	100k OHM 5% 0.4W	PHILIPS	2322 181 53104	01.250
R631	RESISTOR MF	470k OHM 5% 0.4W	PHILIPS	2322 181 53474	01.266
R632	RESISTOR MF	3k3 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-3k3	01.712
R633	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R634	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R635	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R636	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R637	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R638	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R639	RESISTOR MF	10k OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-10k	01.725
R640	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222	01.208
R641	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R642	RESISTOR MF	470 OHM 5% 0.4W	PHILIPS	2322 181 53471	01.191
R643	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R644	RESISTOR MF	82k OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-82k	01.747

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R645	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R646	POTENTIOMETER TRIMMING	10 KOHM 20% 0.05W	PHILIPS	2322 410 03357	07.578
R647	RESISTOR MF	10k OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-10k	01.725
R648	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222	01.208
R649	RESISTOR MF	82k OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-82k	01.747
R650	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R651	RESISTOR MF	10k OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-10k	01.725
R652	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222	01.208
R653	RESISTOR MF	3k3 OHM 5% 0.4W	PHILIPS	2322 181 53332	01.212
R654	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R655	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
R656	RESISTOR MF	68k OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-68k	01.745
R657	RESISTOR MF	68k OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-68k	01.745
R658	RESISTOR MF	560 OHM 5% 0.4W	PHILIPS	2322 181 53561	01.193
R659	POTENTIOMETER TRIMMING	1 KOHM 20% 0.05W	PHILIPS	2322 410 03354	07.570
R660	RESISTOR MF	820 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-820R	01.697
R661	RESISTOR	11.5 KOHM 1% 0.4W	*PHILIPS	2322 156 11153	03.428
R662	RESISTOR MF	18k OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-18k	01.731
R663	RESISTOR MF	18k OHM 5% 0.4W	PHILIPS	2322 181 53183	01.231
R664	RESISTOR MF	10k OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-10k	01.725
R665	RESISTOR MF	1k8 OHM 5% 0.4W	PHILIPS	2322 181 53182	01.206
R666	RESISTOR MF	47 OHM 5% 0.4W	PHILIPS	2322 181 53479	01.166
R667	POTENTIOMETER TRIMMING	1 KOHM 20% 0.05W	PHILIPS	2322 410 03354	07.570
R668	RESISTOR MF	470 OHM 5% 0.4W	PHILIPS	2322 181 53471	01.191
R669	RESISTOR MF	100k OHM 5% 0.4W	PHILIPS	2322 181 53104	01.250
R670	RESISTOR MF	820k OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-820k	01.772
R671	RESISTOR MF	120k OHM 5% 0.4W	PHILIPS	2322 181 53124	01.252
R672	RESISTOR MF	150k OHM 5% 0.4W	PHILIPS	2322 181 53154	01.254
R673	RESISTOR MF	270k OHM 5% 0.4W	PHILIPS	2322 181 53274	01.260
R674	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R675	RESISTOR MF	8k2 OHM 5% 0.4W	PHILIPS	2322 181 53822	01.222
R676	RESISTOR MF	22k OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-22k	01.733
R677	RESISTOR MF	10k OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-10k	01.725
R678	RESISTOR MF	100k OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-100k	01.750
R679	RESISTOR MF	10k OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-10k	01.725
R680	RESISTOR MF	100k OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-100k	01.750
R681	RESISTOR MF	33k OHM 5% 0.4W	PHILIPS	2322 181 53333	01.237
R682	RESISTOR MF	12k OHM 5% 0.4W	PHILIPS	2322 181 53123	01.227
R683	RESISTOR MF	390 OHM 5% 0.4W	PHILIPS	2322 181 53391	01.189
R684	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
R685	RESISTOR MF	390 OHM 5% 0.4W	PHILIPS	2322 181 53391	01.189
R686	RESISTOR MF	39k OHM 5% 0.4W	PHILIPS	2322 181 53393	01.239
R687	RESISTOR MF	10k OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-10k	01.725
R688	POTENTIOMETER TRIMMING	470 OHM 20% 0.05W	PHILIPS	2322 410 03353	07.568

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R689	RESISTOR MF	220 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-220R	01.683
R690	RESISTOR MF	220 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-220R	01.683
R691	RESISTOR MF	220 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-220R	01.683
R692	RESISTOR MF	180 OHM 5% 0.5W	PHILIPS	2322 156 11801	01.381
R693	RESISTOR MF	820 OHM 5% 0.4W	PHILIPS	2322 181 53821	01.197
RA601	RESISTOR ARRAY	8x10k OHM 5% 1/8W	PANASONIC	EXBF8V104G (8X10K)	08.630
RA602	RESISTOR ARRAY	4X33k OHM 5% 1/8W	PANASONIC	EXB-F8V-333-J	08.640
RA603	RESISTOR ARRAY	4X33k OHM 5% 1/8W	PANASONIC	EXB-F8V-333-J	08.640
RA604	RESISTOR ARRAY	8x100k OHM 5% 1/8W	MURATA	RG LD 8 X 104 J	08.655
RA605	RESISTOR ARRAY	8x10k OHM 5% 1/8W	PANASONIC	EXBF8V104G (8X10K)	08.630
RE601	RELAY	E3206H	EICHHOFF	BV-55-280R	21.026
RE602	RELAY	12V DC 2A 1 SK.	SIEMENS	V23040-A0002-B201	21.059
T601	TRANSISTOR AF	BC328-25 PNP TO-92	PHILIPS	BC328-25	28.052
T602	TRANSISTOR AF	BC548B NPN TO-92	PHILIPS	BC548B	28.076
T603	TRANSISTOR	BD138	PHILIPS*	BD138	29.057
T604	TRANSISTOR AF	BC548B NPN TO-92	PHILIPS	BC548B	28.076
T605	TRANSISTOR AF	BC548 NPN TO-92	PHILIPS	BC548 (-A/-B/-C)	28.070
T606	TRANSISTOR	BC638	AEG*	BC638	28.117
T607	TRANSISTOR AF	BC548 NPN TO-92	PHILIPS	BC548 (-A/-B/-C)	28.070
T608	TRANSISTOR	BC638	AEG*	BC638	28.117
T609	TRANSISTOR AF	BC548 NPN TO-92	PHILIPS	BC548 (-A/-B/-C)	28.070
T610	TRANSISTOR	BC638	AEG*	BC638	28.117
T611	TRANSISTOR AF	BC548 NPN TO-92	PHILIPS	BC548 (-A/-B/-C)	28.070
T612	TRANSISTOR AF	BC548 NPN TO-92	PHILIPS	BC548 (-A/-B/-C)	28.070
T613	TRANSISTOR AF	BC558B	PHILIPS	BC558B	28.100
T614	TRANSISTOR AF	BC558B	PHILIPS	BC558B	28.100
T615	TRANSISTOR	BD234	PHILIPS	BD234	29.070
T616	TRANSISTOR AF	BC338-25 NPN TO-92	PHILIPS	BC338-25	28.058
T617	TRANSISTOR	BC558	PHILIPS	BC558	28.097
T618	TRANSISTOR	BC556A	PHILIPS*	BC556A	28.084
T619	TRANSISTOR AF	NPN BC639 TO-92	PHILIPS	BC639	28.120

Symbol	*Description*			*Manufact.*	
C701	Capacitor, ceramic	1 nF	400V	Ferroperm	9/0138.9
C702	Capacitor, ceramic	470 pF -20/+80%	400V	Ferroperm	9/0129.9
C703	Capacitor, ceramic	470 pF -20/+80%	400V	Ferroperm	9/0129.9
C704	Capacitor, ceramic	470 pF -20/+80%	400V	Ferroperm	9/0129.9
C705	Capacitor, ceramic	470 pF -20/+80%	400V	Ferroperm	9/0129.9
C706	Capacitor, polyester	1 uF ±10%	100V	Philips	2222 341 29105
DF701	Duplex filter			S.P.	DF701/RT146
J701	Control unit jack (female)			Hirschmann	Meb 160
J702	Supply jack (male)			Hirschmann	Mek 60BZ
P702	Supply jack (male)			Hirschmann	Mesei 60F
J703	Antenna jack (female)			K.V.Hansen	SO239
P703	Antenna plug (male)			K.V.Hansen	PL259
R701	Resistor	15 Kohm ±5%	0,33W	Philips	2322 211 13153

Symbol	Description			Manufact.	b
C101	Capacitor polyester	2,2 uF ±10%	100V	Siemens	B32512-E1225-K
C102	Capacitor electrolytic	100 uF -10/+50%	40V	ROE	EKM 00 DD 310G
C103	Capacitor polyester	2,2 uF ±10%	100V	Siemens	B32512-E1225-K
C104	Capacitor polyester	220 nF ±10%	100V	Siemens	B32511-D1224-K
C105	Capacitor polyester	220 nF ±10%	100V	Siemens	B32511-D1224-K
C106	Capacitor electrolytic	100 uF -10/+50%	40V	ROE	EKM 00 DD 310P
C107	Capacitor electrolytic	2200 uF -10/+50%	40V	ROE	EG 00 MG 422G
C108	Capacitor electrolytic	47 uF -10/+50%	40V	Philips	2222 030 17479
C109	Capacitor polyester	100 nF ±10%	100V	Siemens	B32510-D1104-K
C110	Capacitor polyester	4,7 nF ±10%	400V	Siemens	B32510-D6472-K
C111	Capacitor polyester	22 nF ±10%	250V	Siemens	B32510-D3223-K
C112	Capacitor polyester	100 nF ±10%	100V	Siemens	B32510-D1104-K
C113	Capacitor polyester	22 nF ±10%	250V	Siemens	B32510-D3223-K
C114	Capacitor ceramic	1 nF ±10%	100V	Philips	2222 630 03102
C115	Capacitor polyester	220 nF ±10%	100V	Siemens	B32511-D1224-K
C116	Capacitor polyester	4,7 nF ±10%	400V	Siemens	B32510-D6472-K
C117	Capacitor polyester	4,7 nF ±10%	400V	Siemens	B32510-D6472-K
C118	Capacitor polyester	220 nF ±10%	100V	Siemens	B32511-D1224-K
C119	Capacitor polyester	100 nF ±10%	100V	Siemens	B32510-D1104-K
C120	Capacitor polyester	22 nF ±10%	250V	Siemens	B32510-D3223-K
C121	Capacitor polyester	4,7 nF ±10%	400V	Siemens	B32510-D6472-K
C122	Capacitor electrolytic	1000 uF -10/+50%	40V	ROE	EG 00 KE 410G
C123	Capacitor electrolytic	1000 uF -10/+50%	40V	ROE	EG 00 KE 410G
C124	Capacitor electrolytic	100 uF -10/+50%	40V	ROE	EKM 00 DD 310P
C125	Capacitor polyester	220 nF ±10%	100V	Siemens	B32511-D1224-K
C126	Capacitor polyester	220 nF ±10%	100V	Siemens	B32511-D1224-K
C127	Capacitor polyester	100 nF ±10%	100V	Siemens	B32510-D1104-K
C128	Capacitor polyester	100 nF ±10%	100V	Siemens	B32510-D1104-K
D101	Diode, zener	36V ±5%	5W	Motorola	1N6284A
D102	Diode			Motorola	1N4007
D103	Diode			Motorola	1N4007
D104	Diode, zener	36V	1.5W	Philips	BZV 85C36
D105	Diode			Motorola	1N4007
F101	Fuse	5A time-lag		ELU	5AT 5x20mm
IC101	Integrated circuit			Exar	XR 3524 CP
IC102	Integrated circuit			RCA	CA 3140 E

Symbol	Description			Manufact.	b
L101	Choke			Danica	141-068360
L102	Choke			Danica	93-12808
L103	Choke			Ferroperm	1580-25uH
L104	Choke			Danica	141-068350
L105	Choke			Trans.Elect.	1545
L106	Choke			Danica	93-12808
L107	Coil	TL392		S.P.	6-0-24035
R101	Resistor	5,6 Kohm ±5%	0.33W	Philips	2322 181 13562
R102	Resistor	100 Kohm ±5%	0.33W	Philips	2322 181 13104
R103	Resistor	5,6 Kohm ±5%	0.33W	Philips	2322 181 13562
R104	Resistor	3,9 Kohm ±5%	0.33W	Philips	2322 181 13392
R105	Pre.Set.Potentiometer	5 Kohm ±20%		Noble	TM8 KV2-1S-5K
R106	Resistor	3,9 Kohm ±5%	0.33W	Philips	2322 181 13392
R107	Resistor	12 Kohm ±5%	0.33W	Philips	2322 181 13123
R108	Resistor	4,7 Kohm ±5%	0.33W	Philips	2322 181 13472
R109	Resistor	6,8 Kohm ±5%	0.33W	Philips	2322 181 13682
R110	Resistor	5,6 Kohm ±5%	0.33W	Philips	2322 181 13562
R111	Pre.Set.Potentiometer	100 ohm ±20%		Noble	TM8 KV2-1S-100
R112	Resistor	820 ohm ±5%	0.33W	Philips	2322 181 13821
R113	Resistor	12 Kohm ±5%	0.33W	Philips	2322 181 13123
R114	Resistor	2,2 Kohm ±5%	0.33W	Philips	2322 181 13222
R115	Resistor	330 ohm ±5%	1.6W	Philips	2322 191 33301
R116	Resistor	100 ohm ±5%	0.33W	Philips	2322 181 13101
R117	Resistor	3,9 Kohm ±5%	0.33W	Philips	2322 181 13392
R118	Resistor	120 ohm ±5%	0.33W	Philips	2322 181 13121
R119	Resistor	6,8 Kohm ±5%	0.33W	Philips	2322 181 13682
R120	Resistor	1 Kohm ±5%	0.33W	Philips	2322 181 13102
R121	Resistor	560 ohm ±5%	1.6W	Philips	2322 191 35601
R122	Resistor	15 Kohm ±5%	0.33W	Philips	2322 181 13153
R123	Resistor	5,6 ohm ±5%	0.33W	Philips	2322 181 13568
R124	Resistor	10 ohm ±5%	0.33W	Philips	2322 181 13109
R125	Resistor	2,2 ohm ±5%	0.33W	Philips	2322 181 13228
R126	Resistor	0,005 ohm		S.P.	TL381
R127	Resistor	1,2 Kohm ±5%	0.33W	Philips	2322 181 13122
T101	Transistor			Philips	BD 140-10
T102	Transistor			Philips	BD 140-10
T103	Transistor			Philips	BD 139-10

Symbol	*Description*	*Manufact.*	
D201	Diode	Sescossem	BYW 80-150
T201	Transistor	Philips	BD 140-10
T202	Transistor	Sescossem	BUV 26
P201	Plug	Hirshmann	MEK 60 BZ

PART III INSTRUCTION BOOK FOR VHF CONTROL UNITS C401, C402, C403 AND REMOTE CONTROL BOX H410

1. GENERAL DESCRIPTON FOR SAILOR VHF CONTROL UNIT C401, C402, C403

1.1 TECHNICAL DATA FOR VHF CONTROL UNIT C401, C402, C403

1.2 CONTROLS FOR VHF CONTROL UNIT C401

1.3 CONTROLS FOR VHF CONTROL UNIT C402

1.4 CONTROLS FOR VHF CONTROL UNIT C403

1.5 PRINCIPLE OF OPERATION FOR VHF CONTROL UNIT C401, C402, C403

2. CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMMES FOR C401, C402, C403

2.1 CHANNEL SELECTOR UNIT (100) VALID FROM SERIAL NO. 235700

2.1.1 CHANNELS SELECTOR UNIT (100) VALID FROM SERIAL NO. 265215

2.2 KEYBOARD (200)

2.3 AUDIO AMPLIFIER UNIT (300)

BOARD FOR SWITCHES (400) SEE MAIN DIAGRAM 2.8

MOUNTING PANEL (500) SEE MAIN DIAGRAM 2.8

MAIN CHASSIS (600) SEE MAIN DIAGRAM 2.8

2.7 SELCALL UNIT (700) ONLY C402

2.8 MAIN DIAGRAM FOR VHF CONTROL UNIT C401, C402, C403

3. MECHANICAL LAYOUT

3.1 MODULE LOCATION

4. SERVICE

4.1 ADJUSTMENT PROCEDURE FOR AUDIO AMP.

5. PART LISTS FOR VHF CONTROL UNITS

6. GENERAL DESCRIPTON FOR SAILOR REMOTE CONTROL BOX H410

6.1 TECHNICAL DATA FOR REMOTE CONTROL BOX H410

6.2 PRINCIPLE OF OPERATION FOR REMOTE CONTROL BOX H410

6.3 CONTROLS FOR REMOTE CONTROL BOX H410

6.4 CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAM FOR REMOTE CONTROL BOX H410

6.5 PART LISTS FOR REMOTE CONTROL BOX H410

7. FUNCTION DIAGRAMMES FOR THE INTEGRATED CIRCUITS

8. PIN CONFIGURATIONS FOR IC's AND TRANSISTORS

1. GENERAL DESCRIPTION FOR SAILOR VHF CONTROL UNITS

SAILOR VHF CONTROL UNIT C401 is designed to be used in conjunction with the SAILOR VHF RT145.

SAILOR C401 is provided with keyboard control of all functions needed to operate on all 55 international VHF maritime channels and 20 private channels.

SAILOR C401 is also provided with keyboard control of the following functions, volume control, squelch control, dimmer, dual watch and quick ch. 16 facilities.

SAILOR C401 can be operated under all lighting conditions. The lettering on the control panel is illuminated from the rear so the control unit can be operated in complete darkness.

The channel read-out is a LED-display of high efficiency, covered with a circular polarizer for contrasts improvement. This means that reading of the channel number can be achieved even in the strongest sunshine.

SAILOR C401 includes the microtelephone and loudspeaker.

SAILOR C401 can be provided with an external loudspeaker.

SAILOR C401 can because of the small physical dimensions be placed everywhere on the ship and up to a distance of 100 metres away from the SAILOR VHF RT145.

SAILOR VHF CONTROL UNITS C402 is provided with the same facilities as VHF CONTROL UNIT C401.

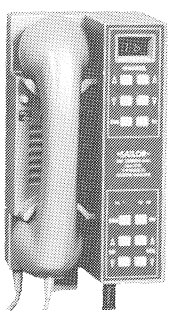
SAILOR C402 is equipped with a selcall decoder. This means that C402 has facilities to detect an all ships call and can be programmed to detect an individual selcall number received from the coast station.

SAILOR C402 can start an external alarm signal generator by means of a relay contact, which will be activated when a call is detected.

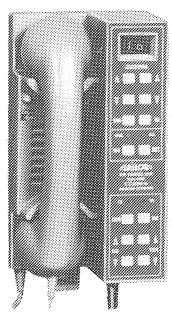
SAILOR C402 will give an acoustic alarm for 10 secs. and a lamp will be turned on when an individual call is detected.

SAILOR VHF CONTROL UNIT C403 is provided with the same facilities as VHF CONTROL UNIT C401.

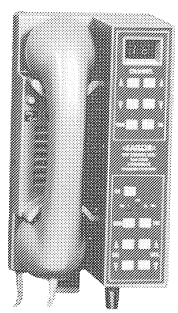
SAILOR C403 can by means of a push button on the keyboard select to operate on the channels required in USA instead of the 55 international maritime VHF channels. The 20 private channels are of course preserved in both modes of operation.



C401



C402



C403

1.1 TECHNICAL DATA FOR VHF CONTROL UNIT C401

All international maritime VHF channels	
Private channels	20
Temperature range	-20°C to +55°C
AF output power	2.5 Watt/4 ohm
Telephone output	0,55V RMS/200 ohm
Distortion	Less than 5%
Dimensions	Height = 220 mm
	Width = 120 mm
	Depth = 90 mm
Weight	1,4 kg

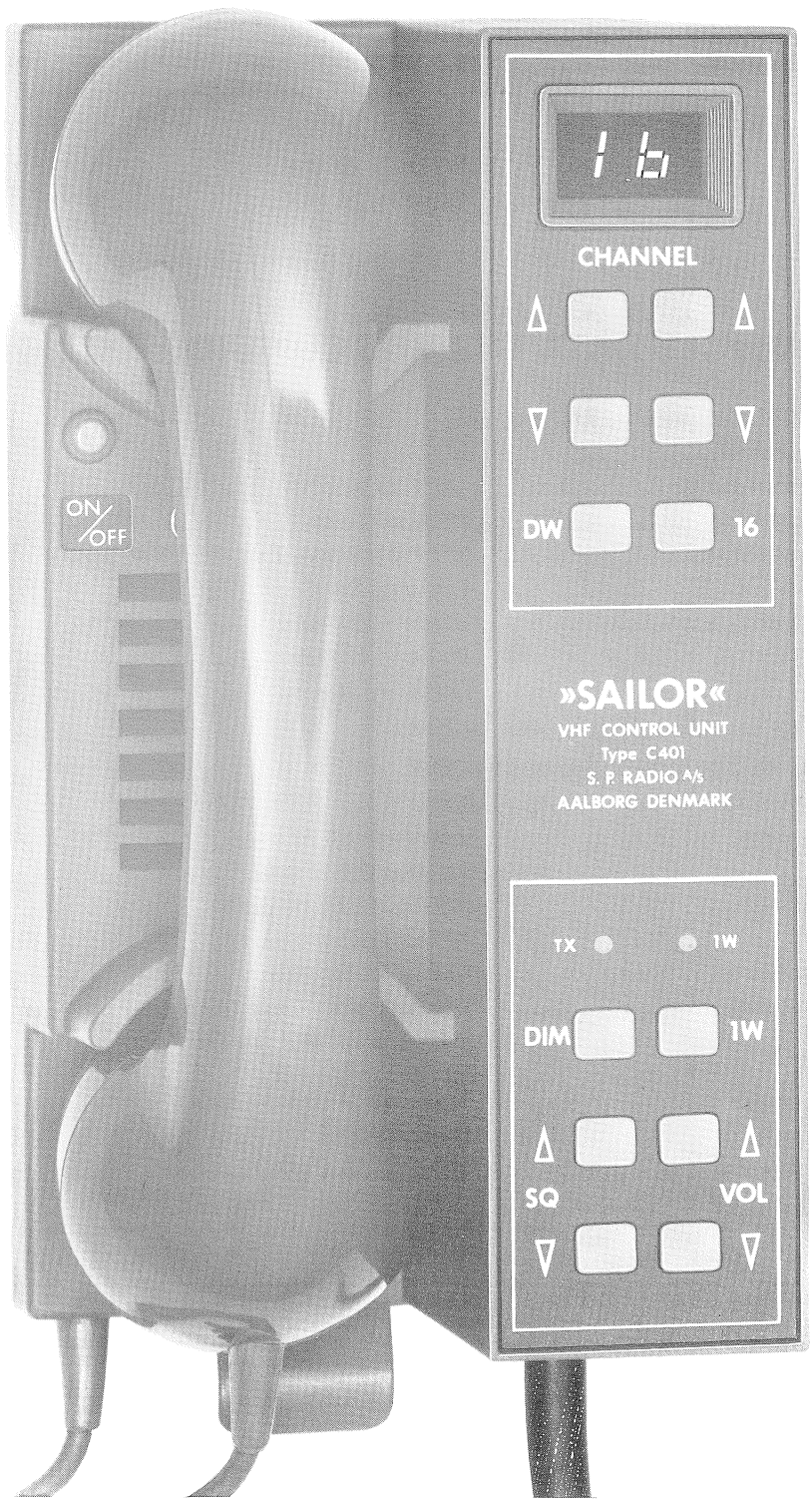
TECHNICAL DATA FOR VHF CONTROL UNIT C402

All international maritime VHF channels	
Private channels	20
Temperature range	-20°C to +55°C
AF output power	2.5 Watt/4 ohm
Telephone output	0,55V RMS/200 ohm
Distortion	Less than 5%
Dimensions	Height = 220 mm
	Width = 120 mm
	Depth = 90 mm
Weight	1,5 kg
Selective call decoder recommended by CCIR	
Signal/Noise ratio	0 dB
Reaction time	Individual call 50 msec.
	All ships call 12 msec.
Wait	Individual call 250 msec.
	All ships call 250 msec.
Acoustic Alarm	Built-in loudspeaker
Visual Alarm	Two light diodes, one for
	Individual call and one for
	All ships call.
Relay contact	I Max: 2A
	V Max: 125 V
	V · I max: 30 W

TECHNICAL DATA FOR VHF CONTROL UNIT C403

All international maritime VHF channels and the channel required in USA (U.S. mode)	
Private channels	20
Temperature range	-20°C to +55°C
AF output power	2,5 Watt/4 ohm
Telephone output	0,55V RMS/200 ohm
Distortion	Less than 5%
Dimensions	Height = 220 mm
	Width = 120 mm
	Depth = 90 mm
Weight	1,4 kg

1.2 CONTROLS C401



1.2 CONTROLS C401

All functions are keyboard controlled.

ON/OFF
To switch the VHF set ON or OFF.
Not in function when remote controlled by H410.

DISPLAY
The LED display shows the selected channel number.

CHANNEL
The two keys to the right shift the unit digit of the channel number up or down.
The two keys to the left shift the tens digit of the channel number up or down.
Operating one of the four buttons causes stop of DW. and resets the key »16«.

D.W. (DUAL WATCH)
When the »D.W.« key is pressed and the handset is in its holder, the receiver is listening to the selected channel and is watching channel 16 (preference channel). The display is flashing showing the selected channel number and channel 16.
If a signal is received on channel 16, the receiver will listen continuously to channel 16, until the signal disappears. The display shows channel number 16.
If the handset is removed from its holder, the Dual Watch is switched off and the selected channel is on.
When the »D.W.« key is pressed again the Dual Watch is switched off.

16. (DISTRESS AND CALLING)
When the key »16« is pressed, channel 16 is quickly selected. Press the key 16 again, and the previous channel is selected.

DIM
The intensity of the LED display and the illumination of the symbols can be controlled in four steps.

1W
When the key »1W« is pressed, the LED »1W« will light, and the transmitter output is reduced to less than 1 Watt.

SQ
The squelch sensitivity can be controlled in 15 steps.
Adjustment of best squelch sensitivity:
Press the key with the arrow »up« until white noise is heard in the loudspeaker. Then press the key with the arrow »down« just until the white noise in the loudspeaker stops. The adjustment is to be done on a channel without signal.

VOL
The volume can be controlled in 15 steps.

1.3 CONTROLS C402

1.3 CONTROLS C402

All functions are keyboard controlled.

ON/OFF
To switch the VHF set ON or OFF.
Not in function when remote controlled by H410.

DISPLAY
The LED display shows the selected channel number.

CHANNEL
The two keys to the right shift the unit digit of the channel number up or down.
The two keys to the left shift the tens digit of the channel number up or down.
Operating one of the four buttons causes stop of DW. and resets the key »16«.

D.W. (DUAL WATCH)
When the »D.W.« key is pressed and the handset is in its holder, the receiver is listening to the selected channel and is watching channel 16 (preference channel). The display is flashing showing the selected channel number and channel 16.
If a signal is received on channel 16, the receiver will listen continuously to channel 16, until the signal disappears. The display shows channel number 16.
If the handset is removed from its holder, the Dual Watch is switched off and the selected channel is on.
When the »D.W.« key is pressed again the Dual Watch is switched off.

16. (DISTRESS AND CALLING)
When the key »16« is pressed, channel 16 is quickly selected. Press the key 16 again, and the previous channel is selected.

DIM
The intensity of the LED display and the illumination of the symbols can be controlled in four steps.

1W
When the key »1W« is pressed, the LED »1W« will light, and the transmitter output is reduced to less than 1 Watt.

SQ
The squelch sensitivity can be controlled in 15 steps.
Adjustment of best squelch sensitivity:
Press the key with the arrow »up« until white noise is heard in the loudspeaker. Then press the key with the arrow »down« just until the white noise in the loudspeaker stops. The adjustment is to be done on a channel without signal.

VOL
The volume can be controlled in 15 steps.

SET
When the key »SET« is pressed the selcall decoder will be reset after a call. The acoustic and the visual alarm will be cancelled.

CALL
The LED will light when an individual call has been received. The acoustic alarm will stop after 10 secs.

CQ
The LED will light when an ALL SHIPS call has been received. The acoustic alarm will be on until the key »SET« is pressed.

TST
When the key »TST« is pressed the selcall decoder will be tested. First the acoustic alarm and the individual call LED will be ON and shortly after the all ships call LED will be ON.

1.4 CONTROLS C403

1.4 CONTROLS C403

All functions are keyboard controlled.

ON/OFF
To switch the VHF set ON or OFF.
Not in function when remote controlled by H410.

DISPLAY
The LED display shows the selected channel number.

CHANNEL
The two keys to the right shift the unit digit of the channel number up or down.
The two keys to the left shift the tens digit of the channel number up or down.
Operating one of the four buttons causes stop of DW. and resets the key »16«.

D.W. (DUAL WATCH)
When the »D.W.« key is pressed and the handset is in its holder, the receiver is listening to the selected channel and is watching channel 16 (preference channel). The display is flashing showing the selected channel number and channel 16.
If a signal is received on channel 16, the receiver will listen continuously to channel 16, until the signal disappears. The display shows channel number 16.
If the handset is removed from its holder, the Dual Watch is switched off and the selected channel is ON.
When the »D.W.« key is pressed again the Dual Watch is switched off.

16. (DISTRESS AND CALLING)
When the key »16« is pressed, channel 16 is quickly selected. Press the key 16 again, and the previous channel is selected.

US (INTERNATIONAL MODE/US-MODE)
The switch can change the channel programming of SAILOR RT145 from International Mode to US-mode. See frequency table.

DIM
The intensity of the LED display and the illumination of the symbols can be controlled in four steps.

1W
When the key »1W« is pressed, the LED »1W« will light, and the transmitter output is reduced to less than 1 Watt.

SQ
The squelch sensitivity can be controlled in 15 steps.
Adjustment of best squelch sensitivity:
Press the key with the arrow »up« until white noise is heard in the loudspeaker. Then press the key with the arrow »down« just until the white noise in the loudspeaker stops. The adjustment is to be done on a channel without signal.

VOL
The volume can be controlled in 15 steps.

1.5 PRINCIPLE OF OPERATION C40X

TURN ON

When the control unit is switched on it will be supplied with +13V from the RT145. When the supply goes high the RESET LOGIC provides the counters with a preset pulse to secure the following initial condition:

The channel code set for CH. 16.

The squelch circuit is set to mute the noise output to the loudspeaker and the telephone.

The AF output level is set to an appropriate listening level.

The equipment is set for operation on international channels.

The equipment is set for full transmit power.

The dimmer is set for maximum intensity on the displays.

CHANNEL SELECTION

The channel code provided for the VHF RT145/RT146 is generated as BCD code in the counters 1 and 2. These counters are preset to ch. 16 when the control unit is switched on. The output is led through two data selectors and thereafter to the VHF and to the display decoder. The data selectors are provided for the D.W. and quick CH. 16 facilities.

DUAL WATCH

When the D.W. push button is activated the D.W./CH. 16 LOGIC will cause the two data selectors to output either the content of the counters 1 and 2 or the fixed CH. 16-code alternately. Removing the handset from the hook will always cause the content of the counters to be output. A carrier on ch. 16 will cause the D.W. oscillator to stop on this frequency until the carrier disappears again.

CH. 16

When the ch. 16 push button is activated the D.W./CH. 16 LOGIC will make the data selectors switch to the fixed CH. 16-code.

The 6 dB/OKTAV filter performs the deemphasis for a PM-receiver.

The LOGIC AF ON/OFF switch mutes both the telephone output and the loudspeaker. It is controlled from the squelch circuit and the D.W./CH. 16 circuit. The squelch detector makes the LOGIC AF ON/OFF circuit switch off the AF when the noise level is too high. The D.W./CH. 16 LOGIC causes the AF to be switched off as long as the D.W. oscillator tunes the set to ch. 16. This function is for muting when there is no carrier on ch. 16 when the set is in D.W.

The telephone amplifier provides the necessary power for the telephone. This output is also led to the volume control and to the selcall unit.

The squelch filter is a high-pass filter to make the detector insensitive to the audio information.

The squelch attenuator controls the level to the detector circuit. The more gain the less noise must be present before the detector causes the LOGIC ON/OFF switch to switch the audio output on.

DIMMER

The intensity of the display and LED illumination is controlled by varying the duty cycle of the squarewave current through the diodes.

The binary output from the counter is converted in the D/A CONVERTER 3 to an analog current which is used to control the duty cycle of the DIM. OSC.

The dimmer is controlled in four steps and will if constantly activated step in a cycle from max. to min. light.

The intensity of the filament lamp illumination is controlled directly from the UP-COUNTER via the lamp driver.

The filament lamps are lightening brightest in the two middle positions. (See note under keyboard in main diagram).

1W

When the 1W push button is activated the 1W-MODE MEMORY will shift to a low output level providing the needed information for the RT145. Activated once more the output will shift back to a high output level.

The 1W-DECODER detects the logic level on the 1W wire, and if held low, (either from C40X or RT145/RT146), the appropriate LED will turn on.

TX

When the transmit key is activated, the TX-DECODER will force the appropriate LED to turn on, and the loudspeaker til be muted by means of the VOLUME ATTENUATOR.

MIC. AMP.

The MIC. AMP. will amplify the signal from the microphone with about 40 dB, to minimize the sensitivity to noise voltages coupled to the wire between RT145 and CONTROL UNIT from the surroundings.

RECEIVER AF-CIRCUIT

First the AF passes a -6 dB/oktave filter which performs the deemphasis of a PM-receiver. Then the AF passes the LOGIC AF ON/OFF switch, which is controlled from the SQUELCH DETECTOR and the DW/CH 16 LOGIC.

The TELEPHONE AMPL. provides the necessary power for the telephone. This output is also led to the volume control and to the selcall unit.

The VOL. ATTENUATOR is controlled by a DC-voltage from the UP/DOWN COUNTER 3 and the DIA-converter 1. The VOL. ATTENUATOR is switched off by the TX-DETECTOR when the transmitter is keyed.

The AF POWER AMPLIFIER delivers the necessary power for the loudspeaker. It also amplifies the alarm signal from the selcall unit.

PRINCIPLE OF OPERATION C40X CONT.:

SQUELCH

The squelch filter is a high-pass filter to make the detector insensitive to the audio information. The output is attenuated in the SQ-ATTENUATOR before it is fed to the SQ-attenuator. The more gain in the attenuator the less noise must be present before the detector causes the LOGIC ON-OFF switch to switch on the audio output. The gain in the SQ-ATTENUATOR is controlled by the DIA-CONVERTER 2 and the UP-DOWN-COUNTER 4.

CLOCK PULSE GENERATOR

When one of the push buttons CHANNEL SELECTOR, VOL, SQ or DIM is activated the clock oscillator is started. The clock pulse is only led to the counter, which performs the wanted function.

SELCALL DECODER ONLY C402

The AF output from the telephone amplifier is fed to the AMP/LIMITER where the signal will be amplified to clipper level at minimum AF input level.

The limiter output is fed to the CONTROLLED BANDPASS FILTER which is loaded with a PEAK DET. followed by a COMPARATOR.

If the received frequency falls inside the passband for the controlled filter, the detector output will force the comparator to a high output level. This signal will reset the AUTOMATIC RESET which in turn enables the FIGURE COUNTER for counting.

When the input frequency changes, the COMPARATOR output will go low and the FIGURE COUNTER will step by one, preparing the CONTROLLED BAND-PASS FILTER for reception of the next tone.

If no more tones are received the AUTOMATIC RESET will reset the FIGURE COUNTER after 250 msec. thus leaving the decoder in the initial state.

If the five tones for which the decoder is programmed (the individual SELCALL number), is received, the CALL MEMORY will be activated when the last tone disappears. The output from the INDIVIDUAL CALL DETECTOR will change after 35 msec. The CALL MEMORY output change activates the CALL indicator, opens the AF output switch to an eventual information decoder and activates the RELAY DRIVER and for 10 sec. the ALARM OSC.

After reception of an ALL SHIPS CALL the CQ. MEMORY will be triggered, which will activate the CQ indicator, the ALARM OSC. and the RELAY DRIVER. All the activated indicators will be opened until the SET push button is activated.

If the TST push button is activated clock pulses will be added to the COMPARATOR input, and the indicators can be tested.

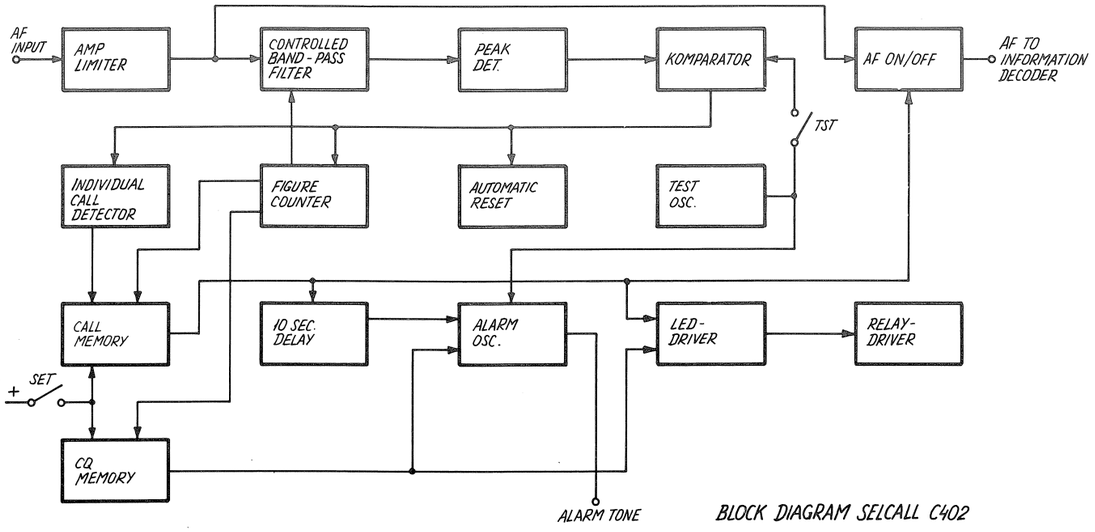
U.S. MODE ONLY C403

The channel code information provided for RT145 can by means of the U.S. MODE MEMORY be changed to meet the channel distribution in U.S.A., concerning simplex/duplex operation.

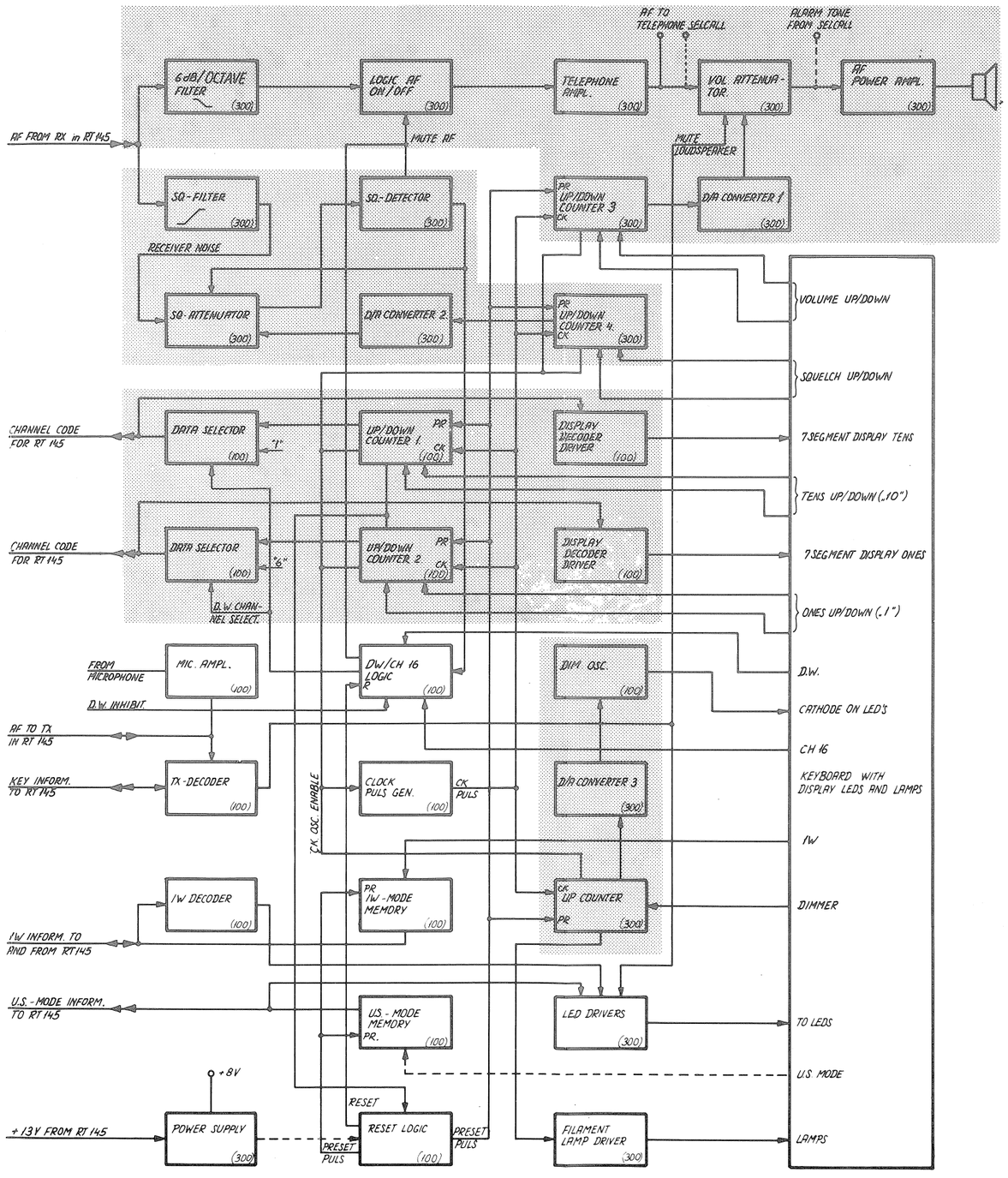
When the U.S. push button is activated the output from the U.S. MODE MEMORY will go high, causing the A-channels in the PROMs to be selected. Another activation of the push button switches the set back to INT-mode.

POWER SUPPLY

The control unit is supplied by an internal short-circuit protected +8V regulator.



BLOCK DIAGRAM SELCALL C402



BLOCK DIAGRAM CONTROL UNIT C401, C402, C403

2.1 CIRCUIT DESCRIPTION FOR CHANNEL SELECTOR UNIT (100)

The channel selector unit comprises the following circuits:

CLOCK OSCILLATOR

The clock oscillator is started when transistor T111 is turned »off« by setting the base to low level. The capacitor C128 will be charged through diode D106 and the resistors R151 and R146.
After about 14 msecs the shifting level for the input of IC108a is reached, the output changes to low level and the output of IC108b will go to high level. Now the input of IC108a will make a jump and the capacitor C128 will discharge through the resistors R146 and R152. After about 450 msecs the shifting level is reached again and the outputs will change back.
The clock oscillator is stopped with transistor T111 in »on« position and the capacitor C128 is discharged through R146 and T111.

DIMMER OSCILLATOR

The function of the dimmer oscillator is in principle like the clock oscillator. The capacitor C107 is loaded through transistor T105 and resistor R104 and is discharged through diode D101 and transistor T101. The current through transistor T101 is controlled by the current through resistor R103 and in DIM. FREQ. CONTROL. With less current the time where the output from the oscillator is »high« is increased. That means the luminous intensity is reduced. Transistors T107 and T109 are buffers for the output to the LED's.

CHANNEL SELECTOR AND DISPLAY DECODER

When the set is switched ON the counters IC107 and IC110 are preset to CH.16. The code from the counter outputs determines the selected channel except when the data selectors IC106 and IC111 are changed to another code from the dual watch/CH.16 circuit. When the data selectors are changed, CH.16. or another programmed channel will be selected no matter what code the counters are set to. From the data selectors IC106 and IC111 the BCD coded information is led to the VHF and to the display decoders. The code for the »1« is decoded in IC105 to the seven segment code for the »1« display DP202. The code for the »10« is decoded in the gates IC101, IC102, IC103 and IC104 to write the wanted digits and the letters P and F in the »10« display, DP201.

DUAL WATCH/CH.16

When pin 1 of D-FF, IC113a is set to »0« by activating D.W. button S203 the transistor T106 turns off and the D.W. oscillator starts. Every time the output pin 4 of IC115b changes to »1«, the output pin 11 of IC115d will change to »0« and receive on CH.16. If a signal is received the level from SQ. DET. OUT. will change to »1« and transistor T113 will turn »ON« and set pin 8 of IC115c to »0«. When the condition, that both the inputs of IC115c are »0« is fulfilled, the output pin 10 will go to »1« and the output pin 11 of IC115d will lock on »0« until the antenna signal disappears.
The D.W. oscillator will stop because transistor T106 will turn on getting base current through resistor R125.
If the handset is removed from its holder when D.W. is locked to CH.16., transistor T113 is turned off by the switch S402 and the listening to CH.16. will be switched off and the selected channel will be listened to. Furthermore transistor T103 will go ON and stop the D.W. oscillator. By activating CH.16. button, S211 pin 13 of IC113b will change to »1«. Pin 10 of IC116 will also go to »1« and pin 11 of IC115d to »0«, and CH.16. will be selected. The D.W. oscillator will stop by resistor R127 and transistor T106.

RESET LOGIC

When the set is switched ON a positive reset pulse is generated from capacitor C102, resistor R106 and IC116a. This pulse presets IC107 and IC110 to CH.16. Furthermore IC302 is preset to a suitable SQ. level, IC307 to a suitable volume and IC305 to give max. light in the LED's. IC113a is set and IC113b is reset by the pulse from IC116d. The same happens when one of the counters IC107 and IC110 are activated. IC114 is preset separately by resistor R164 and capacitor C130.
The function of transistor T116 is to prevent noise coming up in the loudspeaker before the squelch has closed.

TX-DECODER

When the transmitter is keyed the cathode of D104 is grounded and the transistors T110, T112 and T113 will go ON and the TX LED will be alight.
The loudspeaker will be muted through diode D110.
If the channel selector is set to a blocked channel, the level on the base of transistor T110 is »0« and the transistor will turn off. That means the TX LED cannot be alight even if the transmitter is keyed.

1W DECODER

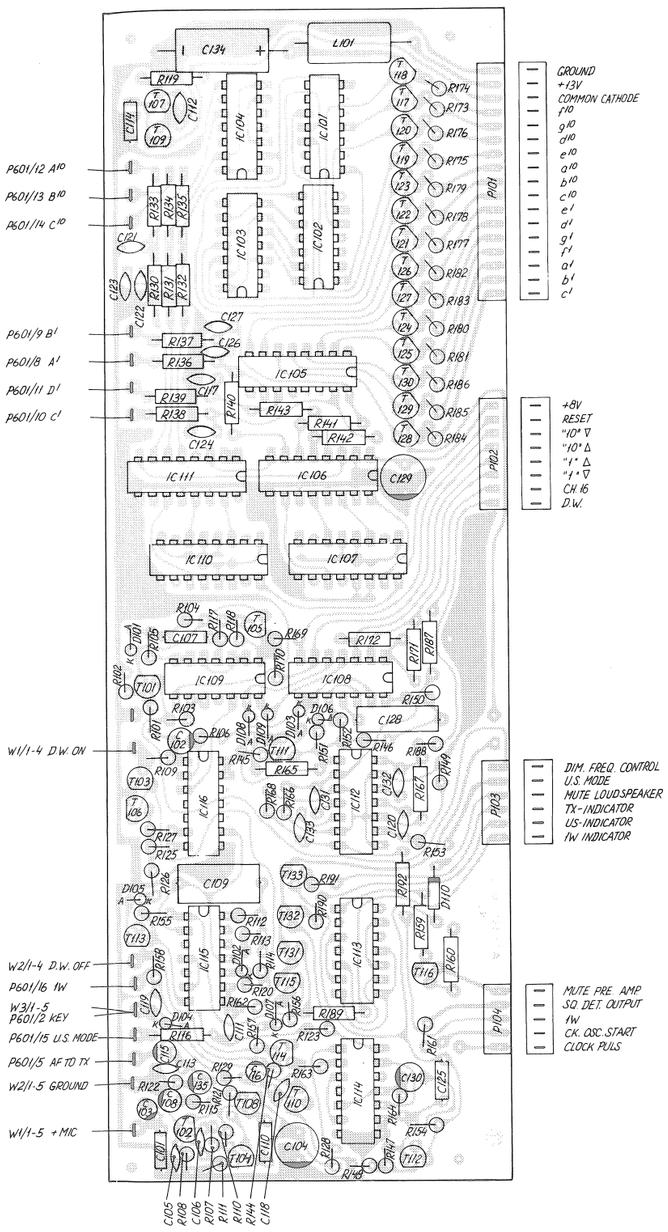
The information to give 1 watt comes from pin 13 of IC114b. When the output is »1« the transistors T114, T115 and T131 will turn on and the 1W LED, D205 will be alight.
If there is »0« level on the 1W-wire from the PROM in the VHF, the 1W LED will also be alight.

US-MODE

In a control-unit type C403 it is possible to select the receiving frequencies used in USA by activating the switch S205. Then pin 1 of IC114a will change to »1« and the information led to the VHF set and transistor T132, driver for U.S. LED, D204.

MICROPHONE-AMPLIFIER

In the microphone amplifier the signal from the microphone cartridge. MC601 is amplified about 40 dB before it is sent to the VHF set.



VIEW FROM SOLDERING SIDE

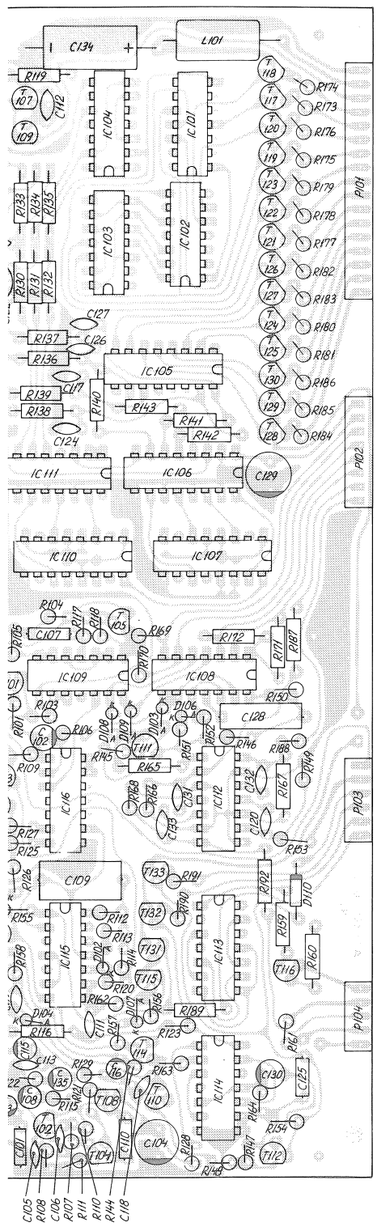
VIEW FROM COMPONENT SIDE

AC voltages outside frame of diagram.
▲ : Measured with AF-voltmeter.
● : Connection to module.

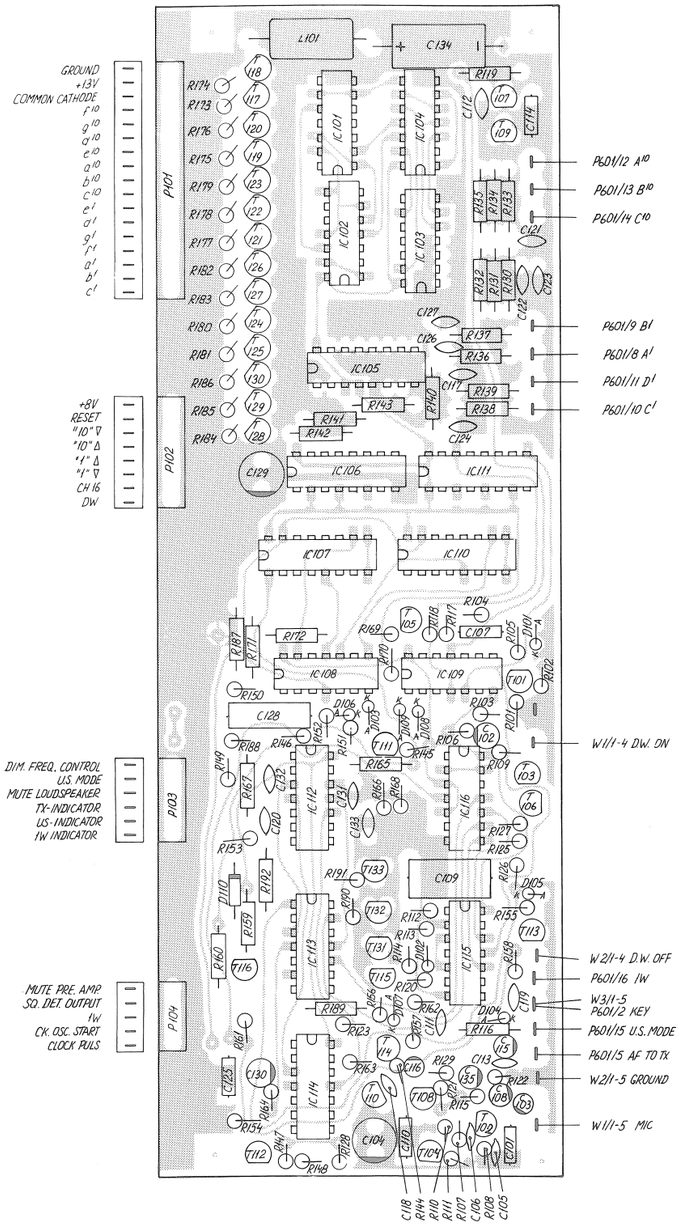
Testconditions:
Voltage without brackets:
Operating in Rx-position.
Antenna signal 1mV EMF: △ f = ±3 kHz ; fm = 1 kHz.

Voltage in brackets: ( )
Operating in Tx-position.
Modulation of transmitter: △ f = ±3 kHz ; fm = 1 kHz.

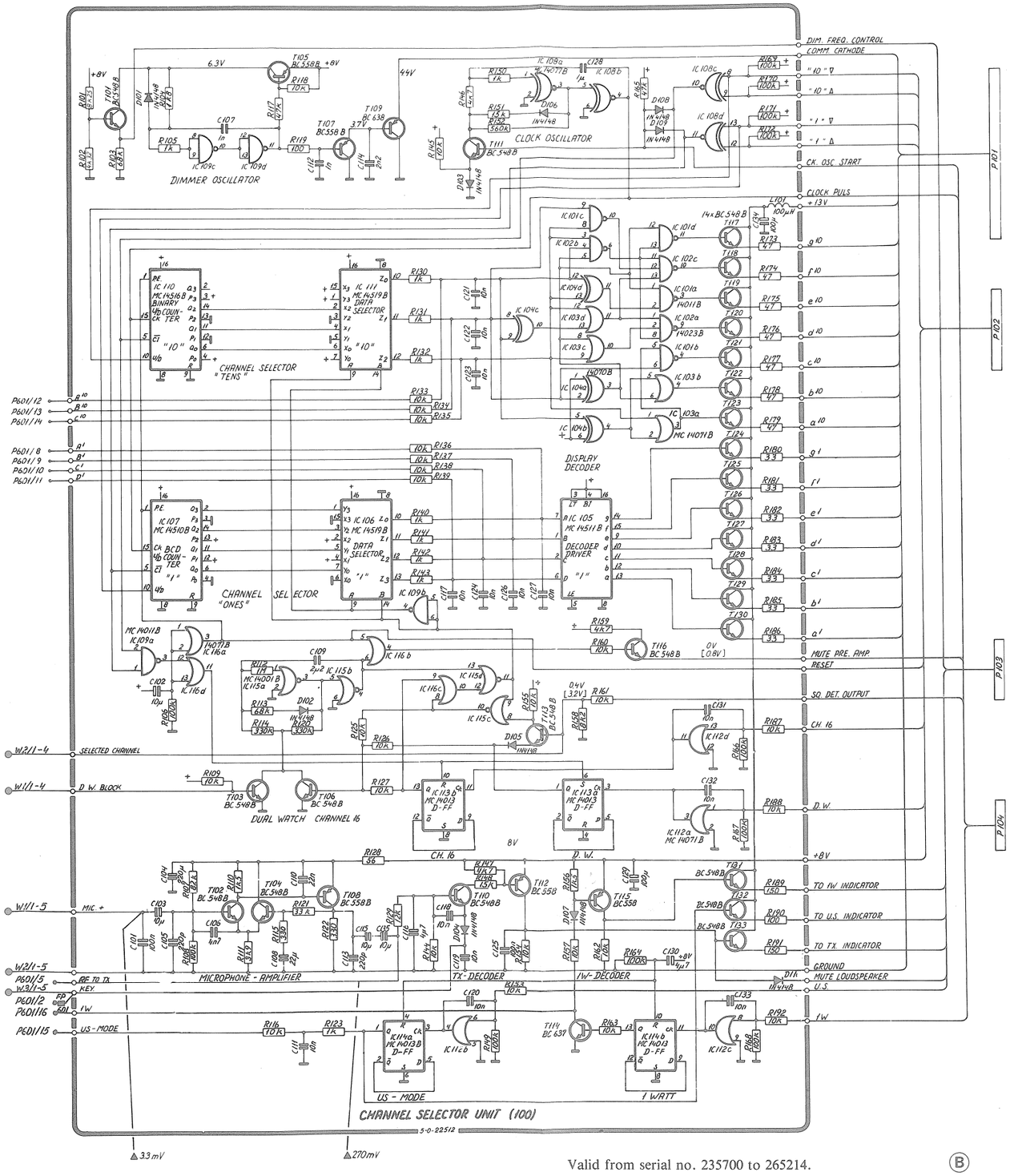
Voltage in brackets: [ ]
Circuit is activated.



VIEW FROM SOLDERING SIDE



VIEW FROM COMPONENT SIDE



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asured with AF-voltmeter.
nnection to module.

Testconditions:

Voltage without brackets:
Operating in Rx-position.
Antenna signal 1mV EMF: △ f = ±3 kHz ; fm = 1 kHz.

Voltage in brackets: ( )
Operating in Tx-position.
Modulation of transmitter: △ f = ±3 kHz ; fm = 1 kHz.

Voltage in brackets: [ ]
Circuit is activated.

Valid from serial no. 235700 to 265214.

(B)

When used together with VHF RT146, see service information 85A

2.1.1 CIRCUIT DESCRIPTION FOR CHANNEL SELECTOR UNIT (100)

The channel selector unit comprises the following circuits:

CLOCK OSCILLATOR

The clock oscillator is started when transistor T111 is turned »off« by setting the base to low level. The capacitor C128 will be charged through diode D106 and the resistors R151 and R146.
After about 14 msecs the shifting level for the input of IC108a is reached, the output changes to low level and the output of IC108b will go to high level. Now the input of IC108a will make a jump and the capacitor C128 will discharge through the resistors R146 and R152. After about 450 msecs the shifting level is reached again and the outputs will change back.
The clock oscillator is stopped with transistor T111 in »on« position and the capacitor C128 is discharged through R146 and T111.

DIMMER OSCILLATOR

The function of the dimmer oscillator is in principle like the clock oscillator. The capacitor C107 is loaded through transistor T105 and resistor R104 and is discharged through diode D101 and transistor T101. The current through transistor T101 is controlled by the current through resistor R103 and in DIM. FREQ. CONTROL. With less current the time where the output from the oscillator is »high« is increased. That means the luminous intensity is reduced. Transistors T107 and T109 are buffers for the output to the LED's.

CHANNEL SELECTOR AND DISPLAY DECODER

When the set is switched ON the counters IC107 and IC110 are preset to CH.16. The code from the counter outputs determines the selected channel except when the data selectors IC106 and IC111 are changed to another code from the dual watch/CH.16 circuit. When the data selectors are changed, CH.16. or another programmed channel will be selected no matter what code the counters are set to. From the data selectors IC106 and IC111 the BCD coded information is led to the VHF and to the display decoders. The code for the »1« is decoded in IC105 to the seven segment code for the »1« display DP202. The code for the »10« is decoded in the gates IC101, IC102, IC103 and IC104 to write the wanted digits and the letters P and F in the »10« display, DP201.

DUAL WATCH/CH.16

When pin 1 of D-FF, IC113a is set to »0« by activating D.W. button S203 the transistor T106 turns off and the D.W. oscillator starts. Every time the output pin 4 of IC115b changes to »1«, the output pin 11 of IC115d will change to »0« and receive on CH.16. If a signal is received the level from SQ. DET. OUT. will change to »1« and transistor T113 will turn »ON« and set pin 8 of IC115c to »0«. When the condition, that both the inputs of IC115c are »0« is fulfilled, the output pin 10 will go to »1« and the output pin 11 of IC115d will lock on »0« until the antenna signal disappears.
The D.W. oscillator will stop because transistor T106 will turn on getting base current through resistor R125.
If the handset is removed from its holder when D.W. is locked to CH.16., transistor T113 is turned off by the switch S402 and the listening to CH.16. will be switched off and the selected channel will be listened to. Furthermore transistor T103 will go ON and stop the D.W. oscillator. By activating CH.16. button, S211 pin 13 of IC113b will change to »1«. Pin 10 of IC116 will also go to »1« and pin 11 of IC115d to »0«, and CH.16. will be selected. The D.W. oscillator will stop by resistor R127 and transistor T106.

RESET LOGIC

When the set is switched ON a positive reset pulse is generated from capacitor C102, resistor R106 and IC116a. This pulse presets IC107 and IC110 to CH.16. Furthermore IC302 is preset to a suitable SQ. level, IC307 to a suitable volume and IC305 to give max. light in the LED's. IC113a is set and IC113b is reset by the pulse from IC116d. The same happens when one of the counters IC107 and IC110 are activated. IC114 is preset separately by resistor R164 and capacitor C130.
The function of transistor T116 is to prevent noise coming up in the loudspeaker before the squelch has closed.

TX-DECODER

When the transmitter is keyed the cathode of D104 is grounded and the transistors T110, T112 and T113 will go ON and the TX LED will be alight.
The loudspeaker will be muted through diode D110.
If the channel selector is set to a blocked channel, the level on the base of transistor T110 is »0« and the transistor will turn off. That means the TX LED cannot be alight even if the transmitter is keyed.

1W DECODER

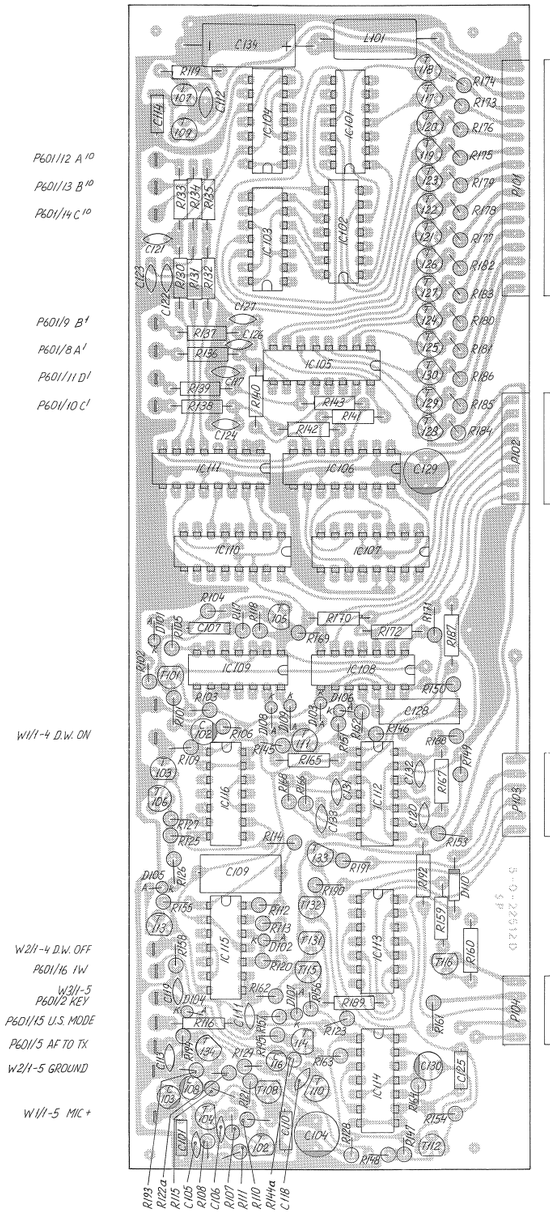
The information to give 1 watt comes from pin 13 of IC114b. When the output is »1« the transistors T114, T115 and T131 will turn on and the 1W LED, D205 will be alight.
If there is »0« level on the 1W-wire from the PROM in the VHF, the 1W LED will also be alight.

US-MODE

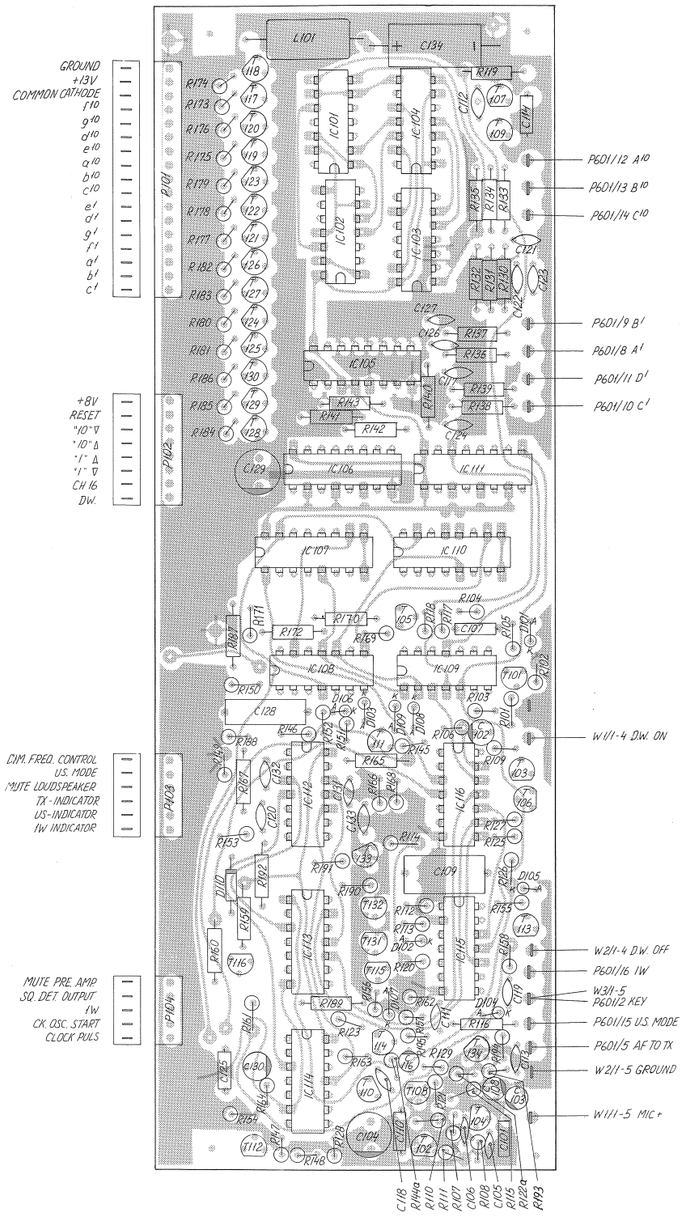
In a control-unit type C403 it is possible to select the receiving frequencies used in USA by activating the switch S205. Then pin 1 of IC114a will change to »1« and the information led to the VHF set and transistor T132, driver for U.S. LED, D204.

MICROPHONE-AMPLIFIER

In the microphone amplifier the signal from the microphone cartridge. MC601 is amplified about 40 dB before it is sent to the VHF set.



VIEW FROM SOLDERING SIDE



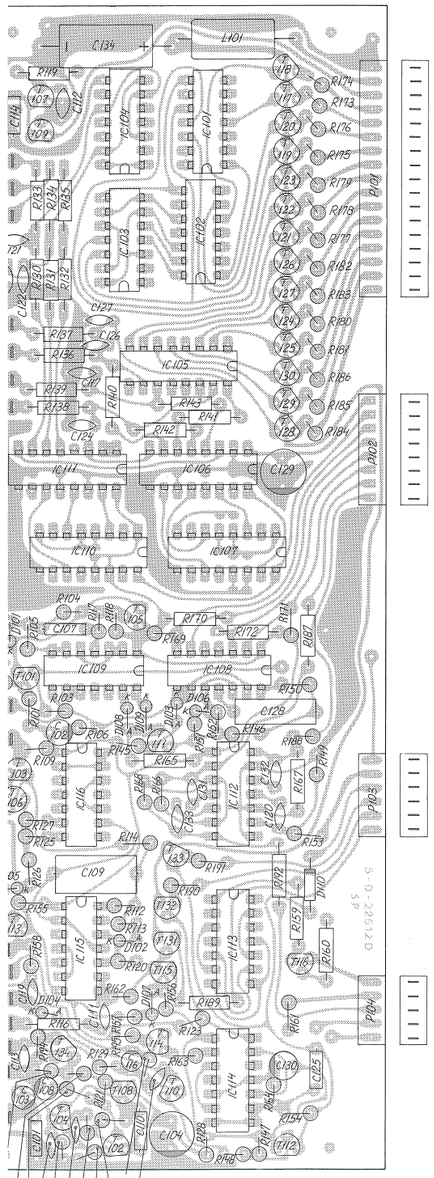
VIEW FROM COMPONENT SIDE

AC voltages outside frame of diagram.
▲ : Measured with AF-voltmeter.
● : Connection to module.

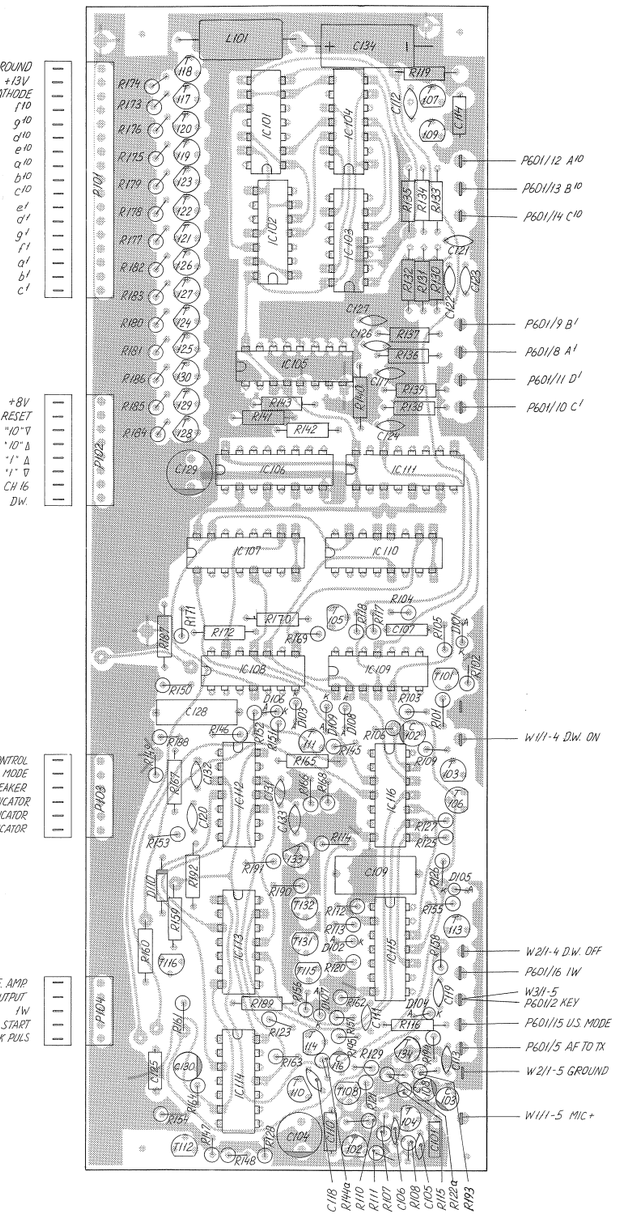
Testconditions:
Voltage without brackets:
Operating in Rx-position.
Antenna signal 1mV EMF: △ f = ±3 kHz ; fm = 1 kHz.

Voltage in brackets: ( )
Operating in Tx-position.
Modulation of transmitter: △ f = ±3 kHz ; fm = 1 kHz.

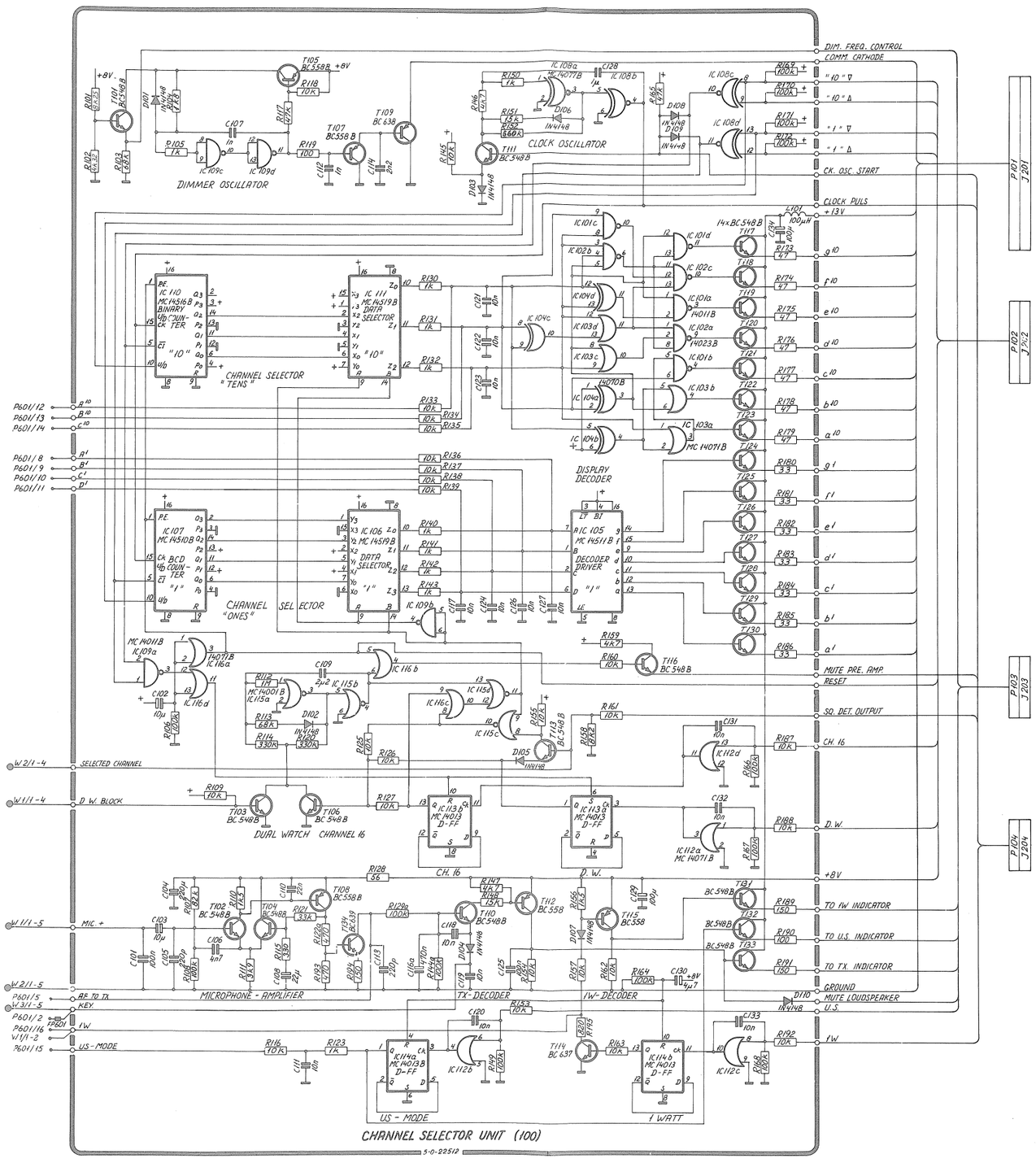
Voltage in brackets: [ ]
Circuit is activated.



VIEW FROM SOLDERING SIDE



VIEW FROM COMPONENT SIDE



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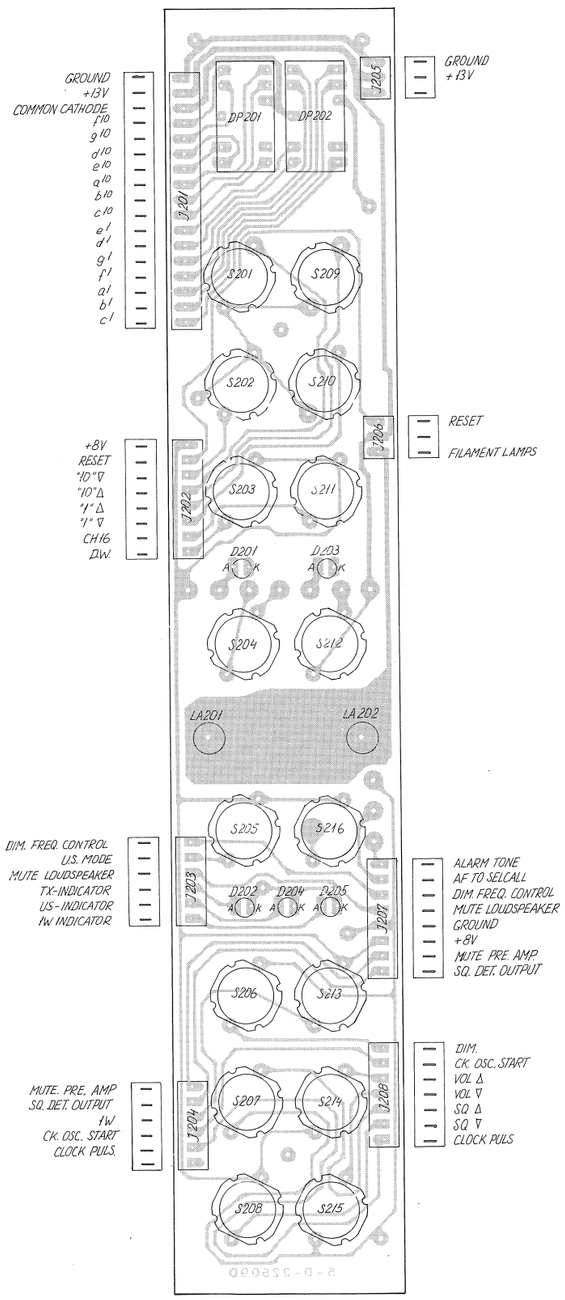
Testconditions:
Voltage without brackets:
Operating in Rx-position.
Antenna signal 1mV EMF: △ f = ±3 kHz ; fm = 1 kHz.

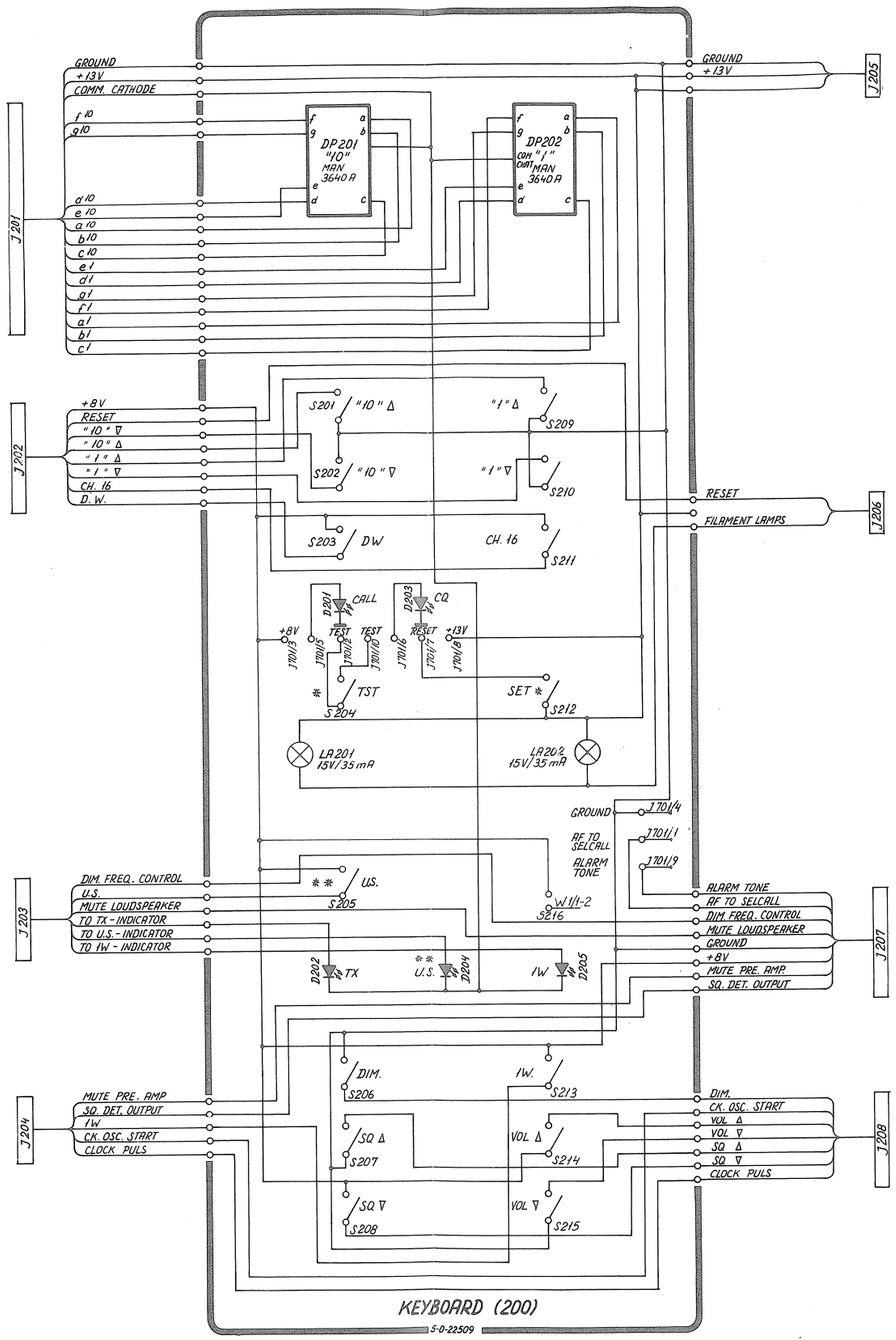
Voltage in brackets: ( )
Operating in Tx-position.
Modulation of transmitter: △ f = ±3 kHz ; fm = 1 kHz.

Voltage in brackets: [ ]
Circuit is activated.

Valid from serial no. 265215

2.2 KEYBOARD (200)





* ONLY MOUNTED IN C402
J 701 AND J702 ONLY MOUNTED IN C402
** ONLY MOUNTED IN C403

NOTE: RESISTORS R103 AND R361 ARE TO BE REMOVED IF DIMMER MUST HAVE ONE POSITION WITH FULL EXTINCTION OF LIGHTS.

2.3 CIRCUIT DESCRIPTION AUDIO AMPLIFIER UNIT (300)

The audio amplifier unit comprises the following circuits.

Squelch circuit

The signal to the squelch is fed to the active high pass filter IC303a. The filter attenuates signals below 10 kHz, which means that talk will not be detected. The white noise is fed to the SQ attenuator. The noise is first attenuated by the resistors R315, R335 and R336 and then amplified of transistor T304.

The amplification is controlled by the DC-current to the base of transistor T304 through resistor R336 from the D/A converter.

Through transistor T301 the white noise is fed to the peak detector comprising capacitor C310, diodes D307, D308, resistors R331, R337 and capacitor C314. When the voltage on the base of transistor T303 is low enough, T303 will be conducting and turn transistor T305 on. Further the switch transistor T307 will be turned on and switch off the audio signal.

When a signal is received the white noise is suppressed in the IF-amplifier in the VHF set and transistor T307 will open for the audio signal.

The D/A converter (R320-R323, D306, R329 and R327) is arranged so that the amplification in transistor T304 is increased when the counter is counting upwards. The transistor T302 and resistors R326 and R330 gives hysteresis to the detector. When a signal is received, the noise level will be reduced and at a certain point the transistors T303, T305 and T302 will turn off and the audio signal will come through. When T305 turns off the transistor T302 wille be conducting and the current in the base of transistor T304 will be reduced and the noise for the detector further reduced.

When the push button S207, SQΔ is activated, a »0« on input pin 9 of IC304c will change the output pin 10 to »0« and the clock oscillator will start. Further the transistor pin 11 and 12 of IC301 will turn »on« and the clock pulse fed to pin 15 of IC302. When the counter has reached »0«, that means {Q_0, Q_1, Q_2 and Q_3} = {0, 0, 0, 0}, current from +8V supply will go through IC301, pin 14 to 13 and through pin 2 to 1 to diodes D303 and D305. Now IC304 pin 9 will go to »1« and the clock oscillator is stopped. Through diode D305 and resistor R328, transistor T304 is turned off and the detector will open for audio signals.

When the push button S208, SQΔ is activated, +8V supply on IC302 pin 10 will get the counter to count up Pin 8 of IC304c will also go to »1«, change the output pin 10 to »0« and start the clock oscillator.

When the counter has come to the top,({Q_0, Q_1, Q_2, Q_3} = {1, 1, 1, 1}.) The level on IC304 pin 8 will change to »0« through diode D304, IC 301 pin 5 to 4 and IC302 pin 7 to ground and the clock oscillator will stop.

AF-circuit

The AF signal from the discriminator in the VHF set is fed to the active filter comprising the operational amplifier IC303b. The filter provides a frequency response of -6 dB/Oct. in the range 0.3 - 3 kHz and limits the signals outside the range 0.3 - 3 kHz. Further the signal is fed to the telephone output transistor T308 passing the squelch controlled transistor T307.

From the telephone output the signal is fed through potentiometer R377 and capacitor C333 to the AF attenuator IC308 pin 12 and further from pin 5 to the AF POWER AMPLIFIER.

The AF-attenuator is built up in the following way. The transistor between pin 6, 7 and 8 are filtering the supply voltage. The transistor between pin 9, 10 and 11 are biasing the differential amplifier to about 4V DC. The DC current through the differential amplifier is controlled by the transistor between pin 12, 13 and 14. The attenuation will be at its minimum when the current through the transistor between pin 3, 4 and 5 is at maximum and so it will be with all counter outputs »high«. In that case the voltage on pin 4 of the differential amplifier will be the same as on pin 2. The D/A converter (R364-R368) is together with resistor R382 functioning as voltage divider and with all the counter outputs »low« the voltage difference between pin 4 and pin 2 will be about 200 mV. That means the current through the transistor between pin 3, 4 and 5 is at minimum and the signal will be attenuated about 60 dB. Resistor R390 and capacitor C351 prevent cross talk from the supply voltage to the output of the attenuator.

The counter IC307 is functioning as described under the squelch circuit. When the push button S214 VOLΔ is activated, the counter will count up and count down when the push button S215 VOLΔ is activated. The AF POWER AMPLIFIER has an amplification of about 30 dB. Remember there is DC voltage on the loudspeaker wires, do not connect them directly to ground.

+8V POWER SUPPLY

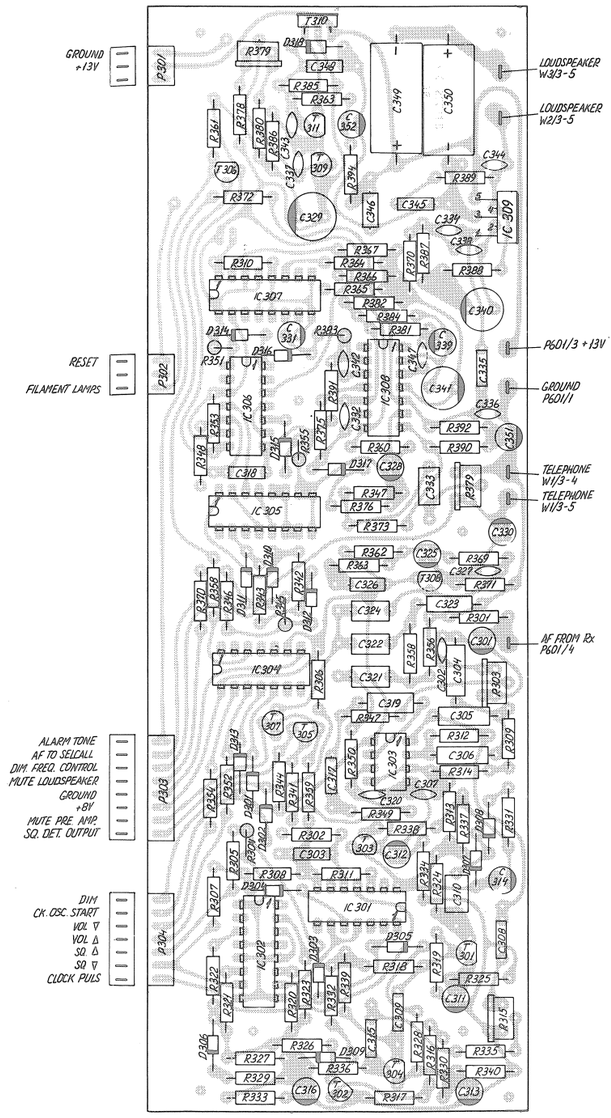
When the set is switched »ON«, base current from resistors R393 and R394 will run through transistor T311. The base current from transistor T310 will run through transistor T311 and the voltage at the output will rise until transistor T309 is conducting and limits the current through transistor T311. Hereby the output voltage is stabilized to a predeterminated value adjusted by potentiometer R379.

The voltage regulator is short-circuit protected because the base of transistor T311 is pulled down through resistor R385 and the short-circuit current is limited.

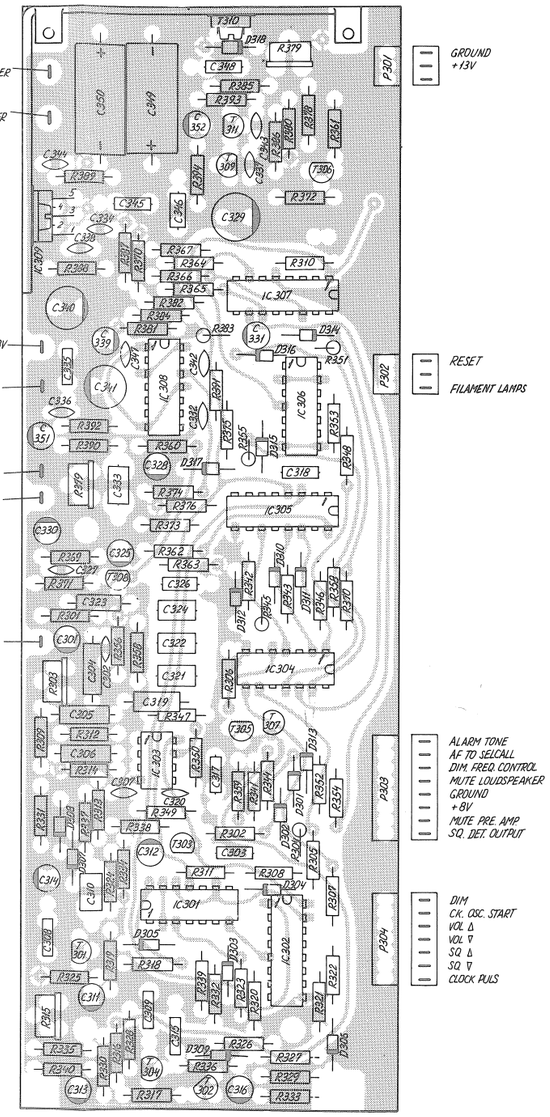
DIMMER CONTROL

When the push button S206 DIM is activated the counter IC305 will count up.

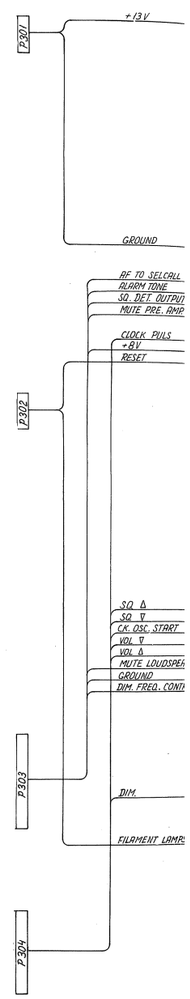
When both Q_1 and Q_2 are low, current will run through the diodes D310, D311 and D312 and max. current will run through the wire DIM FREQ.CONTROL. When the set is switched »ON«, Q_1 and Q_2 will reset to »low«, and there will be max. luminuous intensity in the LED's. The dimemr has 4 positions. In pos. 1 and 4 the output of IC304a is »0« and transistor T306 will be »off«. Only if R361 is mounted, a dimmed light will appear, otherwise the filament lamps LA201 and LA202 are full extinguished. In dimmer pos. 2 and 3 the output of IC304a is »1«, transistor T306 is conducting and the lamps will be alight. If resistor R103 and R361 are not mounted, dimmer position 4 gives full extinction of lights.

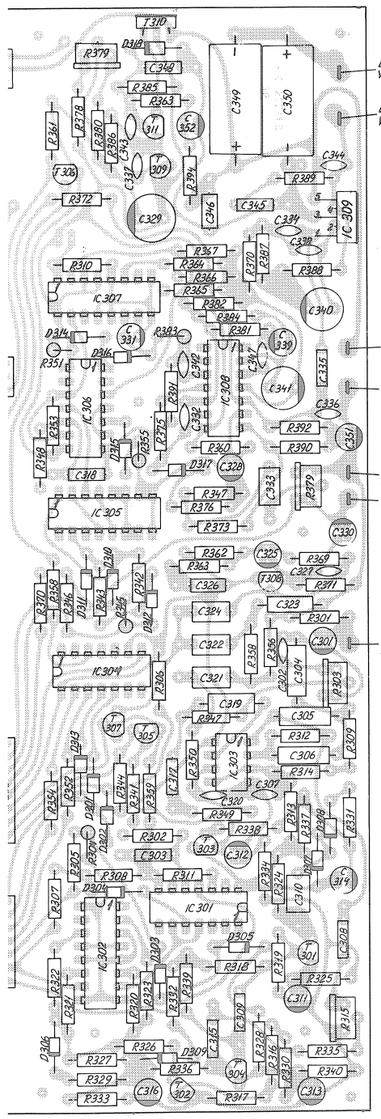


VIEW FROM SOLDERING SIDE

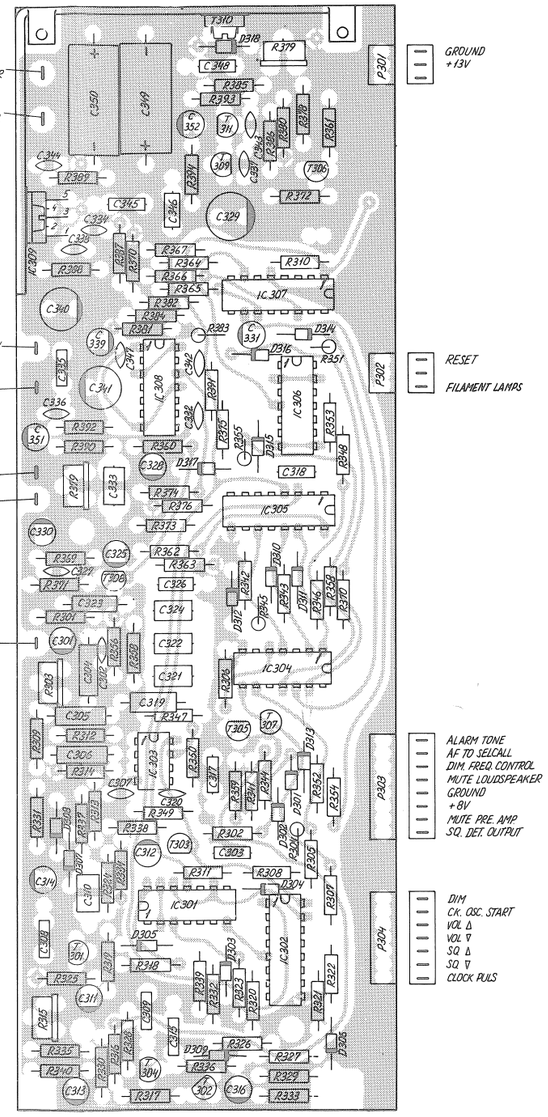


VIEW FROM COMPONENT SIDE

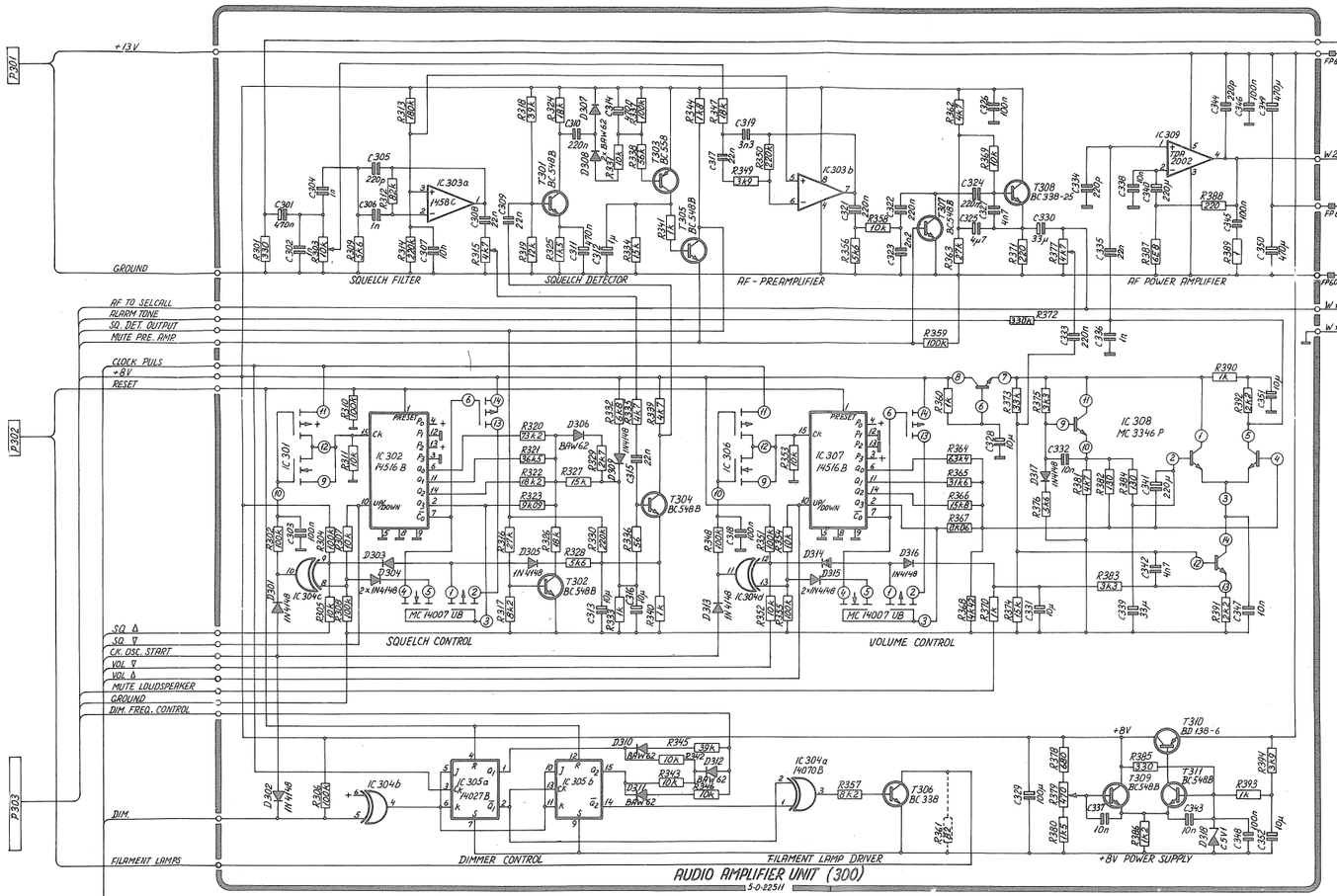




VIEW FROM SOLDERING SIDE



VIEW FROM COMPONENT SIDE



AC voltage outside frame of diagram.
▲ : Measured with AF-voltmeter.
● : Connections to module.

Testconditions:
Voltage without brackets:
Operating in Rx-position with antenna signal 1mV EMF. Δ f = ± 3 kHz ; fm = 1 kHz.
Voltage in brackets: [ ]
No antennasignal, squelch max. closed.

Ⓑ

Valid from serial no. 235700

R361 is mounght will appear, ent lamps LA201 extinguished. In 3 the output of ansistor T306 is e lamps will be 103 and R361 are ner position 4 giof lights.

2.7 CIRCUIT DESCRIPTON FOR SELCALL (700)

The AF signal from the telephone output is fed to the AMP/LIMITER, IC703a. In this stage the signal is amplified/limited so that variations in the input amplitude will not reduce the sensitivity. From here the signal is fed to the CONTROLLED BAND-PASS FILTER, L701, C705 and further to the PEAK DETECTOR IC703b and COMPARATOR IC703d. If the first tone lies within the passing limits to the filter, a DC-signal from the detector, which is higher than the reference voltage of the comparator, will change the output pin 14 of IC703d to a high level. This signal resets the FIGURE COUNTER IC701 through the AUTOMATIC RESET circuit IC703c. When the tone disappears pin 14 on IC703d will go to low level and clock the FIGURE COUNTER IC701 on step forward on the clock enable input pin 13 (negative going edge) and so the circuit is ready for the next tone. After the last approved signal has disappeared the AUTOMATIC RESET are waiting 250 msec. for the next tone otherwise the FIGURE COUNTER is reset to Q_0.

If the decoder has received the 5 tones, it is coded for, the CALL MEMORY will be activated when the last tone has disappeared.

Resistor R732 and capacitor C716 secure together with IC705a and b that only signals of 35 msec. duration (individual call signals) can activate the CALL MEMORY IC704a.

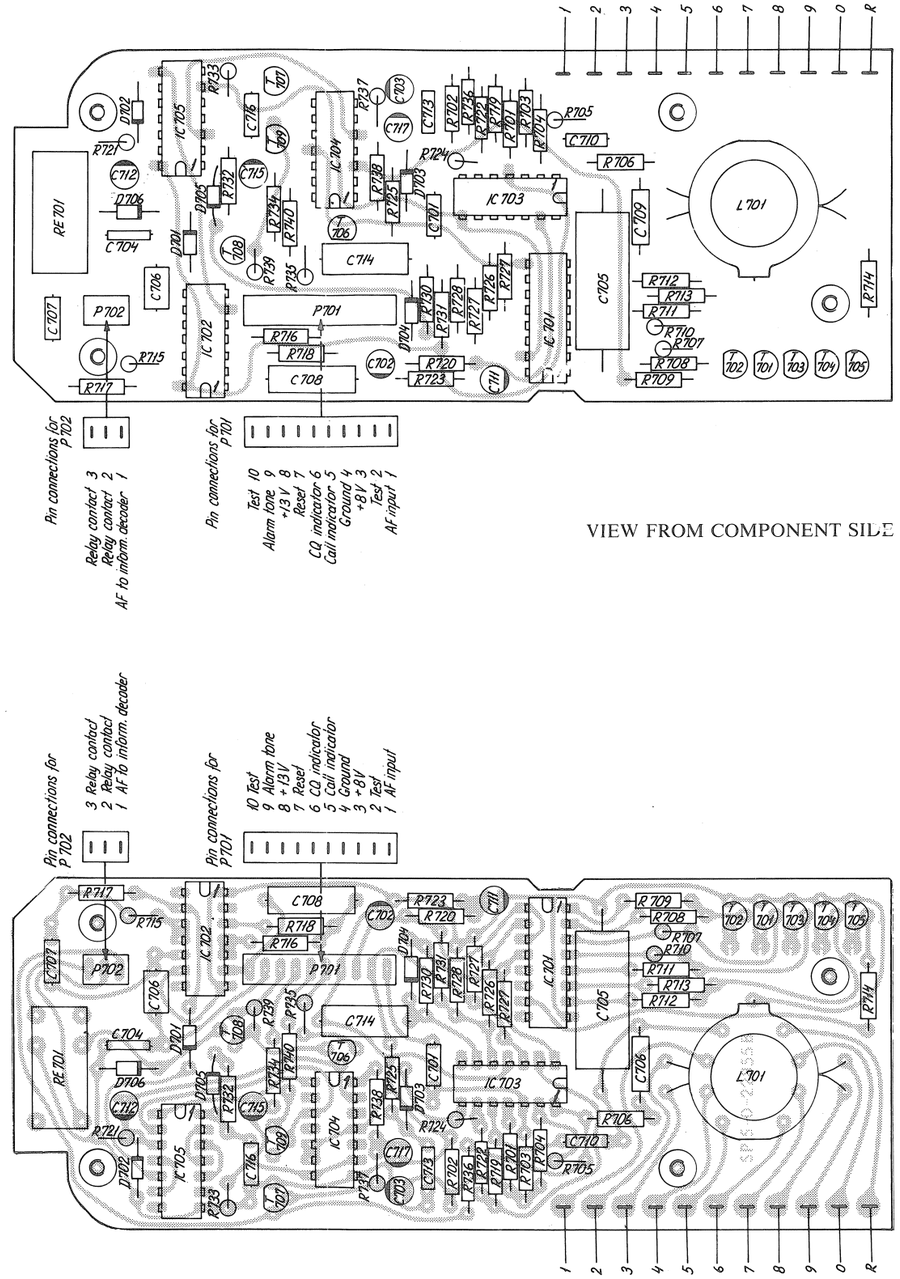
The output of the CALL MEMORY pin 2 of IC704a activates the »CALL« LED D201, the ALARM OSCILLATOR IC702c and IC702d in 10 sec. and the ALARM RELAY RE701. Pin 1 of IC104a changes to low level when the IC is clocked and transistor T707 goes off and AF can be led to an information decoder.

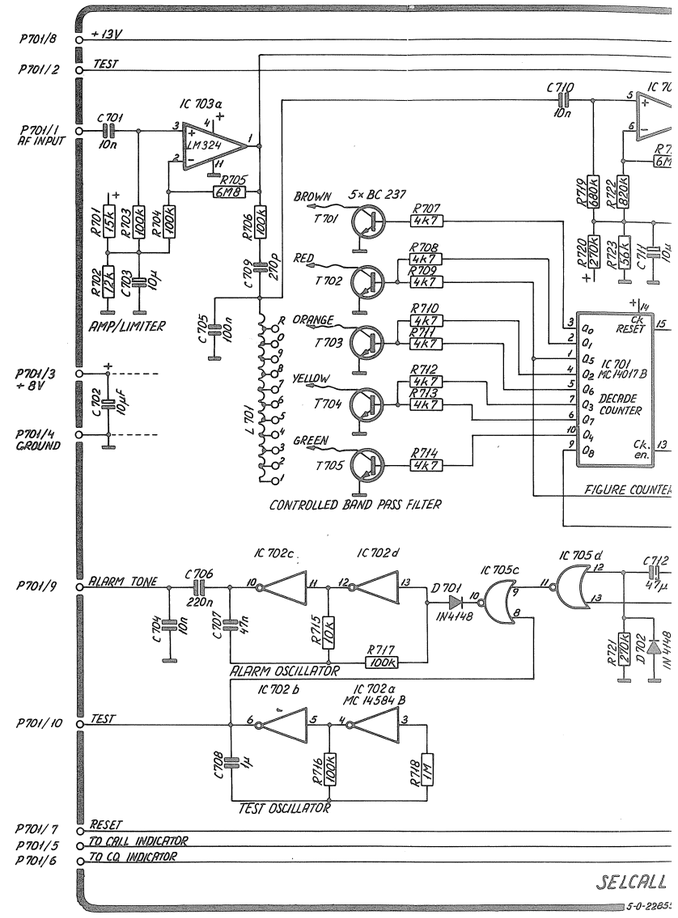
If an all ships call is received, CQ MEMORY IC704b pin 12 will go high and turn transistor T709 on. Now the »CQ« LED, D203 will be alight the ALARM OSCILLATOR will start and the ALARM RELAY RE701 is activated.

When the ALARM RELAY RE701 is activated two wires are connected for special purposes. When the push button TST, S204 is activated pulses with a frequency of 4 c/s is fed to the input pin 12 of IC703d from the TEST oscillator IC702a and b. Thus the alarm and trigger circuits of the decoder are controlled.

When the counter IC701 has got 5 pulses (the TST push button has to be activated in 1-2 sec.) the individual call circuit will be activated. When the counter IC701 has got 8 pulses (the TST push button has to be activated in 2-3 sec.) the all ships call will be activated. The dual Flip Flop IC704a and b are reset by activating the SET push button S212.

The ALARM OSCILLATOR IC702c and d is oscillating with a frequency of 800 c/s and the howling pulsatory is controlled by the TEST OSCILLATOR.





COLOUR OF WIRES C40X

P601/1	Violet-Black
P601/2	Green/White
P601/3	White-Grey
P601/4	Blue
P601/5	Green
P601/6	Pin 1 and 6 is short circuited
P601/7	White/Grey
P601/8	Brown
P601/9	Red
P601/10	Pink
P601/11	Yellow
P601/12	Brown/Yellow
P601/13	Brown/Green
P601/14	Brown/Grey
P601/15	White/Yellow
P601/16	Red/Blue

W1/1-4	Black/Green
W2/1-4	Black/Blue
W1/1-5	Blue
W2/1-5	White
W3/1-5	Brown
W1/3-4	Black
W1/3-5	Red
W2/3-5	Orange
W3/3-5	Green
W1/4-5	Yellow

J701/1	Brown/Blue
J701/2	Yellow
J701/3	Red
J701/4	Black
J701/5	Brown/Green
J701/6	Brown/White
J701/7	Red/White
J701/8	Red/Orange
J701/9	Green/White
J701/10	Brown/Yellow

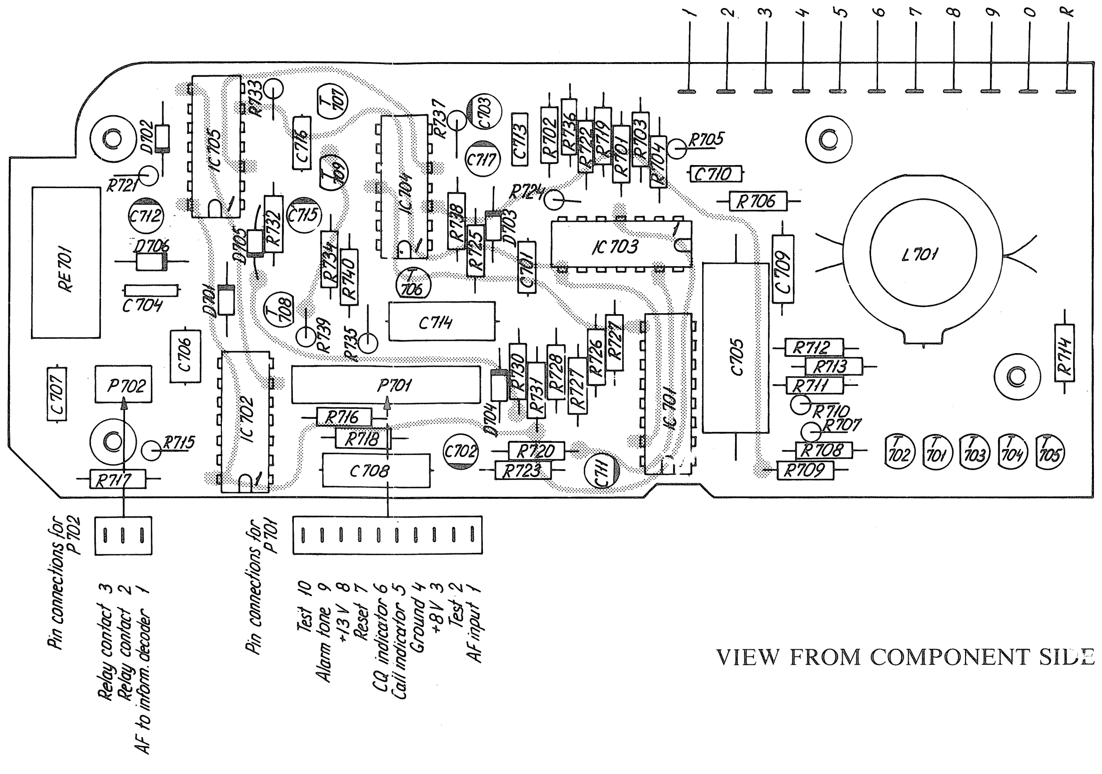
J702/1	Brown/White
J702/2	Red/White
J702/3	Blue/White

Production alteration.
The microphone amplifier has been altered:
R121 is changed from 47Kohm to 33Kohm.
R122 is changed from 1Kohm to 330 Ohm
R124 2,2Kohm is replaced by C115 10u.

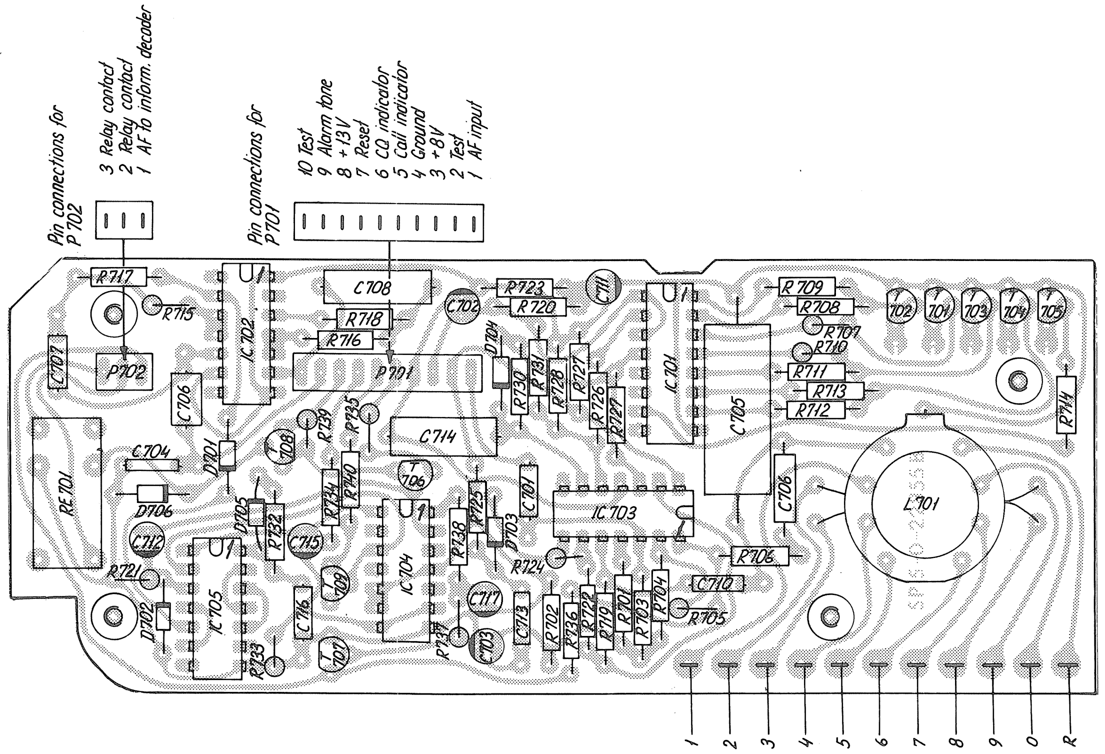
L (700)

.Y RE701
:onnected
. the push
:ed pulses
fed to the
from the
d b. Thus
its of the

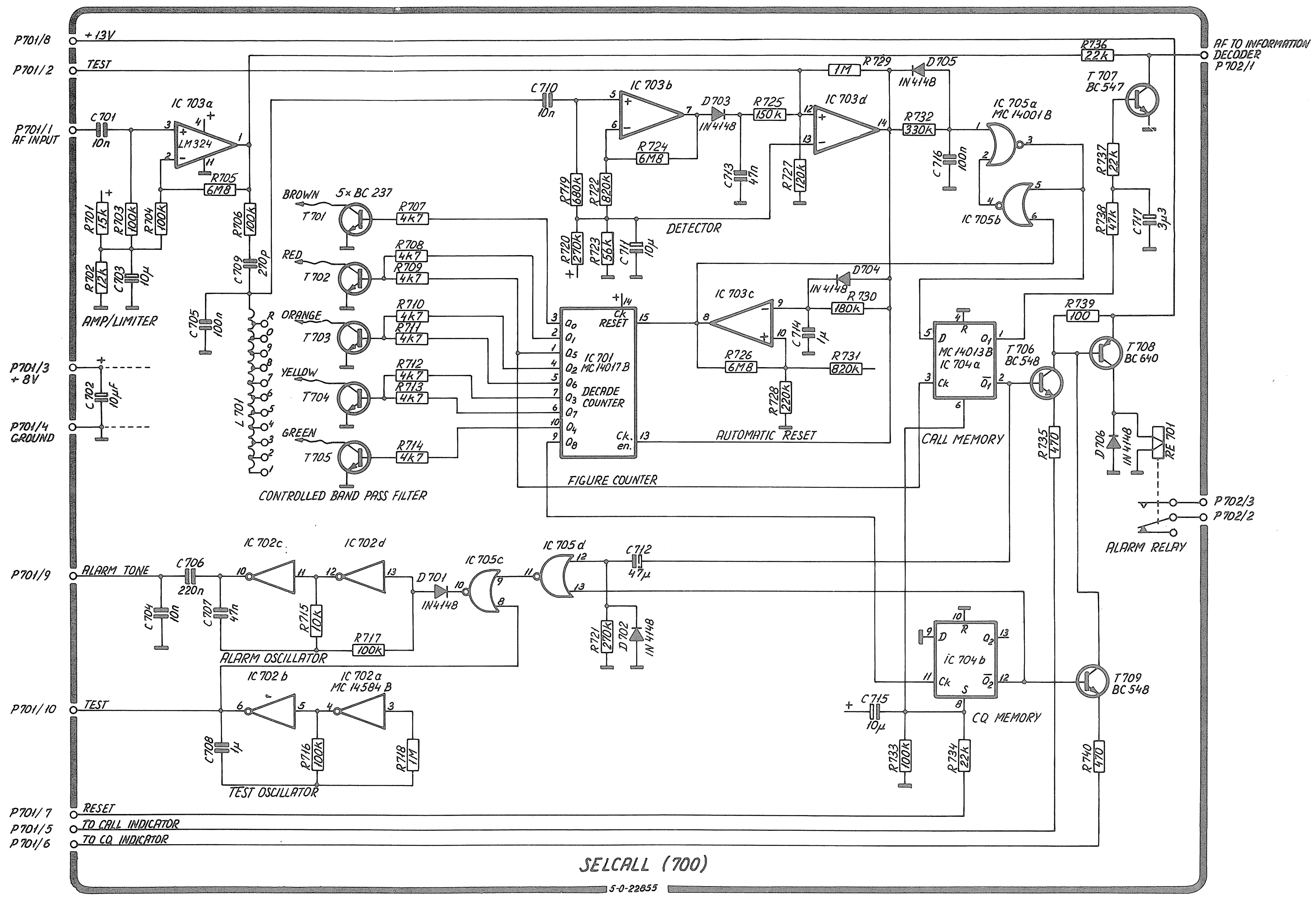
has got 5
on has to
he indivi-
activated.
has got 8
on has to
: all ships
dual Flip
:t by acti-
n S212.
:LATOR
with a fre-
: howling
he TEST



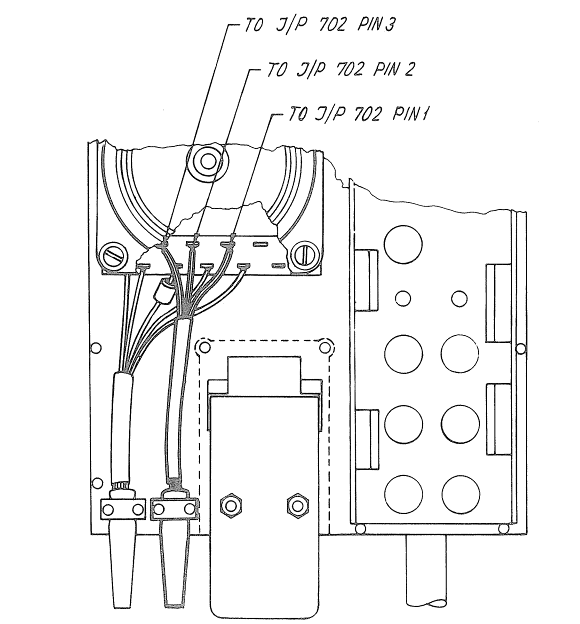
VIEW FROM COMPONENT SIDE



VIEW FROM SOLDERING SIDE



CONNECTION OF EXTERNAL ALARM TO SELCALL UNIT



COLOUR OF WIRES C40X

P601/1	Violet-Black
P601/2	Green/White
P601/3	White-Grey
P601/4	Blue
P601/5	Green
P601/6	Pin 1 and 6 is short circuited
P601/7	White/Grey
P601/8	Brown
P601/9	Red
P601/10	Pink
P601/11	Yellow
P601/12	Brown/Yellow
P601/13	Brown/Green
P601/14	Brown/Grey
P601/15	White/Yellow
P601/16	Red/Blue

W1/1-4	Black/Green
W2/1-4	Black/Blue
W1/1-5	Blue
W2/1-5	White
W3/1-5	Brown
W1/3-4	Black
W1/3-5	Red
W2/3-5	Orange
W3/3-5	Green
W1/4-5	Yellow

J701/1	Brown/Blue
J701/2	Yellow
J701/3	Red
J701/4	Black
J701/5	Brown/Green
J701/6	Brown/White
J701/7	Red/White
J701/8	Red/Orange
J701/9	Green/White
J701/10	Brown/Yellow

J702/1	Brown/White
J702/2	Red/White
J702/3	Blue/White

Production alteration.
The microphone amplifier has been altered:
R121 is changed from 47Kohm to 33Kohm.
R122 is changed from 1Kohm to 330 Ohm
R124 2,2Kohm is replaced by C115 10u.

DIMMER OSCILLATOR

CLOCK OSCILLATOR

CHANNEL SELECTOR "TENS"

CHANNEL SELECTOR "ONES"

DISPLAY DECODER

DUAL WATCH CHANNEL 16

MICROPHONE - AMPLIFIER

TX-DECODER

1W-DECODER

US-MODE

1 WATT

CHANNEL SELECTOR UNIT (100)

5-0-22512

KEYBOARD (200)

5-0-22509

* ONLY MOUNTED IN C402
J 701 AND J702 ONLY MOUNTED IN C402
** ONLY MOUNTED IN C403

NOTE: RESISTORS R103 AND R361 ARE TO BE REMOVED IF DIMMER MUST HAVE ONE POSITION WITH FULL EXTINCTION OF LIGHTS.

SELCALL-CONNEC

J 701

BOARD FOR

SAILOR VHF CONTROL UNIT C401, C402, C403.
Valid from serial no. 235700 to 265214

MULTI REMOTE VHF SYSTEM

4-0-22937C

KEYBOARD (200)
5-0-22509

AUDIO AMPLIFIER UNIT (300)
5-0-22511

BOARD FOR SWITCHES (400)
5-0-22510

MOUNTING PANEL (500)
5-0-22900

SQUELCH FILTER
SQUELCH DETECTOR
AF - PREAMPLIFIER
AF POWER AMPLIFIER
SQUELCH CONTROL
VOLUME CONTROL
DIMMER CONTROL
FILAMENT LAMP DRIVER
+8V POWER SUPPLY
MICROTELEPHONE

SELCALL-CONNECTORS

VHF-CONNECTOR
PLUG IS SEEN FROM BEHIND
PIN 1 AND 6 IS SHORT CIRCUITED
P 601
PLUG FOR RT 145 / H410/H411

* ONLY MOUNTED IN C402
J 701 AND J702 ONLY MOUNTED IN C402
** ONLY MOUNTED IN C403

NOTE: RESISTORS R103 AND R361 ARE TO BE REMOVED IF DIMMER MUST HAVE ONE POSITION WITH FULL EXTINCTION OF LIGHTS.

S402 IS RELEASED WHEN THE MICROTELEPHONE IS REMOVED FROM THE HOOK.

3. MECHANICAL LAYOUT VHF CONTROL UNIT

For removal of cabinet only loosen screws with recessed head.
See fig. 1.

Rear View of VHF Control Unit

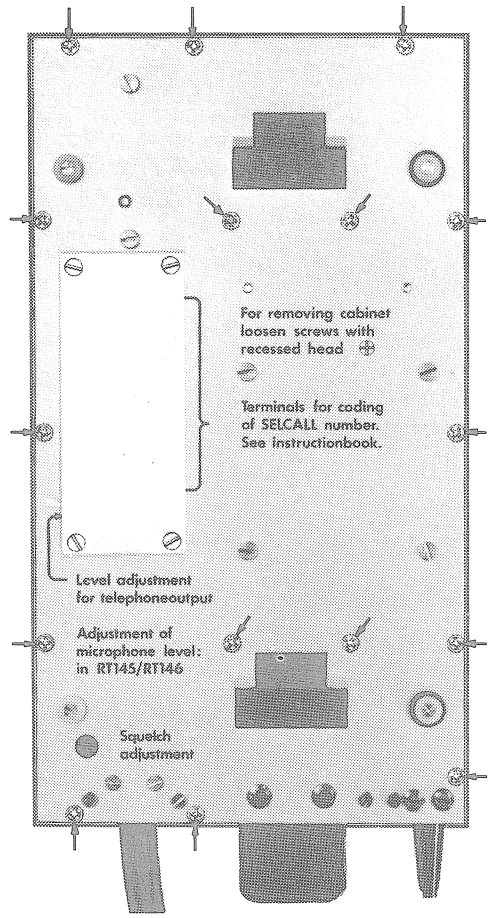


Fig 1.

When you have removed the screws with recessed head, lift the plastic cabinet in the arrow's direction, see fig. 2. When assembling the VHF Control Unit take care that the Light Emitting Diodes at the Keyboard PCB. not have been bended during service. They should correspond with the holes in the plastic cabinet, so you are able to assemble the set without using force.

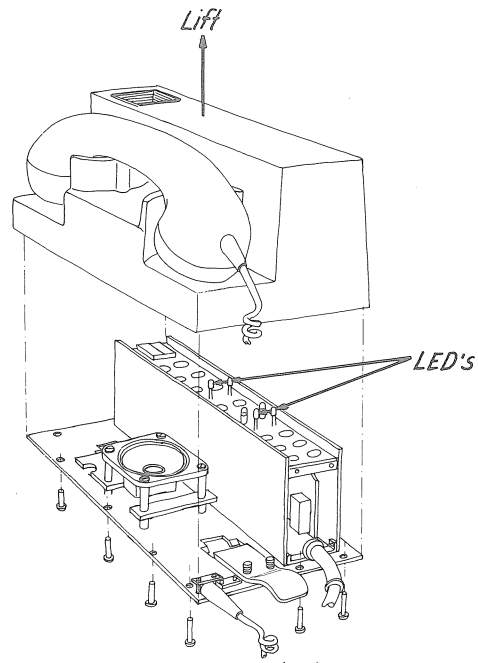
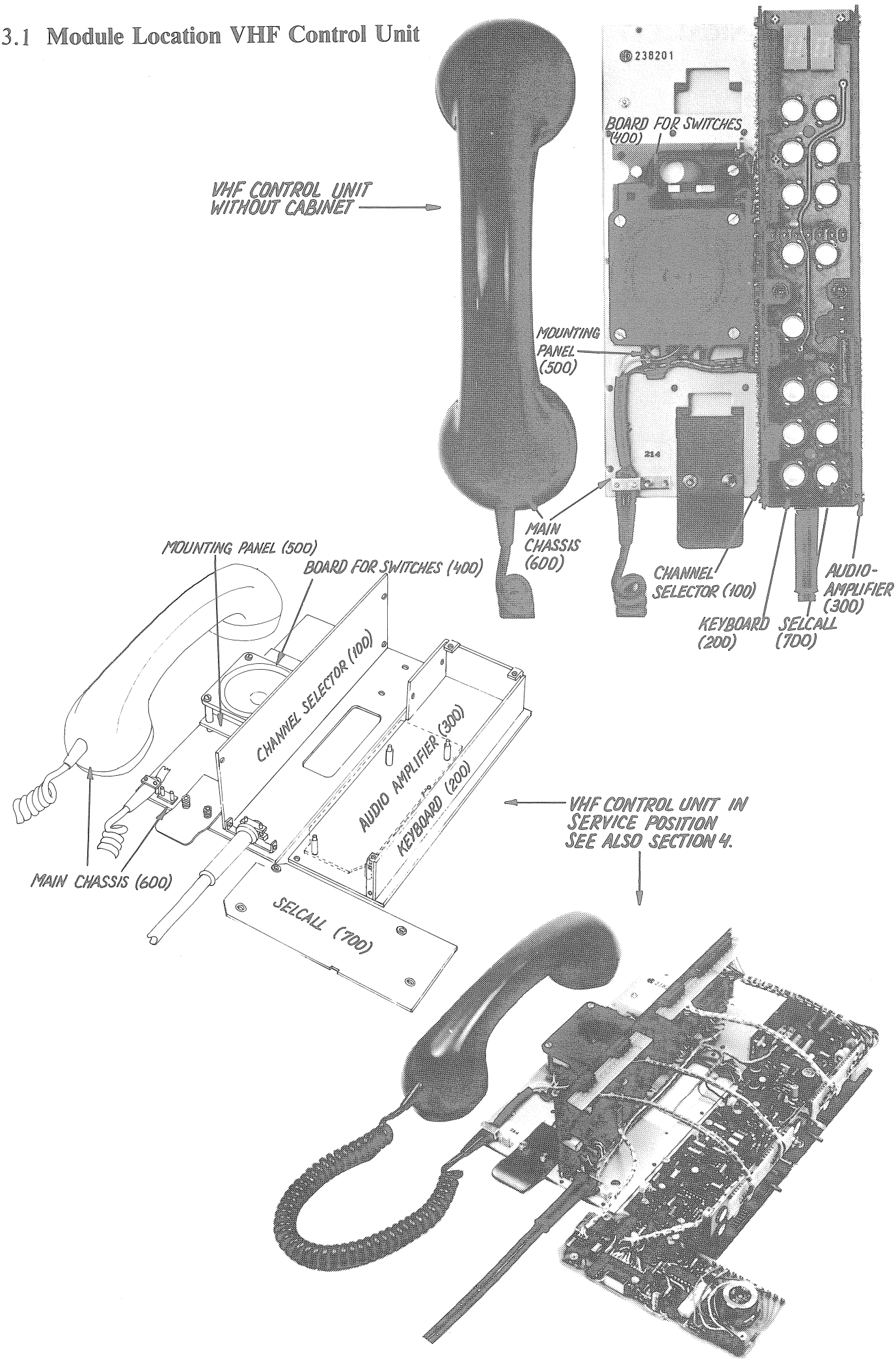


Fig 2.

3.1 Module Location VHF Control Unit



4. SERVICE

For removal of plastic cabinet see section 3. If it's necessary to disassemble the PCB's during service it has to be done as shown in fig. 1-6. When you have removed the screws as shown in fig. 1, 2, 3, use screwdriver gently, to unlock the connectors at the left side of the Keyboard PCP as shown in fig. 4. The Control Unit can now be placed in service position fig. 5 and 6. If you want to remove the Selcall Unit unscrew the 4 selcall fixing screws shown in fig. 3. Service extension cable fig. 6 is available from S. P. Radio A/S.

Fig 1. Rear View

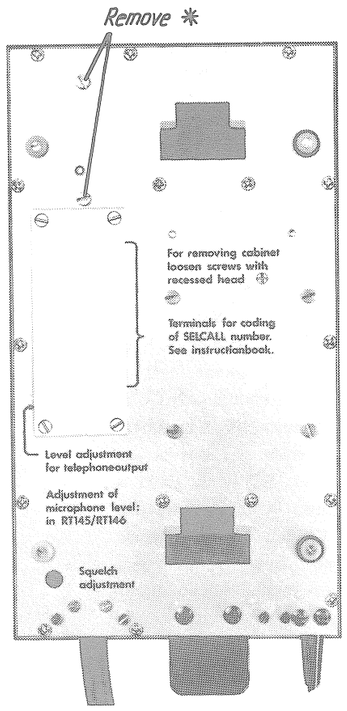


Fig 2. Leftside View

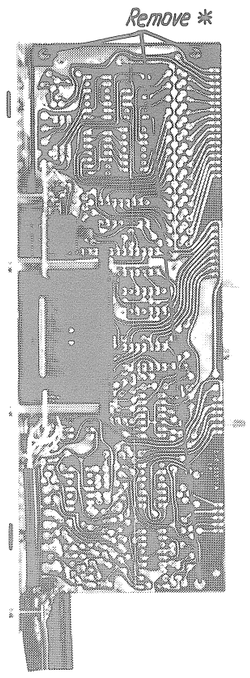


Fig 3. Rightside View

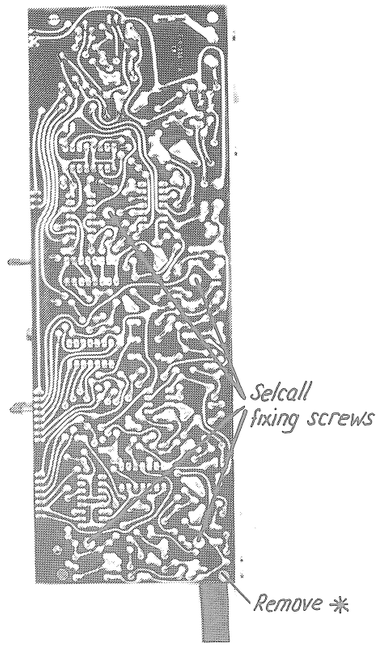
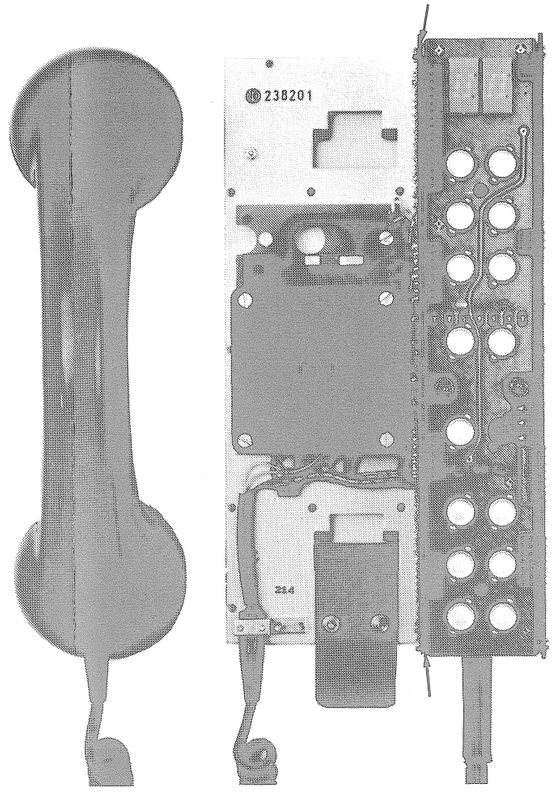


Fig 4. Front View



WARNING!
If you operate the Keyboard switches when the plastic cabinet is removed, you must not use fingernail etc. to activate the switches, they can be damaged. Use your finger tip and give the switch a gently push.

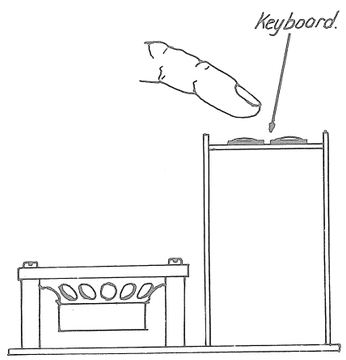


Fig 5.

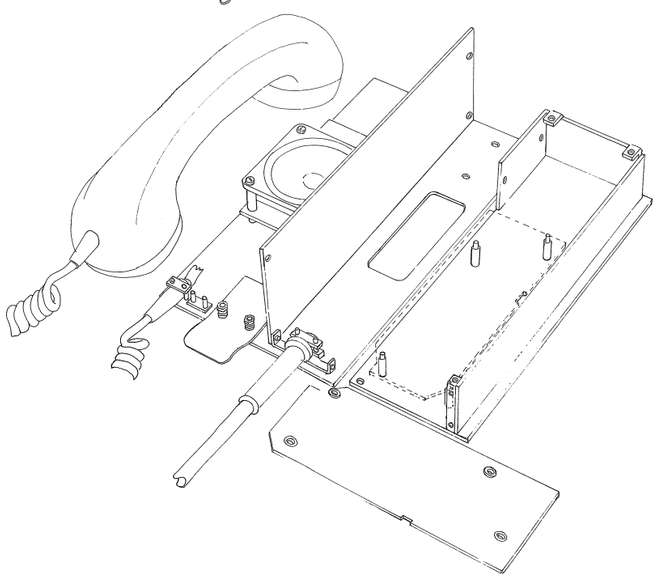
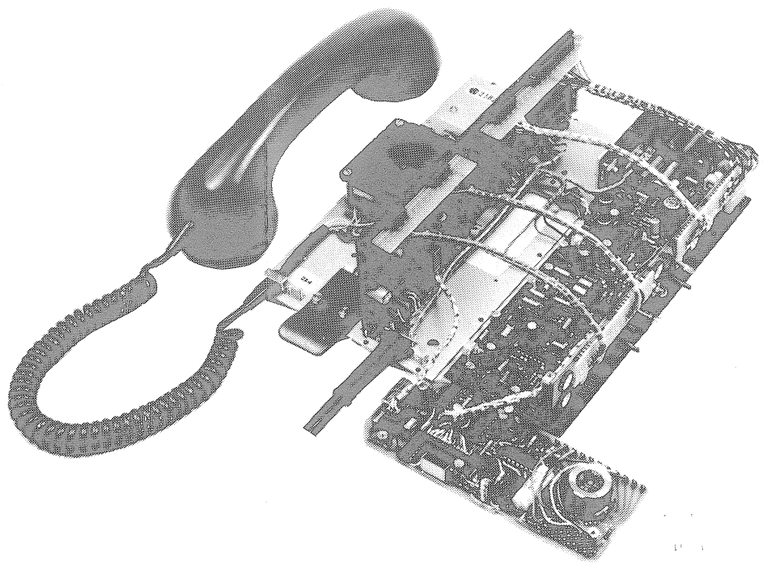


Fig 6.



4.1 ADJUSTMENT PROCEDURE

Adjustment of AUDIO AMPLIFIER UNIT (300).

1. R379 is adjusted so there is + 8V on collector T310.
2. With a test signal with f_m = 1KHz and + ÷ 3KHz deviation, R303 is adjusted to 0,55V_{RMS} telephone output measured across TC601.
3. R377 is adjusted with the volume control in max. position to 3,5V_{RMS} measured across LS601.
4. R315 (squelch adjustment). With no carrier at the antenna and the potentiometer turned fully CCW the SQ Δ push-button in activated until noise is heard in the loudspeaker. SQ ∇ is given a short push. R315 is thereafter turned CW until noise is heard again and then turned CW just enough to make the noise disappear again.

5. PART LISTS FOR VHF CONTROL UNITS C401, C402, C403

Symbol	Description			Manufact.	
R101	Resistor	8.25Kohm ± 1%	0.4W	Philips	2322 151 58252
R102	Resistor	4.32Kohm ± 1%	0.4W	Philips	2322 151 54322
R103	Resistor	68Kohm ± 5%	0.33W	Philips	2322 106 33683
R104	Resistor	1.8Kohm ± 5%	0.33W	Philips	2322 106 33182
R105	Resistor	1Kohm ± 5%	0.33W	Philips	2322 106 33102
R106	Resistor	100Kohm ± 5%	0.33W	Philips	2322 106 33104
R107	Resistor	82Kohm ± 5%	0.33W	Philips	2322 106 33823
R108	Resistor	100Kohm ± 5%	0.33W	Philips	2322 106 33104
R109	Resistor	10Kohm ± 5%	0.33W	Philips	2322 106 33103
R110	Resistor	1.5Kohm ± 5%	0.33W	Philips	2322 106 33152
R111	Resistor	3.9Kohm ± 5%	0.33W	Philips	2322 106 33392
R112	Resistor	1Mohm ± 5%	0.33W	Philips	2322 106 33105
R113	Resistor	68Kohm ± 5%	0.33W	Philips	2322 106 33683
R114	Resistor	330Kohm ± 5%	0.33W	Philips	2322 106 33334
R115	Resistor	330 ohm ± 5%	0.33W	Philips	2322 106 33331
R116	Resistor	10Kohm ± 5%	0.33W	Philips	2322 211 13103
R117	Resistor	47Kohm ± 5%	0.33W	Philips	2322 106 33473
R118	Resistor	10Kohm ± 5%	0.33W	Philips	2322 106 33103
R119	Resistor	100 ohm ± 5%	0.33W	Philips	2322 211 13101
R120	Resistor	330Kohm ± 5%	0.33W	Philips	2322 106 33334
R121	Resistor	33Kohm ± 5%	0.33W	Philips	2322 106 33333
R122	Resistor	330 ohm ± 5%	0.33W	Philips	2322 106 33331
R122a	Resistor	470 ohm ± 5%	0.33W	Philips	2322 106 33471
R123	Resistor	1Kohm ± 5%	0.33W	Philips	2322 106 33102
R124	Resistor	2.2Kohm ± 5%	0.33W	Philips	2322 106 33222
R125	Resistor	10Kohm ± 5%	0.33W	Philips	2322 106 33103
R126	Resistor	10Kohm ± 5%	0.33W	Philips	2322 106 33103
R127	Resistor	10Kohm ± 5%	0.33W	Philips	2322 106 33103
R128	Resistor	56 ohm ± 5%	0.33W	Philips	2322 106 33569
R129	Resistor	12Kohm ± 5%	0.33W	Philips	2322 106 33123
R129a	Resistor	100Kohm ± 5%	0.33W	Philips	2322 106 33104
R130	Resistor	1Kohm ± 5%	0.33W	Philips	2322 211 13102
R131	Resistor	1Kohm ± 5%	0.33W	Philips	2322 211 13102
R132	Resistor	1Kohm ± 5%	0.33W	Philips	2322 211 13102
R133	Resistor	10Kohm ± 5%	0.33W	Philips	2322 211 13103
R134	Resistor	10Kohm ± 5%	0.33W	Philips	2322 211 13103
R135	Resistor	10Kohm ± 5%	0.33W	Philips	2322 211 13103
R136	Resistor	10Kohm ± 5%	0.33W	Philips	2322 211 13103
R137	Resistor	10Kohm ± 5%	0.33W	Philips	2322 211 13103
R138	Resistor	10Kohm ± 5%	0.33W	Philips	2322 211 13103

Symbol	Description			Manufact.	
R139	Resistor	10Kohm ± 5%	0.33W	Philips	2322 211 13103
R140	Resistor	1Kohm ± 5%	0.33W	Philips	2322 211 13102
R141	Resistor	1Kohm ± 5%	0.33W	Philips	2322 211 13102
R142	Resistor	1Kohm ± 5%	0.33W	Philips	2322 211 13102
R143	Resistor	1Kohm ± 5%	0.33W	Philips	2322 211 13102
R144	Resistor	10Kohm ± 5%	0.33W	Philips	2322 106 33103
R144a	Resistor	100Kohm ± 5%	0.33W	Philips	2322 106 33104
R145	Resistor	10Kohm ± 5%	0.33W	Philips	2322 106 33103
R146	Resistor	4.7Kohm ± 5%	0.33W	Philips	2322 106 33472
R147	Resistor	4.7Kohm ± 5%	0.33W	Philips	2322 106 33472
R148	Resistor	15Kohm ± 5%	0.33W	Philips	2322 106 33153
R149	Resistor	100Kohm ± 5%	0.33W	Philips	2322 106 33104
R150	Resistor	1Kohm ± 5%	0.33W	Philips	2322 106 33102
R151	Resistor	15Kohm ± 5%	0.33W	Philips	2322 106 33153
R152	Resistor	560Kohm ± 5%	0.4W	Beyschlag	MUB 0207-50
R153	Resistor	10Kohm ± 5%	0.33W	Philips	2322 106 33103
R154	Resistor	10Kohm ± 5%	0.33W	Philips	2322 106 33103
R155	Resistor	10Kohm ± 5%	0.33W	Philips	2322 106 33103
R156	Resistor	1.5Kohm ± 5%	0.33W	Philips	2322 106 33152
R157	Resistor	10Kohm ± 5%	0.33W	Philips	2322 106 33103
R158	Resistor	8.2Kohm ± 5%	0.33W	Philips	2322 106 33822
R159	Resistor	4.7Kohm ± 5%	0.33W	Philips	2322 211 13472
R160	Resistor	10Kohm ± 5%	0.33W	Philips	2322 211 13103
R161	Resistor	10Kohm ± 5%	0.33W	Philips	2322 106 33103
R162	Resistor	10Kohm ± 5%	0.33W	Philips	2322 106 33103
R163	Resistor	10Kohm ± 5%	0.33W	Philips	2322 106 33103
R164	Resistor	100Kohm ± 5%	0.33W	Philips	2322 106 33104
R165	Resistor	47Kohm ± 5%	0.33W	Philips	2322 211 13473
R166	Resistor	100Kohm ± 5%	0.33W	Philips	2322 106 33104
R167	Resistor	100Kohm ± 5%	0.33W	Philips	2322 211 13104
R168	Resistor	100Kohm ± 5%	0.33W	Philips	2322 106 33104
R169	Resistor	100Kohm ± 5%	0.33W	Philips	2322 106 33104
R170	Resistor	100Kohm ± 5%	0.33W	Philips	2322 106 33104
R171	Resistor	100Kohm ± 5%	0.33W	Philips	2322 211 13104
R172	Resistor	100Kohm ± 5%	0.33W	Philips	2322 211 13104
R173	Resistor	47 ohm ± 5%	0.33W	Philips	2322 106 33479
R174	Resistor	47 ohm ± 5%	0.33W	Philips	2322 106 33479
R175	Resistor	47 ohm ± 5%	0.33W	Philips	2322 106 33479
R176	Resistor	47 ohm ± 5%	0.33W	Philips	2322 106 33479
R177	Resistor	47 ohm ± 5%	0.33W	Philips	2322 106 33479

Symbol	Description	Manufact.	
R178	Resistor 47 ohm ± 5% 0.33W	Philips	2322 106 33479
R179	Resistor 47 ohm ± 5% 0.33W	Philips	2322 106 33479
R180	Resistor 33 ohm ± 5% 0.33W	Philips	2322 106 33339
R181	Resistor 33 ohm ± 5% 0.33W	Philips	2322 106 33339
R182	Resistor 33 ohm ± 5% 0.33W	Philips	2322 106 33339
R183	Resistor 33 ohm ± 5% 0.33W	Philips	2322 106 33339
R184	Resistor 33 ohm ± 5% 0.33W	Philips	2322 106 33339
R185	Resistor 33 ohm ± 5% 0.33W	Philips	2322 106 33339
R186	Resistor 33 ohm ± 5% 0.33W	Philips	2322 106 33339
R187	Resistor 10Kohm ± 5% 0.33W	Philips	2322 211 13103
R188	Resistor 10Kohm ± 5% 0.33W	Philips	2322 106 33103
R189	Resistor 150 ohm ± 5% 0.33W	Philips	2322 211 13151
R190	Resistor 100 ohm ± 5% 0.33W	Philips	2322 106 33101
R191	Resistor 150 ohm ± 5% 0.33W	Philips	2322 106 33151
R192	Resistor 10Kohm ± 5% 0.33W	Philips	2322 211 13103
R193	Resistor 470 ohm ± 5% 0.33W	Philips	2322 106 33471
R194	Resistor 150 ohm ± 5% 0.33W	Philips	2322 106 33151
R195	Resistor 820 ohm ± 5% 0.33W	Philips	2322 184 43821
C101	Capacitor MKT 100nF±10% 100V	Siemens	B32560-D1104-K
C102	Capacitor electrolytic 10uF±20% 35V	ROE	EKI 00 AA 210F
C103	Capacitor tantal 10uF-20/+50% 16V	ERO	ETP 2 E
C104	Capacitor electrolytic 220uF-10/+50% 10V	ROE	EKM 00 CC 322C
C105	Capacitor ceramic 220pF-20/+80% 400V	Ferroperm	9/0129.9
C106	Capacitor ceramic 4.7nF-20/+80% 30V	Ferroperm	9/0145.9
C107	Capacitor MKT 1nF±10% 400V	Siemens	B32510-D6102-K
C108	Capacitor electrolytic 22uF±20% 25V	ROE	EKI 00 AA 222E
C109	Capacitor MKT 2.2uF±10% 100V	Siemens	B32562-D1225-K
C110	Capacitor MKT 22nF±10% 250V	Siemens	B32560-D3223-K
C111	Capacitor ceramic 10nF-20/+80% 30V	Ferroperm	9/0145.9
C112	Capacitor ceramic 1nF-20/+80% 40V	Ferroperm	9/0129.8
C113	Capacitor ceramic 220pF-20/+80% 400V	Ferroperm	9/0129.9
C114	Capacitor MKT 2.2nF±10% 400V	Siemens	B32560-D6222-K
C115	Capacitor electrolytic 10uF±20% 35V	ROE	EKI 00 AA 210F
C116	Capacitor tantal 4.7uF-20/+80% 16V	ERO	ETP2C
C116a	Capacitor electrolytic 470nF±20% 50V	ROE	EKI 00 AA 047H
C117	Capacitor ceramic 10nF-20/+80% 30V	Ferroperm	9/0145.9
C118	Capacitor ceramic 10nF-20/+80% 30V	Ferroperm	9/0145.9
C119	Capacitor ceramic 10nF-20/+80% 30V	Ferroperm	9/0145.9
C120	Capacitor ceramic 10nF-20/+80% 30V	Ferroperm	9/0145.9
C121	Capacitor ceramic 10nF-20/+80% 30V	Ferroperm	9/0145.9

Symbol	*Description*	*Manufact.*	
C122	Capacitor ceramic 10nF-20/+80% 30V	Ferroperm	9/0145.9
C123	Capacitor ceramic 10nF-20/+80% 30V	Ferroperm	9/0145.9
C124	Capacitor ceramic 10nF-20/+80% 30V	Ferroperm	9/0145.9
C125	Capacitor MKT 100nF±10% 100V	Siemens	B32560-D1104-K
C126	Capacitor ceramic 10nF-20/+80% 30V	Ferroperm	9/0145.9
C127	Capacitor ceramic 10nF-20/+80% 30V	Ferroperm	9/0145.9
C128	Capacitor MKT 1uF±10% 100V	Siemens	B32562-D1105-K
C129	Capacitor electrolytic 100uF-10/+50% 16V	ROE	EKM 00 DC 310D
C130	Capacitor electrolytic 4.7uF±20% 50V	ROE	EKI 00 AA 147H
C131	Capacitor ceramic 10nF-20/+80% 30V	Ferroperm	9/0145.9
C132	Capacitor ceramic 10nF-20/+80% 30V	Ferroperm	9/0145.9
C133	Capacitor ceramic 10nF-20/+80% 30V	Ferroperm	9/0145.9
C134	Capacitor electrolytic 100uF-10/+50% 25V	ROE	EB 00 FB 310E
C135	Capacitor electrolytic 10uF±20% 35V	ROE	EKI 00 AA 210F
L101	Coil 100uH±10% 0.4A	Ferroperm	1583
D101	Diode	Philips	1N4148
D102	Diode	Philips	1N4148
D103	Diode	Philips	1N4148
D104	Diode	Philips	1N4148
D105	Diode	Philips	1N4148
D106	Diode	Philips	1N4148
D107	Diode	Philips	1N4148
D108	Diode	Philips	1N4148
D109	Diode	Philips	1N4148
D110	Diode	Philips	1N4148

Symbol	*Description*	*Manufact.*	
P101	Connector	AMP	1-164713-7
P102	Connector	AMP	164713-8
P103	Connector	AMP	164713-6
P104	Connector	AMP	164713-5
T101	Transistor	Philips	BC 548 B
T102	Transistor	Philips	BC 548 B
T103	Transistor	Philips	BC 548 B
T104	Transistor	Philips	BC 548 B
T105	Transistor	Philips	BC 558 B
T106	Transistor	Philips	BC 548 B
T107	Transistor	Philips	BC 558 B
T108	Transistor	Philips	BC 558 B
T109	Transistor	Philips	BC 638
T110	Transistor	Philips	BC 548 B
T111	Transistor	Philips	BC 548 B
T112	Transistor	Philips	BC 558
T113	Transistor	Philips	BC 548 B
T114	Transistor	Philips	BC 637
T115	Transistor	Philips	BC 558
T116	Transistor	Philips	BC 548 B
T117	Transistor	Philips	BC 548 B
T118	Transistor	Philips	BC 548 B
T119	Transistor	Philips	BC 548 B
T120	Transistor	Philips	BC 548 B
T121	Transistor	Philips	BC 548 B
T122	Transistor	Philips	BC 548 B
T123	Transistor	Philips	BC 548 B
T124	Transistor	Philips	BC 548 B
T125	Transistor	Philips	BC 548 B
T126	Transistor	Philips	BC 548 B
T127	Transistor	Philips	BC 548 B
T128	Transistor	Philips	BC 548 B
T129	Transistor	Philips	BC 548 B
T130	Transistor	Philips	BC 548 B
T131	Transistor	Philips	BC 548 B
T132	Transistor	Philips	BC 548 B
T133	Transistor	Philips	BC 548 B
T134	Transistor	Philips	BC 639

Symbol	*Description*	*Manufact.*	
IC101	Quad 2-input nand gate	Motorola	MC 14011 BCP
IC102	Triple 3-input nand gate	Motorola	MC 14023 BCP
IC103	Quad 2-input or gate	Motorola	MC 14071 BCP
IC104	Quad excl. or gate	Motorola	MC 14070 BCP
IC105	Decoder, driver	Motorola	MC 14511 BCP
IC106	Data selector	Motorola	MC 14519 BCP
IC107	BCD up/down counter	Motorola	MC 14510 BCP
IC108	Quad excl. nor gate	Motorola	MC 14077 BCP
IC109	Quad 2-input nand gate	Motorola	MC 14011 BCP
IC110	Binary up/down counter	Motorola	MC 14516 BCP
IC111	Data selector	Motorola	MC 14519 BCP
IC112	Quad 2-input or gate	Motorola	MC 14071 BCP
IC113	Dual D flip flop	Motorola	MC 14013 BCP
IC114	Dual D flip flop	Motorola	MC 14013 BCP
IC115	Quad 2-input nor gate	Motorola	MC 14001 BCP
IC116	Quad 2-input or gate	Motorola	MC 14071 BCP

Symbol	*Description*	*Manufact.*	
D201	LED, yellow General	Instrument	MV 5374/B
D202	LED, red General	Instrument	MV 5774/B
D203	LED, red General	Instrument	MV 5774/B
D204	LED, yellow General	Instrument	MV 5374/B
D205	LED, red General	Instrument	MV 5374/B
DP201	7 segment display General	Instrument	MAN 3640 A (EFG)
DP202	7 segment display General	Instrument	MAN 3640 A (EFG)
LA201	Filament lamp 15V/35mA	OSHINO	OL-6003 MB
LA202	Filament lamp 15V/35mA	OSHINO	OL-6003 MB
S201	Disc. element ITT	Jeanrenaud	ED
S202	Disc. element ITT	Jeanrenaud	ED
S203	Disc. element ITT	Jeanrenaud	ED
S204	Disc. element ITT	Jeanrenaud	ED
S205	Disc. element ITT	Jeanrenaud	ED
S206	Disc. element ITT	Jeanrenaud	ED
S207	Disc. element ITT	Jeanrenaud	ED
S208	Disc. element ITT	Jeanrenaud	ED
S209	Disc. element ITT	Jeanrenaud	ED
S210	Disc. element ITT	Jeanrenaud	ED
S211	Disc. element ITT	Jeanrenaud	ED
S212	Disc. element ITT	Jeanrenaud	ED
S213	Disc. element ITT	Jeanrenaud	ED
S214	Disc. element ITT	Jeanrenaud	ED
S215	Disc. element ITT	Jeanrenaud	ED
J201	Connector	AMP	1-164711-7
J202	Connector	AMP	164711-8
J203	Connector	AMP	164711-6
J204	Connector	AMP	164711-5
J205	Connector	AMP	164711-3
J206	Connector	AMP	164711-3
J207	Connector	AMP	164711-8
J208	Connector	AMP	164711-7

Symbol	Description	Manufact.	
R301	Resistor 330 ohm ±5% 0.33W	Philips	2322 211 13331
R302	Resistor 100 kohm ±5% 0.33W	Philips	2322 211 13104
R303	Trimming potentiometer 10 kohm ±20% 0.3W	NOBLE	TM8 KH1-1S
R304	Resistor 100 kohm ±5% 0.33W	Philips	2322 106 33104
R305	Resistor 10 kohm ±5% 0.33W	Philips	2322 211 13103
R306	Resistor 100 kohm ±5% 0.33W	Philips	2322 211 13104
R307	Resistor 10 kohm ±5% 0.33W	Philips	2322 211 13103
R308	Resistor 100 kohm ±5% 0.33W	Philips	2322 211 13104
R309	Resistor 5.6 kohm ±5% 0.33W	Philips	2322 211 13562
R310	Resistor 100 kohm ±5% 0.33W	Philips	2322 211 13104
R311	Resistor 10 kohm ±5% 0.33W	Philips	2322 211 13103
R312	Resistor 82 kohm ±5% 0.33W	Philips	2322 211 13823
R313	Resistor 180 kohm ±5% 0.33W	Philips	2322 211 13184
R314	Resistor 220 kohm ±5% 0.33W	Philips	2322 211 13224
R315	Trimming potentiometer 47 kohm ±20% 0.3W	NOBLE	TM8 KH1-1S
R316	Resistor 27 kohm ±5% 0.33W	Philips	2322 211 13273
R317	Resistor 8.2 kohm ±5% 0.33W	Philips	2322 211 13822
R318	Resistor 39 kohm ±5% 0.33W	Philips	2322 211 13393
R319	Resistor 12 kohm ±5% 0.33W	Philips	2322 211 13123
R320	Resistor 73.2 kohm ±1% 0.4W	Philips	2322 151 57323
R321	Resistor 36.5 kohm ±1% 0.4W	Philips	2322 151 53653
R322	Resistor 18.2 kohm ±1% 0.4W	Philips	2322 151 51823
R323	Resistor 9.09 kohm ±1% 0.4W	Philips	2322 151 59092
R324	Resistor 18 kohm ±5% 0.33W	Philips	2322 211 13183
R325	Resistor 1.5 kohm ±5% 0.33W	Philips	2322 211 13152
R326	Resistor 18 kohm ±5% 0.33W	Philips	2322 211 13183
R327	Resistor 15 kohm ±5% 0.33W	Philips	2322 211 13153
R328	Resistor 5.6 kohm ±5% 0.33W	Philips	2322 211 13562
R329	Resistor 2.7 kohm ±5% 0.33W	Philips	2322 211 13272
R330	Resistor 220 kohm ±5% 0.33W	Philips	2322 211 13224
R331	Resistor 10 kohm ±5% 0.33W	Philips	2322 211 13103
R332	Resistor 6.8 kohm ±5% 0.33W	Philips	2322 211 13682
R333	Resistor 1 kohm ±5% 0.33W	Philips	2322 211 13102
R334	Resistor 15 kohm ±5% 0.33W	Philips	2322 211 13153
R335	Resistor 4.7 kohm ±5% 0.33W	Philips	2322 211 13472
R336	Resistor 56 ohm ±5% 0.33W	Philips	2322 211 13569
R337	Resistor 100 kohm ±5% 0.33W	Philips	2322 211 13104
R338	Resistor 56 kohm ±5% 0.33W	Philips	2322 211 13563
R339	Resistor 4.7 kohm ±5% 0.33W	Philips	2322 211 13472
R340	Resistor 1 kohm ±5% 0.33W	Philips	2322 211 13102
R341	Resistor 1 kohm ±5% 0.33W	Philips	2322 211 13102

Symbol	Description		Manufact.	
R342	Resistor 10kohm ±5%	0.33W	Philips	2322 211 13103
R343	Resistor 10kohm ±5%	0.33W	Philips	2322 211 13103
R344	Resistor 1.8kohm ±5%	0.33W	Philips	2322 211 13182
R345	Resistor 39Kohm ±5%	0.33W	Philips	2322 106 33393
R346	Resistor 10kohm ±5%	0.33W	Philips	2322 211 13103
R347	Resistor 18kohm ±5%	0.33W	Philips	2322 211 13183
R348	Resistor 100kohm ±5%	0.33W	Philips	2322 211 13104
R349	Resistor 3.9kohm ±5%	0.33W	Philips	2322 211 13392
R350	Resistor 220kohm ±5%	0.33W	Philips	2322 211 13224
R351	Resistor 100kohm ±5%	0.33W	Philips	2322 106 33104
R352	Resistor 10kohm ±5%	0.33W	Philips	2322 211 13103
R353	Resistor 10kohm ±5%	0.33W	Philips	2322 211 13103
R354	Resistor 10kohm ±5%	0.33W	Philips	2322 211 13103
R355	Resistor 100kohm ±5%	0.33W	Philips	2322 106 33104
R356	Resistor 5.6kohm ±5%	0.33W	Philips	2322 211 13562
R357	Resistor 8.2kohm ±5%	0.33W	Philips	2322 211 13822
R358	Resistor 10kohm ±5%	0.33W	Philips	2322 211 13103
R359	Resistor 100kohm ±5%	0.33W	Philips	2322 211 13104
R360	Resistor 1kohm ±5%	0.33W	Philips	2322 211 13102
R361	Resistor 82 ohm ±5%	0.33W	Philips	2322 211 13829
R362	Resistor 4.7kohm ±5%	0.33W	Philips	2322 211 13472
R363	Resistor 27kohm ±5%	0.33W	Philips	2322 211 13273
R364	Resistor 63,4kohm ±1%	0.4W	Philips	2322 151 56343
R365	Resistor 31.6kohm ±1%	0.4W	Philips	2322 151 53163
R366	Resistor 15.8kohm ±1%	0.4W	Philips	2322 151 51583
R367	Resistor 8.06kohm ±1%	0.4W	Philips	2322 151 58062
R368	Resistor 4.42kohm ±1%	0.4W	Philips	2322 151 54422
R369	Resistor 10kohm ±5%	0.33W	Philips	2322 211 13103
R370	Resistor 1kohm ±5%	0.33W	Philips	2322 211 13102
R371	Resistor 220 ohm ±5%	0.33W	Philips	2322 211 13221
R372	Resistor 330kohm ±5%	0.33W	Philips	2322 211 13334
R373	Resistor 33kohm ±5%	0.33W	Philips	2322 211 13333
R374	Resistor 15kohm ±5%	0.33W	Philips	2322 211 13153
R375	Resistor 3.3kohm ±5%	0.33W	Philips	2322 211 13332
R376	Resistor 5.6kohm ±5%	0.33W	Philips	2322 211 13562
R377	Trimming pot.meter 4.7kohm ±20%	0.3W	Noble	TM8 KH1-1S
R378	Resistor 680 ohm ±5%	0.33W	Philips	2322 211 13681
R379	Trimming pot.meter 470 ohm ±20%	0.3W	Noble	TM8 KH1-1S
R380	Resistor 1.5kohm ±5%	0.33W	Philips	2322 211 13152
R381	Resistor 4.7kohm ±5%	0.33W	Philips	2322 211 13472

Symbol	Description			Manufact.	
R382	Resistor	130 ohm ±1%	0.4W	Philips	2322 151 51301
R383	Resistor	3.3kohm ±5%	0.33W	Philips	2322 211 13332
R384	Resistor	130 ohm ±1%	0.4W	Philips	2322 151 51301
R385	Resistor	330 ohm ±5%	0.33W	Philips	2322 211 13331
R386	Resistor	1.2kohm ±5%	0.33W	Philips	2322 211 13122
R387	Resistor	6.8 ohm ±5%	0.33W	Philips	2322 211 13688
R388	Resistor	220 ohm ±5%	0.33W	Philips	2322 211 13221
R389	Resistor	1 ohm ±5%	0.33W	Philips	2322 211 13108
R390	Resistor	1kohm ±5%	0.33W	Philips	2322 211 13102
R391	Resistor	2.2kohm ±5%	0.33W	Philips	2322 211 13222
R392	Resistor	2.2kohm ±5%	0.33W	Philips	2322 211 13222
R393	Resistor	1kohm ±5%	0.33W	Philips	2322 211 13102
R394	Resistor	3.9kohm ±5%	0.33W	Philips	2322 211 13392
C301	Capacitor electrolytic	470nF±20%	50V	ROE	EKI 00 AA 047H
C302	Capacitor ceramic	1nF±20%	500V	KCK	HM 60 SJ YD 102M
C303	Capacitor MKT	100nF±10%	100V	Siemens	B32560-D1104-K
C304	Capacitor polystyrene	1nF± 5%	160V	Philips	2222 425 21002
C305	Capacitor polystyrene	220pF± 5%	500V	Philips	2222 427 22201
C306	Capacitor polystyrene	1nF± 5%	160V	Philips	2222 425 21002
C307	Capacitor ceramic	10nF-20/+80%	50V	Ferroperm	9/145.9
C308	Capacitor MKT	22nF±10%	250V	Siemens	B32560-D3223-K
C309	Capacitor MKT	22nF±10%	250V	Siemens	B32560-D3223-K
C310	Capacitor MKT	220nF±10%	63V	ERO	MKT1818
C311	Capacitor electrolytic	470nF±20%	50V	ROE	EKI 00 AA 047H
C312	Capacitor electrolytic	1uF±20%	50V	ROE	EKI 00 AA 110H
C313	Capacitor electrolytic	10uF±20%	35V	ROE	EKI 00 AA 210F
C314	Capacitor electrolytic	470nF±20%	50V	ROE	EKI 00 AA 047H
C315	Capacitor MKT	22nF±10%	250V	Siemens	B32560-D3223-K
C316	Capacitor electrolytic	10uF±20%	35V	ROE	EKI 00 AA 210F
C317	Capacitor MKT	22nF±10%	250V	Siemens	B32560-D3223-K
C318	Capacitor MKT	100nF±10%	100V	Siemens	B32560-D1104-K
C319	Capacitor polystyrene	3.3nF± 5%	160V	Philips	2222 425 23302
C321	Capacitor MKT	220nF±10%	63V	ERO	MKT1818

Symbol	Description			Manufact.	
C322	Capacitor MKT	220nF±10%	63V	ERO	MKT1818
C323	Capacitor polystyrene	2.2nF± 5%	160V	Philips	2222 425 22202
C324	Capacitor MKT	220nF±10%	63V	ERO	MKT1818
C325	Capacitor electrolytic	4.7uF±20%	50V	ROE	EKI 00 AA 147A
C326	Capacitor MKT	100nF±10%	100V	Siemens	B32560-D1104-K
C327	Capacitor ceramic	4.7nF±20%	50V	KCK	HE 80 SJ YD 472M
C328	Capacitor electrolytic	10uF±20%	35V	ROE	EKI 00 AA 210F
C329	Capacitor electrolytic	100uF±20%	16V	ROE	EKM 00 CC 310D
C330	Capacitor electrolytic	33uF±20%	16V	ROE	EKI 00 AA 233D
C331	Capacitor electrolytic	10uF±20%	35V	ROE	EKI 00 AA 210F
C332	Capacitor ceramic	10nF-20/+80%	50V	Ferroperm	9/145.9
C333	Capacitor MKT	220nF±10%	63V	ERO	MKT1818
C334	Capacitor ceramic	220pF-20/+80%	400V	Ferroperm	9/129.9
C335	Capacitor MKT	22nF±10%	250V	Siemens	B32560-D3223-K
C336	Capacitor ceramic	1nF±20%	500V	KCK	HM 60 SJ YD 102M
C337	Capacitor ceramic	10nF-20/+80%	50V	Ferroperm	9/145.9
C338	Capacitor ceramic	10nF-20/+80%	50V	Ferroperm	9/145.9
C339	Capacitor electrolytic	33uF±20%	16V	ROE	EKI 00 AA 233D
C340	Capacitor electrolytic	220uF±20%	10V	ROE	EKM 00 CC 322C
C341	Capacitor electrolytic	220uF±20%	10V	ROE	EKM 00 CC 322C
C342	Capacitor ceramic	4.7nF±20%	50V	KCK	HE 80 SJ YD 472M
C343	Capacitor ceramic	10nF-20/+80%	50V	Ferroperm	9/145.9
C344	Capacitor ceramic	220pF-20/+80%	400V	Ferroperm	9/129.9
C345	Capacitor MKT	100nF±10%	100V	Siemens	B32560-D1104-K
C346	Capacitor MKT	100nF±10%	100V	Siemens	B32560-D1104-K
C347	Capacitor ceramic	10nF-20/+80%	50V	Ferroperm	9/145.9
C348	Capacitor MKT	100nF±10%	100V	Siemens	B32560-D1104-K
C349	Capacitor electrolytic	470uF-10/+50%	10V	ROE	EB 00 GC 347C
C350	Capacitor electrolytic	470uF-10/+50%	10V	ROE	EB 00 GC 347C
C351	Capacitor electrolytic	10uF±20%	35V	ROE	EKI 00 AA 210F
C352	Capacitor electrolytic	10uF±20%	35V	ROE	EKI 00 AA 210F

Symbol	*Description*	*Manufact.*	
D301	Diode	Philips	1N4148
D302	Diode	Philips	1N4148
D303	Diode	Philips	1N4148
D304	Diode	Philips	1N4148
D305	Diode	Philips	1N4148
D306	Diode	Philips	BAW62
D307	Diode	Philips	BAW62
D308	Diode	Philips	BAW62
D309	Diode	Philips	1N4148
D310	Diode	Philips	BAW62
D311	Diode	Philips	BAW62
D312	Diode	Philips	BAW62
D313	Diode	Philips	1N4148
D314	Diode	Philips	1N4148
D315	Diode	Philips	1N4148
D316	Diode	Philips	1N4148
D317	Diode	Philips	1N4148
D318	Diode, zener 5.1V +5% 0,5W	Motorola	BZX79 C5V1
T301	Transistor	Philips	BC 548
T302	Transistor	Philips	BC 548
T303	Transistor	Philips	BC 558
T304	Transistor	Philips	BC 548
T305	Transistor	Philips	BC 548
T306	Transistor	Philips	BC 338
T307	Transistor	Philips	BC 548
T308	Transistor	Philips	BC 338-25
T309	Transistor	Philips	BC 548B
T310	Transistor	Motorola	BD 138-6
T311	Transistor	Philips	BC 548B

Symbol	*Description*	*Manufact.*	
IC301	Dual complementary pair plus inverter	Motorola	MC 14oo7 UBCP
IC302	Binary up/down counter	Motorola	MC 14516 BCP
IC303	Dual operational amplifier	Motorola	MC 1458C
IC304	Quad excl. or gate	Motorola	MC 14o7o BCP
IC305	Dual J-K flip flop	Motorola	MC 14o27 BCP
IC306	Dual complementary pair plus inverter	Motorola	MC 14oo7 UBCP
IC307	Binary up/down counter	Motorola	MC 14516 BCP
IC308	Transistor array	Motorola	MC 3346P
IC309	Audio power amplifier	SGS-ATES	TDA 2002
P301	Connector	AMP	164713-3
P302	Connector	AMP	164713-8
P303	Connector	AMP	164713-8
P304	Connector	AMP	164713-7

BOARD FOR SWITCHES (400) C401, C402, C403

Symbol	*Description*	*Manufact.*	
S401	Modular switch MK II Push-Push	MEC	15.550
S402	Micro-switch	CHERRY	E62 10H SPDT

CHASSIS (600) C401, C402, C403

Symbol	*Description*	*Manufact.*	
P601	Plug	Hirschmann	MES 160
LS601	Loudspeaker 8 ohm	SEAS	S6F-B
TC601	Telephone cartridge	HOLMCO	6890 350 A3
MC601	Microphone cartridge	HOLMCO	6890 350 A3
S601	Microtelephone handset switch	CHERRY	E62 10H 3PDT
FP601	Ferroxcube bead	Kasche	K3/1200/0.1 Hz/4/2/7A
FP602	Ferroxcube bead	Kasche	K3/1200/0.1 Hz/4/2/7A
FP603	Ferroxcube bead	Kasche	K3/1200/0.1 Hz/4/2/7A
FP604	Ferroxcube bead	Kasche	K3/1200/0.1 Hz/4/2/7A
FP605	Ferroxcube bead	Kasche	K3/1200/0.1 Hz/4/2/7A

Symbol	Description			Manufact.	
R701	Resistor	15Kohm ±5%	0.33W	Philips	2322 211 13153
R702	Resistor	12Kohm ±5%	0.33W	Philips	2322 211 13123
R703	Resistor	100Kohm ±5%	0.33W	Philips	2322 211 13104
R704	Resistor	100Kohm ±5%	0.33W	Philips	2322 211 13104
R705	Resistor	6.8Mhom ±5%	0.25W	Philips	2322 241 13685
R706	Resistor	100Kohm ±5%	0.33W	Philips	2322 211 13104
R707	Resistor	4.7Kohm ±5%	0.33W	Philips	2322 106 33472
R708	Resistor	4.7Kohm ±5%	0.33W	Philips	2322 211 13472
R709	Resistor	4.7Kohm ±5%	0.33W	Philips	2322 211 13472
R710	Resistor	4.7Kohm ±5%	0.33W	Philips	2322 106 33472
R711	Resistor	4.7Kohm ±5%	0.33W	Philips	2322 211 13472
R712	Resistor	4.7Kohm ±5%	0.33W	Philips	2322 211 13472
R713	Resistor	4.7Kohm ±5%	0.33W	Philips	2322 211 13472
R714	Resistor	4.7Kohm ±5%	0.33W	Philips	2322 211 13472
R715	Resistor	10Kohm ±5%	0.33W	Philips	2322 106 33103
R716	Resistor	100Kohm ±5%	0.33W	Philips	2322 211 13104
R717	Resistor	100Kohm ±5%	0.33W	Philips	2322 211 13104
R718	Resistor	1Mohm ±5%	0.33W	Philips	2322 211 13105
R719	Resistor	680Kohm ±5%	0.33W	Philips	2322 211 13684
R720	Resistor	270Kohm ±5%	0.33W	Philips	2322 211 13274
R721	Resistor	270Kohm ±5%	0.33W	Philips	2322 106 33274
R722	Resistor	820Kohm ±5%	0.33W	Philips	2322 211 13824
R723	Resistor	56Kohm ±5%	0.33W	Philips	2322 211 13563
R724	Resistor	6.8Mohm ±5%	0.25W	Philips	2322 241 13685
R725	Resistor	150Kohm ±5%	0.33W	Philips	2322 211 13154
R726	Resistor	6.8Mohm ±5%	0.25W	Philips	2322 241 13685
R727	Resistor	120Kohm ±5%	0.33W	Philips	2322 211 13124
R728	Resistor	220Kohm ±5%	0.33W	Philips	2322 211 13224
R729	Resistor	1Mohm ±5%	0.33W	Philips	2322 211 13105
R730	Resistor	180Kohm ±5%	0.33W	Philips	2322 211 13184
R731	Resistor	820Kohm ±5%	0.33W	Philips	2322 211 13824
R732	Resistor	330Kohm ±5%	0.33W	Philips	2322 211 13334
R733	Resistor	100Kohm ±5%	0.33W	Philips	2322 211 13104
R734	Resistor	22Kohm ±5%	0.33W	Philips	2322 211 13223
R735	Resistor	470 ohm ±5%	0.33W	Philips	2322 106 33471
R736	Resistor	22Kohm ±5%	0.33W	Philips	2322 211 13223
R737	Resistor	22Kohm ±5%	0.33W	Philips	2322 106 33223
R738	Resistor	47Kohm ±5%	0.33W	Philips	2322 211 13473
R739	Resistor	100 ohm ±5%	0.33W	Philips	2322 106 33101
R740	Resistor	470 ohm ±5%	0.33W	Philips	2322 211 13471

Symbol	*Description*		*Manufact.*	
C701	Capacitor MKT 10nF±10%	400V	Siemens	B32560-D6103-K
C702	Capacitor electrolytic 10uF±20%	35V	ROE	EKI 00 AA 210F
C703	Capacitor electrolytic 10uF±20%	35V	ROE	EKI 00 AA 210F
C704	Capacitor MKT 10nF±10%	400V	Siemens	B32560-D6103-K
C705	Capacitor polystyrene 100nF± 1%	63V	Philips	2222 444 41004
C706	Capacitor MKT 220nF±10%	100V	Siemens	B32560-D1224-K
C707	Capacitor MKT 47nF±10%	250V	Siemens	B32560-D3473-K
C708	Capacitor MKT 1uF±10%	100V	Siemens	B32562-D1105-K
C709	Capacitor polystyrene 270pF± 1%	630V	Philips	2222 427 42701
C710	Capacitor MKT 10nF±10%	400V	Siemens	B32560-D6103-K
C711	Capacitor electrolytic 10uF±20%	35V	ROE	EKI 00 AA 210F
C712	Capacitor electrolytic 47uF±20%	10V	ROE	EKI 00 AA 247C
C713	Capacitor MKT 47nF±10%	250V	Siemens	B32560-D3473-K
C714	Capacitor MKT 1uF±10%	100V	Siemens	B32562-D1105-K
C715	Capacitor electrolytic 10uF±20%	35V	ROE	EKI 00 AA 210F
C716	Capacitor MKT 100nF±10%	100V	Siemens	B32560-D1104-K
C717	Capacitor electrolytic 3.3uF±20%	50V	ROE	EKI 00 AA 133H
L701	Coil		S.P.	TL262
T701	Transistor		Siemens	BC237
T702	Transistor		Siemens	BC237
T703	Transistor		Siemens	BC237
T704	Transistor		Siemens	BC237
T705	Transistor		Siemens	BC237
T706	Transistor		Philips	BC548
T707	Transistor		Philips	BC547
T708	Transistor		Philips	BC640
T709	Transistor		Philips	BC548
D701	Diode		Philips	1N4148
D702	Diode		Philips	1N4148
D703	Diode		Philips	1N4148
D704	Diode		Philips	1N4148
D705	Diode		Philips	1N4148
D706	Diode		Philips	1N4148

Symbol	*Description*	*Manufact.*	
IC701	Decade counter	Motorola	MC14017BCP
IC702	HEX inverter	Motorola	MC14584BCP
IC703	Operational amplifier	National	LM324N
IC704	Dual D flip flop	Motorola	MC14013BCP
IC705	Quad nor-grate	Motorola	MC14001BCP
RE701	12V relay 2A contacts	Siemens	V23040-A0002-B201

6. GENERAL DESCRIPTION FOR SAILOR REMOTE CONTROL BOX H410

SAILOR H410 is designed to be used in conjunction with the SAILOR CONTROL UNITS C401, C402 or C403.
SAILOR H410 gives full remote control facilities for the SAILOR UNITS.
SAILOR H410 switches ON and OFF the SAILOR CONTROL UNIT.
SAILOR H410 indicates if the VHF is »IN USE« from other location.
SAILOR H410 can be programmed (with jumpers) for preference. More than one location can have preference e.g. if there are more than one operating point on the bridge.
SAILOR H410 secures that only one CONTROL UNIT at a time can be switched on.

6.1 TECHNICAL DATA FOR SAILOR REMOTE CONTROL BOX H410

Power supply: 12V DC.
Power consumption: Typical 50mA.
Dimensions: Height = 121 mm, width = 96 mm, depth = 44 mm.
Weight: 0,7 Kg.
Cable length: 12V DC max. 40 metres, 24V DC max. 100 metres.
Max. cable length in total installation: 200 metres.

6.2 PRINCIPLE OF OPERATION H410

A REMOTE CONTROL BOX H410 can only be switched on or off with a control-unit connected to it.
If switching on a REMOTE CONTROL BOX H410 without preference and the LED »IN USE« extinguished: The VHF set will be switched on and the associated control-unit is ready for operation. The LED »IN USE« will be alight on all remote control boxes in the installation, when one of the control-units is in use.
REMOTE CONTROL BOX H410 with preference can always take over the command from another H410 even if the LED »IN USE« is alight.

6.3 CONTROLS H410

ON
Switches the VHF set ON.
(The ON/OFF key on C401, C402 and C403 is not in function).
OFF
Switches the VHF set OFF.
IN USE
The LED will light when one of the CONTROL UNITS C401, C402, C403 is in use.
DIM
The switch has the function to extinquish the LED »IN USE«.
PREFERENCE
One or more of the REMOTE CONTROL BOXES H410 can be programmed for preference. (Programming information: See installation section).
The REMOTE CONTROL BOX with preference can always be switched ON also when the LED »IN USE« is lightening.
The REMOTE CONTROL BOX without preference, can not be switched ON when the LED »IN USE« is lightening.

6.4 CIRCUIT DESCRIPTION REMOTE CONTROL BOX H410

REMOTE CONTROL BOX H410 WITH PREFERENCE

When the ON push button S201 is activated the ON/OFF line will be grounded through the diode D105 and the push button, The ON/OFF relay in the VHF set will be activated and the level on the supply line will rise to +13V. Now the transistor T101 will go »ON« and the relay RE102 in H410 will be activated. Once the relay in H410 is activated, the ON/OFF line and the emitter of T101 will be grounded through the diodes D105 and D108 and the contacts in the relay. Thus a self stabilized condition is reached and the VHF set, the remote control box and the associated control-unit will be turned on, until the base of transistor T101 is grounded either by the OFF push button S202 or over control wire 2 by another H410 with preference.

When the remote control box is turned on the control wire 1 will be grounded through the diode D103 and relay RE102. Control wire 1 is via relay RE102 connected to the base of transistor T101 in the other remote control boxes and has the function to prevent other remote control boxes without preference to take command of the VHF set.

If control wire 1 is grounded the LED's D201 in all remote control boxes will be alight and indicate that the VHF set is »IN USE«.

A remote control box with preference can always take the command from another remote control box by activating the ON push button S201.

If the ON push button is activated control wire 2 will ground the base of transistor T101 in the H410, that had the command. The transistor T101 will turn off and the H410 wanted to take command can be activated.

REMOTE CONTROL BOX H410 WITHOUT PREFERENCE

A REMOTE CONTROL BOX H410 without preference cannot take the command from another H410 because control wire 2 is not connected to the ON push button S201.

H410 without preference can only take the command if the LED »IN USE« is extinguished otherwise the control wire 1 is grounded to prevent transistor T101 to go »ON«, when the ON push button is activated.

The relay RE102 has four functions:

1. To ground the relay itself when activated.
2. To connect the base of transistor T101 to either control wire 1 or 2.
3. Supply relay RE101 and associated control unit with +13V.
4. Connect microphone signal (AF to TX) from control-unit to VHF set.

The relay RE101 has two functions:

1. Connects the key line from control-unit to VHF set.
2. Connects AF signal from VHF receiver to control-unit.

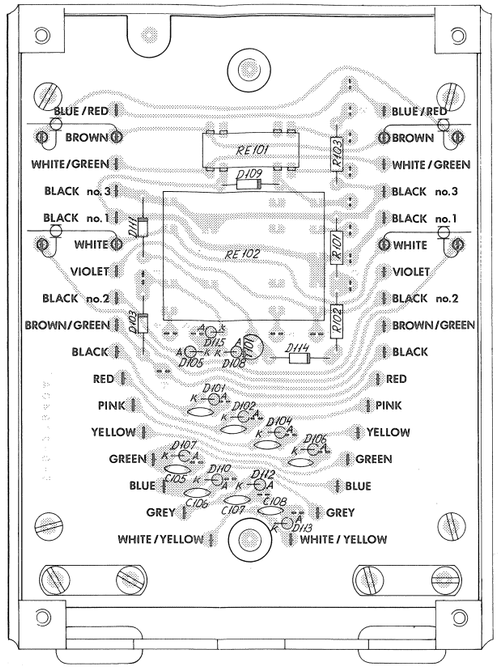
All other lines from control-unit to VHF set are controlled by diodes or connected directly.

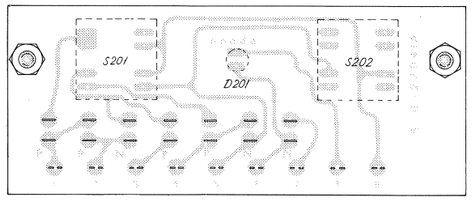
The switch S301 has the function to extinguish the LED »IN USE«.

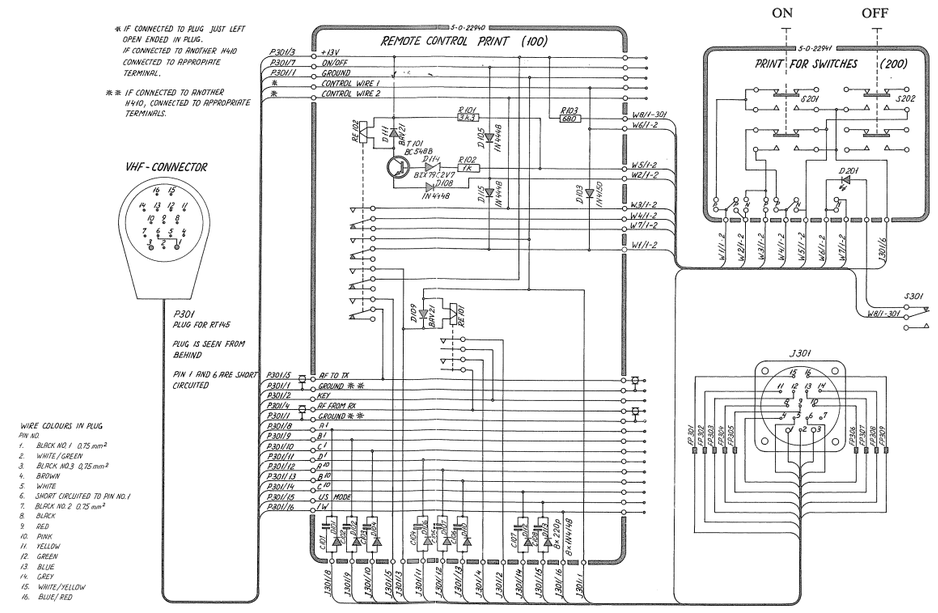
The REMOTE CONTROL BOX H410 can only be activated with a control-unit connected to multiconnector J301 because the ground is led through pin 6 to pin 1 in the plug from the control-unit.

Whether it is a H410 with preference or not can be checked by opening the H410 and look into the cover, A sticker shows the way to strap the soldering tags on the printboard to get a H410 with preference or a normal one.

Modification of a H410 without preference to a H410 with preference or vice versa is described under INSTALLATION OF SAILOR REMOTE CONTROL BOX H410.







6.5 PART LISTS FOR REMOTE CONTROL BOX H410, H412, H414, H415

REMOTE CONTROL PRINT (200) FOR H410

Symbol	*Description*		*Manufact.*	
R101	Resistor 3k3 ohm ±5%	0.33W	Philips	2322 211 13332
R102	Resistor 1k0 ohm ±5%	0.33W	Philips	2322 211 13102
R103	Resistor 680 ohm ±5%	0.33W	Philips	2322 211 13681
T101	Transistor		Philips	BC548B
D101	Diode		Philips	1N4148
D102	Diode		Philips	1N4148
D103	Diode		Philips	1N4150
D104	Diode		Philips	1N4148
D105	Diode		Philips	1N4448
D106	Diode		Philips	1N4148
D107	Diode		Philips	1N4148
D108	Diode		Philips	1N4448
D109	Diode		Philips	BAV 21
D110	Diode		Philips	1N4148
D111	Diode		Philips	BAV 21
D112	Diode		Philips	1N4148
D113	Diode		Philips	1N4148
D114	Zenerdiode		Philips	BZX79C2V7
D115	Diode		Philips	1N4448
RE101	Reed relay (DPST)		Siemens	V23100-V43-12-B000
RE102	Relay (4PDT)		National	NF-4C-12V
C101-C108	Capacitor ceramic	220pF/400V	Ferroperm	9/0129.9-20/+80%

PRINT FOR SWITCHES (200) FOR H410

Symbol	*Description*	*Manufact.*	
D201	L.E.D. red	General Electr.	MV5753
S201	Miniswitch, Unimec, momentary	M.E.C.	MKII
S202	Miniswitch	M.E.C.	MKII

CHASSIS FOR H410

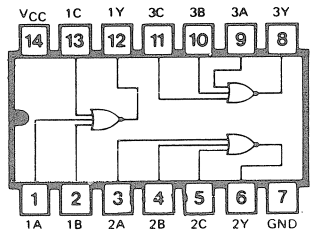
Symbol	*Description*	*Manufact.*	
J301	16 pole connector, MEB160	Hirschmann	973009-100
S301	Switch	C & K	7101
FP301-FP309	Ferrit bead	Kaschke	K3/1200/0.1Hz/4/2/7A
	Accessory		
H415	16 pole connector, MES160	Hirschmann	973-018-100

CONNECTION BOX H412

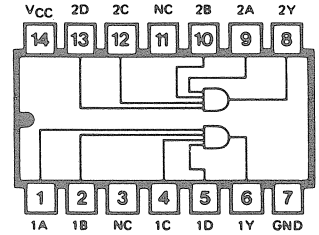
Symbol	*Description*	*Manufact.*	
H412	16 pole receptacle MED160	Hirschmann	973004-100
	Accessories:		
H415	16 pole plug MES160	Hirschmann	973018-100
H414	Multicable (length after special wishes)	Livy	Ref. st. 0170281

7. Functional block diagrams for the INTEGRATED CIRCUITS

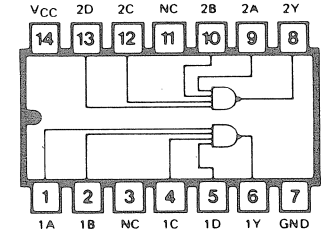
SN7427N
Triple 3-input NOR gate



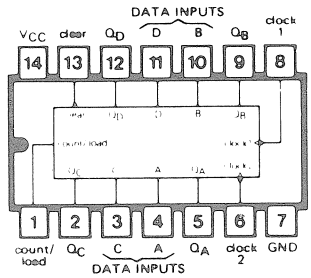
SN74H21N
Dual 4-input AND gate



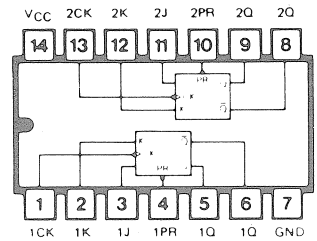
SN7420N
Dual 4-input NAND gate



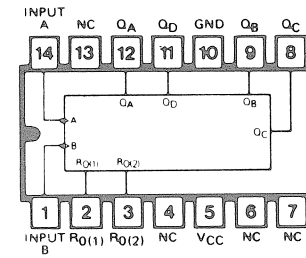
SN74197N
50 MHz Binary Counter



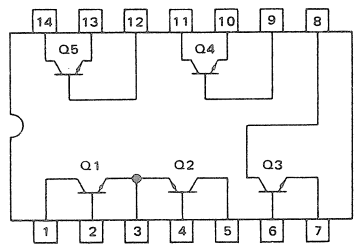
SN74S113N
Dual J-K master-slave flip-flop



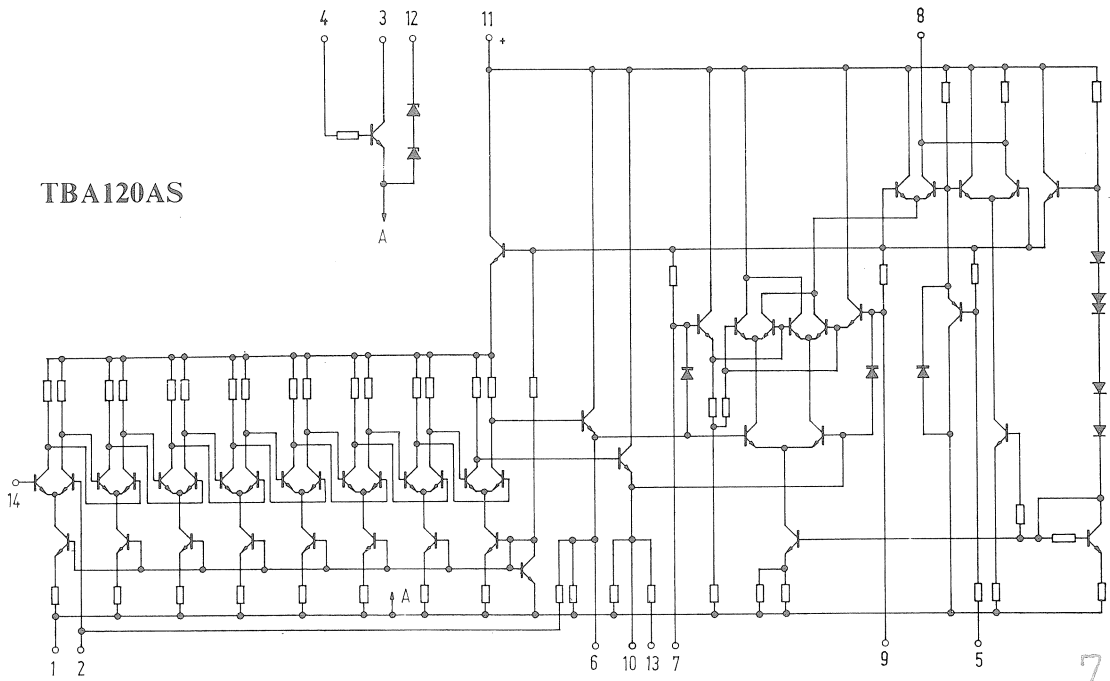
SN7493N
4-bit binary counter



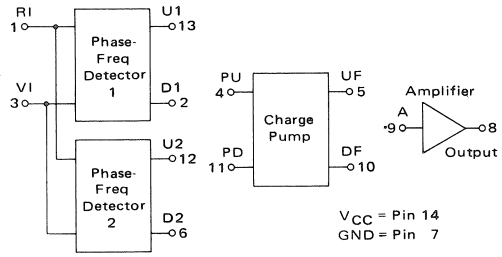
MC3346P



TBA120AS



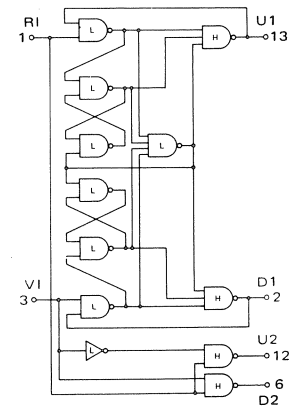
MC4044



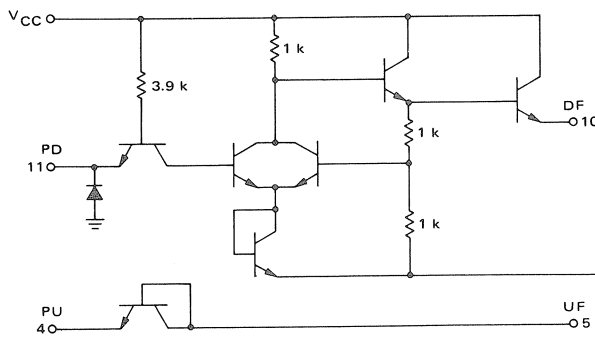
V_{CC} = Pin 14
GND = Pin 7

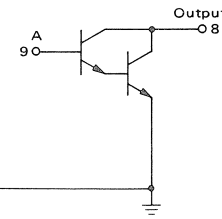
Input Loading Factor: RI, VI = 3
Output Loading Factor (Pin 8) = 10
Total Power Dissipation = 85 mW typ/pkg
Propagation Delay Time = 9.0 ns typ
(thru phase detector)

PHASE DETECTOR



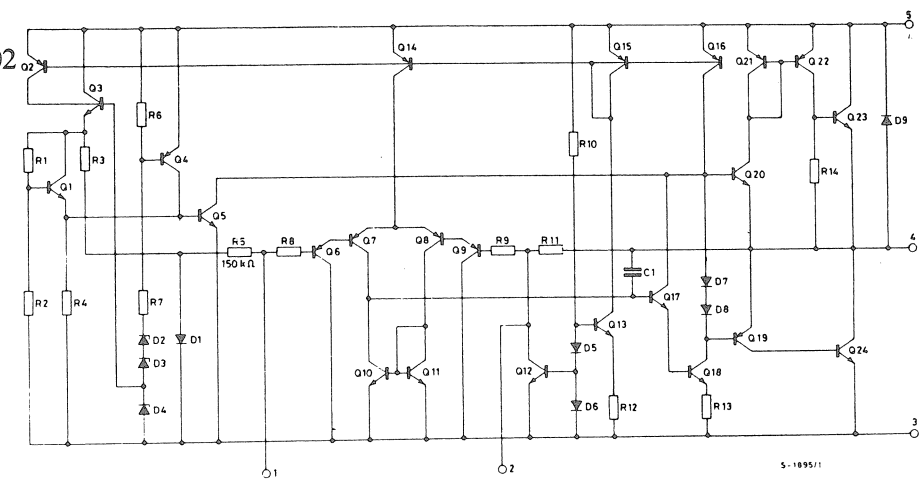
CHARGE PUMP



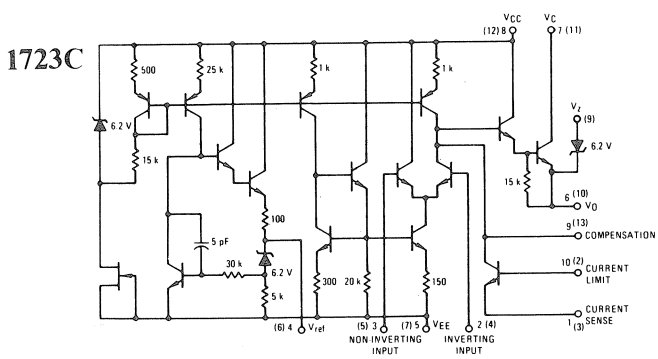


AMPLIFIER

TDA2002



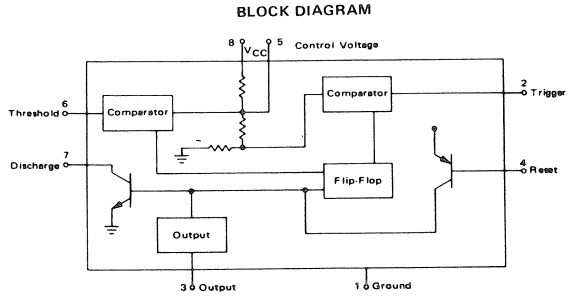
1723C



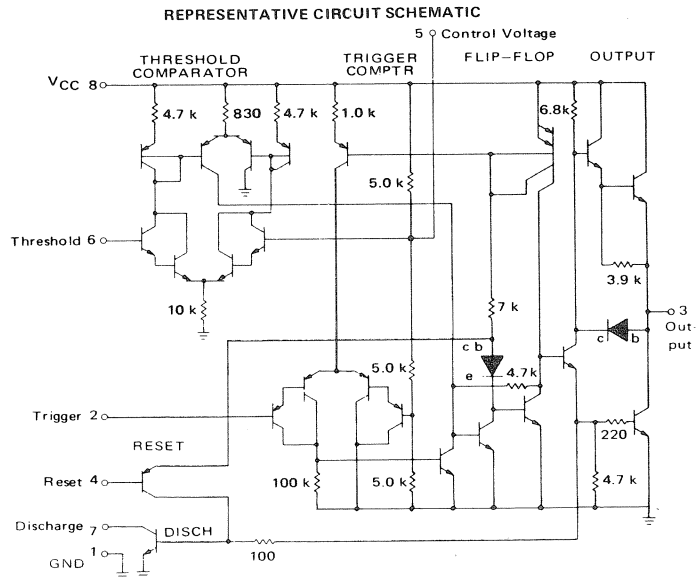
PIN NUMBERS ADJACENT TO TERMINALS ARE FOR THE METAL AND CERAMIC FLAT PACKAGE.
PIN NUMBERS IN PARENTHESIS ARE FOR THE CERAMIC DUAL IN-LINE PACKAGE

555

BLOCK DIAGRAM



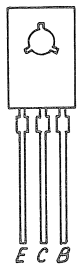
REPRESENTATIVE CIRCUIT SCHEMATIC



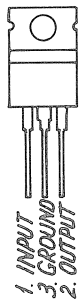
Multi-remote VHF SYSTEM

8. PIN. CONFIGURATION

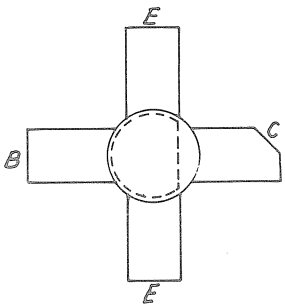
TOP VIEW



BD138

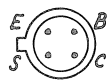


7805

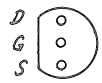


MRF 238

BOTTOM VIEW



BF 200



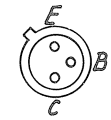
TIS 88A

BF 494
BF 199
BF 450

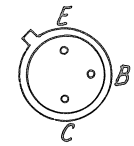
BC 237
BC 547
BC 548
BC 548 B/C
BC 558
BC 338

BC 637
BC 638
BC 639
BC 640

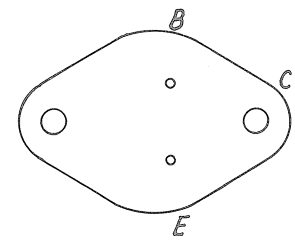
BOTTOM VIEW



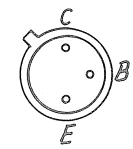
2N 2368



2N 4073

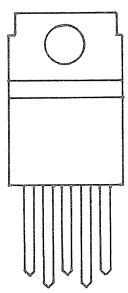


MJ 3000



SRF 1831
MRF 237

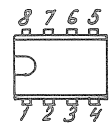
TOP VIEW



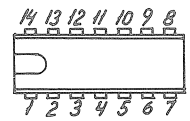
TDA 2002

1. NON INVERTING INPUT
2. INVERTING INPUT
3. GROUND
4. OUTPUT
5. SUPPLY VOLTAGE

TOP VIEW

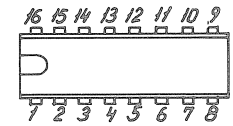


1458C
555

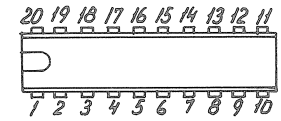


TBA 120S
1723C
LM324
MC 3346P
MC 4044
SN 7420
74H20
74H21
SN 7427
SN 7493
SN 74S113
SN 74197
MC 14001
MC 14007
MC 14011
MC 14013
MC 14023
MC 14070
MC 14071
MC 14077
MC 14584

TOP VIEW



MC 14027
MC 14510
MC 14511
MC 14519



6308-1

Multi-remote VHF SYSTEM