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INSTRUCTION MANUAL

SSB EXCITER

Type E5002

skanti

E5002 INSTRUCTION MANUAL

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E 5002

INSTRUCTION MANUAL

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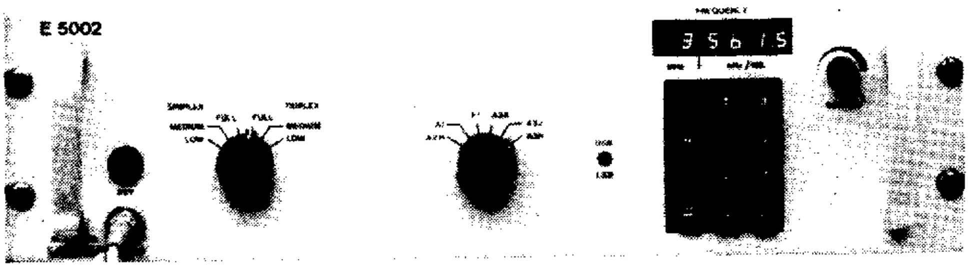
1. Introduction



1.1. The E 5002 exciter is designed for use in conjunction with the T 5000, T 5001 or T 5002 transmitter power amplifier and the P 5000 (DC) or P 5001 (AC) power packs. It can also be used in conjunction with other transmitter power amplifiers and power packs where the necessary interface is available.

The exciter is fully synthesized for operation in the frequency range 400 kHz to 29.9999 MHz in 100 Hz steps and contains a memory for up to 32 discrete channels which can be freely distributed over the entire frequency range.

The exciter is designed for transmitting of F1, A1, A2H and upper sideband A3H, A3J and A3A signals (optionally upper and lower sideband A3H, A3J and A3A signals).

The dimensions match a standard 19-inch rack and the exciter is intended for mounting in the cabinet with the T 5002 transmitter. When so mounted, the exciter and transmitter together with the receiver and the transmitter power pack constitute the TRP 5002 SSB general purpose radiotelephone.

As we are constantly processing the experience gained during the production and operation of our equipment, it is possible for minor modifications to occur relative to the information given in this instruction manual. Wherever practicable, however, any corrections will be listed on a correction sheet at the back of the front cover of this manual.

This manual describes the exciter E 5002 in conjunction with the T 5002, P 5000 or P 5001 and a receiver of the R 5000 series.

2. Operating Instructions

2.1. Distress Operation on 2182 kHz (valid for TRP 5002 with T 5000 only)

Set controls as follows:

A SUPPLY to TRANSMIT

B BAND to 2182 kHz

D VOLUME clockwise

E SENSITIVITY fully clockwise

F MODE to TRANSMIT ALARM

G Press and release ALARM START

The alarm signal is now transmitted for approx. 45 seconds and may be monitored in the handset earpiece. When the alarm signal ceases, depress handset key and, speaking clearly into microphone, transmit distress message.

If it is required to repeat the alarm signal transmission, it is only necessary to press and release the ALARM START push button again.

An alarm signal transmission may be interrupted at any time by turning the MODE switch to A3H.

NOTE: In the TRANSMIT ALARM mode on 2182 kHz the power output of the transmitter is automatically set to FULL POWER SIMPLEX independent of the setting of the POWER switch.

2.2. Tuning to 2182 kHz (valid for TRP 5002 with T 5000 only)

1. Set SUPPLY switch to TRANSMIT.
   30 seconds after switching on the transmitter is ready for operation.

2. Set BAND switch to 2182 kHz.
   The band-indicator lamp will show constant light indicationg that 2182 kHz is selected. The FREQUENCY display will show frequency no. zero for approx. 1 sec. followed by a display of 2182.0 kHz.

3. Press TUNE button and adjust TUNING control for maximum deflection on ANTENNA CURRENT meter.
   The tuning range on 2182 kHz is reduced so that power is transmitted even when the TUNING control is not adjusted.

The transmitter is now ready for operation.

NOTE: The type of service used on 2182 kHz is A3H, simplex. This mode is automatically selected when the BAND switch is set to 2182 kHz, and the MODE switch can therefore be set to any position except TEST ALARM. The equipment will also work in the simplex mode even if the POWER switch is in a DUPLEX position.

2.3. Tuning to a Frequency

1. Set SUPPLY switch to TRANSMIT.
   30 seconds after switching on the transmitter is ready for operation.

2. Turn DIMMER control fully clockwise.

3. If the display does not show zero, clear display using C key of keyboard.

4. Select the desired frequency with the keyboard or look up the desired frequency in frequency chart and read frequency No. and key frequency No. into keyboard. If a frequency No. is chosen it will be displayed for approx. 1 sec. followed by display of the actual frequency.

5. Set BAND switch to position indicated by flashing band indicator lamp. If no flashing occurs the BAND switch is already correctly set.

6. Press TUNE button and adjust TUNING control for maximum deflection on ANTENNA CURRENT meter.

7. Select desired type of service with MODE and POWER switches.

Transmitter is now ready for operation.

2.4. Operating Controls and their Function

2.4.1. The SUPPLY switch has four positions:

OFF	Receiver and transmitter are switched off.
RECEIVE ONLY	Power Pack is started up and supplies power to receiver (and grid bias to transmitter output valves). Remote speaker of receiver is connected to receiver output.
STAND BY	Power Pack supplies power to receiver, exciter, band indicator and filaments of transmitter output valves. Remote speaker of receiver is connected to receiver output.
TRANSMIT	Transmitter can be keyed. Remote speaker of receiver is disconnected.

NOTE: A built-in delay circuit protects the output valves of the transmitter from being keyed for the first 30 sec. after switching from OFF or RECEIVE ONLY to STAND BY or TRANSMIT.

2.4.2. The POWER switch has six positions:

LOW POWER SIMPLEX	Transmitter is keyed from handset key, morse key or telex equipment depending on mode of operation. Receiver is muted while transmitting. Transmitter can be driven to approx. 1/20 fo full output power.

MEDIUM POWER SIMPLEX	As above, but transmitter can be driven to approx. 1/4 of full output power.
FULL POWER SIMPLEX	As above, but transmitter can be driven to full power. Not to be used for A1 transmission below 4 MHz.
FULL POWER DUPLEX	Transmitter is keyed constantly in the F1, A3A, A3J and A3H modes. Receiver is on, but built-in speaker is disconnected. In the A2H and A1 modes the operation is simplex independent of the setting of the POWER switch. Transmitter can be driven to full output power. Not to be used for A1 transmission below 4 MHz.
MEDIUM POWER DUPLEX	As above, but transmitter can be driven to approx. 1/4 of full output power.
LOW POWER DUPLEX	As above, but transmitter can be driven to approx. 1/20 of full output power.

2.4.3. The MODE switch has six positions (eight on E 5002 for T 5000):

A2H	Transmission of modulated radiotelegraphy. Only the morse key input is open.
A1	Transmission of unmodulated radiotelegraphy. Only the morse key input is open (Reduce power to medium or low power for frequencies below 4 MHz).
F1	Transmission of telex. Only the telex inputs are open.
A3A	Transmission of single sideband signal with reduced carrier. The transmitter can be keyed from the handset key or by setting the POWER switch to DUPLEX.
A3J	As above, but carrier suppressed.
A3H	As above, but full carrier.
(TEST ALARM)	The built-in two tone alarm generator is connected to the receiver AF amplifier. Transmitter cannot be keyed.
(TRANSMIT ALARM)	The two-tone alarm generator is connected to the receiver AF amplifier and the alarm generator is ready for transmission of an alarm signal. The mode is A3H as above.

NOTE: Using preprogrammed frequencies, note that the frequency might be programmed A3H-simplex, and this is overriding the POWER and MODE switch setting.

2.4.4. The keyboard is used for frequency selection.

The key marked # is used for choosing between direct or programmed frequency selection.

When the key is in its outer position, free frequency selection mode is selected. The frequency is keyed-in on the keyboard and the frequency is shown on the display. When the key is in its inner position the preprogrammed frequency mode is selected. The programmed frequencies are listed in the frequency chart. Each frequency is supplied with a number which is keyed into the keyboard. The keyed-in frequency number is shown in the display with a "no." sign in front for approx. 1 sec. after which the actual frequency is displayed. If a frequency number is cancelled the display will be blanked except the "10 MHz" digit and the "1 MHz" digit.

2.4.5. The DIMMER controls the intensity of the display.

2.4.6. The LSB/USB switch (optional) selects the sideband to be transmitted (lower sideband or upper sideband) of the modes A3H, A3A and A3J. In the modes A1, F1 and A2H the USB position <u>must</u> always be selected.

2.4.7. The ALARM START push-button on E 5002 for T 5000 is used to start the alarm generator after the MODE switch has been turned to the TRANSMIT ALARM position. The push-button is depressed and released and the alarm signal will be transmitted for approx. 45 seconds.

The push-button is also used for starting the alarm generator in the TEST ALARM position.

2.4.8. The TUNING control is used for tuning the antenna circuit to maximum antenna current indicated on the ANTENNA CURRENT meter.

2.4.9. The BAND switch has 16 positions.

2.4.10. A band indicator lamp at each position shows by flashing light where to set the BAND switch in accordance with the frequency selected. The light will extinguish when the BAND switch is set at the correct position.

2.4.11. The 2182 kHz position on the BAND switch on T 5000 selects frequency no. zero on the Exciter (normally programmed 2182.0 kHz Simplex A3H overriding the selected frequency and mode on the Exciter). The band indicator lamp shows constant light indicating that 2182 kHz is selected. The range of the TUNING control is reduced.

2.4.12. The TUNE push-button is used when tuning the antenna circuit. The transmitter is keyed and a tune signal is generated. During tuning the receiver is muted.

2.4.13. The CHECK SWITCH is normally inoperative. Pulling the switch knob out will switch the ANTENNA CURRENT meter to read the voltage or current selected with the switch. When released the knob will return to its original position.

3. Installation

3.1. <u>Programming of the Memories on $\boxed{303}$ General</u>

3.1.1. The building block of the memory, located on printed circuit board $\boxed{303}$ is the Programmable Read Only Memory, in short PROM.

A PROM is not reprogrammable because programming a bit position is like blowing a fuse.

3.1.2. On printed circuit board $\boxed{303}$ 8 PROMs can be mounted in separate sockets. Five PROMs are used for band information and three PROMs are used for storing frequency information.

3.1.3. The programming of the PROMs can be done in two ways.

The optional Programming Unit /241\ can be used for this job as described in paragraph 3.3. But only the six TI-types shown in the table 3.1.1. can be programmed by means of printed circuit board /241\.

The other way is to let the local PROM-distributor do the programming. In this case all the PROM-types shown in table 3.1.1. can be used.

Manufacturer	Types	
INTERSIL	IM 5600	
INTERSIL	IM 5610	
SIGNETICS	N 82 S 23	
SIGNETICS	N 82 S 123	
TI	SN 54188	Only these PROM-types can be programmed by means of the optional programming unit /241\.
TI	SN 54188 A	
TI	SN 54S188	
TI	SN 74188	
TI	SN 74188 A	
TI	SN 74S188	

Table 3.1.1.

3.1.4. The Band Information Memory controls the Band Indicator of the Transmitter Power Amplifier.

Each position of the transmitter power amplifier BAND switch can be adjusted to any frequency, but once adjusted the frequency coverage of each band is limited.

In order to obtain a reasonable output power the ratio between the highest and lowest frequency within a band of the T 5002 should not exceed approx. 1:1.2.

The table 3.1.2. suggest a subdivision of the frequency range 1.6 MHz - 30 MHz for the T 5002.

Transmitting frequency (MHz)	BAND	Transmitting frequency (MHz)	BAND
1.6 - 1.9	K	7.0 - 8.4	S
1.9 - 2.3	L	8.4 - 10.0	T
2.3 - 2.8	M	10.0 - 12.0	U
2.8 - 3.4	N	12.0 - 14.4	V
3.4 - 4.0	O	14.4 - 16.9	W
4.0 - 4.8	P	16.9 - 20.3	X
4.8 - 5.8	Q	20.3 - 25.0	Y
5.8 - 7.0	R	25.0 - 30.0	Z

Table 3.1.2.

The band decoding memory runs in steps of 100 kHz.

NOTE: When the exciter E 5002 is used on frequencies below 1600.0 kHz, the PROM 303 IC16 must be changed according to paragraph 3.2.13.

3.1.5. Information on the transmitting frequency of every frequency No. is stored in the frequency memory. It is possible to store two more bits of information on each frequency No.; one is determined for transmission of mode A3H-simplex irrespective of the mode selected by the POWER and MODE switches (e.g. distress frequency), the other for auxiliary purpose via the remote control interface (e.g. change of beam direction).

3.1.6. Programming frequency No. zero can be done in two ways.

If it is convenient that this frequency No. contains the information associated with an often used transmitting frequency.

On the other hand, if it is not desired to store any transmitting frequency information associated with frequency No. zero, this can be done by programming the frequency 00000.0 kHz into the memory at frequency No. zero.

When the exciter is used in conjunction with the T 5000 transmitter power amplifier the frequency No. zero is selected when the band switch on T 5000 is set in the 2182 position.

The programming instructions for frequency No. zero do not differ from the instructions concerning any other frequency No.

3.1.7. The easiest method of checking the programmed frequencies and band information when the PROMs have been mounted in their sockets is to connect a frequency counter to the output BNC socket, 301SK5, of the exciter. The output socket is the one carrying no colour code. It is normally connected to the transmitter power amplifier via a coaxial cable. - Unplug the cable and connect the counter to this socket.

The check is made with the SUPPLY switch in STAND BY. The frequency measured is the transmitting frequency, f_t, and it is measured in the A3H mode and DUPLEX. Observe the band indicator lamps on the transmitter power amplifier.

3.2. Ordering programmed PROMs

3.2.1. To make it possible for the local PROM-distributor to do the programming the customer must fill in a Word Pattern Sheet, supplied by the distributor for each PROM to be programmed.

3.2.2. The frequency information programmed in the frequency memory PROMs is the transmitting frequency in BCD-code.

NOTE: When the exciter E 5002 is used on frequencies below 1600.0 kHz the PROM 303 IC16 must be changed according to paragraph 3.2.13.

Observe that the transmitting frequency f_t is the carrier frequency in the modes A2H, A1, A3A, A3J and A3H. In the F1-mode f_t is the assigned frequency, provided that the center frequency of the AF output from the telex equipment is 1500 Hz. If the AF center frequency if 1700 Hz, subtract 200 Hz from the assigned frequency to obtain f_t.

3.2.3. The input address of the PROMs corresponds directly to the frequency No.

3.2.4. Each of the five least significant digits of the transmitting frequency ("1MHz", "100 kHz", "10 kHz", 1 kHz" and "100 Hz") is encoded as follows:

Number	Code
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001

Table 3.2.1.

3.2.5. The most significant digit of the transmitting frequency ("10 MHz") is encoded as follows:

Number	Code
0	00
1	01
2	10

Table 3.2.2.

3.2.6. If the transmission of the frequency No. concerned must always be A3H simplex irrespective of the MODE selected by the POWER and MODE switches the MODE-bit must be programmed "0". Otherwise programme the MODE-bit "1".

3.2.7. If it is desired to use the auxiliary information on the remote control interface socket pin 28a (301-Sk1-28a) this is programmed according to its use.

3.2.8. A selfadhesive sticker marked A, B and C respectively should be placed on the package of each PROM indicating in which socket it is to be mounted.

The Word Pattern Sheet on page 3-16 is at your disposal.

3.2.9. Example 1:

Assume that the frequency 14170.0 kHz is to be programmed at frequency No. 13.

According to paragraph 3.2.3. the input address is "13" (1)
The auxiliary bit is set according to paragraph 3.2.7. to for example "1" (2)
For free selection of MODE the MODE-bit is set according to paragraph 3.2.6. to "1" (3)

By use of table 3.2.2. and table 3.2.1. the associated codes can be found:

Digit	Number	Code	
"10 MHz"	1	01	(4)
"1 MHz"	4	0100	(5)
"100 kHz"	1	0001	(6)
"10 kHz"	7	0111	(7)
"1 kHz"	0	0000	(8)
"100 Hz"	0	0000	(9)

The total amount of information is now to be arranged:

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Input Address	Aux. bit	Mode bit	Transmitting frequency					
			10MHz	1MHz	100kHz	10kHz	1kHz	100Mz
13	1	1	01	0100	0001	0111	0000	0000
	0_7	0_6	$0_5 0_4$	$0_3 0_2 0_1 0_0$	$0_7 0_6 0_5 0_4$	$0_3 0_2 0_1 0_0$	$0_7 0_6 0_5 0_4$	$0_3 0_2 0_1 0_0$
	Prom-C				Prom-B		Prom-A	

Example 2:

Assume that the maritime radiotelephone call and distress frequency 2182.0 kHz is to be programmed at frequency No. 2 and the omnidirectional antenna must be selected. On 2182.0 kHz the type of service used is A3H-simplex. Let us say that the omnidirectional antenna is selected by a "0" on the auxiliary pin of the remote control interface.

From paragraph 3.2.3. we have the input address "2" (1)
According to paragraph 3.2.7. the aux. bit is set to "0" (2)
According to paragraph 3.2.6. the MODE bit is set to "0" (3)

By use of table 3.2.2. and table 3.2.1. the associated codes can be found:

Digit	Number	Code	
"10 MHz"	0	00	(4)
"1 MHz"	2	0010	(5)
"100 kHz"	1	0001	(6)
"10 kHz"	8	1000	(7)
"1 kHz"	2	0010	(8)
"100 Hz"	0	0000	(9)

The total amount of information is now to be arranged:

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Input Address	Aux. bit	Mode bit	Transmitting frequency					
			10MHz	1MHz	100kHz	10kHz	1kHz	100Mz
2	0	0	00	0010	0001	1000	0010	0000
	0_7	0_6	$0_5 0_4$	$0_3 0_2 0_1 0_0$	$0_7 0_6 0_5 0_4$	$0_3 0_2 0_1 0_0$	$0_7 0_6 0_5 0_4$	$0_3 0_2 0_1 0_0$
	Prom-C				Prom-B		Prom-A	

3.2.10. The information in the five band decoding memory PROMs is stores as follows:

Frequency in MHz (both included)	PROM
0 - 6.3	IC 9
6.4 - 12.7	IC 8
12.8 - 19.1	IC 7
19.2 - 25.5	IC 6
25.6 - 31.9	IC 5

Table 3.2.3.

Each input address covers 200 kHz. The four most significant bits cover the first 100 kHz and the four least significant bits cover the next 100 kHz. In this way the bands can be changed every 100 kHz.

The band information codes for T 5000/T 5001/T 5002 are:

Band in T 5001/T 5002	Code	Band in T 5000
K	1111	Not to be used
L	0000	A
M	0001	B
N	0010	C
O	0011	D
P	0100	E
Q	0101	F
R	0110	G
S	0111	H
T	1000	4 MHz
U	1001	6 MHz
V	1010	8 MHz
W	1011	12 MHz
X	1100	16 MHz
Y	1101	22 MHz
Z	1110	25 MHz

Table 3.2.4.

From the function tables showing the standard programming for 303 IC5 - IC9 on pages 7-11 to 7-15 the input addresses and frequency coverage can be seen.

The word pattern sheet on page 3-17 is at your disposal.

3.2.11. On the package of each PROM a selfadhesive sticker should be placed indicating in which socket it is to be mounted. The stickers are marked 0-6.3, 6.4-12.7, 12.8-19.1, 19.2-25.5 and 25.6-31.9 corresponding to IC 9 to 5 respectively.

3.2.12. Example:

Assume that the frequency range from 1600.0 kHz to 1899.9 kHz is to be programmed for operation in band W of the T 5002.

From the table 3.2.4. the code for band W is read: "1011".

From the function table for 303 IC9 on page 7-11 we have the addresses to be changed:

1600.0 kHz - 1699.9 kHz	address 8	(low order byte)
1700.0 kHz - 1799.9 kHz	address 8	(high order byte)
1800.0 kHz - 1899.9 kHz	address 9	(low order byte).

The PROM must be programmed as shown below:

Frequency Coverage in kHz	Input Address	Output 0_7	0_6	0_5	0_4	0_3	0_2	0_1	0_0	Frequency Coverage in kHz
1500.0 - 1599.9	7	1	1	1	0	1	1	1	0	1400.0 - 1499.9
1700.0 - 1799.9	8	1	0	1	1	1	0	1	1	1600.0 - 1699.9
1900.9 - 1999.9	9	0	0	0	0	1	0	1	1	1800.0 - 1899.9

3.2.13. When transmitting on frequencies below 1600.0 kHz the keyline in the exciter must be enabled. This is done by changing the band decoder PROM 303 IC16 labelled 382 239 7 into a PROM labelled 382 239 8 . The difference between the two PROMs is the 0_7 bit in address 0. The function tables are shown on page 7-16 and page 7-17.

3.2.14. When the PROMs are to be installed in the Display and Keyboard $\boxed{303}$ make sure that they are mounted correctly.

The three frequency memory PROMs are mounted on the back of the Display and Keyboard 303 in the sockets marked A, B and C. PROM A is mounted in the socket marked with an A, PROM B in socket B and PROM C in socket C.

The five band decoder memory PROMs are mounted in their appropriate sockets . The PROM marked 0-6.3 in the socket marked 0-6.3, the PROM 6.3-12.7 in the socket 6.3-12.7 etc.

The top mark of the PROM package is to be uppermost when the Display and Keyboard is mounted in its normal position.

The band decoder PROM is soldered onto the front of the Display and Keyboard $\boxed{303}$. This is due to the fact that the PROM is usually only changed when the exciter is installed in conjunction with a transmitter.

3.3. Instruction for Use of Programming Unit /241\ when used in E 5002

3.3.1. A minor disadvantage associated with the use of the PROM as the memory building block is that a few per cent of the PROMs cannot be programmed in one or more bit positions due to tolerance problems in the manufacturing process. In this case the sections 3.3.14 and 3.3.31 describe what to do.

3.3.2. As a PROM is not reprogrammable the greatest care should be taken concerning the programming procedure.

3.3.3. There are two ways of calculating the setting of the sliders on the PROGRAMMING UNIT /241\ when programming the frequency memory PROMs, the hard way and the easy method.

If you do not have a Programming Slide-rule 342 244 31 at your disposal you must go the hard way described below.

3.3.4. Calculate the codes for the frequency information to be stored in the frequency memory PROMs according to the tables 3.3.1. and 3.3.2. (see paragraph 3.2.2.)

Desired frequency in MHz ("10 MHz", "1 MHz")	Code for slider in /241\ Band	Mode	MHz
0	4 MHz	RT	5
1	4 MHz	RT	4
2	4 MHz	RT	3
3	4 MHz	RT	-
4	4 MHz	WT	5
5	4 MHz	WT	4
6	4 MHz	WT	3
7	4 MHz	WT	-
8	6 MHz	RT	5
9	6 MHz	RT	4
10	8 MHz	RT	5
11	8 MHz	RT	4
12	8 MHz	RT	3
13	8 MHz	RT	-
14	8 MHz	WT	5
15	8 MHz	WT	4
16	8 MHz	WT	3
17	8 MHz	WT	-
18	12 MHz	RT	5
19	12 MHz	RT	4
20	16 MHz	RT	5
21	16 MHz	RT	4
22	16 MHz	RT	3
23	16 MHz	RT	-
24	16 MHz	WT	5
25	16 MHz	WT	4
26	16 MHz	WT	3
27	16 MHz	WT	-
28	22 MHz	RT	5
29	22 MHz	RT	4

table 3.3.1. Calculating Codes for the two MHz digits.

Desired frequency "100 kHz", "10 kHz", "1 kHz", "100 Hz"	Code for sliders on 241 "100 kHz", "10 kHz", "1 kHz", "100 Hz"
0	9
1	8
2	7
3	6
4	5
5	4
6	3
7	2
8	1
9	0

Table 3.3.2. Codes for calculating the four kHz digits and the 100 Hz digit.

3.3.5. Presuming you have the Programming Slide-rule 342 244 31, set the slides ① on the slide-rule according to the desired frequency (see paragraph 3.2.2.) and from the window ② on the slide-rule you have the codes for the sliders on the programming unit 241.

3.3.6. In the three sockets on the programming unit 241 three unprogrammed PROMs are inserted. The PROMs must be of the type which can be programmed by means of the programming unit 241 according to table 3.1.1.

3.3.7. Switch on 241 by means of the ON-OFF switch.

3.3.8. The sliders on the programming unit 241 are adjusted as obtained from paragraph 3.3.4. or paragraph 3.3.5. In the other window some holes appear, and these are the positions which must be programmed.

3.3.9. By means of the keyboard on the frontpanel the Frequency No. which is to be programmed is selected. The No. button "#" must be in its inner position and the frequency No. will only be displayed for approx. one second after being keyed-in

3.3.10. The Programming Pin is now placed in the extreme right hole in the window. The lamp of the red pushbutton will light as long as the programming pin does not have proper contact with the underlying socket-terminal or if this hole position has already been programmed.

3.3.11. Now activate the red pushbutton.

3.3.12. If the programming was successful, the lamp of the red pushbutton will light and the pin is moved to the next hole.

3.3.13. If the programming was unsuccessful, the red pushbutton must be activated repeatedly until the lamp is lit.

3.3.14. If it turns out that it is impossible to program this hole position, the only thing to do is to cancel the frequency No. and then choose another frequency No. and start programming all over again.

The cancelling is done by setting the sliders on the programming unit 241 as follows:
"BAND" = A, "MODE" = RT and "kHz" = 4111.1 and programming the holes in the window as per paragraph 3.3.10 to 3.3.13. Then the sliders are set to: "BAND" = A, "MODE" = RT and "kHz" = 5222.2 and the holes in the window are programmed.

When a frequency No. installed in the frequency memory is cancelled the display will blank all the digits except the "10 MHz" digit and the "1 MHz" digit when the display after approx. one second of displaying frequency No. switches over to displaying the selected frequency.

3.3.15. If the transmission on the frequency No. concerned must always be A3H-simplex irrespective of the mode selected by the POWER and MODE switches, do not programme the extreme left hole in the window.

3.3.16. If it is desired to use the auxiliary information on the remote control interface socket pin 28a (301-SK1-28a) this is programmed to logic one by programming the hole "Enabling of a correctly programmed frequency No.". Otherwise the auxiliary information will be a logic zero. The programming is to be done after programming of the frequency information into the PROMs.

3.3.17. Concerning the programming of frequency No. zero some considerations are to be made, refer to paragraph 3.1.6.

3.3.18. When the programming of the frequency Nos has been accomplished the programming unit is turned off, the programming pin is placed in its holding clips and the three PROMs are moved to the Display and Keyboard $\boxed{303}$.

Take care that the PROMs are mounted in the correct way and in the correct sockets.

3.3.19. Programming procedure step by step.

1. By means of the programming slide-rule 342 244 31 the codes for the programming unit 241 are found for each frequency No. to be programmed.
2. Mount three PROMs in the sockets on 241 (take care that they are correctly positioned).
3. Turn on the programming unit.
4. Adjust the seven sliders according to step 1.
5. Select by means of the keyboard the frequency No. to be programmed.
6. Place the programming pin in one of the holes in the window of the tool, beginning from the right.
   If this hole is unprogrammed the lamp in the red pushbutton will extinguish.
7. Activate the red pushbutton.
   The lamp of the red pushbutton will now light if the programming was successful.
   As long as there are unprogrammed hole positions the steps 6 and 7 are repeated.

8. The extreme left hole is left unprogrammed if it is desired that the frequency must be programmed A3H-simplex.
9. If the auxiliary bit is to be programmed insert the pin in the "Enable" hole position in the middle of the programming tool and program this hole position. This should finally be done before changing to a new frequency No.
10. If there are more frequency Nos to program revert to step 4, otherwise to step 12.
11. If there is a hole position which cannot be programmed, cancel the frequency No. and start from step 6. (refer to paragraph 3.3.14.).
12. Turn off the programming unit.
13. Place the programming pin in its holding clips.
14. Place a selfadhesive sticker on the package of each PROM indicating in which socket (A, B or C) it is to be mounted on Display and Keyboard $\boxed{303}$.
15. Move the three PROMs to $\boxed{303}$. (Take care that they are mounted in the correct way and in the correct sockets).

3.3.20. The band decoder memory PROMs are programmed by means of the programming unit 241 as described below.

3.3.21. Obtain the PROM number, the addresses and the band information codes as described in paragraph 3.2.10 and paragraph 3.2.12.

3.3.22. Translate the most significant five bits (O_7, O_6, O_5, O_4, O_3) according to table 3.3.3. and the least significant three bits (O_2, O_1, O_o) according to table 3.3.4.

The "x" in the "En" column of table 3.3.3. means that the hole position marked "Enabling of a correctly programmed frequency No." is to be programmed.
The programming work sheet on page 3-17 is at your disposal.

3.3.23. In the socket C on the programming unit 241 an unprogrammed PROM is inserted. The PROM must be of the type which can be programmed by means of the programming unit 241 according to table 3.1.1.

3.3.24. Switch on 241 by means of the ON-OFF switch.

3.3.25. The sliders on the programming unit 241 are adjusted according to paragraph 3.3.22.

3.3.26. By means of the keyboard on the front panel the input address which is to be programmed is selected.
The No. button "#" must be in its inner position and the input address will only be displayed approx. one second after being keyed-in.

3.3.27. The programming pin is now placed in the right in the window. The lamp of the red pushbutton will light as long as the programming pin does not have proper contact with the underlying socket-terminal or if this hole position has already been programmed.

Band information codes					Codes for 241	
0_7	0_6	0_5	0_4	0_3	"En"	"Band"
0	0	0	0	0	0	A
0	0	0	0	1	0	B
0	0	0	1	0	0	C
0	0	0	1	1	0	D
0	0	1	0	0	0	E
0	0	1	0	1	0	F
0	0	1	1	0	0	G
0	0	1	1	1	0	H
0	1	0	0	0	0	4 MHz
0	1	0	0	1	0	6 MHz
0	1	0	1	0	0	8 MHz
0	1	0	1	1	0	12 MHz
0	1	1	0	0	0	16 MHz
0	1	1	0	1	0	22 MHz
0	1	1	1	0	0	25 MHz
0	1	1	1	1	0	MF
1	0	0	0	0	x	A
1	0	0	0	1	x	B
1	0	0	1	0	x	C
1	0	0	1	1	x	D
1	0	1	0	0	x	E
1	0	1	0	1	x	F
1	0	1	1	0	x	G
1	0	1	1	1	x	H
1	1	0	0	0	x	4 MHz
1	1	0	0	1	x	6 MHz
1	1	0	1	0	x	8 MHz
1	1	0	1	1	x	12 MHz
1	1	1	0	0	x	16 MHz
1	1	1	0	1	x	22 MHz
1	1	1	1	0	x	25 MHz
1	1	1	1	1	x	MF

Table 3.3.3.

Band information codes			Codes for 241					
0_2	0_1	0_0	"MODE"	"1 MHz"	"100 kHz"	"10 kHz"	"1 kHz"	"100 Hz"
0	0	0	RT	5	9	9	9	9
0	0	1	RT	4	9	9	9	9
0	1	0	RT	3	9	9	9	9
0	1	1	RT	-	9	9	9	9
1	0	0	WT	5	9	9	9	9
1	0	1	WT	4	9	9	9	9
1	1	0	WT	3	9	9	9	9
1	1	1	WT	-	9	9	9	9

Table 3.3.4.

3.3.28. Now activate the red pushbutton.

3.3.29. If the programming was successful the lamp of the red pushbutton will light and the pin is moved to the next hole.

3.3.30. If the programming was be activated repeatedly until the lamp is lit.

3.3.31. If it turns out that it is impossible to program this hole position, the only thing to do is to replace the defective PROM with a new one and start programming all over again.

3.3.32. If the "En" column is "x" the hole in the middle of the unit marked "Enabling of a correctly programmed frequency" must be programmed too.

3.3.33. Programming procedure step by step.

1. Obtain the addresses and codes as described in paragraph 3.2.10. and paragraph 3.2.12. filling in the programming work sheet on page 3-17.
2. Translate by means of table 3.3.3. and table 3.3.4. the codes to 241-codes on the programming work sheet.
3. Mount an unprogrammed PROM in the socket C of the programming unit 241. (Take care that it is correctly positioned).
4. Turn on the programming unit.
5. Adjust the sliders according to the programming work sheet.
6. Select by means of the keyboard the input address for the PROM.
7. Place the programming pin in one of the holes in the window of the tool, beginning from the right.
8. Activate the red pushbutton.

   The lamp of the red pushbutton will now light if the programming was successful.

   As long as there are unprogrammed hole positions the steps 7 and 8 are repeated.

   If all hole positions in the window are programmed and the "Enable" bit is to be programmed go to step 9. Otherwise to step 11.

   If the lamp of the red pushbutton does not light, step 8 is repeated until it lights.

   If there is a hole position which cannot be programmed, go to step 3 and start the programming all over again.
9. Program the "Enable" hole position in the middle of the tool.
10. If there are more input addresses to be programmed, revert to step 5.
11. Turn off the programming unit.
12. Place the programming pin in its holding clips.
13. Place a selfadhesive sticker on the package of the PROM indicating in which socket (0-6.3, 6.4-12.7, 12.8-19.1, 19.2-25.5 or 25.6-31.9) it is to be mounted on the Display and keyboard 303.

14. Move the PROM to $\boxed{303}$. (Take care that it is mounted in the correct way and the correct socket).

3.4. Remote Control

3.4.1. The Remote Control Interface socket 301 SK1 (also used for the programming unit 241) is intended for a remote control interface board.

3.4.2. The remote control interface socket permits the remote control of:

Digital selection of the 32 preprogrammed frequencies.

Digital selection of transmission mode.

Digital selection of operation mode.

Digital selection of power level (full, medium or low).

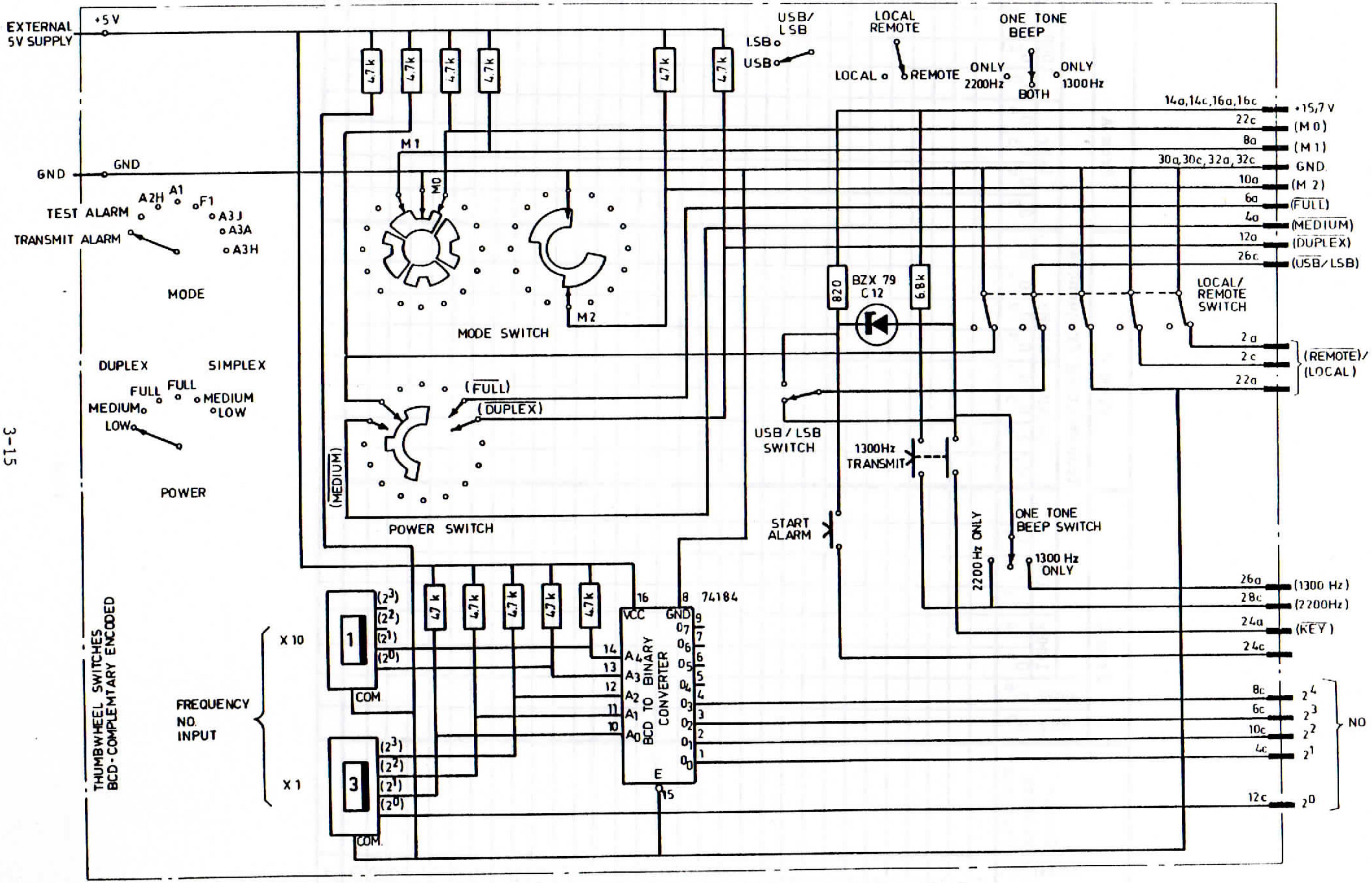
Two-tone alarm generator: Test and start functions.

Provision for transmission of a constant 1300 Hz tone (10 sec. timer not included in E 5002) after transmission of the alarm signal and/or transmission of the navigational warning signal (2200 Hz).

3.4.3. The remote control interface board is customer supply. Nevertheless an example of a remote control circuit is shown on page 3-15.

3.4.4. The power from the E 5002 for supplying the remote control interface board must not exceed:

20 mA from the 15.7V supply
30 mA from the 7.5V supply when the E 5002 is supplied from the P 5000 or P 5001.



EXAMPLE OF REMOTE CONTROL UNIT

Input Address	Transmitting Frequency	Prom C								Prom B								Prom A							
		Aux	Mode	Transmitting Frequencies																					
				10MHz		1MHz				100kHz				10kHz				1kHz				100Hz			
		O_7	O_6	O_5	O_4	O_3	O_2	O_1	O_0	O_7	O_6	O_5	O_4	O_3	O_2	O_1	O_0	O_7	O_6	O_5	O_4	O_3	O_2	O_1	O_0
0																									
1																									
2																									
3																									
4																									
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29																									
30																									
31																									

		Output								Codes 241			
Frequency Coverage in kHz	Input Address	O_7	O_6	O_5	O_4	O_3	O_2	O_1	O_0	"En."	"Mode"	"1MHz"	Frequency Coverage in kHz
	0												
	1												
	2												
	3												
	4												
	5												
	6												
	7												
	8												
	9												
	10												
	11												
	12												
	13												
	14												
	15												
	16												
	17												
	18												
	19												
	20												
	21												
	22												
	23												
	24												
	25												
	26												
	27												
	28												
	30												
	31												

Input Address	Trans-mitting Frequency	Free Mode A3H Simpl.	Auxiliary	Codes for 241							
				"En."	"Band"	"Mode"	"1MHz"	"100kHz"	"10kHz"	"1kHz"	"100Hz"
0											
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
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27											
28											
29											
30											
31											

4. Technical Data

Modes of Operation

Duplex, semiduplex and simplex A3A, A3H, A3J and F1 (USB).
Option for LSB/USB
Semiduplex and simplex A1 and A2H.

Power Output

A1, A2H, A3A and A3J: 2-3.5V pp in 50 ohms (adjustable)
F1: 1.6-2.7V pp in 50 ohms
Medium power: -6 dB
Low power: -13 dB

Frequency Range

405 kHz - 29.9999 MHz
Semicontinuous in 100 Hz steps.

Frequency Selection

a. Direct mode:
   Keyboard selection with fixed decimal point.

b. Programmed mode:
   Keyboard of up to 32 preprogrammed frequencies (PROMs)
   Frequency No. shown on display for approx. 1 sec. after selection of No. Thereafter display of frequency.
   Mode A3H/simplex may be preprogrammed.

c. Remote mode:
   Selection of the 32 preprogrammed frequencies in binary code via 301SK1.

d. Distress frequency:
   When the exciter is used in conjunction with T 5000 the band switch can select frequency No. zero which should be preprogrammed 2182.0 kHz - A3H/simplex.

Frequency Accuracy and Stability:

Depending on master oscillator (connected to 301SK2).
When master oscillator /240\ is fitted:
Accuracy: Less than 2 ppm/year.
Stability: ± 5 Hz in any 15 min. period.

Unwanted Radiation:

Unwanted Radiation 7.5 kHz or more off the assigned frequency: at least 43 dB (typical 50 dB) below the p.e.p. value.

Frequency Linearity:

± 1.5 dB over the frequency range 405 kHz - 29.9999 MHz.

Modulation:

Modulation characteristic within 6 dB from 350 Hz to 2700 Hz.

AF Compression:

Output varies less than 0.75 dB for a variation of input level from -10 dB to +10 dB relative to nominal input.

AF Inputs:

Carbon microphone: 200 ohms nominal 3V pp max. 9.5V pp
Line input: 600 ohms nominal 0 dBm max. +10 dBm.
Telex input: 600 ohms nominal 0 dBm max. +10 dBm.

Two-Tone Alarm:

Included for remote control only.

Intermodulation:

Better than -43 dB (typical -46 dB) as per CCIR specification.

Noise and Hum Level:

More than 40 dB below full power p.e.p.

Remote Control Facility for Exciter:

Digital selection of the 32 preprogrammed frequencies.
Digital selection of transmission mode.
Digital selection of operation mode.
Digital selection of power level (full, medium or low).
Two-tone alarm generator: Test and start functions. Provision for transmission of a constant 1300 Hz tone (10 sec. timer not included) after the alarm signal and/or transmission of the navigational warning signal (2200 Hz).

The digital and other remote control information must be fed via 301SK1 and the digital interface (customer supply) may be placed in the space provided for PCB/241\ programming unit. PCB/241\ may still be used for field programming.

Supply Voltage:

7.5V ± 5 %: max. 2.7A typical 1.9A.
15.7V ± 5 %: max. 1.1A typical 0.9A.

Environmental Conditions:

Complies with CEPT and MPT 1204 (UK) specifications.

Dimensions:

Height:	132.5	mm	
Width:	482	mm	
Depth into rack:	333	mm	
Weight:	9.2	kg	approx.

5. Technical Description

5.1. Mechanical

The exciter is built on a rugged zinc plated and passivated iron chassis.

The exciter contains five plug-in boards 207, 208, 209, 210 and 234 and two boards in separate screened cans 244 and 302 which become accessible after removal of the respective lids. Board 303 is mounted behind the front panel. This board and the motherboard 301 become accessible when the front panel is tilted forward. This is possible after removal of the two upper screws in each side fixing the front panel.

5.2. Circuit Description, General

Each printed circuit board and also the chassis-mounted components have been allocated an identification number between 207 and 303. The designation of a component or terminal includes this number as a prefix, e.g. 207R3 (resistor R3 on board 207), or 244-6 (terminal No. 6 on board 244).

For convenience in this section and on the circuit diagrams the prefix is omitted except where there is a risk of ambiguity.

The circuit diagram is divided into a wiring diagram on page 8- showing the motherboard 301 and the interconnections between the printed circuit boards of which the exciter is composed and circuit diagrams of the individual circuit boards. The block diagrams on pages 8- to page 8- illustrates the operation of the exciter.

5.3. Circuit Summary, Signal Path E 5002

5.3.1. The signal path is contained on boards 244 and 302. The AF input signal, having passed an input selector and a compressor, is converted to a 1.4 MHz double sideband signal by mixing with a 1.4 MHz signal derived from the master oscillator. The upper sideband is removed in a crystal filter and the lower sideband is applied to an amplifier, the gain of which is set in accordance with the mode selected. At the output a 1.4 MHz signal of appropriate level for carrier re-insertion is applied in the modes A3A and A3H.

5.3.2. The 1.4 MHz single sideband signal is fed to the RF translator 302. When the signal enters 302 it passes the level setting circuit which allows the level to be set independently at each band. The 1.4 MHz lower sideband signal is converted in the 1.4 to 38 MHz mixer to a 38 MHz LSB signal by mixing with a 36.6 MHz signal from the 36.6 MHz VCO. The signal is filtered in a crystal filter to remove undesired mixing products.

The signal is converted to a 0-30 MHz upper sideband signal in the 38 to 0-30 MHz mixer by mixing with the 38-68 MHz signal from the synthesizer VCO_3. The signal is then amplified and fed to the 30 MHz low-pass filter. Having passed the filter the signal is amplified to full power level. Before the signal is fed to the transmitter it passes the step attenuator controlled from the POWER switch.

5.3.3. In the A1, A3H and TRANSMIT ALARM modes the AF signal is supplied from the tone generators on board 234. The 1.5 kHz oscillator is used for generating the carrier frequencies in the modes A1 and A2H. A 1.5 kHz shift command from the mode control circuit makes the synthesizer decrease its output frequency by 1.5 kHz in these modes which means that the output frequency of the exciter becomes the correct transmission frequency. The 2.2 kHz oscillator is in addition used for generating the sideband in the A2H mode giving a modulation frequency of 700 Hz.

The keyline output from the keying circuit to the power pack informs the HT converter to start when the line goes high. However, this is inhibited if an illegal frequency has been selected.

5.3.4. The 1.4 MHz reference frequency is normally supplied from the master oscillator of the R 500X receiver. However, if the receiver is not installed in the cabinet, master oscillator 240 is available for mounting in the exciter.

5.4. Circuit Summary, Frequency Synthesizer

This frequency synthesizer consists of two programmable phase locked loops (loop 1 and loop 2), the outputs of which are controlling a third (loop 3) from which the complete synthesized signal is derived and fed to the 1st mixer in the signal path.

The output frequency of loop 1 is controlled by the 100 Hz, 1 kHz, and 10 kHz information according to the contents of the displays, provided that the receiving mode chosen is not A1, A2H or F1. If the A1, A2H or F1 mode is chosen the output frequency is decreased by 1.5 kHz.

Loop 1 produces an output frequency in 999 steps from 20.000 MHz to 21.998 MHz in all modes but A1, A2H and F1. In the A1, A2H and F1 modes it is from 19.970 MHz to 21.960 MHz. This frequency is divided by 200 and serves as a variable reference frequency for the Loop Translator.

Independent of the different receiving modes loop 2 is controlled by the 100 kHz, 1 MHz, and 10 MHz information according to the contents of the displays. The output frequency of this loop is variable from 3.70 MHz to 6.69 MHz in 299 steps and is fed to the mixer of the loop translator where it is subtracted from the synthesizer output frequency divided by 10 and finally compared with the variable reference frequency to this loop by means of Phase/Freq. Detector 3. A Frequency Comparator ensures that the synthesizer output frequency divided by ten is higher than the output frequency of loop 2. If this was not the case, it would lead to a stable, unlocked condition of loop 3.

The frequency synthesizer is locked to a 1.4 MHz signal derived from the TCXO so that the output frequency will exhibit exactly the same stability as specified for the TCXO.

Provided that the 3 loops are locked the following equations, where fvcoi is short for output frequency of VCOi, will become valid:

Assumption: Transmitting frequency is (ab, cde.f) kHz.

$(fvco_3 - 10) - fvco_2 = (fvco_1 - 200).$

$(fvco_3 = 10x(fvco_2 + (fvco_1 - 200))$

where

$fvco_1 = (20000 + (d\ e\ f)x2)$ kHz and

$fvco_2 = (3700 + (a\ b\ c)x10)$ kHz and

$fvco_3 = 38000.0$ kHz + a b c d e f kHz.

5.5. Circuit Description, E 5002

5.5.1. 301 Motherboard

The motherboard contains the interconnection between the different units and the wiring. The motherboard also contains the plugs for the cabinet wiring and the voltage regulators: the 5V regulator, the 12V regulator supplying the output amplifier on 302 and the 12V regulator for the remaining circuits.

On the 301 motherboard the 10 divider for the VCO_3 loop is located.

5.5.2. 244 1.4 MHz Exciter

The AF input signals are connected to the compressor through an input selector. The microphone and line inputs are open only if the terminals 4 and 8 are both HIGH. The telex AF input is open only if terminal 8 is LOW. The tone input is always open.

The gain of the compressor is controlled by means of the field effect transistor TR2, which functions as a variable emitter resistor for the left hand transistor in IC1. The control voltage is provided by a rectifier consisting of the pair of IC1 transistors to the right, which detect the sideband level at the output of the crystal filter X1 (or X2). When terminal 4 is LOW the compressor is off as the resistance of TR2 is kept at its maximum value.

The compressed audio signal and a 1.4 MHz signal from the carrier level regulator IC2 are fed to the balanced mixer IC3. The output is a 1.4 MHz double sideband suppressed carrier signal that is fed through crystal filter X1 (or X2) which removes the upper sideband (or the lower sideband) and suppresses the carrier still further.

The gain of the amplifier stages following the filter is controlled from terminals 13, 14 and 15 by inserting different emitter resistors. In the A3H-mode all terminals are HIGH and the gain is determined by R76. Carrier re-insertion is performed by applying the 1.4 MHz signal from the carrier level regulator to TR7 via an attenuator controlled from the same terminals.

The filter shift is made by means of transistor TR4 controlled by the optional LSB/USB switch on the front panel or the remote control interface.

5.5.3. 302 RF Translator

The 1.4 MHz single sideband signal enters the RF translator through a 1.4 MHz filter. The load resistance of the filter is adjustable and can be set individually at each band by means of variable resistors. The signal is converted in the 1.4 to 38 MHz mixer IC1 to a 38 MHz signal by mixing the signal with the 36.6 MHz signal from the 36.6 MHz VCO. After removing the unwanted mixing products in a 38 MHz crystal filter the signal is fed to the 38 to 0-30 MHz mixer.

The 38 to 0-30 MHz mixer 302 IC7 is a double balanced passive mixer converting the signal to the transmitting frequency by mixing it with the injection frequency from the VCO_3. The signal is amplified in TR5 before the image signal is removed in the 7th order low-pass filter. The desired signal is amplified to FULL power level in TR9.

Before the signal leaves the board, it passes the stepattenuator controlled by the POWER switch setting or remote control interface. The attenuator is a modified T-attenuator attenuating 0dB, 6dB and approx. 12dB.

The reference frequency of 1.4 MHz is amplified in the buffer TR1 supplying the 1.4 MHz exciter 244 and the 36.6 MHz VCO. The reference frequency is derived from the TCXO in order to accomplish the necessary degree of frequency stability of the output signal from the voltage controlled oscillators

The 1.4 MHz reference frequency is divided by seven in the divider IC3 before it- as a 200 kHz signal - is fed to one of the input ports of the Phase Detector IC5. The output from the 36.6 MHz VCO is buffered up through TR13, TR14, TR7 and half of IC6 before it is divided by 183 in the synchronous divider consisting of IC9 and IC8 and the other half of IC6 which acts as presetting control.

The output of the VCO is amplitude regulated and fed to the 1.4 MHz to 38 MHz mixer IC1.

The selection of the variable resistor for the level setting is carried out by the band decoders IC2 and IC4 turning the diodes D1 to D17 (except D6) on and off.

5.5.4. M 234 Control Circuit and Tone Generators

The mode control signals from the MODE switch, the A3H simplex signal from the frequency memory in 303 and the MF information from the transmitter power amplifier are the input signals to the programmable read only memory (PROM), IC5, of the Mode Selector. The PROM has been programmed to give at the output the desired control signals corresponding to the wanted mode.

The mode selector controls the input selector and the mode setting of the 1.4 MHz exciter 244 via the respective control leads. The 1.5 kHz SHIFT output tells, when HIGH, the synthesizer to decrease its frequency by 1.5 kHz. In the F1 mode the anode voltage of the P.A. valves is lowered by means of a relay in the power pack controlled from transistor TR5. Automatic selection of FULL POWER is carried out by means of transistor TR4, when A3H simplex (terminal 14a LOW) and TRANSMIT ALARM (output O_6 of IC5 LOW) are selected. The mode selector further controls the key selector.

Keying of the transmitter is only possible from the MORSE KEY input in the A2H and A1 modes, from the TELEX KEY input in the F1 mode, from the HANDSET KEY input in the A3A, A3J, A3H and TRANSMIT ALARM modes, and from the DUPLEX input in the F1, A3A, A3J, A3H or TRANSMIT ALARM modes, provided A3H simplex is not selected as the DUPLEX input is then inhibited. Furthermore the information on terminal 24a (WT) has to be in accordance with the mode selected: HIGH at A2H, A1 and F1, LOW at A3A, A3J, A3H or TRANSMIT ALARM. This is done by connection to the 1500 Hz shift control output at terminal 20c.

The keying signal at IC2, pin 8 controls, via an inverter, transistor TR9, supplying +12V to the output amplifier circuit of the RF translator 302 and activating the keyline to the power pack. In SIMPLEX it supplies base current to TR8 controlling the muting of the receiver.

The two-tone alarm signal generator incorporates the 45 sec. timer the 2Hz astable multivibrator and the 2.2 kHz and 1.3 kHz oscillators. The 45 sec. timer is enabled from the mode selector in TEST ALARM and TRANSMIT ALARM and can be started by pushing the ALARM START push-button that applies +12V to terminal 2c. Via the voltage divider R32 and R33 a keying signal is applied to the key selector. The 2Hz astable multivibrator starts and supplies base current to TR6 and TR11 alternatively. The audio signal from the oscillators is, via the tone keyer, applied to the 1.4 MHz exciter 244 and, via the sidetone keyer, applied to the receiver audio amplifier.

In the A1 mode the 1.5 kHz oscillator is started. The audio signal is keyed in the sidetone keyer and the tone keyer which are both controlled from the morse key. Capacitor C8 and adjoining components at the gain control input of IC7 serve to shape the tone pulses correctly.

In the A2H mode the 2.2 kHz oscillator as well as the 1.5 kHz oscillator are on. R54 is connected to ground in IC4 thereby reducing the peak level of the audio signal at the tone keyer input to the same level as when only one tone is present. The sidetone keyer is connected to the 1.5 kHz oscillator only as TR12 is turned off by means of D24.

When the TUNE-button of the transmitter power amplifier is activated terminal 18c is LOW. A2H is selected by means of D1 and D3 the transmitter is keyed via IC2 pin 9, and the sidetone keyer is turned off by means of IC3 pin 1.

5.5.5. 207 Frequency Divider

There are three divider chains, their associated buffer amplifiers and two phase/freq. detectors located on this board.

The reference divider produces the 2 kHz reference frequency for the phase/freq. detector 1 and the 10 kHz reference signal for the phase/freq. detector 2 from a 1.4 MHz signal derived from the TCXO.

The variable divider chains are composed of programmable up-counters and their associated external gating logic. The dividing action is accomplished by presetting (programming) these counters with the data blocks corresponding to the contents in the displays at the end of each counting cycle. The data blocks contain the BCD 9's complement code of the corresponding digit.

In the loop 1 divider chain the WT modes information (e.g. A1, A2H and F1) is used to control the associated external gating logic. In the WT modes this chain counts 15 clockpulses less than in any other mode before concluding a counting cycle. Thus the contents of the data blocks are independent of the mode.

The loop 2 divider chain counts independent of the receiving mode and adds by means of the external gating logic 370 extra clock cycles to what is determined by the three most important digits before concluding a counting cycle.

The outputs from the variable dividers are led to their respective phase/freq. detectors and are here compared to the fixed reference frequency. In case of a frequency difference the detector will produce a DC error voltage which will adjust the associated VCO to establish the wanted frequency equality.

5.5.6. 208 Loop Translator

This circuit board contains one half of loop 3, namely the frequency comparator - 200 divider, the loop 3 mixer, with its associated 1.5 MHz low-pass filter and phase/freq. detector 3.

The VCO_1 output frequency is divided by 200 and fed as a variable reference frequency to one of the two input ports of phase/freq. detector 3. The output frequency of VCO_3 divided by 10 is fed to the loop mixer whose other injection signal is derived from VCO_2. The sum frequency from this mixing process is removed in a 13-order 1.5 MHz low-pass filter thus allowing only the difference frequency to pass on via the following buffer amplifier to the other port of phase/freq. detector 3. This detector is almost identical to the detectors mentioned in the description of board 207 .

If the VCO_2 output frequency is higher than the synthesizer output frequency divided by 10 at the beginning of an acquisition of loop 3 this loop will end in a stable, unlocked condition. To avoid this these two frequencies are compared. If the frequency of VCO_2 is the higher of the two the monostable multivibrator IC13 is triggered by the latch following the two divider chains and via the phase/freq. detector 3 the frequency of VCO_3 is forced to rise thus pulling loop 3 out of this unwanted condition.

The output pulse from the detector is smoothed by means of a simple RC-filter before leaving this circuit board.

5.5.7. 209 VCO_1 and VCO_2

The loop filter and voltage controlled oscillator of both loop 1 and loop 2 are located on this board.

Both of these filters are active 3rd order low-pass types with an integrated function incorporated. The purpose of the loop filters is to remove the pulses from the output of the phase/freq. detector and allow only the DC-information to pass on to the vari-cap diodes of the voltage controlled oscillators. By use of the phase error adjustment potentiometer the phase error pulse width can be minimized. Once adjusted this width will remain unchanged throughout the whole frequency range of the VCO, due to the use of an integrator in the loop filter. Both of the VCO's are amplitude regulated.

The selection of one of the three bands in which VCO_2 is operating is carried out by means of a decoding circuit on $\boxed{303}$.

5.5.8. 210 $\underline{VCO_3}$

This circuit board contains the loop 3 filter and the voltage controlled oscillator VCO_3.

The loop 3 filter consists of a low-pass filter and an integrator. The filter serves to remove the pulses of the phase/freq. detector output signal and allow only the DC information to pass on to the vari-cap diodes of VCO_3. By use of the phase error adjustment the phase error pulse width can be minimized, and once adjusted it will remain unchanged throughout the whole frequency range of VCO_3 due to the use of an integrator in the loop filter.

VCO_3 consists of three voltage controlled oscillators VCO_{3x}, VCO_{3y} and VCO_{3z}, each covering a band of approximately 10 MHz. The band selection is carried out by means of a decoding circuit on 303 .

The VCO_3 output signal is amplitude regulated and serves as an injection signal to the 38 to 0-30 MHz mixer in the signal path.

5.5.9. 240 Master Oscillator (Optional)

The oscillator itself is a sealed unit containing a highly stable TCXO (temperature compensated crystal oscillator) at 11.2 MHz. The output signal of the TCXO is amplified in the transistors TR1 to TR3 and fed to the binary counter IC1 which divides the input frequency by 8. The 1.4 MHz square wave signal is filtered in a tuned circuit C6, T1, and the resulting sine wave signal is fed to the output terminals.

TCXO's of two different manufactures may be used. In both cases crystal oscillator aging is very small (less than 10^{-6} per annum) and will be greatest during the first few years. Aging will normally cause an increase in frequency which in one case can be compensated for by introducing the connection indicated by the dotted line in the circuit diagram (this will reduce the frequency by approx. $2x10^{-6}$) and in the other case by changing the factory selected resistor. The resistor should be selected at 25°C ambient temperature to give a TCXO output frequency offset from the nominal frequency (11.2 MHz) by the amount marked on the can.

Frequency adjustment should be carried out only if a high quality counter is available for control of the frequency. It must be ensured that the accuracy of the counter at the time of use is better than 10^{-7}.

5.5.10. $\boxed{303}$ Display and Keyboard

When a key is pressed or released some sort of bouncing effect will always appear before the key has settled. This bouncing is removed by means of the Key Bounce Eliminator consisting of IC45 and its associated external components. When a key has settled after being pressed, a read-pulse is produced at pin 12 of IC45 and the BCD code of the key number in question is produced by IC46 and IC47.

Dependant upon whether the number key "#" is in its inner or outer position the read-pulse is passed to the first register in the No. register stack IC42 or to the first register in the frequency digit register stack IC41. The BCD code is at hand on the input of both register stacks. The direction of the read-pulse from IC45 and the clear pulse from the clear key are controlled by IC43 under control of the number key. The data blocks already stored in the register stack concerned are simultaneously shifted to the next register.

Two display modes are possible.

If the No. key S4 is open the outputs from the frequency digit register stack are enabled and the displays show the contents of the frequency digit register stack, and the transistor TR7 turns on the decimal point of display IC40.

If the No. key S4 is closed the No. display timer IC51 guides the contents of the No. digit register stack to the displays IC32 and IC40. IC37 and half of IC33 are enabled to pass the information. By means of TR1 some segments in the displays IC12 and IC13 are switched on together with the decimal point in IC23 forming the letters: "no." (short for frequency No.).

After approx. one second the No. display timer runs out and the outputs of the frequency memory PROMs IC20, IC24 and IC34 are enabled and passed to the displays indicating the frequency stored in the frequency memory.

The diodes D20 and D21 enable the the transmitter power amplifier T 5000 to select frequency No. zero when the band switch is set to distress frequency.

The frequency information is converted through the BCD to BCD9's complement converters IC11, IC3, IC21, IC26, IC30 and IC49 to BCD 9's complement code supplying the frequency dividers 207 with the frequency information for the synthesizer.

At the same time the three most significant digits, the "10 MHz", "1 MHz" and "100 kHz" digits are decoded in the BCD to binary decoders IC11, IC14 and IC15. The binary code controls the band information memory IC5, IC6, IC7, IC8, IC9 and the data selector IC2.

The band information memory PROMs contain the band information for the transmitter and the RF translator 302 . The information is stored in 100 kHz steps. Each address in the PROM contains 2 steps - the least significant four bits the first information, the most significant four bits the next information controlled by the data selector IC2. The band information is split up on five PROMs: IC9 contains information between 0 kHz and 6300 kHz, IC8 the information between 6400 kHz and 12700 kHz, IC7: 12800 kHz - 19100 kHz, IC6: 19200 kHz - 25500 kHz and IC5: 25600 kHz and up.

If the display indicates a frequency equal to or higher than 32 MHz the frequency digit register stack is cleared by means of IC11 pin 5. In the same way IC3 clears the stack if the frequency is equal to or greater than 30 MHz.

The input addresses for the frequency memory PROMs IC20, IC24 and IC34 are derived from the remote control interface in 301 SK1 or from the No. register stack IC36 and IC42 after code conversion in IC39.

If a frequency No. greater than 31 is keyed in, IC39 clears the No. register stack.

5.5.11. 241 Programming Unit (Optional)

The purpose of this printed circuit board is to make it possible to program manually the PROMs used as building blocks in the memories in the 303 Display and Keyboard.

The only types of PROMs which can be programmed by means of the programming unit are the TI-types shown in table 3.1.1.

Three PROMs together can contain the information of 32 different frequency Nos. The three PROMs are placed in SK1, SK2 and SK3. Their input word address is chosen by means of the keyboard on the front panel, thus selecting one of the 32 possible words in each of the three PROMs.

A programmed output will be greater than 2V (HIGH), and an unprogrammed output will be less than 0.8V (LOW).

Half of IC4 is always sensing the voltage level on pin 9 of SK1. If this voltage level is HIGH, pin 5 of IC4 will also become HIGH after the first positive transition of the clock pulse at pin 3, thus disabling IC2 and thereby IC6 and IC8 from being activated by the key S1. This is irrelevant in E 5002.

The outputs from the six monostable multivibrators IC2, IC6 and IC8 are combined by means of 4/6 IC5, 2/4 IC7 and 1/4 IC3 into three pulse-trains, one for the V_{CC}-pins, one for the enable pins of the three PROMs and lastly one for the transistor TR1. This transistor sinks the programming current from the PROM-output to which the programming pin is connected.

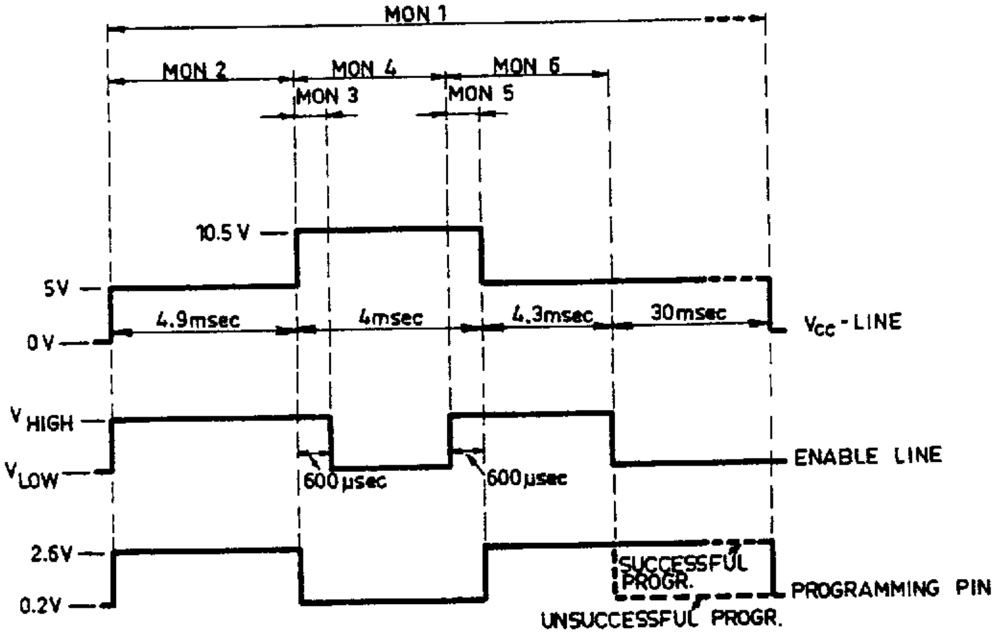
The three pulse-trains are shown on the next page.

The two voltage levels of the V_{CC}-pins of the PROMs are stabilized by means of D3 and IC9.

In order to keep the PROMs as cool as possible which is very essential to obtain good programming results their V_{CC} supply line only receives a 5V pulse in 5 msec out of 100 msec during the period of time where no programming takes place. This pulsed operation is controlled by a clock-pulse generated by IC1 opening and closing via 2/4 IC3 and 2/6 IC5, the transistor TR2. At the end of each 5 msec period the logic levels of pin 9 of SK1 and the programming pin are read into the two D-flipflops of IC4; a HIGH level, corresponding to a programmed bit location will make the associated lamp light.

When the key SK1 is activated and MON1 of IC2 is triggered, the clock generator IC1 is stopped. Once the programming pulse-trains have been accomplished the clock generator is allowed to start again after a delay of approximately 30 msec.

A delay circuit consisting of R71, R72, C12 and D4 prevents the V_{CC}-programming pulse from being generated when the programming unit is first switched on. This prevents falsely generated signals to IC2. This is accomplished by turning off TR2 via 1/4 IC3 and 2/6 IC5 until all the voltage levels have stabilized.



MON 1
MON 2
MON 4
MON 6
MON 3
MON 5
10.5 V
5V
0 V
4.9msec
4msec
4.3msec
30msec
Vcc - LINE
V HIGH
V LOW
600 µsec
600 µsec
ENABLE LINE
2.6V
0.2V
SUCCESSFUL PROGR.
UNSUCCESSFUL PROGR.
PROGRAMMING PIN

6. Simple Service

6.1. Incorrect Operation

If the equipment is not functioning correctly, a check should be made that it is being operated properly. Go through the tuning procedure 2.1. if necessary.

6.2. Battery

The condition of the battery should be checked at frequent intervals. The battery must always be fully charged and should be topped up frequently with distilled water (liquid should be 5 to 10 mm above the plates).

6.3. Checking the Antenna Tuning

The antenna tuning may be checked by adjusting the transmitter as described in section 2.3., preferably on one of the frequencies that was listed in the tuning chart when the equipment was installed.

Then set POWER switch to SIMPLEX, MEDIUM and CHECK SWITCH to LEVEL. Pull the CHECK SWITCH knob out and press TUNE button. Note the meter reading.

Set POWER switch to SIMPLEX, FULL and press TUNE button. Note ANTENNA CURRENT reading.

Compare the readings with the values listed in the tuning chart. If the two readings differ appreciably from the listed values and the transmitter is otherwise functioning normally, the fault can be expected to be in the antenna system or in the transmitter earth connection.

Accordingly the following check should be made.

Have any changes been made in antenna or earth connections since the installation was made?

Have any changes been made in the rigging or in the placement of the derricts etc.?

Is leakage present on the antenna, possibly caused by moisture or dirt on the antenna insulators?

6.4. Using the CHECK SWITCH

The CHECK SWITCH is normally inoperative. Pulling the switch knob out will switch the ANTENNA CURRENT meter to read the voltage or current selected with the switch. When released the knob will return to its original position.

The meter reading in all positions except LEVEL is approx. 3 under normal conditions, i.e. transmitter adjusted as described in section 2.3., POWER switch set to FULL and TUNE button pressed.

Position of CHECK SWITCH	Check of	Deflection to 3 corresponds to approx.	Actual deflection
V_A	anode DC voltage	1700V	2.4 to 3.5 dependent on supply voltage
V_{S1}	screen grid voltage of valve no. 1	300V	
V_{S2}	screen grid voltage of valve no. 2	300V	2.4 to 3.6 dependent on valve characteristics
V_G	control grid bias	-49V	2.3 to 3.7 dependent on valve characteristics
I_1	cathode current of valve no. 1	165 mA	
I_2	cathode current of valve no. 2	165 mA	
V_D	supply voltage to driver amplifier	28V	

Table 6.4.1.

6.5. Replacement of Fuses

All fuses, except the high tension fuse, are accessible on the front panel of the power pack. The high tension fuse becomes accessible when the power pack is pulled out.

NOTE: Set SUPPLY switch to OFF and open external supply voltage switch before opening the equipment and replacing fuses. Short circuit both ends of high tension fuse to chassis using an insulated tool before touching it.

Fuse ratings are given in table 6.5.1. and table 6.5.2. below. Fuses with marked ratings within 5 per cent of the ratings given must be used. Note that slow or fast blowing fuses must be used where specified.

Fuse Rating	Designation	Front Panel Fuses (from left to right)	Symptom if fuse is blown
1.6A fast	260FS 5	7.5V to receiver	no light in display
1.6A fast	260FS 6	15.7V to receiver and exciter	no light in displays, negative deflection on CHECK SWITCH position V_G
3.15A fast	260FS 3	7.5V to exciter	no light in displays
40A fast	260FS 2	24V battery input (LT and HT converters)	no light in displays
8A fast	260FS 1	24V battery input (RL 1, filament supply, blower)	no light in displays no cabinet light
1.6A fast	260FS 4	28V to driver in T 5000	no reading on CHECK SWITCH position V_D
0.5A fast	260FS 8	600V screen grid supply	no reading on CHECK SWITCH positions V_{S1} and V_s
		High tension fuse	
0.5A HT	260FS 7	1700V to anodes	no reading in CHECK SWITCH position V_A

Fuse Rating, 24V DC Power Pack P 5000
Table 6.5.1.

Fuse Rating	Designation	Front Panel Fuses (from left to right)	Symptom if fuse is blows
1.6A fast	265FS 3	7.5V to receiver	no light in display
1.6A fast	265FS 7	15.7V to receiver and exciter	no light in displays negative deflection in CHECK SWITCH position V_G
3.15A fast	265FS 2	7.5V to exciter	no light in display
8/16A slow	265FS 1	mains input	no light in displays no cabinet light
8A fast	265FS 8	filament supply	no reading in CHECK SWITCH positions I_1 and I_2
1.6A fast	265FS 6	28V to driver in T 5000	no reading in CHECK SWITCH position V_D
0.5A fast	265FS 5	600V screen grid supply	no reading in CHECK SWITCH positions V_{S1} and V_{S2}
		High tension fuse	
0.5A HT	265FS 4	1700V to anodes	no reading in CHECK SWITCH position V_A

Fuse Rating, AC Power Pack P 5001
Table 6.5.2.

7. REPAIR AND ALIGNMENT

7.1. Introduction

Repairs and adjustments on the equipment should be performed only by qualified technicians to whom this chapter is addressed. Before attempting any repairs or adjustments a study of Chapter 5, Technical Description, is recommended.

7.2. Cross-Slot Screws

The cross-slot screws used to secure the printed circuit boards are Pozidriv screws. A Pozidriv screwdriver No. 1 should be used in order to avoid damaging such screws.

7.3. Locating Subunits and Components

Locations of circuit boards in the equipment appear from the photographs on pages 8-   to 8-   . Locations of components on each circuit board appear on the component location drawings against the respective circuit diagrams.

7.4. Locating Faults

Fault finding, as described in section 7.5. below, is aided by test points provided for the purpose of permitting rapid localization of faulty circuit boards on the basis of DC measurements. Since not all types of faults can be traced by means of DC measurements, supplementary AC measurements with an oscilloscope may be required; see section 7.6. To facilitate fault finding on each individual circuit board typical voltages are listed on the circuit diagrams.

7.5. Test Points

Several circuit boards contain one or more test points. They are small pin-type terminals, colour coded following the standard colour code in addition to being numbered. In the circuit diagrams, test points are marked TP 1 , TP 2 etc., and typical voltages at the test points are listed there.

The terminals of the circuit boards may to a great extent also be regarded as test points. Typical voltages are therefore also listed against relevant terminals on the circuit diagrams.

If a voltage measured at a test point differs markedly from the listed value it is a fairly certain indication that the circuit board in question is faulty, assuming that the voltages applied to the circuit board are the correct ones. This should likewise be checked.

7.6. AC Voltages

AC voltages listed in the circuit diagrams are typical voltages. Voltages specified are based on measurement with an oscilloscope having an input impedance of 10 Mohms in parallel with 7 pF, a sensitivity of the order of 50 mV/div and a frequency range of not less than DC -50 MHz.

AC voltage values measured in the signal path of the transmitter can be measured only if the transmitter is modulated with a two-tone signal. This can be done by pressing the TUNE button of the transmitter.

7.7. DC Voltages

DC voltages listed in the circuit diagrams are based on measurement with a 25 kohms/Volt multimeter. If a stated voltage is dependent on the setting of a control this is also stated on the circuit diagrams. Typical logic levels (LOW/HIGH) are indicated in brackets.

7.8. Adjustments

The following sections describe alignment procedures for printed circuit boards that contain adjustable components. Bear in mind that no adjustments should be carried out unless there is a clear indition that it is really necessary. Moreover, adjustments should be carried out only by a qualified technician with the necessary equipment at his disposal.

When a unit or printed circuit board is replaced adjustments are in some cases necessary. These cases are listed in the table below.

Replacement of unit or board	Adjustment required of	Procedure given in
E 5002	Level setting	Transmitter manual section 7.8.3.
244	244-R15 Level setting	section 7.9.2. Transmitter manual section 7.8.3.
$\boxed{302}$	Level setting	Transmitter manual section 7.8.3.
M 234	244-R15	section 7.9.2.
209	209-R13 209-R14	section 7.13.3. section 7.13.4.
210	210-RS	section 7.14.2.
T 5000/T 5001/ T 5002	Level setting	Transmitter manual section 7.8.3.

7.9. 244 Realignment of 1.4 MHz Exciter

Measuring equipment:

Oscilloscope having a sensitivity better than 50mV/div. Input impedance 10 Mohm in parallel with 20 pF or less.

7.9.1. Realignment of 244R6, Microphone Sensitivity:

The microphone sensitivity potentiometer is normally fully clockwise, corresponding to full sensitivity. When the transmitter is installed where there is a high acoustic noise level it can be advantageous to reduce the sensitivity by turning the potentiometer half or fully anticlockwise. This has the effect of reducing the background noise coming up in speech pauses. The compressor ensures that the transmitter is still fully modulated by the speech signal.

7.9.2. Realignment of 244 R15:

Control settings: SUPPLY switch: STAND BY.

1. Connect oscilloscope to test point 244 TP7.
2. Unsolder brown lead to terminal 244-4.
3. Set potentiometer 244 R15 to the middle of its range.
4. Press TUNE button and adjust sensitivity of oscilloscope to give full screen peak to peak deflection.
5. Resolder brown lead to terminal 244-4.
6. Press TUNE button and adjust 244 R15 to give exactly the same deflection on oscilloscope as before.

7.9.3. Realignment of 244 R44, Balance:

Control settings: SUPPLY switch: STAND BY
MODE switch: A3J

1. Connect oscilloscope to the hot end of 244 R61.
2. Adjust potentiometer 244 R44 for minimum deflection on oscilloscope.

7.9.4. Realignemnt of 244 R48, Carrier Level:

Control settings: SUPPLY switch: STAND BY
MODE switch: A3H

1. Connect oscilloscope to 244 C44/244 L6.
2. Press TUNE button and adjust sensitivity of oscilloscope to give full screen peak to peak deflection.
3. Unsolder grey lead to terminal 244-13.
4. Press TUNE button and adjust 244 R48 to give exactly the same peak deflection as before.
5. Resolder grey lead to terminal 244-13.

Above procedure implies that 244 R15 is correctly adjusted (paragraph 7.9.2.).

7.9.5. Realignment of 244 T1:

Control settings: SUPPLY switch: STAND BY.

1. Connect oscilloscope to test 244 TP7
2. Press TUNE button and adjust 244 T1 for maximum deflection on oscilloscope.

7.9.6. Realignment of 244 L6:

Control settings: SUPPLY switch: STAND BY

1. Connect oscilloscope to 244 C44/ 244 L6.
2. Connect a shorting strap across capacitor 303 C1.
3. Press TUNE button and adjust 244 L6 for maximum deflection on oscilloscope.
4. Remove shorting strap.

7.10. [302] Realignment of RF Translator

Measuring equipment:

Oscilloscope having a sensitivity better than 50mV/div. Input impedance 10 Mohm in parallel with 20 pF or less. Frequency range up to 50 MHz.

Standard Signal Generator covering the range 20-40 MHz and having a frequency accuracy better than 10^{-4} and an output voltage of at least 3V in 50 ohms.

7.10.1. Realignment of 302 T1, 1.4 MHz input transformer:

Control settings: SUPPLY switch: STAND BY

1. Connect oscilloscope to 244 C44/ 244 L6.
2. Press TUNE button and adjust T1 for minimum deflection on oscilloscope.

7.10.2. Realignment of 302 R18, balance of 1.4 to 38 MHz mixer:

Control settings: SUPPLY switch: STAND BY
MODE switch: A3J
POWER switch: DUPLEX

1. Connect oscilloscope to R45/R55.
2. Adjust R18 for minimum deflection on oscilloscope.

7.10.3. Realignment of 30 MHz Low Pass Filter:

Control settings: SUPPLY switch: STAND BY
MODE switch: A3J
POWER switch: DUPLEX-FULL.

1. Connect oscilloscope to the BNC-socket 301 SK5 through a 50 ohms load.
2. Remove strap between terminals 302-3 and 302-4 and connect signal generator between terminals 302-3 and 302-5 (302-5 ground).
3. Detune the three circuits of the filter by turning the cores anti-clockwise.
4. Set signal generator to 52.5 MHz, approx. 2V.
5. Adjust L5 to minimum deflection on oscilloscope.
6. Set signal generator to 46.0 MHz, approx. 2V.

7. Adjust L4 to maximum deflection on oscilloscope.

8. Set signal generator to 28.0 MHz and an output giving approx. 1.5 Vpp on the oscilloscope.

9. Adjust L5 to maximum deflection on oscilloscope.

10. Remove signal generator and resolder the strap between terminals 302-3 and 302-4.

7.10.4. Realignment of 302 L6, 36.6 MHz VCO:

Control settings: SUPPLY switch: STAND BY

1. Connect oscilloscope to IC5 pin 3.

2. Adjust L6 to symmetry of the square wave (e.g. 50% duty cycle).

7.10.5. Realignment of 302 T2, 36.6 MHz Transformer.

Control settings: SUPPLY switch: STAND BY
MODE switch: A3J.

1. Connect oscilloscope to IC1 pin 1 and ground at pin 13.

2. Adjust T2 for maximum deflection on oscilloscope.

7.10.6. Realignment of Level Setting Potentiometers

The level setting potentiometers control the RF drive voltage to the transmitter and is therefore described in the transmitter manual. (The T 5002 manual paragraph 7-).

7.11. M 234 Realignment of Control Circuit and Tone Generators

Measuring equipment:

Frequency Counter having an accuracy better than 10^{-4} and a sensitivity of at least o.5V.

Extender Board 259.

7.11.1. Realignment of 234 T1 and 234 T2:

Control settings: SUPPLY switch: STAND BY
MODE switch: TEST ALARM

1. Insert extender board.

2. Connect frequency counter between terminals 234-32c and 234-4c (ground).

3. Connect the adjustment terminals marked 1 and 2 together.

4. Depress and release ALARM START pushbutton.

5. Adjust 234 T1 until counter reads 2200 Hz ± 1 Hz.

6. Remove connection referred to in point 3 above.

7. Connect the terminals marked 2 and 3.

8. Depress and release ALARM START button.

9. Adjust 234 T2 until counter reads 1300 Hz ± 1 Hz.

10. Remove connection referred to in point 7 above.

7.11.2. Realignment of 234 T3:

Control settings: SUPPLY switch: STAND BY
MODE switch: A1

1. Insert extender board.
2. Connect frequency counter between terminals 234-32c and 234-4c (ground).
3. Depress morse key or alternatively short circuit the terminals of the jack socket 300 SK2.
4. Adjust 234 T3 until counter reads 1500 Hz ± 1 Hz.

7.12. 208 Realignment of Loop Translator

Measuring Equipment:

Signal Generator covering the range 100 kHz to 10 MHz.

Oscilloscope or RF Voltmeter having an input impedance greater than 10 kohm and a sensitivity of at least 10 mV/div.

Extension board 259.

7.12.1 Realignment and Check of 1.5 MHz LP-filter:

Control settings: SUPPLY switch: STAND BY
Frequency selected: Greater than 5 MHz.

1. Remove PCBs 209 and 210 from their sockets.
2. Adjust the cores of L2, L3, L4 and L5 until they are flush with the top of the coil former.
3. Connect the signal generator to pin 12 of 208 IC4 through a 0.1 pF capacitor and common.
4. Connect the oscilloscope probe tip to the collector of 208 TR5 and the oscilloscope ground clip to common.
5. Adjust the signal generator to 20mV rms.
6. Sweep the signal generator from 60 kHz to 1.45 MHz; the voltage reading level on the oscilloscope must not change more than 1 dB. (Take care that the output level of the signal generator does not change during the sweep).
7. Readjust the signal generator until the signal level measured is decreased by 3 dB relative to the maximum signal level found under 5). The frequency should then be between 1.5 MHz and 1.9 MHz.
8. Readjust the signal generator until the signal level measured is decreased by 20 dB relative to the maximum signal found under 5). The frequency should then be between 1.8 MHz and 1.9 MHz.

7.12.2. Realignment of Transformer 208 T1:

Control settings: SUPPLY switch: STAND BY

1. Insert the PCB 207 into its socket.
2. Select by means of the keyboard 29,900.0 MHz as the transmitting frequency.

3. Connect the oscilloscope probe tip to pin 1 of 208 IC4.
4. Adjust the transformer 208 T1 until the signal measured is approximately 2Vpp.

7.13. 209 Realignment of VCO_1 and VCO_2

Measuring equipment:

Oscilloscope having an input impedance of 10 Mohms in parallel with 20 pF or less.

Frequency Counter having an accuracy better than 10^{-3} and a sensitivity of at least 0.5V.

Extension Board 259.

7.13.1. Realignment of VCO_1:

Control settings: SUPPLY switch: STAND BY

1. Connect a shorting lead between terminal 209-32c and common.
2. Connect the frequency counter between 209-22c and common.
3. Adjust transformer 209 T1 until the counter reads 23.0 MHz.
4. Remove the shorting lead referred to in (1).

7.13.2. Realignment of VCO_2:

Control settings: SUPPLY switch: STAND BY

1. Connect shorting lead between terminal 209-2c and common.
2. Connect the frequency counter between 209-16c and common.
3. Select the (3.7-4.69) MHz VCO_2-band. (A frequency between 100 kHz and 10 MHz as transmitting frequency).
4. Adjust transformer 209 T2 until the counter reads 5.0 MHz.
5. Select the (4.70-5.69) MHz VCO_2-band. (A frequency between 10 MHz and 20 MHz as transmitting frequency).
6. Adjust coil 209 L6 until the counter reads 6.1 MHz.
7. Select the (5.70-6.69) MHz VCO_2-band. (A frequency between 20 MHz and 30 MHz as transmitting frequency).
8. Adjust coil 209 L5 until the counter reads 7.1 MHz.
9. Remove the short circuit referred to in 1.

7.13.3. Realignment of Phase/Frequency Detector 1 Error Signal:

Control settings: SUPPLY switch: STAND BY

1. Connect the oscilloscope between 209-32c and common.
2. Adjust 209 R13 for minimum puls width.

7.13.4. Realignment of Phase/Frequency Detector 2 Error Signal:

Control settings: SUPPLY switch: STAND BY
Frequency selected: Greater than 1 MHz.

1. Connect the oscilloscope between 209-2c and common.

2. Adjust 209 R14 for minimum pulse width.

7.14. 210 Realignment of VCO_3

Measuring equipment:

Oscilloscope having an input impedance of 10 Mohms in parallel with 20 pF or less.

Frequency Counter having an accuracy better than 10^{-3}, a sensitivity of at least 1V and an upper frequency limit of at least 75 MHz.

Extension Board 259.

7.14.1. Realignment of 210 C24, 210 C26, 210 C28, VCO_3:

Control settings: SUPPLY switch: STAND BY

1. Connect a shorting lead between terminal 210-6c and common.
2. Connect the frequency counter between 210-16c and common.
3. Select VCO_{3z}. (A frequency between 100 kHz and 10 MHz as transmitting frequency).
4. Adjust 210 C24 until the counter reads 51.0 MHz.
5. Select VCO_{3y} (A frequency between 10 MHz and 20 MHz as transmitting frequency).
6. Adjust 210C26 until the counter reads 61.3 MHz.
7. Select VCO_{3x} (A frequency between 20 MHz and 30 MHz as transmitting frequency).
8. Adjust 210 C28 until the counter reads 71.3 MHz.
9. Remove the shorting lead referred to in 1.

7.14.2. Realignment of 210 R5 Phase/Frequency Detector 3 Error Signal:

Control settings: SUPPLY switch: STAND BY
Frequency selected: Greater than 1 MHz.

1. Connect the oscilloscope between the junction of 208 R48 / 208 R49 and common.
2. Adjust 210 R5 for minimum pulse width.

7.15. 240 Realignment of Master Oscillator

Measuring equipment:

Oscilloscope having an input impedance of 10 Mohms in parallel with 20 pF or less.

Frequency counter, accuracy better than 10^{-7}.

7.15.1. Realignment of 240 T1, 1.4 MHz coil:

Control settings: SUPPLY switch: STAND BY

1. Connect oscilloscope to terminals 240-2 and 240-3 (ground).
2. Adjust 240 T1 for maximum deflection on oscilloscope.

7.15.2a Realignment of TCXO frequency (in case of an ITT TCXO):

Control settings: SUPPLY switch: STAND BY

1. Connect the counter to IC1 pin 1.
2. At approx. 25° C the frequency must be within ± 2 Hz of the nominal frequency 11.2 MHz ± the offset frequency (marked on the top of the metal case).

If the frequency is not within these limits, the value of the resistor R2 must be changed, generally with a lower value. A resistor can therefore normally be placed in parallel with R2.

7.15.2b Realignment of TCXO frequency (in case of a Philips TCXO):

Control settings: SUPPLY switch: STAND BY

1. Connect the counter to the IC1 pin 1.
2. If the frequency is higher than 11,200,011 Hz, the connection indicated by the dotted line in the circuit diagram must be introduced. (This will reduce the frequency by approx. 2 ppm).

INPUT (MF) (A3H Simplex) Mode switch

OUTPUT

	$A_4A_3A_2A_1A_0$		$O_7O_6O_5O_4O_3O_2O_1O_0$	Mode of operation
0	0 0 0 0 0	Transmit Alarm	1 1 1 1 1 0 1 1	A2H
1	0 0 0 0 1	Test Alarm	1 1 1 1 1 0 1 1	A2H
2	0 0 0 1 0	A2H	1 1 1 1 1 0 1 1	A2H
3	0 0 0 1 1	AI	1 1 1 1 1 0 1 1	A2H
4	0 0 1 0 0	FI	1 1 1 1 1 0 1 1	A2H
5	0 0 1 0 1	A3A	1 1 1 1 1 0 1 1	A2H
6	0 0 1 1 0	A3J	1 1 1 1 1 0 1 1	A2H
7	0 0 1 1 1	A3H	1 1 1 1 1 0 1 1	A2H
8	0 1 0 0 0	Transmit Alarm	1 1 1 1 1 0 1 1	A2H
9	0 1 0 0 1	Test Alarm	0 0 1 0 1 1 1 1	Test Alarm
10	0 1 0 1 0	A2H	1 1 1 1 1 0 1 1	A2H
11	0 1 0 1 1	AI	0 1 1 1 1 0 1 1	AI
12	0 1 1 0 0	FI	1 1 1 1 1 0 1 1	A2H
13	0 1 1 0 1	A3A	1 1 1 1 1 0 1 1	A2H
14	0 1 1 1 0	A3J	1 1 1 1 1 0 1 1	A2H
15	0 1 1 1 1	A3H	1 1 1 1 1 0 1 1	A2H
16	1 0 0 0 0	Transmit Alarm	0 0 0 0 1 1 1 1	Transmit Alarm
17	1 0 0 0 1	Test Alarm	0 0 1 0 1 1 1 1	Test Alarm
18	1 0 0 1 0	A2H	0 1 0 0 1 1 1 1	A3H
19	1 0 0 111	AI	0 1 0 0 1 1 1 1	
20	1 0 1 0 0	FI	0 1 0 0 1 1 1 1	A3H
21	1 0 1 0 1	A3A	0 1 0 0 1 1 1 1	A3H
22	1 0 1 1 0	A3J	0 1 0 0 1 1 1 1	A3H
23	1 0 1 1 1	A3H	0 1 0 0 1 1 1 1	A3H
24	1 1 0 0 0	Transmit Alarm	0 0 0 0 1 1 1 1	Transmit Alarm
25	1 1 0 0 1	Test Alarm	0 0 1 0 1 1 1 1	Test Alarm
26	1 1 0 1 0	A2H	1 1 1 1 1 0 1 1	A2H
27	1 1 0 1 1	AI	0 1 1 1 1 0 1 1	AI
28	1 1 1 0 0	FI	0 1 1 0 0 1 0 1	FI
29	1 1 1 0 1	A3A	0 1 0 0 1 1 1 0	A3A
30	1 1 1 1 0	A3J	0 1 0 0 1 0 1 1	A3J
31	1 1 1 1 1	A3H	0 1 0 0 1 1 1 1	A3H

Function Table for 234M IC5
32 x bit Prom of Control Circuit and Tone Generators M 234

The MODES Transmit Alarm and Test Alarm are only accessible from the Remote Control Interface and from the frontpanel MODE Switch in conjunction with T 5000 and on request.

Input	frq input MHz in binary code						9's compliment							output
								10 MHz			1 MHz			
	2^4	2^3	2^2	2^1	2^0		$(\overline{\text{clear}})$	8	2+4	1	8	4	2	1
	A_4	A_3	A_2	A_1	A_0		O_7	O_6	O_5	O_4	O_3	O_2	O_1	O_0
0	0	0	0	0	0		1	1	0	1	1	0	0	1
1	0	0	0	0	1		1	1	0	1	1	0	0	0
2	0	0	0	1	0		1	1	0	1	0	1	1	1
3	0	0	0	1	1		1	1	0	1	0	1	1	0
4	0	0	1	0	0		1	1	0	1	0	1	0	1
5	0	0	1	0	1		1	1	0	1	0	1	0	0
6	0	0	1	1	0		1	1	0	1	0	0	1	1
7	0	0	1	1	1		1	1	0	1	0	0	1	0
8	0	1	0	0	0		1	1	0	1	0	0	0	1
9	0	1	0	0	1		1	1	0	1	0	0	0	0
10	0	1	0	1	0		1	1	0	0	1	0	0	1
11	0	1	0	1	1		1	1	0	0	1	0	0	0
12	0	1	1	0	0		1	1	0	0	0	1	1	1
13	0	1	1	0	1		1	1	0	0	0	1	1	0
14	0	1	1	1	0		1	1	0	0	0	1	0	1
15	0	1	1	1	1		1	1	0	0	0	1	0	0
16	1	0	0	0	0		1	1	0	0	0	0	1	1
17	1	0	0	0	1		1	1	0	0	0	0	1	0
18	1	0	0	1	0		1	1	0	0	0	0	0	1
19	1	0	0	1	1		1	1	0	0	0	0	0	0
20	1	0	1	0	0		1	0	1	1	1	0	0	1
21	1	0	1	0	1		1	0	1	1	1	0	0	0
22	1	0	1	1	0		1	0	1	1	0	1	1	1
23	1	0	1	1	1		1	0	1	1	0	1	1	0
24	1	1	0	0	0		1	0	1	1	0	1	0	1
25	1	1	0	0	1		1	0	1	1	0	1	0	0
26	1	1	0	1	0		1	0	1	1	0	0	1	1
27	1	1	0	1	1		1	0	1	1	0	0	1	0
28	1	1	1	0	0		1	0	1	1	0	0	0	1
29	1	1	1	0	1		1	0	1	1	0	0	0	0
30	1	1	1	1	0	over range	0	1	0	1	1	0	0	1
31	1	1	1	1	1		0	1	0	1	1	0	0	1

Function Table for 303 IC 3 (382 239 51)
32 x 8 bit Prom binary to 9's complement converter in Display and Keyboard 303

Input	BCD input: MSD 2^1	2^0	LSD 2^3	2^2	2^1		don't care O_7	O_6	O_5	$\overline{\text{(clear)}}$ O_4	Binary output 2^4	2^3	2^2	2^1
	A_4	A_3	A_2	A_1	A_0		O_7	O_6	O_5	O_4	O_3	O_2	O_1	O_0
0	0	0	0	0	0	0 - 1	0	0	0	1	0	0	0	0
1	0	0	0	0	1	2 - 3	0	0	0	1	0	0	0	1
2	0	0	0	1	0	4 - 5	0	0	0	1	0	0	1	0
3	0	0	0	1	1	6 - 7	0	0	0	1	0	0	1	1
4	0	0	1	0	0	8 - 9	0	0	0	1	0	1	0	0
5	0	0	1	0	1		0	0	0	0	1	1	1	1
6	0	0	1	1	0	irrelevant	0	0	0	0	1	1	1	1
7	0	0	1	1	1		0	0	0	0	1	1	1	1
8	0	1	0	0	0	10 - 11	0	0	0	1	0	1	0	1
9	0	1	0	0	1	12 - 13	0	0	0	1	0	1	1	0
10	0	1	0	1	0	14 - 15	0	0	0	1	0	1	1	1
11	0	1	0	1	1	16 - 17	0	0	0	1	1	0	0	0
12	0	1	1	0	0	18 - 19	0	0	0	1	1	0	0	1
13	0	1	1	0	1		0	0	0	0	1	1	1	1
14	0	1	1	1	0	irrelevant	0	0	0	0	1	1	1	1
15	0	1	1	1	1		0	0	0	0	1	1	1	1
16	1	0	0	0	0	20 - 21	0	0	0	1	1	0	1	0
17	1	0	0	0	1	22 - 23	0	0	0	1	1	0	1	1
18	1	0	0	1	0	24 - 25	0	0	0	1	1	1	0	0
19	1	0	0	1	1	26 - 27	0	0	0	1	1	1	0	1
20	1	0	1	0	0	28 - 29	0	0	0	1	1	1	1	0
21	1	0	1	0	1		0	0	0	0	1	1	1	1
22	1	0	1	1	0	irrelevant	0	0	0	0	1	1	1	1
23	1	0	1	1	1		0	0	0	0	1	1	1	1
24	1	1	0	0	0	30 - 31	0	0	0	1	1	1	1	1
25	1	1	0	0	1	32 - 33	0	0	0	0	1	1	1	1
26	1	1	0	1	0	34 - 35 over	0	0	0	0	1	1	1	1
27	1	1	0	1	1	36 - 37 range	0	0	0	0	1	1	1	1
28	1	1	1	0	0	38 - 39	0	0	0	0	1	1	1	1
29	1	1	1	0	1		0	0	0	1	1	1	1	1
30	1	1	1	1	0	irrelevant	0	0	0	1	1	1	1	1
31	1	1	1	1	1		0	0	0	1	0	0	0	0

Function table for 303 IC 11 + 303 IC 39 (382 239 61)
32 x 8 bit Prom BCD to Binary Converter in Display and Keyboard 303

Frequency Coverage in kHz	Input Address	O_7	O_6	O_5	O_4	O_3	O_2	O_1	O_0	Frequency Coverage in kHz
100.0 - 199.9	0	1	1	1	0	1	1	1	0	0.0 - 99.9
300.0 - 399.9	1	1	1	1	0	1	1	1	0	200.0 - 299.9
500.0 - 599.9	2	1	1	1	0	1	1	1	0	400.0 - 499.9
700.0 - 799.9	3	1	1	1	0	1	1	1	0	600.0 - 699.9
900.0 - 999.9	4	1	1	1	0	1	1	1	0	800.0 - 899.9
1100.0 - 1199.9	5	1	1	1	0	1	1	1	0	1000.0 - 1099.9
1300.0 - 1399.9	6	1	1	1	0	1	1	1	0	1200.0 - 1299.9
1500.0 - 1599.9	7	1	1	1	0	1	1	1	0	1400.0 - 1499.9
1700.0 - 1799.9	8	1	1	1	1	1	1	1	1	1600.0 - 1699.9
1900.0 - 1999.9	9	0	0	0	0	1	1	1	1	1800.0 - 1899.9
2100.0 - 2199.9	10	0	0	0	0	0	0	0	0	2000.0 - 2099.9
2300.0 - 2399.9	11	0	0	0	1	0	0	0	0	2200.0 - 2299.9
2500.0 - 2599.9	12	0	0	0	1	0	0	0	1	2400.0 - 2499.9
2700.0 - 2799.9	13	0	0	0	1	0	0	0	1	2600.0 - 2699.9
2900.0 - 2999.9	14	0	0	1	0	0	0	1	0	2800.0 - 2899.9
3100.0 - 3199.9	15	0	0	1	0	0	0	1	0	3000.0 - 3099.9
3300.0 - 3399.9	16	0	0	1	0	0	0	1	0	3200.0 - 3299.9
3500.0 - 3599.9	17	0	0	1	1	0	0	1	1	3400.0 - 3499.9
3700.0 - 3799.9	18	0	0	1	1	0	0	1	1	3600.0 - 3699.9
3900.0 - 3999.9	19	0	0	1	1	0	0	1	1	3800.0 - 3899.9
4100.0 - 4199.9	20	0	1	0	0	0	1	0	0	4000.0 - 4099.9
4300.0 - 4399.9	21	0	1	0	0	0	1	0	0	4200.0 - 4299.9
4500.0 - 4599.9	22	0	1	0	0	0	1	0	0	4400.0 - 4499.9
4700.0 - 4799.9	23	0	1	0	0	0	1	0	0	4600.0 - 4699.9
4900.0 - 4999.9	24	0	1	0	1	0	1	0	1	4800.0 - 4899.9
5100.0 - 5199.9	25	0	1	0	1	0	1	0	1	5000.0 - 5099.9
5300.0 - 5399.9	26	0	1	0	1	0	1	0	1	5200.0 - 5299.9
5500.0 - 5599.9	27	0	1	0	1	0	1	0	1	5400.0 - 5499.9
5700.0 - 5799.9	28	0	1	0	1	0	1	0	1	5600.0 - 5699.9
5900.0 - 5999.9	29	0	1	1	0	0	1	1	0	5800.0 - 5899.9
6100.0 - 6199.9	30	0	1	1	0	0	1	1	0	6000.0 - 6099.9
6300.0 - 6399.9	31	0	1	1	0	0	1	1	0	6200.0 - 6299.9

Function Table for 303 IC 9 Standard (382 246 21) 0 - 6.3
32 x 8 bit Prom of the Band Decoder Memory in Display and Keyboard $\boxed{303}$
for T 5002.

Frequency Coverage in kHz	Input Address	Output O_7	O_6	O_5	O_4	O_3	O_2	O_1	O_0	Frequency Coverage in kHz
6500.0 - 6599.9	0	0	1	1	0	0	1	1	0	6400.0 - 6499.9
6700.0 - 6799.9	1	0	1	1	0	0	1	1	0	6600.0 - 6699.9
6900.0 - 6999.9	2	0	1	1	0	0	1	1	0	6800.0 - 6899.9
7100.0 - 7199.9	3	0	1	1	1	0	1	1	1	7000.0 - 7099.9
7300.0 - 7399.9	4	0	1	1	1	0	1	1	1	7200.0 - 7299.9
7500.0 - 7599.9	5	0	1	1	1	0	1	1	1	7400.0 - 7499.9
7700.0 - 7799.9	6	0	1	1	1	0	1	1	1	7600.0 - 7699.9
7900.0 - 7999.9	7	0	1	1	1	0	1	1	1	7800.0 - 7899.9
8100.0 - 8199.9	8	0	1	1	1	0	1	1	1	8000.0 - 8099.9
8300.0 - 8399.9	9	0	1	1	1	0	1	1	1	8200.0 - 8299.9
8500.0 - 8599.9	10	1	0	0	0	1	0	0	0	8400.0 - 8499.9
8700.0 - 8799.9	11	1	0	0	0	1	0	0	0	8600.0 - 8699.9
8900.0 - 8999.9	12	1	0	0	0	1	0	0	0	8800.0 - 8899.9
9100.0 - 9199.9	13	1	0	0	0	1	0	0	0	9000.0 - 9099.9
9300.0 - 9399.9	14	1	0	0	0	1	0	0	0	9200.0 - 9299.9
9500.0 - 9599.9	15	1	0	0	0	1	0	0	0	9400.0 - 9499.9
9700.0 - 9799.9	16	1	0	0	0	1	0	0	0	9600.0 - 9699.9
9900.0 - 9999.9	17	1	0	0	0	1	0	0	0	9800.0 - 9899.9
10100.0 - 10199.9	18	1	0	0	1	1	0	0	1	10000.0 - 10099.9
10300.0 - 10399.9	19	1	0	0	1	1	0	0	1	10200.0 - 10299.9
10500.0 - 10599.9	20	1	0	0	1	1	0	0	1	10400.0 - 10499.9
10700.0 - 10799.9	21	1	0	0	1	1	0	0	1	10600.0 - 10699.9
10900.0 - 10999.9	22	1	0	0	1	1	0	0	1	10800.0 - 10899.9
11100.0 - 11199.9	23	1	0	0	1	1	0	0	1	11000.0 - 11099.9
11300.0 - 11399.9	24	1	0	0	1	1	0	0	1	11200.0 - 11299.9
11500.0 - 11599.9	25	1	0	0	1	1	0	0	1	11400.0 - 11499.9
11700.0 - 11799,9	26	1	0	0	1	1	0	0	1	11600.0 - 11699.9
11900.0 - 11999.9	27	1	0	0	1	1	0	0	1	11800.0 - 11899.9
12100.0 - 12199.9	28	1	0	1	0	1	0	1	0	12000.0 - 12099.9
12300.0 - 12399.9	29	1	0	1	0	1	0	1	0	12200.0 - 12299.9
12500.0 - 12599.9	30	1	0	1	0	1	0	1	0	12400.0 - 12499.9
12700.0 - 12799.9	31	1	0	1	0	1	0	1	0	12600.0 - 12699.9

Function Table for 303 IC 8 Standard (382 246 31) 6.4 - 12.7
32 x bit Prom of the Band Decoder Memory in Display and Keyboard $\boxed{303}$
for T 5002.

Frequency Coverage in kHz	Input Address	O_7	O_6	O_5	O_4	O_3	O_2	O_1	O_0	Frequency Coverage in kHz
12900.0 - 12999.9	0	1	0	1	0	1	0	1	0	12800.0 - 12899.9
13100.0 - 13199.9	1	1	0	1	0	1	0	1	0	13000.0 - 13099.9
13300.0 - 13399.9	2	1	0	1	0	1	0	1	0	13200.0 - 13299.9
13500.0 - 13599.9	3	1	0	1	0	1	0	1	0	13400.0 - 13499.9
13700.0 - 13799.9	4	1	0	1	0	1	0	1	0	13600.0 - 13699.9
13900.0 - 13999.9	5	1	0	1	0	1	0	1	0	13800.0 - 13899.9
14100.0 - 14199.9	6	1	0	1	0	1	0	1	0	14000.0 - 14099.9
14300.0 - 14399.9	7	1	0	1	0	1	0	1	0	14200.0 - 14299.9
14500.0 - 14599.9	8	1	0	1	1	1	0	1	1	14400.0 - 14499.9
14700.0 - 14799.9	9	1	0	1	1	1	0	1	1	14600.0 - 14699.9
14900.0 - 14999.9	10	1	0	1	1	1	0	1	1	14800.0 - 14899.9
15100.0 - 15199.9	11	1	0	1	1	1	0	1	1	15000.0 - 15099.9
15300.0 - 15399.9	12	1	0	1	1	1	0	1	1	15200.0 - 15299.9
15500.0 - 15599.9	13	1	0	1	1	1	0	1	1	15400.0 - 15499.9
15700.0 - 15799.9	14	1	0	1	1	1	0	1	1	15600.0 - 15699.9
15900.0 - 15999.9	15	1	0	1	1	1	0	1	1	15800.0 - 15899.9
16100.0 - 16199.9	16	1	0	1	1	1	0	1	1	16000.0 - 16099.9
16300.0 - 16399.9	17	1	0	1	1	1	0	1	1	16200.0 - 16299.9
16500.0 - 16599.9	18	1	0	1	1	1	0	1	1	16400.0 - 16499.9
16700.0 - 16799.9	19	1	0	1	1	1	0	1	1	16600.0 - 16699.9
16900.0 - 16999.9	20	1	1	0	0	1	0	1	1	16800.0 - 16899.9
17100.0 - 17199.9	21	1	1	0	0	1	1	0	0	17000.0 - 17099.9
17300.0 - 17399.9	22	1	1	0	0	1	1	0	0	17200.0 - 17299.9
17500.0 - 17599.9	23	1	1	0	0	1	1	0	0	17400.0 - 17499.9
17700.0 - 17799.9	24	1	1	0	0	1	1	0	0	17600.0 - 17699.9
17900.0 - 17999.9	25	1	1	0	0	1	1	0	0	17800.0 - 17899.9
18100.0 - 18199.9	26	1	1	0	0	1	1	0	0	18000.0 - 18099.9
18300.0 - 18399.9	27	1	1	0	0	1	1	0	0	18200.0 - 18299.9
18500.0 - 18599.9	28	1	1	0	0	1	1	0	0	18400.0 - 18499.9
18700.0 - 18799.9	29	1	1	0	0	1	1	0	0	18600.0 - 18699.9
18900.0 - 18999.9	30	1	1	0	0	1	1	0	0	18800.0 - 18899.9
19100.0 - 19199.9	31	1	1	0	0	1	1	0	0	19000.0 - 19099.9

Function Table for 303 IC 7 Standard (382 246 42) 12.8 - 19.1
32 x 8 bit Prom of the Band Decoder Memory in Display and Keyboard 303
for T 5002

Frequency Coverage in kHz	Input Address	O_7	O_6	O_5	O_4	O_3	O_2	O_1	O_0	Frequency Coverage in kHz
19300.0 - 19399.9	0	1	1	0	0	1	1	0	0	19200.0 - 19299.9
19500.0 - 19599.9	1	1	1	0	0	1	1	0	0	19400.0 - 19499.9
19700.0 - 19799.9	2	1	1	0	0	1	1	0	0	19600.0 - 19699.9
19900.0 - 19999.9	3	1	1	0	0	1	1	0	0	19800.0 - 19899.9
20100.0 - 20199.9	4	1	1	0	0	1	1	0	0	20000.0 - 20099.9
20300.0 - 20399.9	5	1	1	0	1	1	1	0	0	20200.0 - 20299.9
20500.0 - 20599.9	6	1	1	0	1	1	1	0	1	20400.0 - 20499.9
20700.0 - 20799.9	7	1	1	0	1	1	1	0	1	20600.0 - 20699.9
20900.0 - 20999.9	8	1	1	0	1	1	1	0	1	20800.0 - 20899.9
21100.0 - 21199.9	9	1	1	0	1	1	1	0	1	21000.0 - 21099.9
21300.0 - 21399.9	10	1	1	0	1	1	1	0	1	21200.0 - 21299.9
21500.0 - 21599.9	11	1	1	0	1	1	1	0	1	21400.0 - 21499.9
21700.0 - 21799.9	12	1	1	0	1	1	1	0	1	21600.0 - 21699.9
21900.0 - 21999.9	13	1	1	0	1	1	1	0	1	21800.0 - 21899.9
22100.0 - 22199.9	14	1	1	0	1	1	1	0	1	22000.0 - 22099.9
22300.0 - 22399.9	15	1	1	0	1	1	1	0	1	22200.0 - 22299.9
22500.0 - 22599.9	16	1	1	0	1	1	1	0	1	22400.0 - 22499.9
22700.0 - 22799.9	17	1	1	0	1	1	1	0	1	22600.0 - 22699.9
22900.0 - 22999.9	18	1	1	0	1	1	1	0	1	22800.0 - 22899.9
23100.0 - 23199.9	19	1	1	0	1	1	1	0	1	23000.0 - 23099.9
23300.0 - 23399.9	20	1	1	0	1	1	1	0	1	23200.0 - 23299.9
23500.0 - 23599.9	21	1	1	0	1	1	1	0	1	23400.0 - 23499.9
23700.0 - 23799.9	22	1	1	0	1	1	1	0	1	23600.0 - 23699.9
23900.0 - 23999.9	23	1	1	0	1	1	1	0	1	23800.0 - 23899.9
24100.0 - 24199.9	24	1	1	0	1	1	1	0	1	24000.0 - 24099.9
24300.0 - 24399.9	25	1	1	0	1	1	1	0	1	24200.0 - 24299.9
24500.0 - 24599.9	26	1	1	0	1	1	1	0	1	24400.0 - 24499.9
24700.0 - 24799.9	27	1	1	0	1	1	1	0	1	24600.0 - 24699.9
24900.0 - 24999.9	28	1	1	0	1	1	1	0	1	24800.0 - 24899.9
25100.0 - 25199.9	29	1	1	1	0	1	1	1	0	25000.0 - 25099.9
25300.0 - 25399.9	30	1	1	1	0	1	1	1	0	25200.0 - 25299.9
25500.0 - 25599.9	31	1	1	1	0	1	1	1	0	25400.0 - 25499.9

Function Table for 303 IC 6 Standard (382 246 52) 19.2 - 25.5
38 x 8 bit Prom of the Band Decoder Memory in Display and Keyboard 303
for T 5002.

Frequency Coverage in kHz	Input Address	O_7	O_6	O_5	O_4	O_3	O_2	O_1	O_0	Frequency Coverage in kHz
25700.0 - 25799.9	0	1	1	1	0	1	1	1	0	25600.0 - 25699.9
25900.0 - 25999.9	1	1	1	1	0	1	1	1	0	25800.0 - 25899.9
26100.0 - 26199.9	2	1	1	1	0	1	1	1	0	26000.0 - 26099.9
26300.0 - 26399.9	3	1	1	1	0	1	1	1	0	26200.0 - 26299.9
26500.0 - 26599.9	4	1	1	1	0	1	1	1	0	26400.0 - 26499.9
26700.0 - 26799.9	5	1	1	1	0	1	1	1	0	26600.0 - 26699.9
26900.0 - 26999.9	6	1	1	1	0	1	1	1	0	26800.0 - 26899.9
27100.0 - 27199.9	7	1	1	1	0	1	1	1	0	27000.0 - 27099.9
27300.0 - 27399.9	8	1	1	1	0	1	1	1	0	27200.0 - 27299.9
27500.0 - 27599.9	9	1	1	1	0	1	1	1	0	27400.0 - 27499.9
27700.0 - 27799.9	10	1	1	1	0	1	1	1	0	27600.0 - 27699.9
27900.0 - 27999.9	11	1	1	1	0	1	1	1	0	27800.0 - 27899.9
28100.0 - 28199.9	12	1	1	1	0	1	1	1	0	28000.0 - 28099.9
28300.0 - 28399.9	13	1	1	1	0	1	1	1	0	28200.0 - 28299.9
28500.0 - 28599.9	14	1	1	1	0	1	1	1	0	28400.0 - 28499.9
28700.0 - 28799.9	15	1	1	1	0	1	1	1	0	28600.0 - 28699.9
28900.0 - 28999.9	16	1	1	1	0	1	1	1	0	28800.0 - 28899.9
29100.0 - 29199.9	17	1	1	1	0	1	1	1	0	29000.0 - 29099.9
29300.0 - 29399.9	18	1	1	1	0	1	1	1	0	29200.0 - 29299.9
29500.0 - 29599.9	19	1	1	1	0	1	1	1	0	29400.0 - 29499.9
29700.0 - 29799.9	20	1	1	1	0	1	1	1	0	29600.0 - 29699.9
29900.0 - 29999.9	21	1	1	1	0	1	1	1	0	29800.0 - 29899.9
Irrelevant	22	1	1	1	1	1	1	1	1	Irrelevant
	23	1	1	1	1	1	1	1	1	
	24	1	1	1	1	1	1	1	1	
	25	1	1	1	1	1	1	1	1	
	26	1	1	1	1	1	1	1	1	
	27	1	1	1	1	1	1	1	1	
	28	1	1	1	1	1	1	1	1	
	29	1	1	1	1	1	1	1	1	
	30	1	1	1	1	1	1	1	1	
	31	1	1	1	1	1	1	1	1	

Function Table for 303 IC 5 Standard (382 246 61) 25.6 - 31.9
32 x 8 bit Prom of the Band Decoder Memory in Display and Keyboard 303
for T 5002.

Frequency Coverage in kHz	Input Address	O_7 (Keyline Inhibit)	O_6 Dont Care	O_5 (Enable IC 5)	O_4 (Enable IC 6)	O_3 (Enable IC 7)	O_2 (Enable IC 8)	O_1 (Enable IC 9)	O_0 Address 4 to Band Memory Proms
0.0	0	0	0	1	1	1	1	0	0
3200.0 - 4799.9	1	1	0	1	1	1	1	0	1
6400.0 - 7999.9	2	1	0	1	1	1	1	1	0
9600.0 - 11199.9	3	1	0	1	1	1	0	1	1
12800.0 - 14399.9	4	1	0	1	1	0	1	1	0
	5	0	0	1	1	1	1	1	0
Irrelevant	6	0	0	1	1	1	1	1	0
	7	0	0	1	1	1	1	1	0
16000.0 - 17599.9	8	1	0	1	1	0	1	1	1
19200.0 - 20799.9	9	1	0	1	0	1	1	1	0
22400.0 - 23999.9	10	1	0	1	0	1	1	1	1
25600.0 - 27199.9	11	1	0	0	1	1	1	1	0
28800.0 - 30399.9	12	1	0	0	1	1	1	1	1
	13	0	0	1	1	1	1	1	0
Irrelevant	14	0	0	1	1	1	1	1	0
	15	0	0	1	1	1	1	1	0
1600.0 - 3199.9	16	1	0	1	1	1	1	0	0
4800.0 - 6399.9	17	1	0	1	1	1	1	0	1
8000.0 - 9599.9	18	1	0	1	1	1	0	1	0
11200.0 - 12799.9	19	1	0	1	1	1	0	1	1
14400.0 - 15999.9	20	1	0	1	1	0	1	1	0
	21	0	0	1	1	1	1	1	0
Irrelevant	22	0	0	1	1	1	1	1	0
	23	0	0	1	1	1	1	1	0
17900.0 - 19199.9	24	1	0	1	1	0	1	1	1
20800.0 - 22399.9	25	1	0	1	0	1	1	1	0
24000.0 - 25599.9	26	1	0	1	0	1	1	1	1
27200.0 - 28799.9	27	1	0	0	1	1	1	1	0
	28	0	0	1	1	1	1	1	0
Irrelevant	29	0	0	1	1	1	1	1	0
	30	0	0	1	1	1	1	1	0
Disabling	31	0	0	1	1	1	1	1	0

Function Table for 303 IC 16 Standard (382 239 72) excl. MF
32 x 8 bit Prom of the Band Decoder in Display and Keyboard $\boxed{303}$.

Frequency Coverage in kHz	Input Address	Output O_7 (Keyline Inhibit)	O_6 Dont Care	O_5 (Enable IC 5)	O_4 (Enable IC 6)	O_3 (Enable IC 7)	O_2 (Enable IC 8)	O_1 (Enable IC 9)	O_0 Address 4 to Band Memory Proms
0.0	0	1	0	1	1	1	1	0	0
3200.0 - 4799.9	1	1	0	1	1	1	1	0	1
6400.0 - 7999.9	2	1	0	1	1	1	1	1	0
9600.0 - 11199.9	3	1	0	1	1	1	0	1	1
12800.0 - 14399.9	4	1	0	1	1	0	1	1	0
	5	0	0	1	1	1	1	1	0
Irrelevant	6	0	0	1	1	1	1	1	0
	7	0	0	1	1	1	1	1	0
16000.0 - 17599.9	8	1	0	1	1	0	1	1	1
19200.0 - 20799.9	9	1	0	1	0	1	1	1	0
22400.0 - 23999.9	10	1	0	1	0	1	1	1	1
25600.0 - 27199.9	11	1	0	0	1	1	1	1	0
28800.0 - 30399.9	12	1	0	0	1	1	1	1	1
	13	0	0	1	1	1	1	1	0
Irrelevant	14	0	0	1	1	1	1	1	0
	15	0	0	1	1	1	1	1	0
1600.0 - 3199.9	16	1	0	1	1	1	1	0	0
4800.0 - 6399.9	17	1	0	1	1	1	1	0	1
8000.0 - 9599.9	18	1	0	1	1	1	0	1	0
11200.0 - 12799.9	19	1	0	1	1	1	0	1	1
14400.0 - 15999.9	20	1	0	1	1	0	1	1	0
	21	0	0	1	1	1	1	1	0
Irrelevant	22	0	0	1	1	1	1	1	0
	23	0	0	1	1	1	1	1	0
17900.0 - 19199.9	24	1	0	1	1	0	1	1	1
20800.0 - 22399.9	25	1	0	1	0	1	1	1	0
24000.0 - 25599.9	26	1	0	1	0	1	1	1	1
27200.0 - 28799.9	27	1	0	0	1	1	1	1	0
	28	0	0	1	1	1	1	1	0
Irrelevant	29	0	0	1	1	1	1	1	0
	30	0	0	1	1	1	1	1	0
Disabling	31	0	0	1	1	1	1	1	0

Function Table for 303 IC 16 Speciel (382 239 82) incl. MF
32 x 8 bit Prom of the Band Decoder in Display and Keyboard $\boxed{303}$.

8. PARTS LIST AND CIRCUIT DIAGRAMS

8.1. Numbering

An identification number between 207 and 303 is assigned to each module. The designation of a component or terminal includes this number as a prefix - example: 207R3 (resistor R3 on module 207), or 207-12 (terminal No. 12 on module 207).

8.2. Switches

Switches with stops are shown in the extreme anticlockwise position. the BAND switch is shown in the BAND K position.

Switch wafer No. 1 is the wafer nearest to the front panel, and the front side of a wafer is the side facing the front panel.

8.3. Terminals

Locations of terminals appear from the component location drawings. On the circuit diagrams, each terminal is identified by a number and in most cases by an explanatory text. In addition to this, the number of the module and terminal to which the lead is connected is indicated (example: 244 -12). Where interconnections consist of coaxial cables only the number of the terminal is given to which the inner conductor of the cable is connected.

8.4. Voltages

Typical DC voltages are indicated on the circuit diagrams next to the points to which they refer and are marked with a "V".

Typical logic levels are indicated in a bracket (LOW/HIGH) on the circuit diagrams next to the point to which they refer and are marked with a "V".

Typical AC voltages are likewise indicated on the circuit diagrams. They are marked with "Vpp" or "mVpp".

For measuring conditions see Chapter 7.

8.5. Test Points

Location of test points is shown on the component location drawings. Typical voltage at each test point is indicated on the circuit diagram.

8.6. Symbol Explanation

8.6.1. Logic circuits:

A small circle at an external input means that the specific input is active LOW, i.e. it produces the desired function in conjunction with other inputs if its voltage is the lower of the two logic levels in the system; otherwise the specific input is HIGH

A small circle at a clock input means that the outputs change on the HIGH to LOW clock transition.

A small circle at an output indicates that when the function designated is true the output is LOW.

Inputs and outputs are labelled with mnemonic letters as described in table 8.6.1.

8.6.2. Logic Functions:

Logic functions are labelled with mnemonic letters in a bracket. An active LOW function is given a bar over the label.

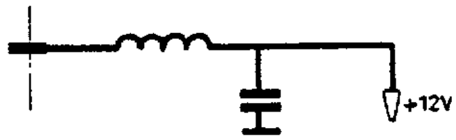
More logic functions may be connected by means of the principles of Boolean Algebra.

8.6.3. Arrows:

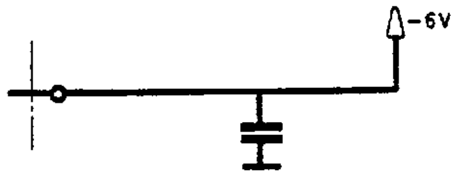
A black arrow on a line indicates in which direction an AC-signal flows.

A white arrow on a line indicates in which direction the information of a DC signal flows. An exception from this rule is the supply lines and their connections, which are always indicated by a supply voltage level or its associated label.

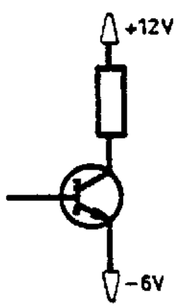
Positive supply line: Example



Negative supply line: Example



Connections to supply line: Example



Label	Short for	Meaning
I_x	Input	Inputs to combinatorial circuits
J,K		Inputs to JK flip flops
D_x	Data	Inputs to D flip flops and latches
S,R	Set, Reset	Inputs to JK and D flip flops, latches, registers, and counters; R resets output to LOW; S sets output to HIGH
P_x		Inputs to registers and counters
A_x	Address	Inputs used for selection of an input, output, data route, or memory location
E	Enable	
PE	Parallel Enable	Control input used to synchronously load information in parallel into a circuit
MR	Master Reset	Input which resets asynchronously all outputs to LOW, overriding all other inputs
CL	Clear	Input which resets outputs to LOW, but does not override all other inputs
CP	Clock Pulse	
CE, CEP, CET	Count Enable	Control inputs to counters
O_x	Output	Outputs of combinatorial circuits
Q_x		Outputs of sequential circuits
TC	Terminal Count	(Output of a counter indicating 1111 for up binary counters, 1001 for up decimal counters, or 0000 for down counters).

Table 8.6.1.

8.7. Abbreviations

A	=	ampere, amperes
C	=	capacitor
Car.	=	carbon
Cer.	=	ceramic
D	=	diode
F	=	farad
FS	=	fuse
H	=	henry
IC	=	integrated circuit
k	=	kilo or 10^3
L	=	inductor
LS	=	loudspeaker
lin.	=	linear
log.	=	logarithmic
m	=	milli or 10^{-3}
M	=	mega or 10^6
ME	=	instrument
MF	=	metal film
Mi	=	mica
MP	=	metallized paper
u	=	micro or 10^{-6}
n	=	nano or 10^{-9}
NPO	=	temp. coefficient 0
N150	=	temp. coefficient -150
NTC	=	neg. temp. coefficient
P	=	pico or 10^{-12}
PL	=	connector (plug)
Polyes.	=	polyester
Polyst.	=	polystyrene
PTC	=	pos. temp. coefficient
R	=	resistor
RN	=	resistor network
RL	=	relay
S	=	switch
SK	=	connector (socket)
SL	=	lamp
T	=	transformer
Tan	=	tantalum electrolytic capacitor
TR	=	transistor
V	=	working voltage DC or volts
V1...	=	valve
Vac.	=	working voltage AC
Var.	=	variable
Vpp	=	peak to peak voltage
Varicap	=	variable capacitance diode
ww	=	wire wound
W	=	watt, watts
W.alum.	=	wet aluminium electrolytic
X	=	crystal, crystal osc. or crystal filter

PARTS LIST

FOR

△ 300

300C1-4	10 nF	-20/+80%	32V	602 410 00
C5	47 nF	-20/+80%	16V	601 447 00
S1				372 200 15
S2				372 200 25
SK1				751 000 03
SK2				750 000 12

PARTS LIST

FOR

301

301C1-4	0,1u	10%	100V	Polyes	623 510 01
C5-7	10 nF	10%	100V	Polyes	623 410 00
C8	0,22 uF	10%	63V	Polyes	622 522 00
C9-10	1 uF	10%	100V	Polyes	623 610 00
C11-23	0,1uF	10%	100V	Polyes	623 510 01
C24-25	47 nF	10%	100V	Polyes	623 447 00
C26	22 uF		15V	Tan	651 722 00
C27-29	0,1uF	10%	100V	Polyest	623 510 01
301D1	AA143				850 014 30
301IC1-2	MA7812		12V		850 781 20
IC3	SN7416				850 741 60
IC4	74LS257				857 425 70
IC5	MA7805				850 780 50
IC6	SN74S196				857 419 60
301L1-8	47 uH	10%		RF-Choke	740 147 00
L9-10	25 uH	10%		RF-Choke	740 125 00
L11-18	47 uH	10%		RF-Choke	740 147 00
L19	25 uH	10%		RF-Choke	740 125 00
L20	47 uH	10%		RF-Choke	740 147 00
L21-23	25 uH	10%		RF-Choke	740 125 00
L24	220 uH	10%		RF-Choke	740 222 00
L25	100 uH	10%		RF-Choke	740 210 00
L26	47 uH	10%		RF-Choke	740 147 00
301PL1	8 Way				751 000 26
PL2	20 Way				751 000 28
PL3	64 Way				751 000 77
301R1	470 ohm	5%	1/3W	Car	501 247 00
R2-3	10 kohm	5%	1/3W	Car	501 410 00
R4-11	4.7 kohm	5%	1/3W	Car	501 347 00
R12	1.5 kohm	5%	1/3W	Car	501 315 00
R13	1 kohm	5%	1/3W	Car	501 310 00
R14	10 kohm	5%	1/3W	Car	501 410 00
R15	1.8 kohm	5%	1/3W	Car	501 318 00
301SK1	32 Way				751 000 10
SK2	BNC				750 000 10
SK3-4	32 Way				751 000 10
SK5	BNC				750 000 10
SK6-7	32 Way				751 000 10
SK8	64 Way				751 000 77
SK9	64 Way				751 000 23
TR1-2	BC547B				840 054 70

PARTS LIST

FOR

244

244C1-3	0.1 uF	10%	100V	Polyes	623 510 01
C4-5	10 nF	10%	100V	Polyes	623 410 00
C6-8	0.1 uF	10%	100V	Polyes	623 510 01
C9	22 uF		15V	Tan	651 722 00
C10	0.15 uF	10%	100V	Polyes	623 515 00
C11	22 uF		15V	Tan	651 722 00
C12	0.1 uF	10%	100V	Polyes	623 510 01
C13	10 nF	10%	100V	Polyes	623 410 00
C14	22 uF		15V	Tan	651 722 00
C15	2.2 uF	10%	63V	Tan	622 622 00
C16	22 uF		15V	Tan	651 722 00
C17	1 nF	1%	500V	Polyst.	615 310 01
C18	10 nF	10%	100V	Polyes	623 410 00
C19	2.2 uF	10%	63V	Polyes	622 622 00
C20-21	10 nF	10%	250V	Polyes	623 410 00
C22	2.2 uF	10%	63V	Polyes	622 622 00
C23-25	0.1 uF	10%	100V	Polyes	623 510 01
C26	10 nF	10%	100V	Polyes	623 410 00
C27	2.7 nF	1%	125V	Polyst.	613 327 00
C28	0.1 uF	10%	100V	Polyes	623 510 01
C29	680 pF	1%	500V	Polyst.	615 268 00
C30-31	10 nF	10%	100V	Polyes	623 410 00
C32-35	0.1 uF	10%	100V	Polyes	623 510 01
C37	10 nF	10%	100V	Polyes	623 410 00
C38-43	0.1 uF	10%	100V	Polyes	623 510 01
C44	1.8 nF	1%	250V	Polyst.	614 318 00
244D1-6	1S920				830 192 00
D7-9	AA217				830 001 70
D10-14	1S920				830 192 00
244IC1	CA3046				850 304 60
IC2	LM1496				850 149 60
IC3	CA3046				850 304 60
244L1	100 uH		RF Choke		740 210 00
L2	4.7 uH		RF Choke		740 047 00

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244C1-3	0.1 uF	10%	100V	Polyes	623 510 01
C4-5	10 nF	10%	100V	Polyes	623 410 00
C6-8	0.1 uF	10%	100V	Polyes	623 510 01
C9	22 uF		15V	Tan	651 722 00
C10	0.15 uF	10%	100V	Polyes	623 515 00
C11	22 uF		15V	Tan	651 722 00
C12	0.1 uF	10%	100V	Polyes	623 510 01
C13	10 nF	10%	100V	Polyes	623 410 00
C14	22 uF		15V	Tan	651 722 00
C15	2.2 uF	10%	63V	Tan	622 622 00
C16	22 uF		15V	Tan	651 722 00
C17	1 nF	1%	500V	Polyst.	615 310 01
C18	10 nF	10%	100V	Polyes	623 410 00
C19	2.2 uF	10%	63V	Polyes	622 622 00
C20-21	10 nF	10%	250V	Polyes	623 410 00
C22	2.2 uF	10%	63V	Polyes	622 622 00
C23-25	0.1 uF	10%	100V	Polyes	623 510 01
C26	10 nF	10%	100V	Polyes	623 410 00
C27	2.7 nF	1%	125V	Polyst.	613 327 00
C28	0.1 uF	10%	100V	Polyes	623 510 01
C29	680 pF	1%	500V	Polyst.	615 268 00
C30-31	10 nF	10%	100V	Polyes	623 410 00
C32-35	0.1 uF	10%	100V	Polyes	623 510 01
C37	10 nF	10%	100V	Polyes	623 410 00
C38-43	0.1 uF	10%	100V	Polyes	623 510 01
C44	1.8 nF	1%	250V	Polyst.	614 318 00
244D1-6	1S920				830 192 00
D7-9	AA217				830 001 70
D10-14	1S920				830 192 00
244IC1	CA3046				850 304 60
IC2	LM1496				850 149 60
IC3	CA3046				850 304 60
244L1	100 uH		RF Choke		740 210 00
L2	4.7 uH		RF Choke		740 047 00

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244L3	100 uH		RF Choke		740 210 00
L4	220 uH		RF Choke		740 222 00
L5	100 uH		RF Choke		740 210 00
L6			Coil		102 210 02
244R1-2	680 ohm	5%	1/3W	Car	501 268 00
R3	180 ohm	5%	1/3W	Car	502 218 00
R4	1.5 kohm	5%	1/3W	Car	501 315 00
R5	10 kohm	5%	1/3W	Car	501 410 00
R6	47 kohm	Var.			582 447 00
R7	10 kohm	5%	1/3W	Car	501 410 00
R10	15 kohm	5%	1/3W	Car	501 415 00
R11-12	10 kohm	5%	1/3W	Car	501 410 00
R13	390 ohm	5%	1/3W	Car	501 239 00
R14	2.7 kohm	5%	1/3W	Car	501 321 00
R15	1 kohm	Var.			582 310 00
R16	150 ohm	5%	1/3W	Car	501 215 00
R17	470 ohm	5%	1/3W	Car	501 247 00
R18	22 kohm	5%	1/3W	Car	501 422 00
R19	33 kohm	5%	1/3W	Car	501 433 00
R20	15 kohm	5%	1/3W	Car	501 415 00
R21	82 kohm	5%	1/3W	Car	501 482 00
R22	6.8 kohm	5%	1/3W	Car	501 368 00
R23	470 ohm	5%	1/3W	Car	501 247 00
R24	220 ohm	5%	1/3W	Car	501 222 00
R25	560 ohm	5%	1/3W	Car	501 556 00
R26-27	4.7 kohm	5%	1/3W	Car	501 347 00
R28	470 kohm	5%	1/3W	Car	501 247 00
R29	1.5 kohm	5%	1/3W	Car	501 315 00
R30	not used				
R31	10 kohm	5%	1/3W	Car	501 410 00
R32	560 kohm	5%	1/3W	Car	501 556 00
R33	330 ohm	5%	1/3W	Car	501 233 00
R34	10 kohm	5%	1/3W	Car	501 410 00
R35	1 kohm	5%	1/3W	Car	501 310 00
R36	10 kohm	5%	1/3W	Car	501 410 00
R37	22 ohm	5%	1/3W	Car	501 122 00
R38	560 ohm	5%	1/3W	Car	501 256 00
R39	1 kohm	5%	1/3W	Car	501 310 00

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244R40	680 ohm	5%	1/3W	Car	501 268 00
R41	1.2 kohm	5%	1/3W	Car	501 312 00
R42	1.8 kohm	5%	1/3W	Car	501 318 00
R43	4.7 kohm	5%	1/3W	Car	501 347 00
R44	47 kohm	Var.			582 447 00
R45	1 kohm	5%	1/3W	Car	501 310 00
R46-47	4.7 kohm	5%	1/3W	Car	501 347 00
R48	1 kohm	Var.			582 310 00
R49	390 kohm	5%	1/3W	Car	501 239 00
R50	470 ohm	5%	1/3W	Car	501 247 00
R51	680 ohm	5%	1/3W	Car	501 268 00
R52	100 ohm	5%	1/3W	Car	501 210 00
R53	22 kohm	5%	1/3W	Car	501 422 00
R54	10 kohm	5%	1/3W	Car	501 410 00
R55	22 kohm	5%	1/3W	Car	501 422 00
R56	220 ohm	5%	1/3W	Car	501 222 00
R57	820 ohm	5%	1/3W	Car	501 282 00
R58	1 kohm	5%	1/3W	Car	501 310 00
R59	2.7 kohm	5%	1/3W	Car	501 327 00
R60	2.2 kohm	5%	1/3W	Car	501 322 00
R61-62	1 kohm	5%	1/3W	Car	501 310 00
R63	8.2 kohm	5%	1/3W	Car	501 382 00
R64	10 kohm	5%	1/3W	Car	501 410 00
R65	5.6 kohm	5%	1/3W	Car	501 356 00
R66	22 kohm	5%	1/3W	Car	501 422 00
R67	5.6 kohm	5%	1/3W	Car	501 356 00
R68	1.2 kohm	5%	1/3W	Car	501 312 00
R69	6.8 kohm	5%	1/3W	Car	501 368 00
R70	680 ohm	5%	1/3W	Car	501 268 00
R71	100 ohm	5%	1/3W	Car	501 210 00
R72	330 ohm	5%	1/3W	Car	501 233 00
R73	100 ohm	5%	1/3W	Car	501 210 00
R74	1.5 kohm	5%	1/3W	Car	501 315 00
R75	4.7 kohm	5%	1/3W	Car	501 347 00
R76	332 ohm	1%	1/3W	MF	511 233 20
R77	301 ohm	1%	1/3W	MF	511 230 10
R78	220 ohm	5%	1/3W	Car	501 222 00
R79	100 ohm	5%	1/3W	Car	501 210 00

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244R80	2.2 kohm	5%	1/3W	Car	501 322 00
R81	2.7 kohm	5%	1/3W	Car	501 327 00
R82	422 ohm	1%	1/3W	MF	511 242 20
R83	47 ohm	5%	1/3W	Car	501 147 00
R84	270 ohm	5%	1/3W	Car	501 227 00
R85-86	100 ohm	5%	1/3W	Car	501 210 00
R87	422 ohm	1%	1/3W	MF	511 242 20
R88	100 ohm	5%	1/3W	Car	501 210 00
244RL1-2	1 change over	12V Coil	DIL	Option	780 000 25
244I1	Coil				102 104 82
244TR1	BC547B				840 054 70
TR2	J 112				843 011 20
TR3	BC557B				840 055 70
TR4-5	BC547B				840 054 70
TR6	BSX20				840 002 00
TR7	BC547B				840 054 70
244X1	LSB Filter	1 kohm			385 112 03
X2	USB Filter	1.4 MHz		Option	385 244 12

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302C1	47 nF	10%	100 V	Polyes	623 447 00
C2	0.1 uF	10%	100 V	Polyes	623 510 00
C3	1.8 nF	1%	125 V	Polyst.	613 318 00
C4	0.1 uF	10%	100 V	Polyes	623 510 00
C5					
C6	47 nF	10%	100 V	Polyes	623 447 00
C7	1.8 nF	1%	125 V	Polyst	613 318 00
C8	10 nF	10%	100 V	Polyst	623 410 00
C9-10	0.1 uF	10%	100 V	Polyst	623 510 00
C11	1.2 nF	1%	125 V	Polyst	613 312 00
C12	0.1 uF	10%	100 V	Polyes	623 510 00
C13	7.5 pF	±0,25	400 V	Cer	605 075 00
C14	10 nF	10%	100 V	Polyes	623 410 00
C15	0.1 uF	10%	100 V	Polyes	623 510 00
C16	12 pF	5%	400 V	Cer	605 112 01
C17-22	0.1 uF	10%	100 V	Polyes	623 510 00
C23	270 pF	1%	500 V	Polyst	615 227 00
C24-25	0.1 uF	10%	100 V	Polyes	623 510 00
C26	51 pF	5%	400 V	Cer	605 151 00
C27	10 nF	10%	100 V	Polyes	623 410 00
C28	0.1 uF	10%	100 V	Polyes	623 510 00
C29	270 pF	1%	500 V	Polyst	615 227 00
C30	0.1 uF	10%	100 V	Polyes	623 510 00
C31	270 pF	1%	500 V	Polyst	615 227 00
C32-33	0.1 uF	10%	100 V	Polyes	623 510 00
C34	270 pF	1%	500 V	Polyst	615 227 00
C35	0.1 uF	10%	100 V	Polyes	623 510 00
C36	0.22 uF	10%	63 V	Polyes	622 522 00
C37-38	0.1 uF	10%	100 V	Polyes	623 510 00
C39	0.22 uF	10%	63 V	Polyes	622 522 00
C40	0.1 uF	10%	100 V	Polyes	623 510 00
C41	0.22 uF	10%	63 V	Polyes	622 522 00
C42	65 pF	5%	400 V	Cer	605 165 00
C43	470 pF	1%	250 V	Polyst	614 247 00
C44	180 pF	1%	500 V	Polyst	615 218 00
C45	6.8 pF	± 0,25%	400 V	Cer	605 068 00
C46-47	33 pF	5%	400 V	Cer	605 133 00
C48	12 pF	5%	400 V	Cer	605 112 01
C49	91 pF	1%	500 V	Cer	615 191 00
C50	33 pF	5%	400 V	Cer	605 133 00

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302C51	3.3 pF	± 0,25%	400 V	Cer	605 033 00
C52	18 pF	5%	400 V	Cer	605 118 01
C53	82 pF	1%	500 V	Polyst	615 182 00
C54	0.47uF	10%	63 V	Polyes	622 547 00
C55	22 pF	± 0,25%	400 V	Cer	605 122 00
C56	51 pF	5%	400 V	Cer	605 151 00
C57	0.22uF	10%	63 V	Polyes	622 522 00
C58	10 nF	10%	100 V	Polyes	623 410 00
C59	560 pF	1%	125 V	Polyst	613 256 00
C60	0.1 uF	10%	100 V	Polyes	623 510 00
C61	0.22uF	10%	63 V	Polyes	622 522 00
C62	10 nF	10%	100 V	Polyes	623 410 00
C63	0.1 uF	10%	100 V	Polyes	623 510 00
C64	10 nF	10%	100 V	Polyes	623 410 00
C65	0.1 uF	10%	100 V	Polyes	623 510 00
C66	0.22uF	10%	63 V	Polyes	622 522 00
C67	2.2 uF		25 V		652 622 00
C68	0.1 uF	10%	100 V	Polyes	623 510 00
C69	0.22uF	10%	63 V	Polyes	
C70-71	10 nF	10%	100 V	Polyes	623 410 00
C72	51 pF	5%	400 V	Cer	605 151 00
C73	10 nF	10%	100 V	Polyes	623 410 00
C74	22 uF				
C75-76	0.22uF	10%	63 V	Polyes	622 522 00
C77	0.1 uF	10%			
C78	10 nF		100 V	Polyes	623 410 00
C79-80	0.1 uF	10%	100 V	Polyes	623 510 00
C81	47 nF	10%	100 V	Polyes	623 447 00
C82	0.47uF	10%	63 V	Polyes	622 547 00
302D1-5	1S920				830 192 00
D6	AAZ17				830 001 70
D7-17	1S920				830 192 00
D18-19	BB109				833 010 90
D20-21	1S920				830 192 00
302IC1	CA3046				850 304 60
IC2	74LS145				857 414 50
IC3	74LS290				857 429 00
IC4	74LS145				857 414 50
IC5	74LS00				850 740 02

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302IC6	74S74				850 747 41
IC7	CML				850 000 01
IC8-9	74S163				857 416 32
302L1	10 u	Coil			740 110 00
L2	100 u				740 210 00
L3		Coil			102 247 61
L4		Coil			102 247 71
L5					102 247 61
L6					102 243 31
L7	100 uH				740 210 01
L8	10 u				740 110 00
L9-12	100 u				740 210 00
L13	10 uH				740 110 00
L14-16	100 uH				740 210 00
302R1	10 ohm	5%	1/3W	Cer	501 110 00
R2	1 kohm	5%	1/3W	Cer	501 310 00
R3	10 kohm	5%	1/3W	Cer	501 410 00
R4	560 ohm	5%	1/3W	Cer	501 256 00
R5	10 kohm	Var			583 410 00
R6	220 ohm	5%	1/3W	Cer	501 222 00
R7-8	121 ohm	5%	1/3W	Cer	501 212 00
R9	1.2 kohm	5%	1/3W	Cer	501 312 00
R10	390 ohm	5%	1/3W	Cer	501 210 00
R11	560 ohm	5%	1/3W	Cer	501 256 00
R12	10 kohm	Var			583 410 00
R13	220 ohm	5%	1/3W	Cer	501 222 00
R14	100 ohm	5%	1/3W	Cer	501 210 00
R15	1 kohm	5%	1/3W	Cer	501 310 00
R16	47 ohm	5%	1/3W	Cer	501 247 00
R17	1.8 kohm	5%	1/3W	Cer	501 318 00
R18	1 kohm	Var			582 310 00
R19	1.8 kohm	5%	1/3W	Cer	501 318 00
R20	560 ohm	5%	1/3W	Cer	501 256 00
R21	10 kohm	Var			583 410 00
R22-23	220 ohm	5%	1/3W	Cer	501 222 00
R24	22 kohm	5%	1/3W	Cer	501 422 00
R25	560 ohm	5%	1/3W	Cer	501 256 00
R26	10 kohm	Var			583 410 00
R27	220 ohm	5%	1/3W	Cer	501 222 00

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302R28	1 kohm	5%	1/3W	Cer	501 310 00
R29	220 ohm	5%	1/3W	Cer	501 222 00
R30	560 ohm	5%	1/3W	Cer	501 256 00
R31	10 kohm	Var			583 410 00
R32	220 ohm	5%	1/3W	Cer	501 222 00
R33	1.8 kohm	5%	1/3W	Cer	501 318 00
R34	270 ohm	5%	1/3W	Cer	501 227 00
R35	560 ohm	5%	1/3W	Cer	501 256 00
R36	10 kohm	Var			583 410 00
R37	220 ohm	5%	1/3W	Cer	501 222 00
R38	10 kohm	5%	1/3W	Cer	501 410 00
R39	68 ohm	5%	1/3W	Cer	501 168 00
R40	10 kohm	5%	1/3W	Cer	501 410 00
R41	560 ohm	5%	1/3W	Cer	501 256 00
R42	10 kohm	Var			583 410 00
R43	220 ohm	5%	1/3W	Cer	501 222 00
R44	10 kohm	5%	1/3W	Cer	501 410 00
R45-46	22 ohm	5%	1/3W	Cer	501 122 00
R47	560 ohm	5%	1/3W	Cer	501 256 00
R48	10 kohm	Var			583 410 00
R49	220 ohm	5%	1/3W	Cer	501 222 00
R50	3.9 kohm	5%	1/3W	Cer	501 339 00
R51	1 kohm	5%	1/3W	Cer	501 310 00
R52	100 ohm	5%	1/3W	Cer	501 210 00
R53	10 kohm	5%	1/3W	Cer	501 410 00
R54	3.9 kohm	5%	1/3W	Cer	501 339 00
R55-56	22 ohm	5%	1/3W	Cer	501 122 00
R57	560 ohm	5%			501 256 00
R58	10 kohm	Var			583 410 00
R59	220 ohm	5%	1/3W	Cer	501 222 00
R60	1 kohm	5%	1/3W	Cer	501 310 00
R61	56 ohm	5%	1/3W	Cer	501 156 00
R62	560 ohm	5%	1/3W	Cer	501 256 00
R63	10 kohm	Var			583 410 00
R64	220 ohm	5%	1/3W	Cer	501 222 00
R65	560 ohm	5%	1/3W	Cer	501 256 00
R66	10 kohm	Var			583 410 00
R67	220 ohm	5%	1/3W	Cer	501 222 00
R68	8.2 kohm	5%	1/3W	Cer	501 382 00

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302R69	560 ohm	5%	1/3W	Cer	501 256 00
R70	10 kohm	Var			583 410 00
R71	220 ohm	5%	1/3W	Cer	501 222 00
R72	8.2 kohm	5%	1/3W	Cer	501 382 00
R73	560 ohm	5%	1/3W	Cer	501 256 00
R74	10 kohm	Var			583 410 00
R75	220 ohm	5%	1/3W	Cer	501 222 00
R76	10 ohm	5%	1/3W	Cer	501 110 00
R77	560 ohm	5%	1/3W	Cer	501 256 00
R78	10 kohm	Var			583 410 00
R79	220 ohm	5%	1/3W	Cer	501 222 00
R80	560 ohm	5%	1/3W	Cer	501 256 00
R81	10 kohm	Var			583 410 00
R82	220 ohm	5%	1/3W	Cer	501 222 00
R83	68 ohm				501 168 00
R84	470 ohm	5%	1/3W	Cer	501 247 00
R85	680 ohm	5%	1/3W	Cer	501 268 00
R86	6.8 kohm	5%	1/3W	Cer	501 368 00
R87	560 ohm	5%	1/3W	Cer	501 256 00
R88	10 kohm	Var	1/3W	Cer	583 410 00
R89	220 ohm	5%	1/3W	Cer	501 222 00
R90	120 ohm	5%	1/3W	Cer	501 212 00
R91	8.2 ohm	5%	1/3W	Cer	501 382 00
R92-94	100 kohm	5%	1/3W	Cer	501 510 00
R95	6.8 kohm	5%	1/3W	Cer	501 368 00
R96	10 kohm	5%	1/3W	Cer	501 410 00
R97	1 kohm	5%	1/3W	Cer	501 310 00
R98	820 kohm	5%	1/3W	Cer	501 582 00
R99-100	180 kohm	5%	1/3W	Cer	501 518 00
R101	470 ohm	5%	1/3W	Cer	501 247 00
R102	56 ohm	5%	1/3W	Cer	501 156 00
R103	100 ohm	5%	1/3W	Cer	501 210 00
R104	1.2 kohm	5%	1/3W	Cer	501 312 00
R105	100 ohm	5%	1/3W	Cer	501 210 00
R106	1.2 kohm	5%	1/3W	Cer	501 312 00
R107	1 kohm	5%	1/3W	Cer	501 310 00
R108	8.2 ohm	5%	1/3W	Cer	501 382 00
R109	12 ohm	5%	1/3W	Cer	501 112 00
R110	150 ohm	5%	1/3W	Cer	501 215 00
R111	5.6 ohm	5%	1/3W	Cer	501 356 00
R112	56 ohm	5%	1/3W	Cer	501 156 00

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302R28	1 kohm	5%	1/3W	Cer	501 310 00
R29	220 ohm	5%	1/3W	Cer	501 222 00
R30	560 ohm	5%	1/3W	Cer	501 256 00
R31	10 kohm	Var			583 410 00
R32	220 ohm	5%	1/3W	Cer	501 222 00
R33	1.8 kohm	5%	1/3W	Cer	501 318 00
R34	270 ohm	5%	1/3W	Cer	501 227 00
R35	560 ohm	5%	1/3W	Cer	501 256 00
R36	10 kohm	Var			583 410 00
R37	220 ohm	5%	1/3W	Cer	501 222 00
R38	10 kohm	5%	1/3W	Cer	501 410 00
R39	68 ohm	5%	1/3W	Cer	501 168 00
R40	10 kohm	5%	1/3W	Cer	501 410 00
R41	560 ohm	5%	1/3W	Cer	501 256 00
R42	10 kohm	Var			583 410 00
R43	220 ohm	5%	1/3W	Cer	501 222 00
R44	10 kohm	5%	1/3W	Cer	501 410 00
R45-46	22 ohm	5%	1/3W	Cer	501 122 00
R47	560 ohm	5%	1/3W	Cer	501 256 00
R48	10 kohm	Var			583 410 00
R49	220 ohm	5%	1/3W	Cer	501 222 00
R50	3.9 kohm	5%	1/3W	Cer	501 339 00
R51	1 kohm	5%	1/3W	Cer	501 310 00
R52	100 ohm	5%	1/3W	Cer	501 210 00
R53	10 kohm	5%	1/3W	Cer	501 410 00
R54	3.9 kohm	5%	1/3W	Cer	501 339 00
R55-56	22 ohm	5%	1/3W	Cer	501 122 00
R57	560 ohm	5%			501 256 00
R58	10 kohm	Var			583 410 00
R59	220 ohm	5%	1/3W	Cer	501 222 00
R60	1 kohm	5%	1/3W	Cer	501 310 00
R61	56 ohm	5%	1/3W	Cer	501 156 00
R62	560 ohm	5%	1/3W	Cer	501 256 00
R63	10 kohm	Var			583 410 00
R64	220 ohm	5%	1/3W	Cer	501 222 00
R65	560 ohm	5%	1/3W	Cer	501 256 00
R66	10 kohm	Var			583 410 00
R67	220 ohm	5%	1/3W	Cer	501 222 00
R68	8.2 kohm	5%	1/3W	Cer	501 382 00

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302R69	560 ohm	5%	1/3W	Cer	501 256 00
R70	10 kohm	Var			583 410 00
R71	220 ohm	5%	1/3W	Cer	501 222 00
R72	8.2 kohm	5%	1/3W	Cer	501 382 00
R73	560 ohm	5%	1/3W	Cer	501 256 00
R74	10 kohm	Var			583 410 00
R75	220 ohm	5%	1/3W	Cer	501 222 00
R76	10 ohm	5%	1/3W	Cer	501 110 00
R77	560 ohm	5%	1/3W	Cer	501 256 00
R78	10 kohm	Var			583 410 00
R79	220 ohm	5%	1/3W	Cer	501 222 00
R80	560 ohm	5%	1/3W	Cer	501 256 00
R81	10 kohm	Var			583 410 00
R82	220 ohm	5%	1/3W	Cer	501 222 00
R83	68 ohm				501 168 00
R84	470 ohm	5%	1/3W	Cer	501 247 00
R85	680 ohm	5%	1/3W	Cer	501 268 00
R86	6.8 kohm	5%	1/3W	Cer	501 368 00
R87	560 ohm	5%	1/3W	Cer	501 256 00
R88	10 kohm	Var	1/3W	Cer	583 410 00
R89	220 ohm	5%	1/3W	Cer	501 222 00
R90	120 ohm	5%	1/3W	Cer	501 212 00
R91	8.2 ohm	5%	1/3W	Cer	501 382 00
R92-94	100 kohm	5%	1/3W	Cer	501 510 00
R95	6.8 kohm	5%	1/3W	Cer	501 368 00
R96	10 kohm	5%	1/3W	Cer	501 410 00
R97	1 kohm	5%	1/3W	Cer	501 310 00
R98	820 kohm	5%	1/3W	Cer	501 582 00
R99-100	180 kohm	5%	1/3W	Cer	501 518 00
R101	470 ohm	5%	1/3W	Cer	501 247 00
R102	56 ohm	5%	1/3W	Cer	501 156 00
R103	100 ohm	5%	1/3W	Cer	501 210 00
R104	1.2 kohm	5%	1/3W	Cer	501 312 00
R105	100 ohm	5%	1/3W	Cer	501 210 00
R106	1.2 kohm	5%	1/3W	Cer	501 312 00
R107	1 kohm	5%	1/3W	Cer	501 310 00
R108	8.2 ohm	5%	1/3W	Cer	501 382 00
R109	12 ohm	5%	1/3W	Cer	501 112 00
R110	150 ohm	5%	1/3W	Cer	501 215 00
R111	5.6 ohm	5%	1/3W	Cer	501 356 00
R112	56 ohm	5%	1/3W	Cer	501 156 00

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302R113	47 ohm	5%	1/3W	Cer	501 147 00
R114	22 ohm	5%	1/3W	Cer	501 122 00
R115	15 ohm	5%	1/3W	Cer	501 115 00
R116	56 ohm	5%	1/3W	Cer	501 156 00
R117	22 ohm	5%	1/3W	Cer	501 122 00
R118	47 ohm	5%	1/3W	Cer	501 147 00
R119	56 ohm	5%	1/3W	Cer	501 156 00
R120	39 ohm	5%	1/3W	Cer	501 139 00
R121	56 kohm	5%	1/3W	Cer	501 456 00
R122	120 ohm	5%	1/3W	Cer	501 212 00
R123	1 kohm	5%	1/3W	Cer	501 310 00
R124	120 ohm	5%	1/3W	Cer	501 212 00
R125	270 ohm	5%	1/3W	Cer	501 227 00
R126	6.8 kohm	5%	1/3W	Cer	501 368 00
R127	2.2 kohm	5%	1/3W	Cer	501 322 00
R128	330 ohm	5%	1/3W	Cer	501 233 00
R129	56 ohm	5%	1/3W	Cer	501 156 00
R130	100 ohm	5%	1/3W	Cer	501 210 00
R131	1 kohm	5%	1/3W	Cer	501 310 00
R132	10 kohm	5%	1/3W	Cer	501 410 00
R133	1.5 kohm	5%	1/3W	Cer	501 315 00
R134	1 kohm	5%	1/3W	Cer	501 310 00
R135	150 ohm	5%	1/3W	Cer	501 215 00
R136	5.6 kohm	5%	1/3W	Cer	501 356 00
R137	390 ohm	5%	1/3W	Cer	501 239 00
R138	1 kohm	5%	1/3W	Cer	501 310 00
R139	82 ohm	5%	1/3W	Cer	501 182 00
302RL1-2		1 Change Over 12VCoil 14 pin DIL			780 000 25
302RN1-2	7x10 kohm	8 pin	SIL		530 000 05
T1	Coil				102 211 51
T2-3	Coil				102 243 01

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302TR1-3	BC547B	840 054 70
TR4	BSX20	840 002 00
TR5	BFW17A	840 001 70
TR6	BF240	840 024 00
TR7	BSX20	840 002 00
TR8	E310	840 031 00
TR9	BFW17A	840 001 70
TR10	BSX20	840 002 00
TR11	BF240	840 024 00
TR12	BC547B	840 054 70
TR13	BSX20	840 002 00
TR14	BF240	840 024 00
TR15	BSX20	840 002 00
X1		385 201 42

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234C 1	0.1 uF	10%	250V	Polyes.	624 510 00
C 2	6.8 uF	10%	100V	Polyes.	623 668 00
C 3	0.1 uF	10%	250V	Polyes.	624 510 00
C 4	0.15 uF	1%	63V	Polyst.	612 515 00
C 5	3.3 uF	10%	100V	Polyes.	623 633 00
C 6- 8	6.8 uF	10%	100V	Polyes.	623 668 00
C 9	0.1 uF	10%	250V	Polyes.	624 510 00
C10-11	0.15 uF	1%	63V	Polyst.	612 515 00
C12-13	0.1 uF	10%	250V	Polyes.	624 510 00
234D 1- 3	AAZ17				830 001 70
D 4- 5	BZX79C4V7	Zener			832 794 70
D 6- 7	1S920				830 192 00
D 8	AAZ17				830 001 70
D 9-13	1S920				830 192 00
D14	AAZ17				830 001 70
D15-27	1S920				830 192 00
D28	BZX79C4V7	Zener			832 794 70
234IC1	7416				850 741 60
IC2	74LS10				850 741 01
IC3	74LS00				850 740 02
IC4	7416				850 741 60
IC5	74188A	(programmed)			382 215 91
IC6	74LS32				850 743 20
IC7	LM1496				850 149 60
PL	32 Way				751 000 20
234R 1- 7	1 kohm	5%	1/3W	Car.	501 310 00
R 8	2.2 kohms	5%	1/3W	Car.	501 322 00
R 9	1 kohm	5%	1/3W	Car.	501 310 00
R10	1.82 kohms	1%	0.4W	MF	511 318 20
R11	6.81 kohms	1%	0.4W	MF	511 368 10
R12	1 kohm	5%	1/3W	Car.	501 310 00
R13	787 kohms	1%	0.5W	MF	512 578 70
R14	100 ohms	5%	1/3W	Car.	501 210 00
R15	787 kohms	1%	0.5W	MF	512 578 70
R16-18	2.2 kohms	5%	1/3W	Car.	501 322 00
R19	1 kohm	5%	1/3W	Car.	501 310 00
R20	10 kohms	5%	1/3W	Car.	501 410 00
R21	2.2 kohms	5%	1/3W	Car.	501 322 00
R22	10 kohms	5%	1/3W	Car.	501 410 00
R23	470 ohms	5%	1/3W	Car.	501 247 00

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234R24	4.7 kohms	5%	1/3W	Car.	501 347 00
R25	1 kohm	5%	1/3W	Car.	501 310 00
R26-29	2.2 kohms	5%	1/3W	Car.	501 322 00
R30	10 kohms	5%	1/3W	Car.	501 410 00
R31	2.2 kohms	5%	1/3W	Car.	501 322 00
R32	680 ohms	5%	1/3W	Car.	501 268 00
R33	220 ohms	5%	1/3W	Car.	501 222 00
R34-35	2.2 kohms	5%	1/3W	Car.	501 322 00
R36	4.7 kohms	5%	1/3W	Car.	501 347 00
R37	22 kohms	5%	1/3W	Car.	501 422 00
R38	47 kohms	5%	1/3W	Car.	501 447 00
R39	3.3 kohms	5%	1/3W	Car.	501 333 00
R40	820 ohms	5%	1/3W	Car.	501 282 00
R41	1.8 kohms	5%	1/3W	Car.	501 318 00
R42	6.8 kohms	5%	1/3W	Car.	501 368 00
R43-44	10 kohms	5%	1/3W	Car.	501 410 00
R45	6.8 kohms	5%	1/3W	Car.	501 368 00
R46	10 kohms	5%	1/3W	Car.	501 410 00
R47	2.2 kohms	5%	1/3W	Car.	501 322 00
R48	1 kohm	5%	1/3W	Car.	501 310 00
R49-50	56 kohms	5%	1/3W	Car.	501 456 00
R51	3.3 kohms	5%	1/3W	Car.	501 333 00
R53	10 kohms	5%	1/3W	Car.	501 410 00
R54	1.8 kohms	5%	1/3W	Car.	501 318 00
R55	6.8 kohms	5%	1/3W	Car.	501 368 00
R56	1 kohm	5%	1/3W	Car.	501 310 00
R57	3.3 kohms	5%	1/3W	Car.	501 333 00
R58	1.8 kohms	5%	1/3W	Car.	501 318 00
R59	3.3 kohms	5%	1/3W	Car.	501 333 00
R60	820 ohms	5%	1/3W	Car.	501 282 00
R61	2.2 kohms	5%	1/3W	Car.	501 322 00
R62	1.8 kohms	5%	1/3W	Car.	501 318 00
R63	22 kohms	5%	1/3W	Car.	501 422 00
R64	180 ohms	5%	1/3W	Car.	501 218 00
R65	330 ohms	5%	1/3W	Car.	501 233 00
R66	47 kohms	5%	1/3W	Car.	501 447 00
R67-68	6.8 kohms	5%	1/3W	Car.	501 368 00
R69	2.2 kohms	5%	1/3W	Car.	501 322 00
R70	680 ohms	5%	1/3W	Car.	501 268 00

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234R71	220 ohms	5%	1/3W	Car.	501 222 00
R72	6.8 kohms	5%	1/3W	Car.	501 368 00
R73	47 kohms	5%	1/3W	Car.	501 447 00
R74	6.8 kohms	5%	1/3W	Car.	501 368 00
R75	220 ohms	5%	1/3W	Car.	501 222 00
R76	560 ohms	5%	1/3W	Car.	501 256 00
R77	1.8 kohms	5%	1/3W	Car.	501 318 00
R78	4.7 kohms	5%	1/3W	Car.	501 347 00
R79-80	680 ohms	5%	1/3W	Car.	501 268 00
R81	820 ohms	5%	1/3W	Car.	501 282 00
R82	47 kohms	5%	1/3W	Car.	501 447 00
R83	22 kohms	5%	1/3W	Car.	501 422 00
R84	4.7 kohms	5%	1/3W	Car.	501 347 00
R85	1.8 kohms	5%	1/3W	Car.	501 318 00
R86	47 kohms	5%	1/3W	Car.	501 447 00
R87	1 kohm	5%	1/3W	Car.	501 310 00
234T 1	Transformer				102 007 22
T 2	Transformer				102 007 12
T 3	Transformer				102 211 11
234TR1- 3	BC558B				840 055 80
TR4- 6	BC547B				840 054 70
TR7	BC558B				840 055 80
TR8	BC547B				840 054 70
TR9-10	BC558B				840 055 80
TR11-14	BC547B				840 054 70
TR15	BF245B				843 024 50

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E5002

207C 1- 3	0.1 uF	10%	250V	Polyes.	624 510 00
C 4	4.7 nF		32V	Cer.	602 347 00
C 5	47 nF	-20/+80%	12V	Cer.	601 447 00
C 6- 9	47 nF	-20/+80%	16V	Cer.	601 447 00
C10	4.7 nF		32V	Cer.	602 347 00
C11-12	47 nF	-20/+80%	16V	Cer.	601 447 00
C13	47 nF	-20/+80%	12V	Cer.	601 447 00
C14-15	270 pF	1%	500V	Polyst.	615 227 00
C16-17	220 pF	1%	500V	Polyst.	615 222 00
C18-19	0.1 uF	10%	250V	Polyes.	624 510 00
C20	47 nF	-20/+80%	16V	Cer.	601 447 00
C21	820 pF	1%	500V	Polyst.	615 282 00
207IC1	74S74				850 747 41
IC2	74LS74				850 747 40
IC3	74H30				850 743 02
IC4	74LS20				850 742 01
IC5	93S10				850 931 00
IC6	74S32				850 743 21
IC7	74LS160				857 416 00
IC8	74LS93				850 749 32
IC9	74LS00				850 740 02
IC10	74LS02				850 740 21
IC11	93S10				850 931 00
IC12	74LS90				850 749 01
IC13	74LS160				857 416 00
IC14	93S10				850 931 00
IC15	74LS160				850 931 00
IC16	74LS 90				850 749 01
IC17	74163				857 416 30
IC18	74LS30				850 743 01
IC19-20	74LS00				850 740 02
IC21-22	7426				850 742 60
IC23	74LS02				
207L 1- 2	100 uH	10%	RF-Choke		740 210 00
207PL 1	64 Way				751 000 22
207R 1	68 ohms	5%	1/3W	Car.	501 168 00
R 2	3.3 kohms	5%	1/3W	Car.	501 333 00
R 3	1.5 kohms	5%	1/3W	Car.	501 315 00
R 4	10 kohms	5%	1/3W	Car.	501 410 00
R 5	4.7 kohms	5%	1/3W	Car.	501 347 00

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207R 6	330 ohms	5%	1/3W	Car.	501 233 00
R 7	1 kohm	5%	1/3W	Car.	501 310 00
R 8	220 ohms	5%	1/3W	Car.	501 222 00
R 9	82 ohms	5%	1/3W	Car.	501 182 00
R10	220 ohms	5%	1/3W	Car.	501 222 00
R11	82 ohms	5%	1/3W	Car.	501 182 00
R12	180 ohms	5%	1/3W	Car.	501 218 00
R13	47 ohms	5%	1/3W	Car.	501 147 00
R14	390 ohms	5%	1/3W	Car.	501 239 00
R15	3.3 kohms	5%	1/3W	Car.	501 333 00
R16	820 ohms	5%	1/3W	Car.	501 282 00
R17	100 ohms	5%	1/3W	Car.	501 210 00
R18	1 kohm	5%	1/3W	Car.	501 310 00
R19	330 ohms	5%	1/3W	Car.	501 233 00
R20	3.3 kohms	5%	1/3W	Car.	501 333 00
R21	390 ohms	5%	1/3W	Car.	501 239 00
R22-24	1 kohm	5%	1/3W	Car.	501 310 00
R25-26	1.5 kohms	5%	1/3W	Car.	501 315 00
R27	1 kohm	5%	1/3W	Car.	501 310 00
R28	4.7 kohms	5%	1/3W	Car.	501 347 00
R29	1 kohm	5%	1/3W	Car.	501 310 00
R30	10 kohms	5%	1/3W	Car.	501 410 00
R31-32	4.7 kohms	5%	1/3W	Car.	501 347 00
R33-37	1 kohm	5%	1/3W	Car.	501 310 00
R38	1.8 kohm	5%	1/3W	Car.	501 318 00
R39	1 kohm	5%	1/3W	Car.	501 310 00
R40	1.8 kohm	5%	1/3W	Car.	501 318 00
20 TR1	BSX20				840 002 00
TR2- 3	BC547B				840 054 70
TR4	BSX20				840 002 00
TR5- 6	BC547B				840 054 70

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E5002

208C 1	4.7 nF	-20/+80%	32V	Cer.	602 347 00
C 2	0.22 uF	10%	100V	Polyes.	623 522 00
C 3- 5	47 nF	-20/+80%	16V	Cer.	601 447 00
C 6	4.7 nF	-20/+80%	32V	Cer.	602 347 00
C 7	0.1 uF	10%	250V	Polyes.	624 510 00
C 8	47 nF	-20/+80%	16V	Cer.	601 447 00
C 9	0.1 uF	10%	250V	Polyes.	624 510 00
C10-11	47 nF	-20/+80%	16V	Cer.	601 447 00
C12	0.1 uF	10%	250V	Polyes.	624 510 00
C13	180 pF	1%	500V	Polyst.	615 218 00
C14-15	47 nF	-20/+80%	16V	Cer.	601 447 00
C16	0.1 uF	10%	250V	Polyes.	624 510 00
C17	0.47 uF	10%	100V	Polyes.	623 547 00
C18	130 pF	1%	500V	Polyst.	615 213 00
C19	5.6 pF	±0.25 pF	400V	Cer.	605 056 00
C20	220 pF	1%	500V	Polyst.	615 222 00
C21	33 pF	5%	400V	Cer.	605 133 00
C22	180 pF	1%	500V	Polyst.	615 218 00
C23	39 pF	5%	400V	Cer.	605 139 00
C24	180 pF	1%	500V	Polyst.	615 218 00
C25	22 pF	5%	400V	Cer.	605 122 00
C26	120 pF	1%	500V	Polyst.	615 212 00
C27-28	0.1 uF	10%	250V	Polyes.	624 510 00
C29	68 pF	5%	400V	Cer.	605 168 00
C30	220 pF	1%	500V	Polyst.	615 222 00
C31	0.68 uF	10%	100V	Polyes.	623 568 00
C32	68 pF	5%	400V	Cer.	605 168 00
C33	0.1 uF	10%	250V	Polyes.	624 510 00
C34	3.3 nF	1%	125V	Polyes.	613 333 00
C35	1.8 nF	1%	250V	Polyst.	614 318 00
208IC1	7805				850 780 50
IC2	74LS13				850 741 30
IC3	74LS73				850 747 30
IC4	1496				850 149 60
IC5	74LS13				850 741 30
IC6	74490				857 449 00
IC7-10	74LS93				850 749 32
IC11	74LS20				850 742 01
IC12	74LS00				850 740 02

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208R35	10 kohms	5%	1/3W	Car.	501 410 00
R36	47 kohms	5%	1/3W	Car.	501 447 00
R37	560 ohms	5%	1/3W	Car.	501 256 00
R38	150 ohms	5%	1/3W	Car.	501 215 00
R39	15 kohms	5%	1/3W	Car.	501 415 00
R40	4.7 kohms	5%	1/3W	Car.	501 347 00
R41-44	1 kohm	5%	1/3W	Car.	501 310 00
R45	4.7 kohms	5%	1/3W	Car.	501 347 00
R46-47	1 kohm	5%	1/3W	Car.	501 310 00
R48	1.8 kohms	5%	1/3W	Car.	501 318 00
R49	1 kohm	5%	1/3W	Car.	501 310 00
R50	5.6 kohm	5%	1/3W	Car.	501 356 00
208T 1			Transformator		105 219 21
208TR1	BSX20				840 002 00
TR2- 5	BC547B				840 054 70

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E5002

208IC13	74121				857 412 10
IC14	74LS13				850 741 30
IC15	74LS00				850 740 02
IC16	74LS03				850 740 31
IC17	7416				850 741 60
208L 1	100 uH	10%	RF-Choke		740 210 00
L 2			Coil		105 218 92
L 3			Coil		105 219 11
L 4			Coil		105 219 01
L 5			Coil		105 218 81
L 6	100uH	10%	RF-Choke		740 210 00
L 7	22uH	0,75A			740 122 01
208PL1	32 Way				751 000 20
208R 1	4.7 kohms	5%	1/3W	Car.	501 347 00
R 2	680 ohms	5%	1/3W	Car.	501 268 00
R 3	1 kohm	5%	1/3W	Car.	501 310 00
R 4	12 kohms	5%	1/3W	Car.	501 415 00
R 5- 6	4.7 kohms	5%	1/3W	Car.	501 347 00
R 7	1.2 kohms	5%	1/3W	Car.	501 312 00
R 8	1.8 kohms	5%	1/3W	Car.	501 318 00
R 9	18 kohms	5%	1/3W	Car.	501 418 00
R10	12 kohms	5%	1/3W	Car.	501 412 00
R11-14	1 kohm	5%	1/3W	Car.	501 310 00
R15	680 ohms	5%	1/3W	Car.	501 268 00
R16	180 ohms	5%	1/3W	Car.	501 218 00
R17	560 ohms	5%	1/3W	Car.	501 256 00
R18	270 ohms	5%	1/3W	Car.	501 227 00
R19-20	470 ohms	5%	1/3W	Car.	501 247 00
R21-24	1 kohm	5%	1/3W	Car.	501 310 00
R25	15 kohms	5%	1/3W	Car.	501 415 00
R26	12 kohms	5%	1/3W	Car.	501 412 00
R27	470 ohms	5%	1/3W	Car.	501 247 00
R28	560 ohms	5%	1/3W	Car.	501 256 00
R29	10 kohms	5%	1/3W	Car.	501 410 00
R30	27 kohms	5%	1/3W	Car.	501 427 00
R31	100 kohms	5%	1/3W	Car.	501 510 00
R32	1 kohm	5%	1/3W	Car.	501 310 00
R33	390 ohms	5%	1/3W	Car.	501 239 00
R34	1.2 kohms	5%	1/3W	Car.	501 312 00

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E5002

209C 1	0.1 uF	10%	250V	Polyes.	624 510 00
C 2	68 nF	10%	100V	Polyes.	623 468 00
C 3	0.1 uF	10%	250V	Polyes.	624 510 00
C 4	22 nF	10%	250V	Polyes.	624 422 00
C 5	0.1 uF	10%	250V	Polyes.	624 510 00
C 6	22 nF	10%	250V	Polyes.	624 422 00
C 7	2.2 nF	1%	250V	Polyst.	614 322 00
C 8	3.3 nF	1%	125V	Polyst.	613 333 00
C 9	33 pF	5%	400V	Cer.	605 133 00
C10	47 nF	10%	250V	Polyes.	624 447 00
C11	33 pF	5%	400V	Cer.	605 133 00
C12	470 uF		16V	W.alum.	651 847 00
C13	1000 uF		16V	W.alum.	651 910 00
C14-16	100 uF		16V	W.alum.	651 810 00
C17-19	0.1 uF	10%	250V	Polyes.	624 510 00
C20-21	33 pF	5%	400V	Cer.	605 133 00
C22	0.22 uF	10%	250V	Polyes.	624 522 01
C23	0.47 uF	10%	100V	Polyes.	623 547 00
C24	22 nF	10%	250V	Polyes.	624 422 00
C25	10 nF	10%	250V	Polyes.	624 410 00
C26	47 nF	10%	250V	Polyes.	624 447 00
C27-29	10 nF	10%	250V	Polyes.	624 410 00
C30	47 nF	10%	250V	Polyes.	624 447 00
C31	100 pF	1%	500V	Polyst.	615 210 00
C32	12 pF	5%	400V	Cer.	605 112 00
C33	0.1 uF	10%	250V	Polyes.	624 510 00
C34	10 nF	10%	250V	Polyes.	624 410 00
C35	4.7 nF	-20/+80%	32V	Cer.	602 347 00
C36	470 pF	1%	500V	Polyst.	615 247 00
C37-38	0.1 uF	10%	250V	Polyes.	624 510 00
C39	470 uF		16V	W.alum.	651 847 00
C40-41	4.7 nF	-20/+80%	32V	Cer.	602 347 00
C42	0.1 uF	10%	250V	Polyes.	624 510 00
C43	1 uF	10%	100V	Polyes.	623 610 00
C44	47 nF	10%	250V	Polyes.	624 447 00
C45	47 nF	-20/+80%	16V	Cer.	601 447 00
C46	47 nF	10%	250V	Polyes.	624 447 00
C47	4.7 nF	-20/+80%	32V	Cer.	602 347 00
C48	47 nF	-20/+80%	16V	Cer.	601 447 00
C49-50	0.1 uF	10%	250V	Polyes.	624 510 00
C51	1 uF	10%	100V	Polyes.	623 610 00
C52	47 nF	-20/+80%	16V	Car.	601 447 00
C53	47 nF	-20/+80%	16V	Car.	601 447 00

PARTS LIST

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209D 1- 2	BZX79C6V8	Zener			832 796 80
D 3	BB113				833 011 30
D 4	BB104				833 010 40
D 5-6	IS 920				830 192 00
209IC1- 4	301A				850 030 10
209L 1- 2	220 uH	10%	RF-Choke		740 222 00
L 3- 4	1 mH	10%	RF-Choke		740 310 01
L 5			Coil		105 218 61
L 6			Coil		105 218 72
L 7	220 uH	10%	RF-Choke		740 222 00
209PL 1	32 Way				751 000 20
209R 1	22 kohms	5%	1/3W	Car.	501 422 00
R 2	18 kohms	5%	1/3W	Car.	501 418 00
R 3- 4	270 ohms	5%	1/3W	Car.	501 227 00
R 5	22 kohms	5%	1/3W	Car.	501 422 00
R 6	18 kohms	5%	1/3W	Car.	501 418 00
R 7	33 ohms	5%	1/3W	Car.	501 133 00
R 8	22 ohms	5%	1/3W	Car.	501 122 00
R 9	39 ohms	5%	1/3W	Car.	501 139 00
R10-11	4.7 kohms	5%	1/3W	Car.	501 347 00
R12	18 kohms	5%	1/3W	Car.	501 418 00
R13-14	1 kohm		Var.		582 310 00
R15	47 kohms	5%	1/3W	Car.	501 447 00
R16	12 kohms	5%	1/3W	Car.	501 412 00
R17-18	4.7 kohms	5%	1/3W	Car.	501 347 00
R19	15 kohms	5%	1/3W	Car.	501 415 00
R20	56 kohms	5%	1/3W	Car.	501 456 00
R21	18 kohms	5%	1/3W	Car.	501 418 00
R22	12 kohms	5%	1/3W	Car.	501 412 00
R23	18 kohms	5%	1/3W	Car.	501 418 00
R24	8.2 kohms	5%	1/3W	Car.	501 382 00
R26	4.7 kohms	5%	1/3W	Car.	501 347 00
R27	100 kohms	5%	1/3W	Car.	501 510 00
R28	4.7 kohms	5%	1/3W	Car.	501 347 00
R29	560 kohms	5%	1/3W	Car.	501 556 00
R30	100 kohms	5%	1/3W	Car.	501 510 00
R31	2.2 kohms	5%	1/3W	Car.	501 322 00
R32	3.9 kohms	5%	1/3W	Car.	501 339 00
R33	1.5 kohms	5%	1/3W	Car.	501 315 00
R34	4.7 kohms	5%	1/3W	Car.	501 347 00
R35	220 ohms	5%	1/3W	Car.	501 222 00
R36	15 kohms	5%	1/3W	Car.	501 415 00
R37	560 ohms	5%	1/3W	Car.	501 256 00
R38	2.7 kohms	5%	1/3W	Car.	501 327 00
R39	100 ohms	5%	1/3W	Car.	501 210 00

PARTS LIST

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209R40	1 kohm	5%	1/3W	Car.	501 310 00
R41	180 ohms	5%	1/3W	Car.	501 218 00
R42	22 kohms	5%	1/3W	Car.	501 422 00
R43	15 kohms	5%	1/3W	Car.	501 415 00
R44	3.3 kohms	5%	1/3W	Car.	501 333 00
R45	2.7 kohms	5%	1/3W	Car.	501 327 00
R46	4.7 kohms	5%	1/3W	Car.	501 347 00
R47	100 ohms	5%	1/3W	Car.	501 210 00
R48	1 kohm	5%	1/3W	Car.	501 310 00
R49	180 ohms	5%	1/3W	Car.	501 218 00
R50	39 ohms	5%	1/3W	Car.	501 139 00
R51	100 ohms	5%	1/3W	Car.	501 210 00
R52	120 ohms	5%	1/3W	Car.	501 212 00
R53	100 ohms	5%	1/3W	Car.	501 210 00
R54	100 kohms	5%	1/3W	Car.	501 510 00
R55	120 ohms	5%	1/3W	Car.	501 212 00
R56	4.7 kohms	5%	1/3W	Car.	501 347 00
R57	3.3 kohms	5%	1/3W	Car.	501 333 00
R58	10 kohms	5%	1/3W	Car.	501 410 00
R59	82 ohms	5%	1/3W	Car.	501 182 00
R60	56 ohms	5%	1/3W	Car.	501 156 00
R61	220 ohms	5%	1/3W	Car.	501 222 00
R62	10 kohms	5%	1/3W	Car.	501 410 00
R63	100 kohms	5%	1/3W	Car.	501 510 00
R64	120 ohms	5%	1/3W	Car.	501 212 00
R65	22 ohms	5%	1/3W	Car.	501 122 00
R66	22 kohms	5%	1/3W	Car.	501 422 00
209T 1			Transformator		105 218 51
T 2			Transformator		105 218 41
209TR1- 4	BF240				840 024 00
TR5	BSX20				840 002 00
TR6	BC547B				840 054 70
TR7	BSX20				840 002 00
TR8	BC547B				840 054 70

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E5002

210C 1	330 pF	1%	500V	Polyst.	615 233 00
C 2	110 pF	1%	500V	Polyst.	615 211 00
C 3	22 pF	5%	400V	Cer.	605 122 00
C 4-6	0.1 uF	10%	100V	Polyes.	623 510 00
C 7	100 uF		25V	W. alum.	652 810 00
C 8	1000 uF		16V	W. alum.	651 910 00
C 9	33 pF	5%	400V	Cer.	605 133 00
C10-11	0.47 uF	10%	100V	Polyes.	623 547 00
C12	3.9 nF	1%	125V	Polyst.	613 339 00
C13-15	10 nF	10%	250V	Polyes.	624 410 00
C16-18	3.3 pF	±0.25 pF	400V	Cer.	605 033 00
C19	47 pF	5%	400V	Cer.	605 147 00
C20-22	0.1 uF	10%	100V	Polyes.	623 510 00
C23	100 uF		25V	W.alum.	651 910 00
C24	(4.5-26)pF	Var.			683 126 00
C25	100 uF		25V	W.alum	651 910 00
C26	(4.5-26)pF	Var.			683 126 00
C27	100 uF		25V	W.alum.	651 910 00
C28	(4.5-26)pF	Var.			683 126 00
C29-31	100 pF	1%	500V	Polyst.	615 210 00
C32-35	0.1 uF	10%	100V	Polyes.	623 510 00
C36-38	3.3 pF	±0.25 pF	400V	Cer.	605 033 00
C39	10 nF	10%	250V	Polyes.	624 410 00
C40	1 uF	10%	100V	Polyes.	623 610 00
C41	10 nF	10%	250V	Polyes.	624 410 00
C42	82 pF	5%	400V	Cer.	605 182 00
C43	0.1 uF	10%	100V	Polyes.	623 510 00
C44-45	10 nF	10%	250V	Polyes.	624 410 00
C46	0.1 uF	10%	100V	Polyes.	623 510 00
C47	10 nF	10%	250V	Polyes.	624 410 00
C48	51 pF	5%	400V	Cer.	605 151 00
C49	10 nF	10%	250V	Polyes.	624 410 00
C50	22 nF	10%	250V	Polyes.	624 422 00
C51	47 nF	-20/+80%	16V	Cer.	601 447 00
210D 1-4	BB109G				833 010 90
D 5	IS920				830 192 00
D 6-7	BB109G				833 010 90
D 8	1S920				830 192 00

PARTS LIST

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E5002

210D 9-10	BB109G				833 010 90
D11	1S920				830 192 00
D12-21	BB109G				833 010 90
D22-24	BA 282				830 028 20
210IC1- 2	301A				850 030 10
IC3	74S132				857 413 20
210L 1- 2	220 uH	10%	RF-choke		740 222 00
L 3	22 uH	10%	RF-choke		740 122 00
L 4	10 uH	10%	RF-choke		740 110 00
L 5	2.2 uH	10%	RF-choke		740 022 00
L 6			Coil		105 219 42
L 7-8			Coil		105 219 51
L 9-11	100 uH	10%	RF-choke		740 210 00
L 12-13	10 uH	10%	RF-choke		740 110 00
210PL1					751 000 20
210R 1- 2	33 kohms	5%	1/3W	Car.	501 433 00
R 3	4.7 kohms	5%	1/3W	Car.	501 347 00
R 4	56 kohms	5%	1/3W	Car.	501 456 00
R 5	1 kohm	Var.			582 310 00
R 6	330 ohms	5%	1/3W	Car.	501 233 00
R 7	4.7 kohms	5%	1/3W	Car.	501 347 00
R 8	12 kohms	5%	1/3W	Car.	501 412 00
R 9-10	10 kohms	5%	1/3W	Car.	501 410 00
R11	6.8 kohms	5%	1/3W	Car.	501 368 00
R12-14	100 ohms	5%	1/3W	Car.	501 210 00
R15-16	1 kohm	5%	1/3W	Car.	501 310 00
R17-18	10 kohms	5%	1/3W	Car.	501 410 00
R19-20	2.2 kohms	5%	1/3W	Car.	501 322 00
R21-23	180 kohms	5%	1/3W	Car.	501 518 00
R24-26	820 kohms	5%	1/3W	Car.	501 582 00
R27	180 ohms	5%	1/3W	Car.	501 218 00
R28	270 ohms	5%	1/3W	Car.	501 227 00
R29-30	180 ohms	5%	1/3W	Car.	501 218 00
R31	470 ohms	5%	1/3W	Car.	501 247 00
R32	180 ohms	5%	1/3W	Car.	501 218 00

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E5002

210R33	330 ohms	5%	1/3W	Car.	501 233 00
R34	10 kohms	5%	1/3W	Car.	501 410 00
R35	1 kohm	5%	1/3W	Car.	501 310 00
R36	1.2 kohms	5%	1/3W	Car.	501 312 00
R37	1 kohm	5%	1/3W	Car.	501 310 00
R38	12 ohms	5%	1/3W	Car.	501 112 00
R39	150 ohms	5%	1/3W	Car.	501 215 00
R40	56 kohms	5%	1/3W	Car.	501 456 00
R41	120 ohms	5%	1/3W	Car.	501 212 00
R42	120 ohms	5%	1/3W	Car.	501 212 00
R43	220 ohms	5%	1/3W	Car.	501 222 00
R44	1.2 kohms	5%	1/3W	Car.	501 312 00
R45	1.5 kohms	5%	1/3W	Car.	501 315 00
R46	6.8 kohms	5%	1/3W	Car.	501 368 00
R47	2.2 kohms	5%	1/3W	Car.	501 322 00
R48	10 ohms	5%	1/3W	Car.	501 110 00
R49	68 ohms	5%	1/3W	Car.	501 168 00
R50	330 ohms	5%	1/3W	Car.	501 233 00
R51	56 ohms	5%	1/3W	Car.	501 156 00
R52	100 ohms	5%	1/3W	Car.	501 210 00
R53	1.5 kohms	5%	1/3W	Car.	501 315 00

210TR1- 3	BFX 89	840 008 90
TR4	BC547B	840 054 70
TR5- 6	BC577	840 055 70
TR7- 9	E310	840 031 00
TR10	BC547B	840 054 70
TR11	BSX20	840 002 00
TR12	BF240	840 024 00
TR13	BFW17A	840 001 70
TR14	BSX20	840 002 00

PARTS LIST

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E5002

240C 1	47 nF	-20/+80%	16V	Cer.	601 447 00
C 2	0.1 uF	10%	250V	Polyes.	624 510 00
C 3	47 pF	5%	400V	Cer.N150	605 147 00
C 4	10 nF	-20/+80%	32V	Cer.	602 410 00
C 5	0.1 uF	10%	250V	Polyes.	624 510 00
C 6	3.3 nF	1%	125V	Polyst.	613 333 00
240IC 1	7493				850 749 31
240L 1	100 uH	10%	RF Choke		740 210 00
240R 1	470 ohms	5%	1/3W	Car.	501 247 00
R 2	820 ohms	5%	1/3W	Car.	501 282 00
R 3	15 kohms	5%	1/3W	Car.	501 415 00
R 4	2.7 kohms	5%	1/3W	Car.	501 327 00
R 5	1.2 kohms	5%	1/3W	Car.	501 312 00
R 6	270 ohms	5%	1/3W	Car.	501 227 00
R 7	27 kohms	5%	1/3W	Car.	501 427 00
R 8	8.2 kohms	5%	1/3W	Car.	501 382 00
R 9	2.2 kohms	5%	1/3W	Car.	501 322 00
R10	680 ohms	5%	1/3W	Car.	501 268 00
R11	8.2 kohms	5%	1/3W	Car.	501 382 00
R12	15 kohms	5%	1/3W	Car.	501 415 00
R13-14	470 ohms	5%	1/3W	Car.	501 247 00
R15	820 ohms	5%	1/3W	Car.	501 282 00
R16	180 ohms	5%	1/2W	Car.	502 218 00
240T 1					105 215 71
240TR1- 2	BF240				840 024 00
TR3	BSX20				840 002 00
240X 1	OSCILLATOR	TCXO	11.2MHz		811 000 01

PARTS LIST

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E5002

241C1	22 uF		16V	W.alum.	651 722 00
C2	10 nF	10%	250V	Polyes.	624 410 00
C3	22 uF		16V	Tan	651 722 00
C4	0.68 uF	10%	100V	Polyes.	623 568 00
C5	220 pF	1%	500V	Polyst.	615 222 00
C6	0.22 uF	10%	100V	Polyes.	623 522 00
C7	0.47 uF	10%	100V	Polyes.	623 547 00
C8	680 pF	1%	500V	Polyst.	615 268 00
C9	0.22 uF	10%	100V	Polyes.	623 522 00
C10	0.68 uF	10%	100V	Polyes.	623 568 00
C11	0.22 uF	10%	100V	Polyes.	623 522 00
C12	470 uF		6.3V	W.alum.	650 847 00
C13-15	47 nF	-20/+80%	16V	Cer.	601 447 00
241D1-2	TIL209A	Zener			823 000 00
D3	BZX79C5V1				832 795 10
D4	AAZ17				830 001 70
241IC1	555				850 055 50
IC2	74LS123				857 412 30
IC3	74LS00				850 740 02
IC4	74LS74				850 747 40
IC5	7406				850 740 60
IC6	74LS123				857 412 30
IC7	7426				850 742 60
IC8	74LS123				857 412 30
IC9	7805				850 780 50
PL1	32Way				751 000 20
241R1	5.6 kohms	5%	1/3W	Car.	501 356 00
R2	270 ohms	5%	1/3W	Car.	501 227 00
R3	27 kohms	5%	1/3W	Car.	501 427 00
R4-13	3.9 kohms	5%	1/3W	Car.	501 339 00
R14	4.7 kohms	5%	1/3W	Car.	501 347 00
R15-20	3.9 kohms	5%	1/3W	Car.	501 339 00
R21	330 ohms	5%	1/3W	Car.	501 233 00
R22	18 kohms	5%	1/3W	Car.	501 418 00
R23	4.7 kohms	5%	1/3W	Car.	501 347 00
R24-31	3.9 kohms	5%	1/3W	Car.	501 339 00

PARTS LIST

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E5002

241R32	6.8 kohms	5%	1/3W	Car.	501 368 00
R33-36	3.9 kohms	5%	1/3W	Car.	501 339 00
R37	18 kohms	5%	1/3W	Car.	501 418 00
R38-39	3.9 kohms	5%	1/3W	Car.	501 339 00
R40	470 ohms	5%	1/3W	Car.	501 247 00
R41-42	3.9 kohms	5%	1/3W	Car.	501 339 00
R43	4.7 kohms	5%	1/3W	Car.	501 347 00
R44	6.8 kohms	5%	1/3W	Car.	501 368 00
R45-56	3.9 kohms	5%	1/3W	Car.	501 339 00
R57	330 ohms	5%	1/3W	Car.	501 133 00
R58	18 kohms	5%	1/3W	Car.	501 418 00
R59-62	3.9 kohms	5%	1/3W	Car.	501 339 00
R63	820 ohms	5%	1/3W	Car.	501 282 00
R64	560 ohms	5%	1/3W	Car.	501 256 00
R65-68	1 kohm	5%	1/3W	Car.	501 310 00
R69	1.8 kohms	5%	1/3W	Car.	501 318 00
R70	4.7 kohms	5%	1/3W	Car.	501 347 00
R71	10 kohms	5%	1/3W	Car.	501 410 00
R72	33 ohms	5%	1/3W	Car.	501 133 00
241S1					763 000 12
S2					763 000 11
S3					761 000 01
241SK1					751 000 43
SK2-3					751 000 46
SK4-5					751 000 43
241TR1	BC337-25				840 033 70
TR2	BD234-10				842 023 40

PARTS LIST

FOR

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303C1	220 pF	1%	500 V	Polyst	615 222 00
C2	100 uF		25 V	W.Alum.	652 810 00
C3	200 pF	1%	500 V	Polyst	615 222 00
C4	100 uF		25 V	W.Alum.	652 810 00
C5	100 pF	1%	500 V	Polyst	615 210 00
C6	10 nF	10%	100 V	Polyes	623 410 00
C7-10	0.1 uF	10%	100 V	Polyes	623 510 00
C11	22 uF		15 V	Tan	651 722 00
C12-14	0.22 uF	10%	63 V	Polyes	622 522 00
C15	1 u	10%	100 V		623 610 00
C16	0.22 uF	10%	63 V		622 522 00
C17	100 uF		25 V	W.Alum.	652 810 00
303D1-13	AA143				830 014 30
D14-16	1S920				830 192 00
D17-21	AA143				830 014 30
303IC1	7409A				850 740 91
IC2	74LS257				857 425 70
IC3	74S188				382 239 51
IC4	74LS05				857 740 51
IC5	74S188				382 246 61
IC6	74S188 (programmed)				382 246 52
IC7	74S188 (programmed)				382 246 42
IC8	74S188 (programmed)				382 246 31
IC9	74S188 (programmed)				382 246 21
IC10	74LS47				850 744 70
IC11	74S188				382 239 61
IC12	MAN82				824 008 20
IC13	74LS395				857 439 50
IC14-15	74184				857 418 40
IC16	74S188 (programmed)				382 239 72
IC17	74LS47				850 744 70
IC18	MAN82				824 008 20
IC19	74LS395				857 439 50
IC20	74S188				857 418 80
IC21	74184				857 418 40
IC22	74LS47				850 744 70
IC23	MAN82				824 008 20
IC24	74LS188				857 418 80
IC25	74LS395				857 439 50
IC26	74184				857 418 40
IC27	74LS47				850 744 70
IC28	MAN82				824 008 20

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PARTS LIST

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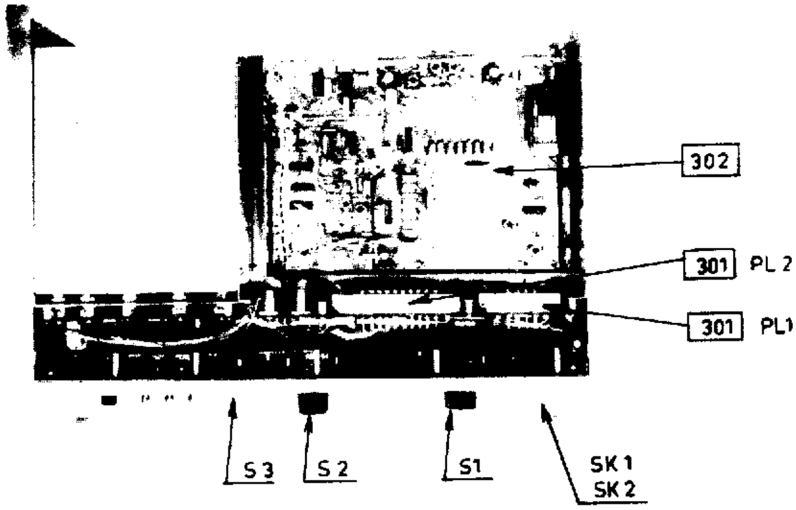
303IC29	74LS395				857 439 50
IC30	74184				857 418 40
IC31	74LS47				850 744 70
IC32	MAN82				824 008 20
IC33	74LS125				857 412 50
IC34	74S188				857 418 80
IC35-36	74LS395				857 439 50
IC37	74LS125				857 412 50
IC38	74LS47				850 744 70
IC39	74S188 (programmed)				382 239 61
IC40	MAN82				824 008 20
IC41-42	74LS395				857 439 50
IC43	74LS32				850 743 20
IC44	74LS03				850 740 31
IC45	74LS123				857 412 30
IC46	74LS00				850 740 02
IC47-49	7805				850 780 50
IC50	74148				857 414 80
IC51	74LS123				857 412 30
IC52	74184				857 418 40
303PL1	64 POL				751 000 77
303RN1-2	15x4,7 kohm Resistor network			DIL	530 000 02
RN3	7x4,7 kohm Resistor network			SIL	530 000 01
RN4-5	15x4,7 kohm Resistor network			DIL	530 000 02
RN6-7	7x4,7 kohm Resistor network			SIL	530 000 01
303R1	4,7 kohm	5%	1/3W	Car	501 347 00
R2-4	100 ohm	5%	1/3W	Car	501 210 00
R5	1 kohm	5%	1/3W	Car	501 310 00
R7-9	100 ohm	5%	1/3W	Car	501 210 00
R10	1 kohm	5%	1/3W	Car	501 310 00
R11	100 ohm	5%	1/3W	Car	501 210 00
R15	1 kohm	5%	1/3W	Car	501 310 00
R16	100 ohm	5%	1/3W	Car	501 210 00
R17	1 kohm	5%	1/3W	Car	501 310 00
R18	100 ohm	5%	1/3W	Car	501 210 00

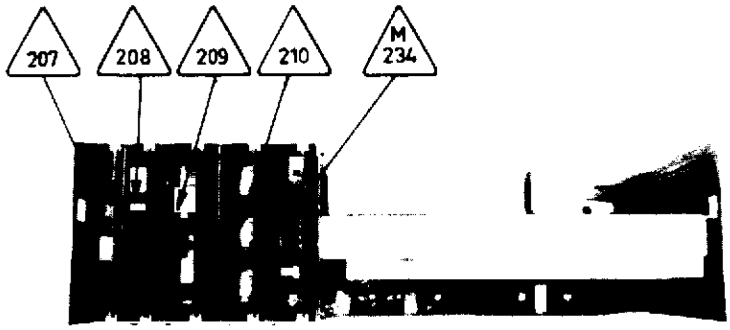
PARTS LIST

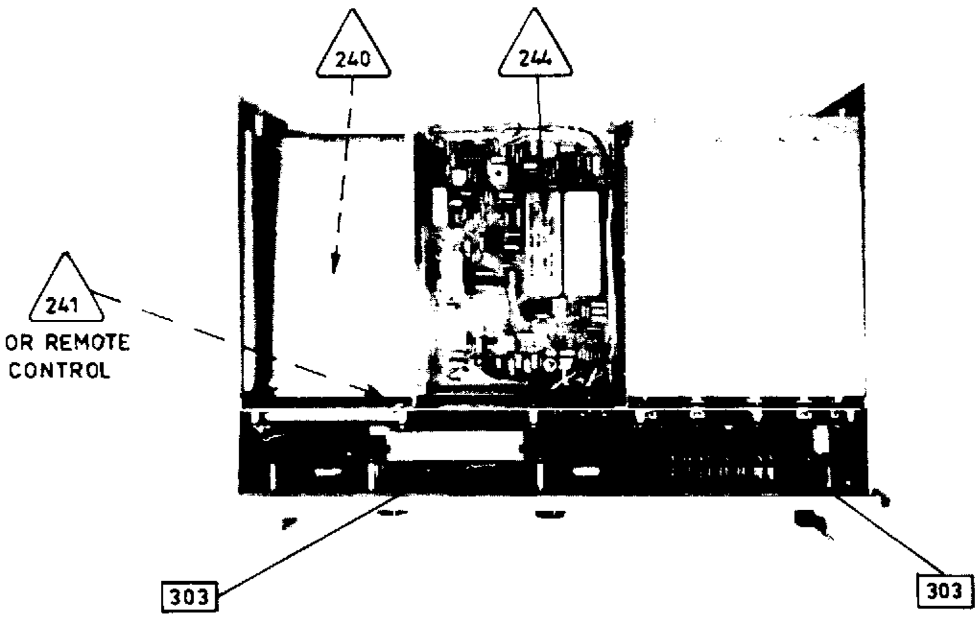
FOR

303

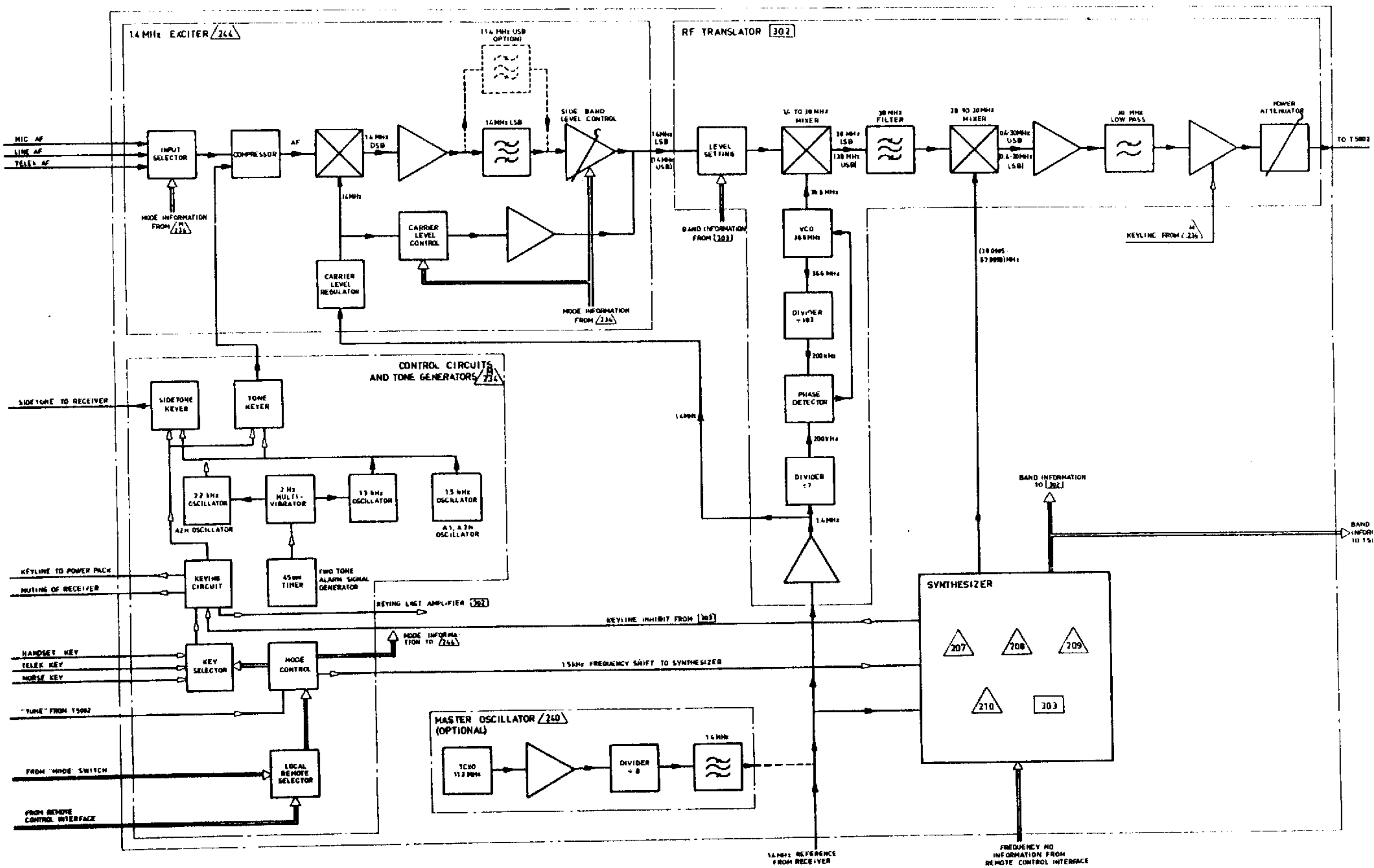
303R19	1 kohm	5%	1/3W	Car	501 310 00
R20-41	100 ohm	5%	1/3W	Car	501 210 00
R42	4.7 ohm	5%	1/3W	Car	501 347 00
R43	33 ohm	5%	1/3W	Car	501 133 00
R44-51	100 kohm	5%	1/3W	Car	501 210 00
R52	4.7 ohm	5%	1/3W	Car	501 347 00
R53-59	100 kohm	5%	1/3W	Car	501 210 00
R60	4.7 ohm	5%	1/3W	Car	501 347 00
R61	100 ohm	5%	1/3W	Car	501 210 00
R62	330 ohm	5%	1/3W	Car	501 233 00
R63	33 ohm	5%	1/3W	Car	501 133 00
R64	150 kohm	5%	1/3W	Car	501 215 00
R65	1 ohm	Var.	Lin		502 213 02
R66	4.7 kohm	5%	1/3W	Car	351 347 00
R67	330 kohm	5%	1/3W	Car	501 233 00
R68	1 kohm	5%	1/3W	Car	501 310 00
R69	4.7 kohm	5%	1/3W	Car	501 347 00
R70	10 kohm	5%	1/3W	Car	501 410 00
R71-72	1 kohm	5%	1/3W	Car	501 310 00
R73	4.7 kohm	5%	1/3W	Car	501 347 00
R74-76	1 kohm	5%	1/3W	Car	501 310 00
R77	100 kohm	5%	1/3W	Car	501 210 00
R78-79	4.7 kohm	5%	1/3W	Car	501 347 00
R80	1.8 kohm	5%	1/3W	Car	501 318 00
R81-93	4.7 kohm	5%	1/3W	Car	501 347 00
R94	47 kohm	5%	1/3W	Car	501 447 00
R95	4.7 kohm	5%	1/3W	Car	501 347 00
303TR1	BC337				840 033 70
TR2-6	BC327				840 032 70
TR7	BC337				840 033 70
TR8	BD135				842 013 50
TR9	BC547				840 054 70
TR10-11	BC327				840 032 70





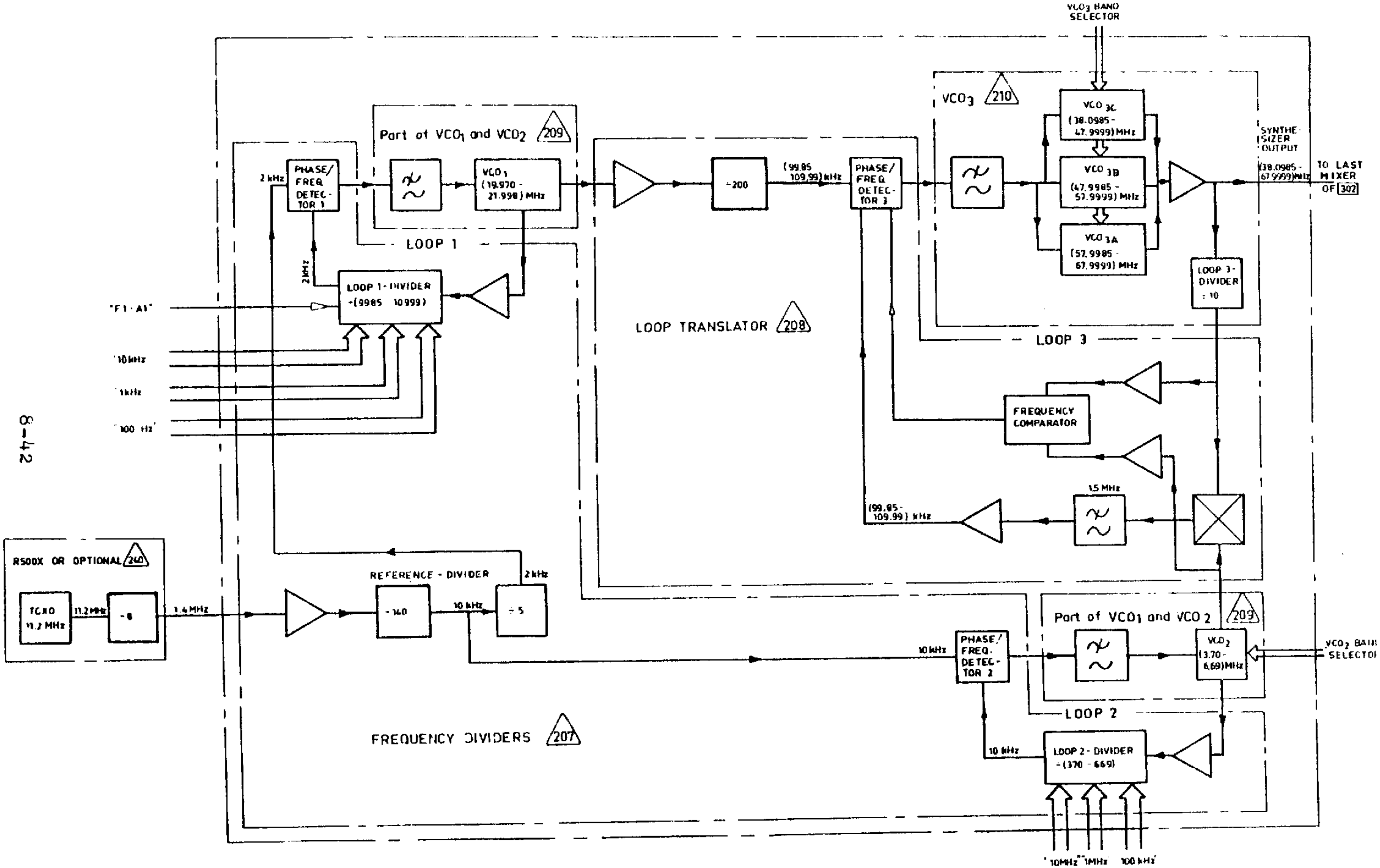


LOCATION OF CIRCUIT BOARDS
EXCITER E5002



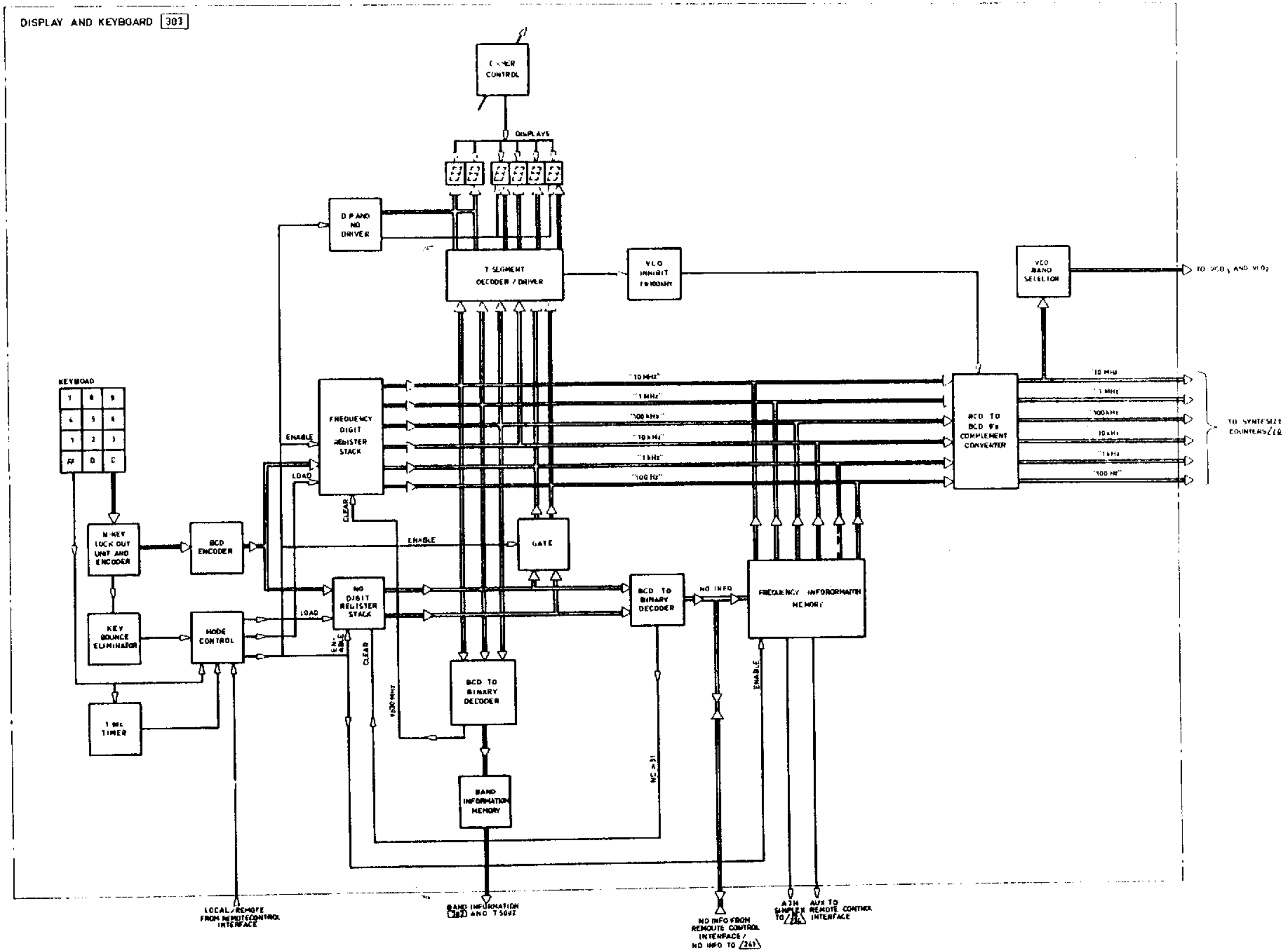
BLOCK DIAGRAM, SIGNAL PATH E5002

w2 247 01



BLOCK DIAGRAM, FREQUENCY SYNTHESIZER
E 5002

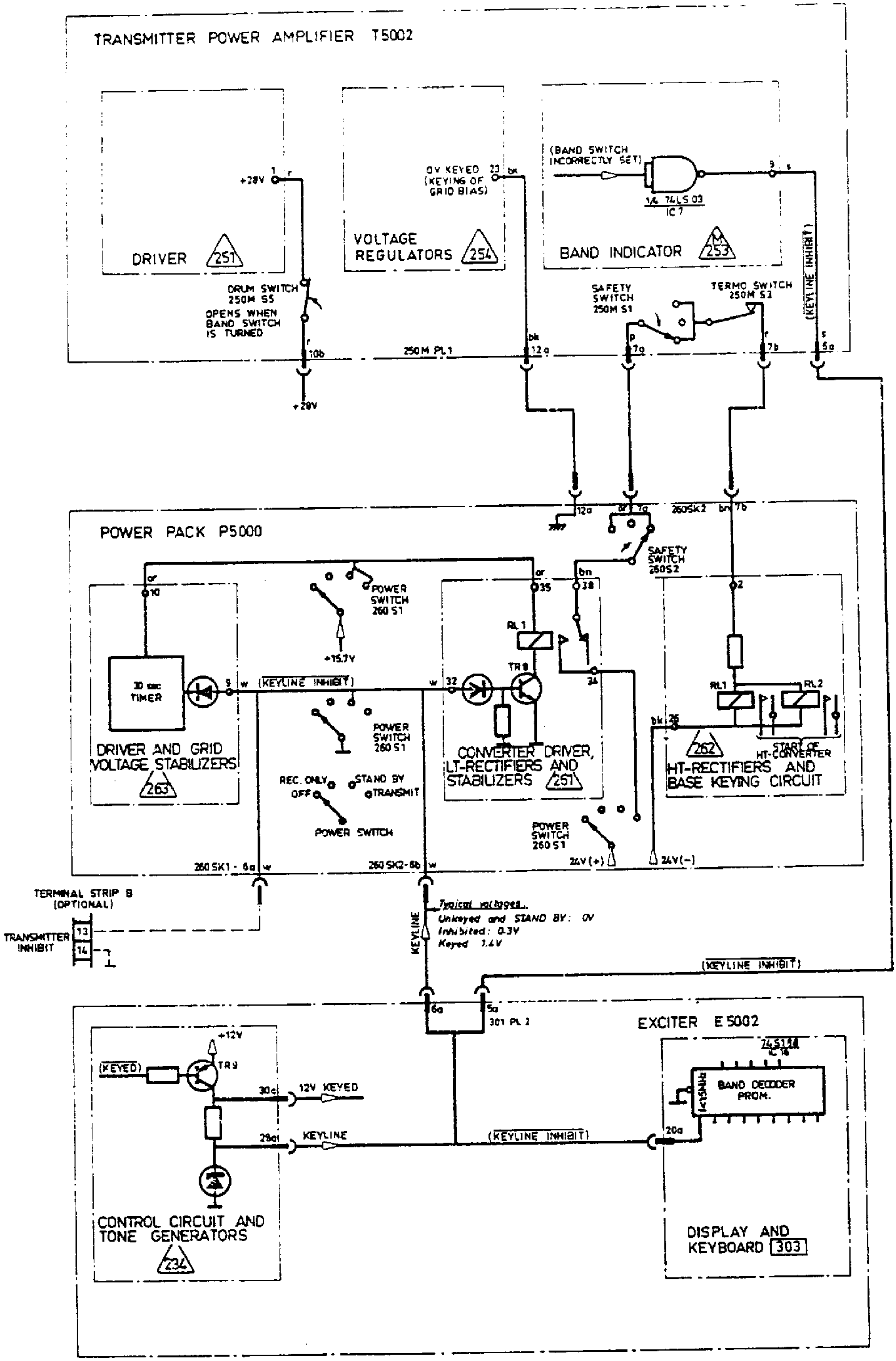
ss2 246 91



8-43

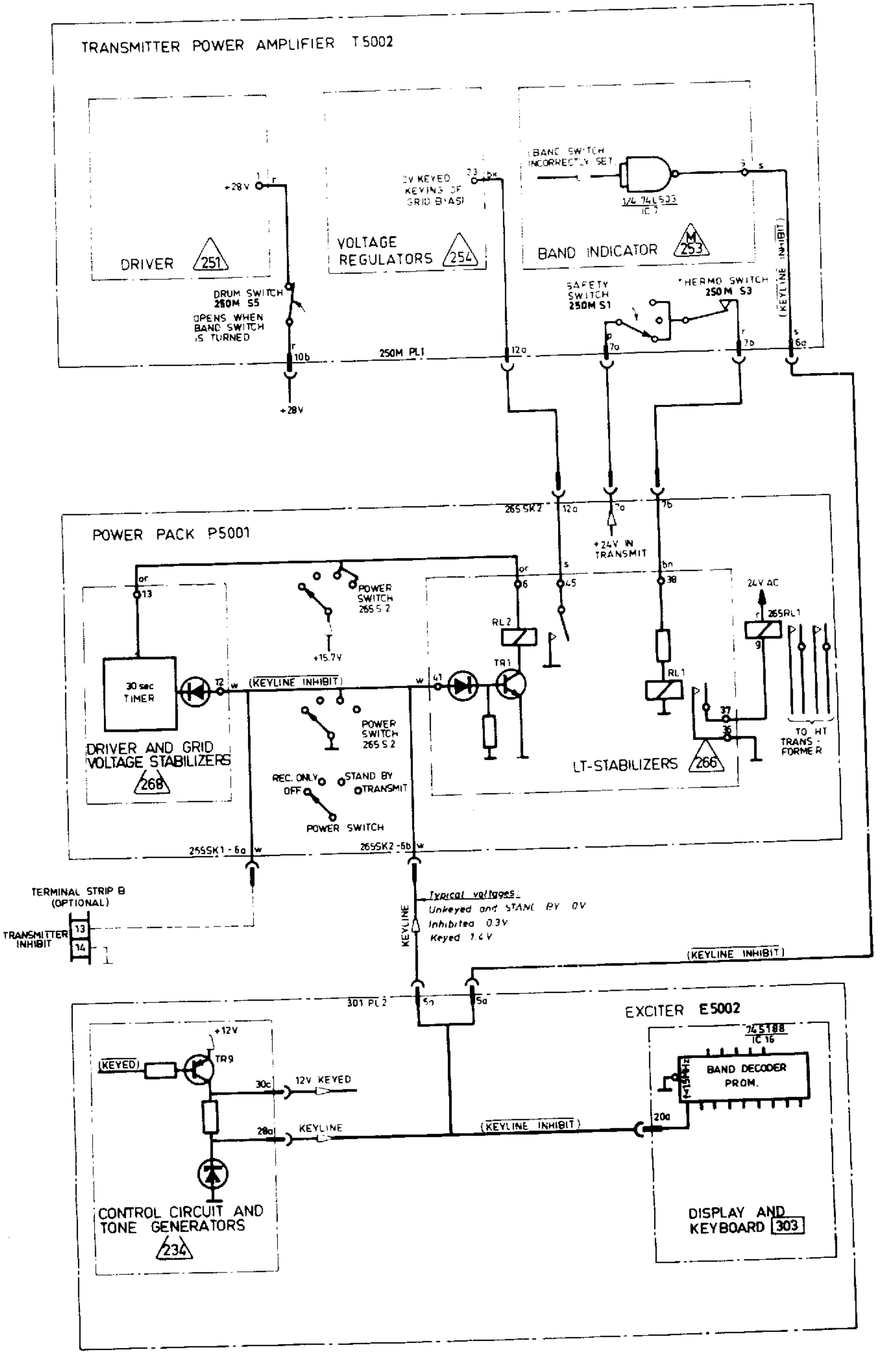
902 247 11

BLOCK DIAGRAM, FREQUENCY SELECTION E 5002

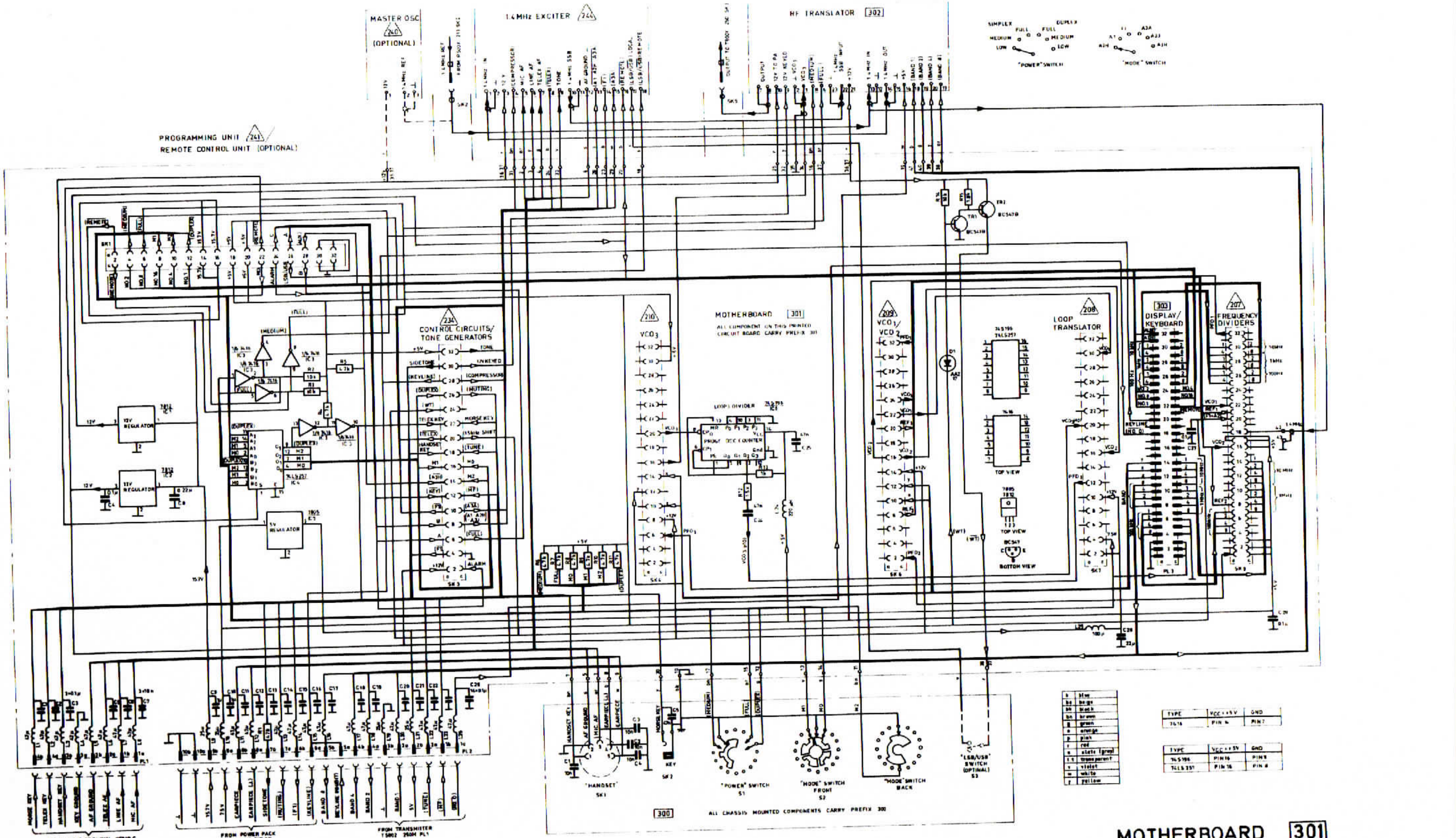


KEYING CIRCUIT, SIMPLIFIED DIAGRAM
TRP 5002 INCORPORATING DC POWER PACK P5000

992 247 31

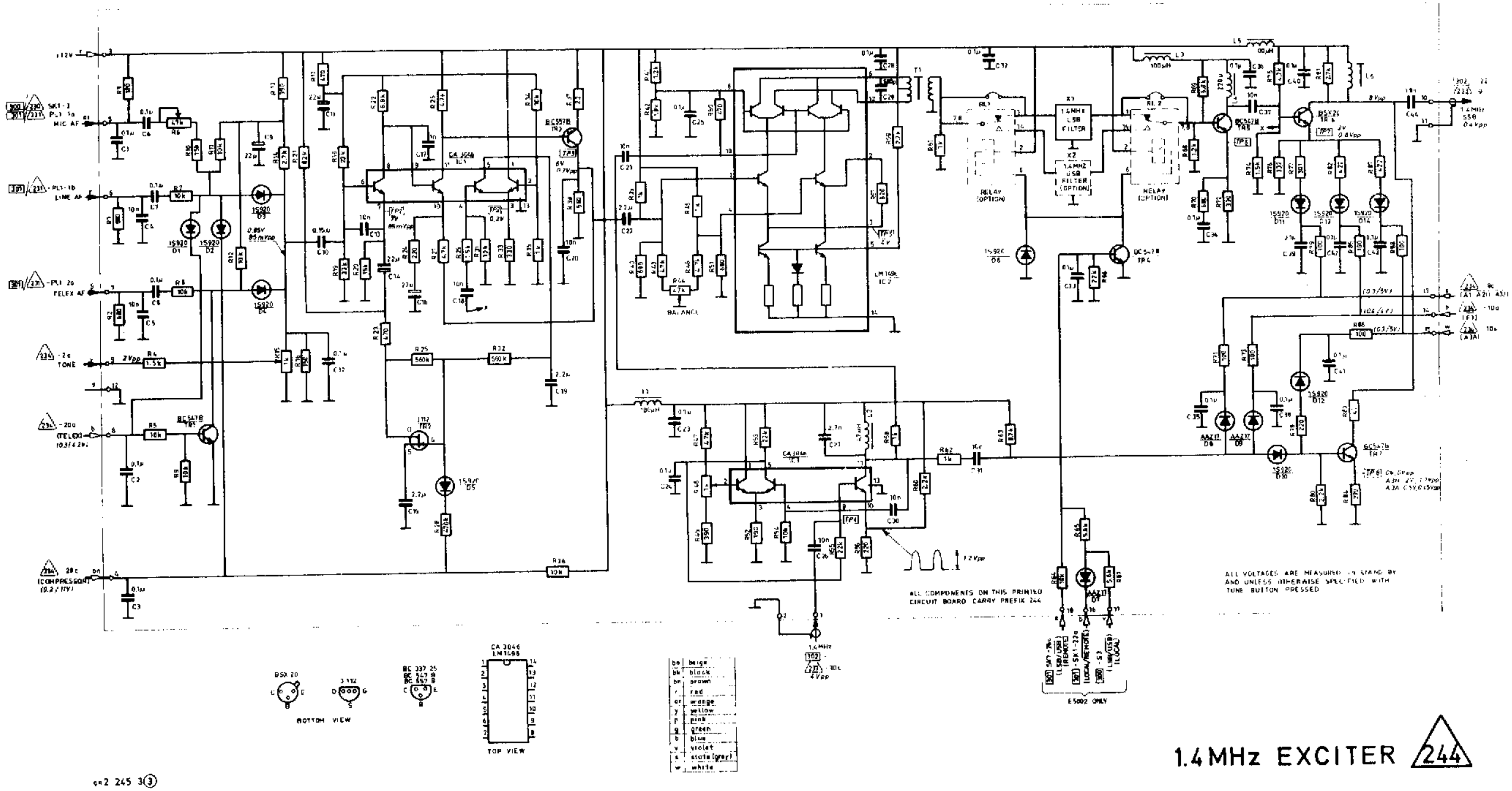


KEYING CIRCUIT, SIMPLIFIED DIAGRAM
TRP 5002 INCORPORATING AC POWER PACK P5001

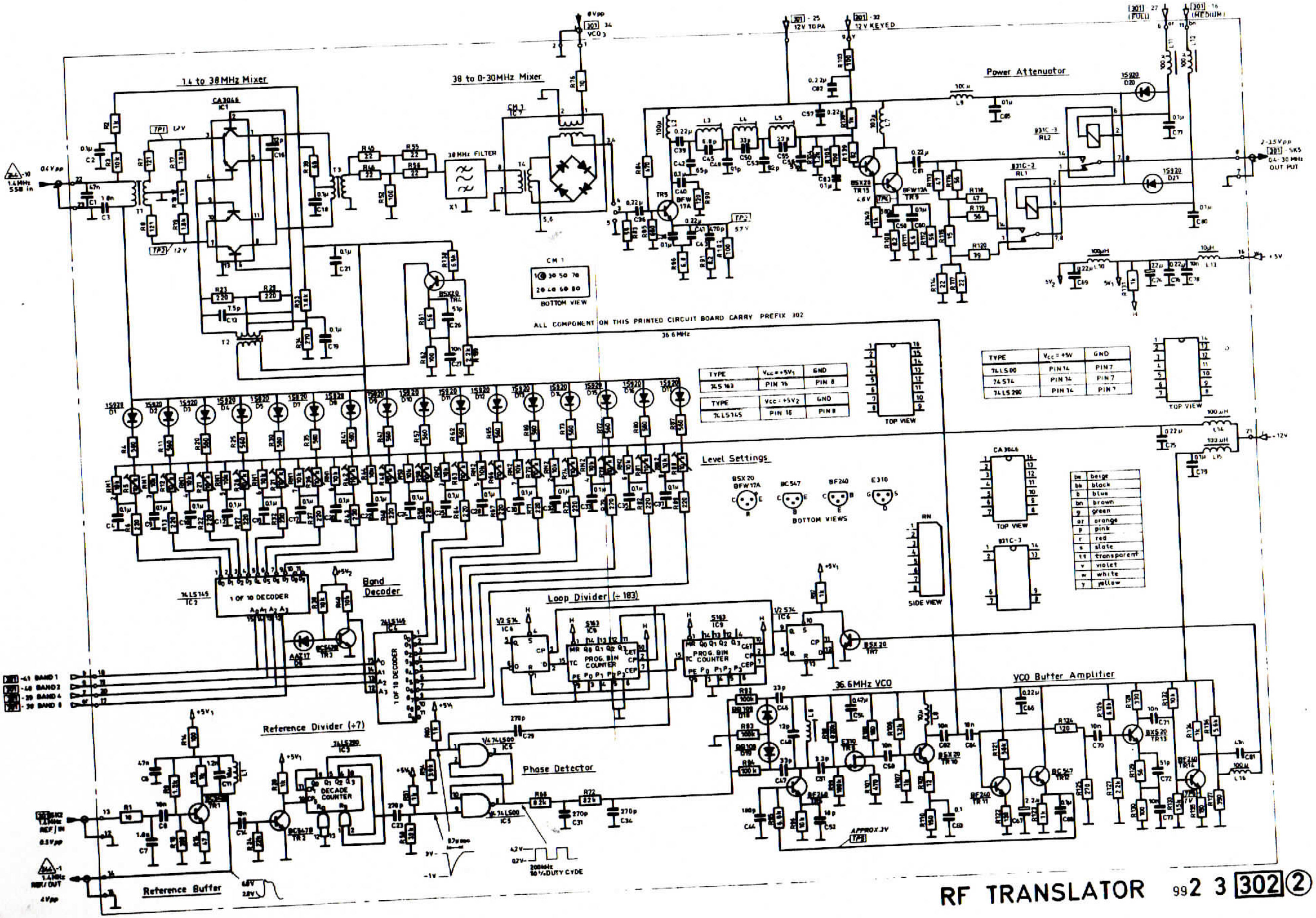


MOTHERBOARD 301

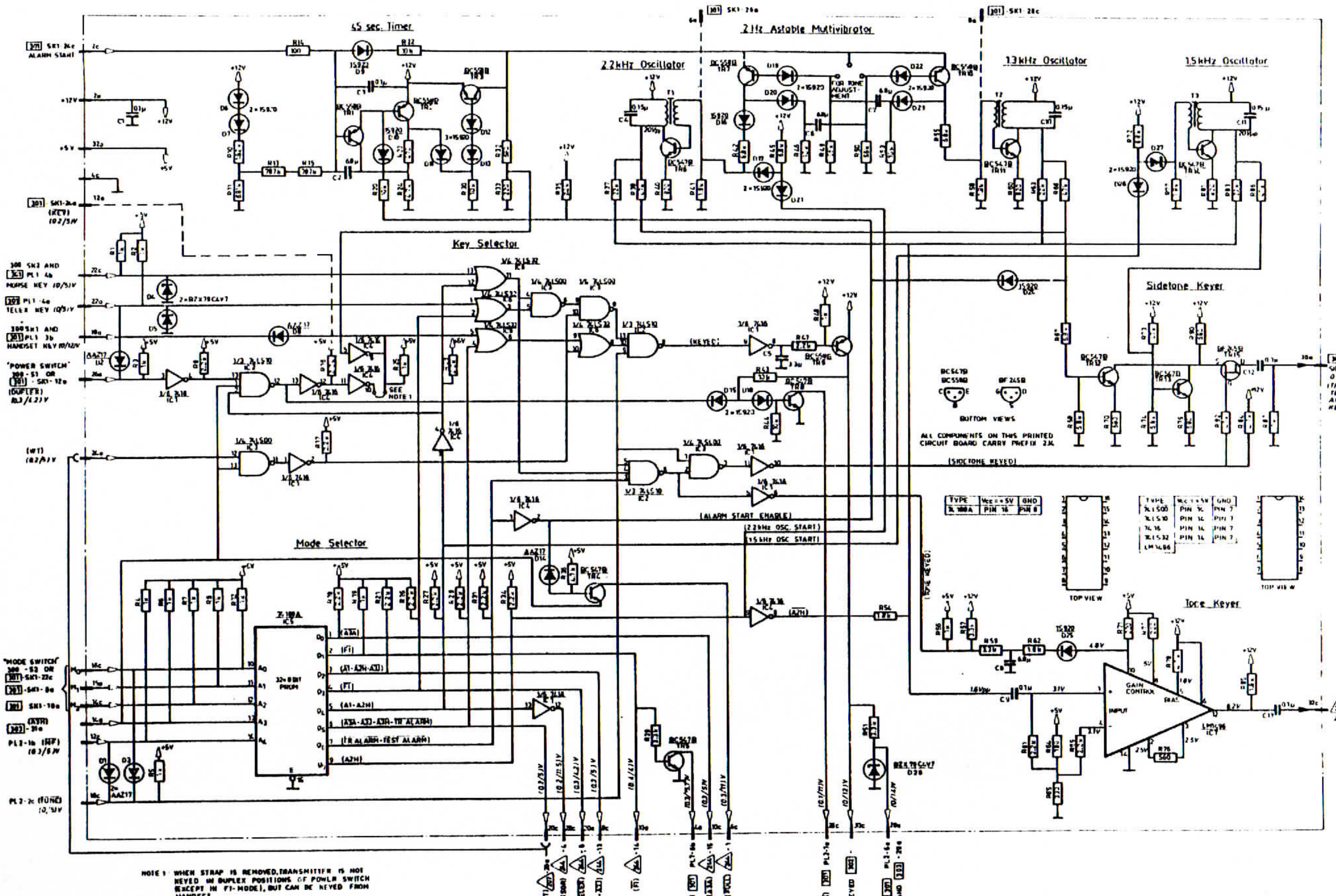
E5002 WIRING DIAGRAM 99 2 3 300 ②



1.4MHz EXCITER 244



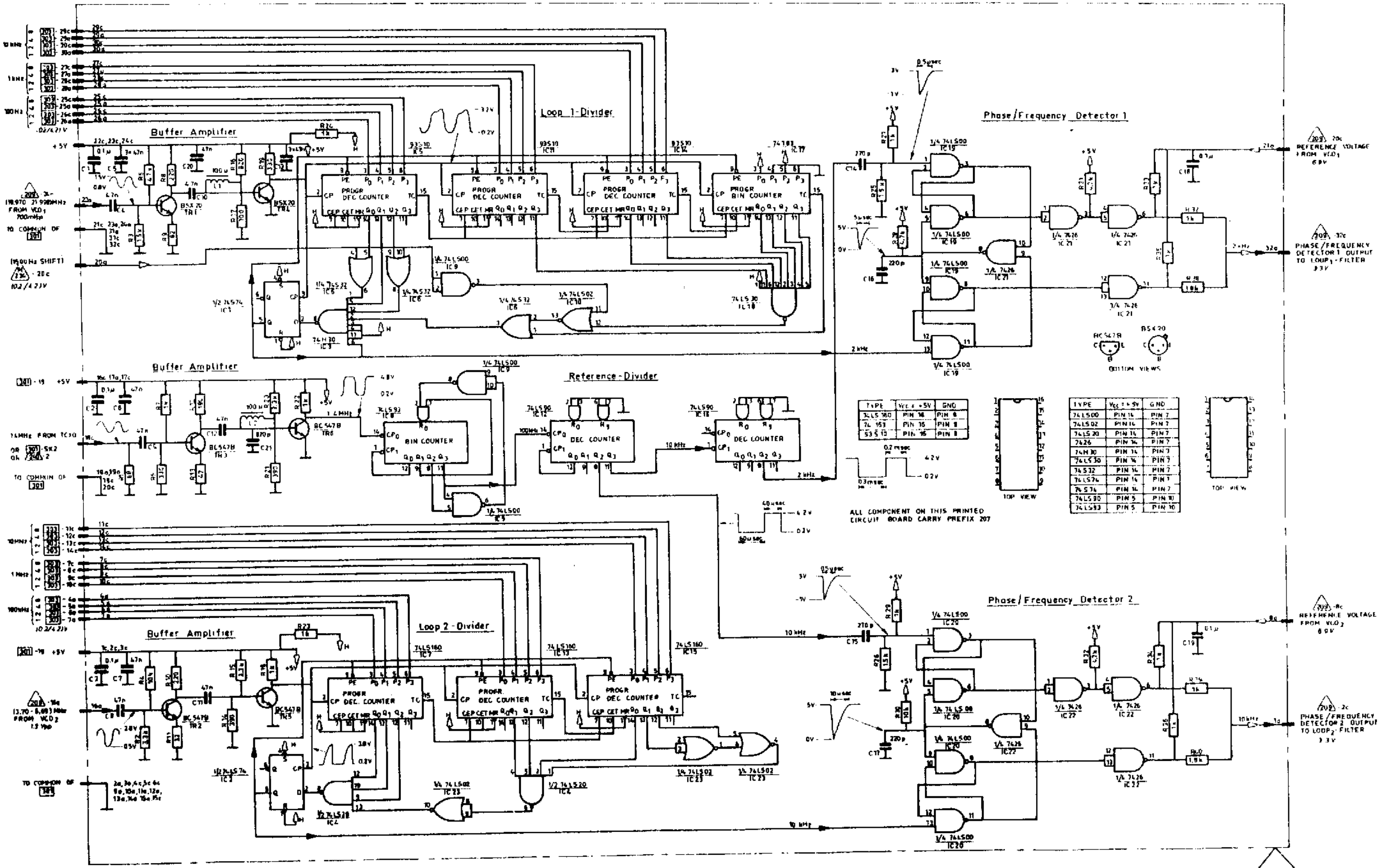
RF TRANSLATOR 99 2 3 302 ②



CONTROL CIRCUIT AND TONE GENERATORS

M 234

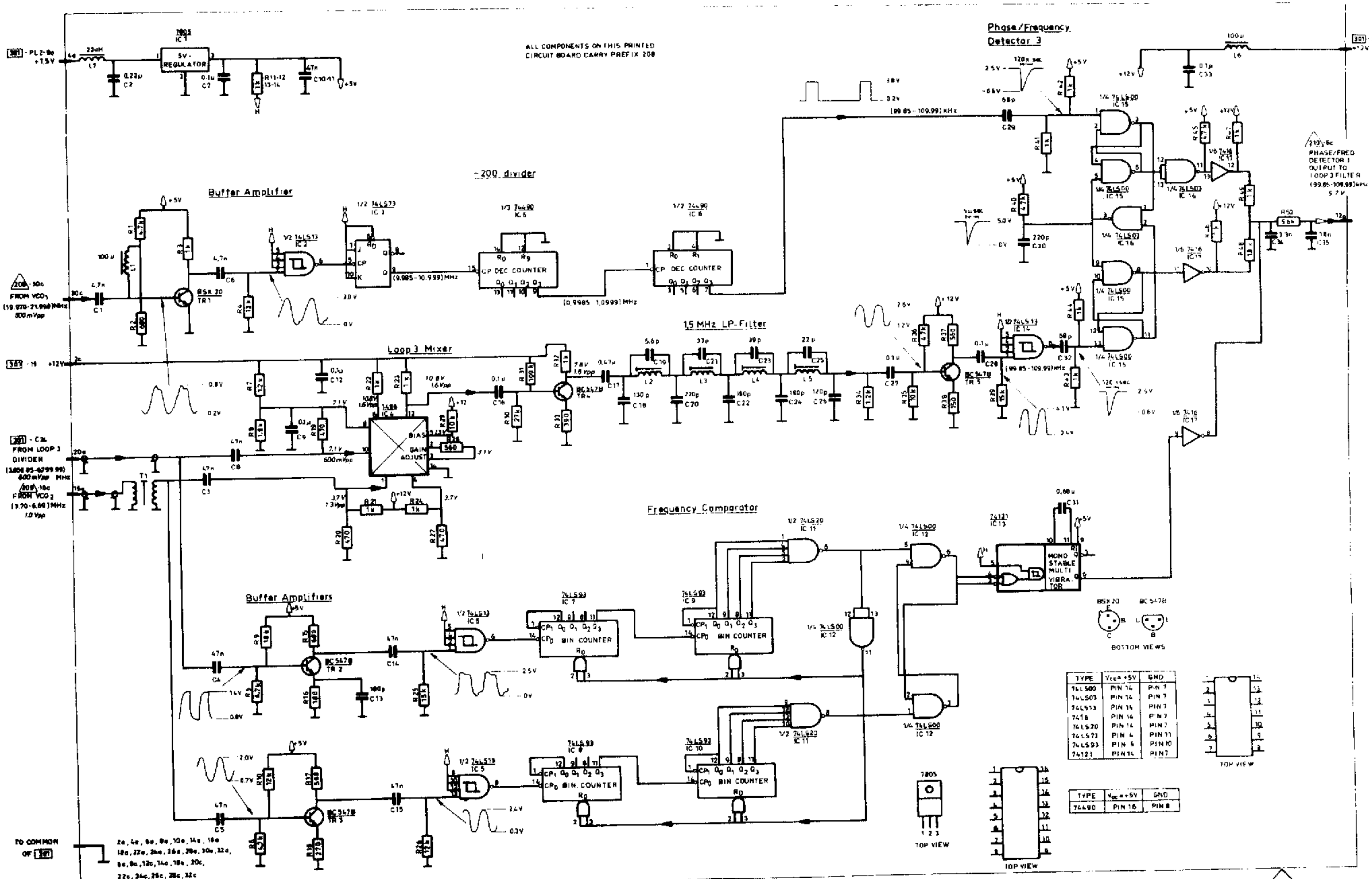
FOR E5002



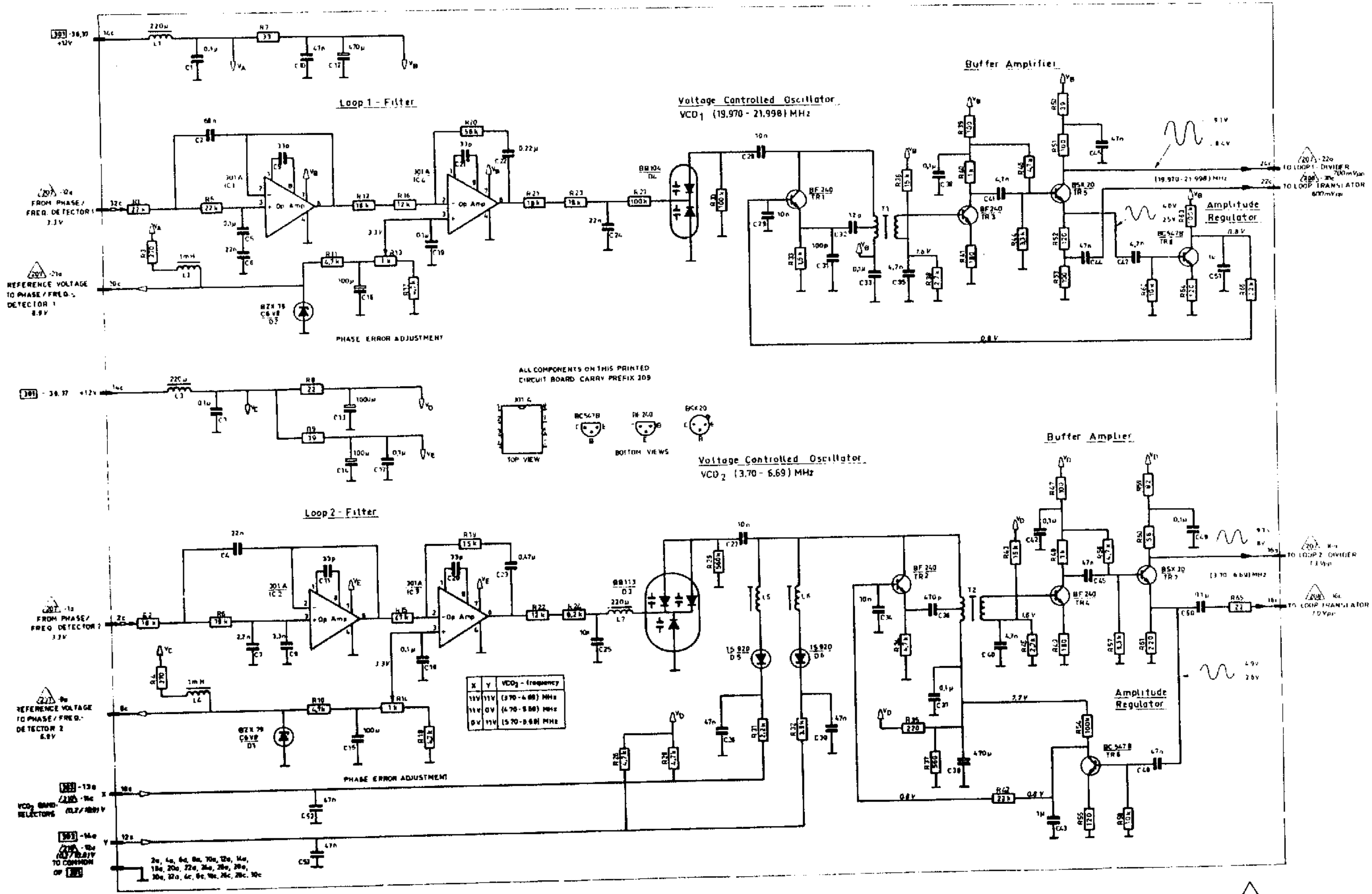
TYPE	Vcc = +5V	GND
74LS160	PIN 16	PIN 8
74 163	PIN 16	PIN 8
93S10	PIN 16	PIN 8

TYPE	Vcc = +5V	GND
74LS00	PIN 14	PIN 7
74LS02	PIN 14	PIN 7
74LS20	PIN 14	PIN 7
7426	PIN 14	PIN 7
74H30	PIN 14	PIN 7
74LS30	PIN 14	PIN 7
74S32	PIN 14	PIN 7
74LS74	PIN 14	PIN 7
74S74	PIN 14	PIN 7
74LS90	PIN 5	PIN 10
74LS93	PIN 5	PIN 10

FREQUENCY DIVIDERS 207



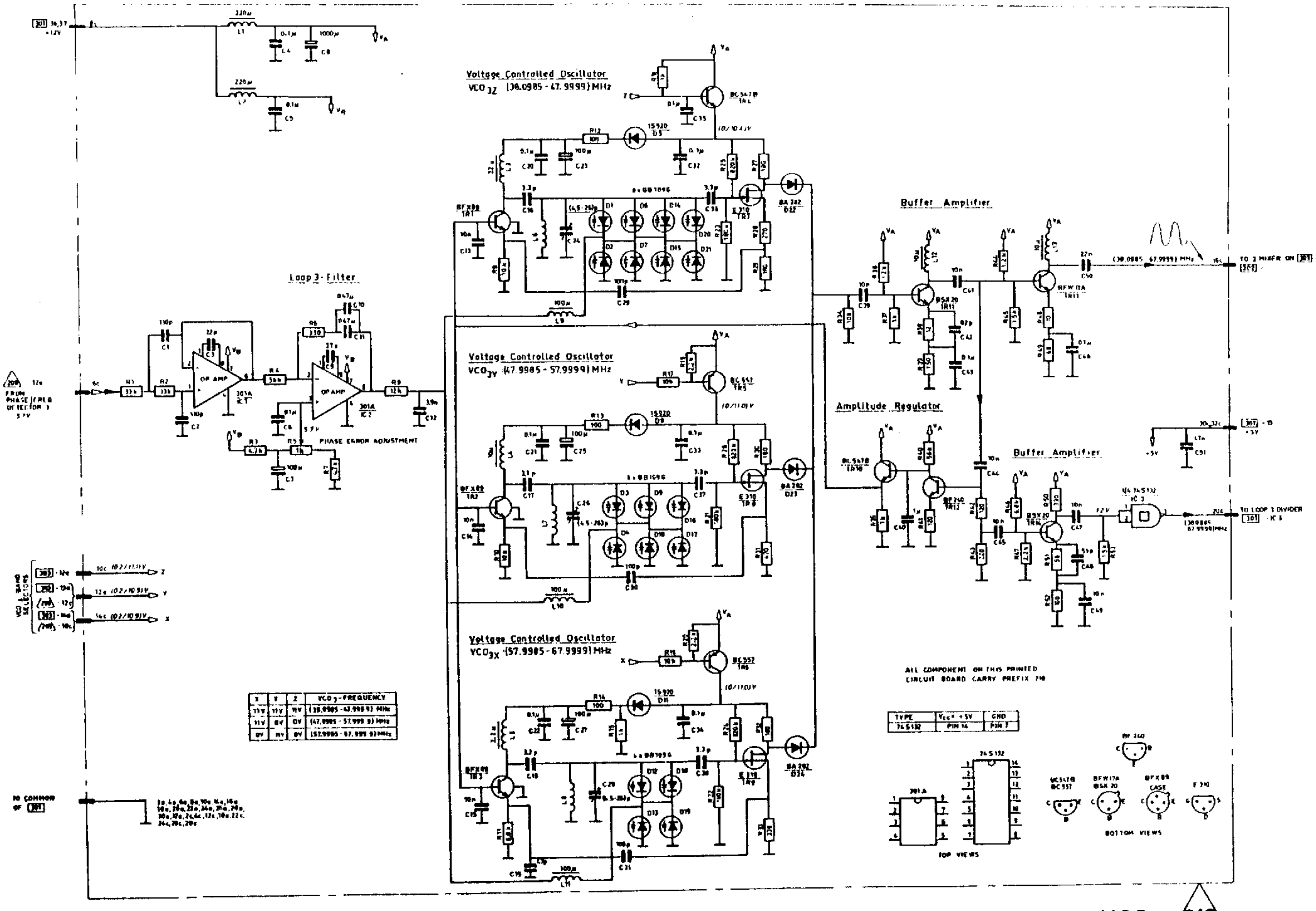
LOOP TRANSLATOR 208 FOR E5002



9x2 245 6①

VCO1 and VCO2 209

FOR E5002

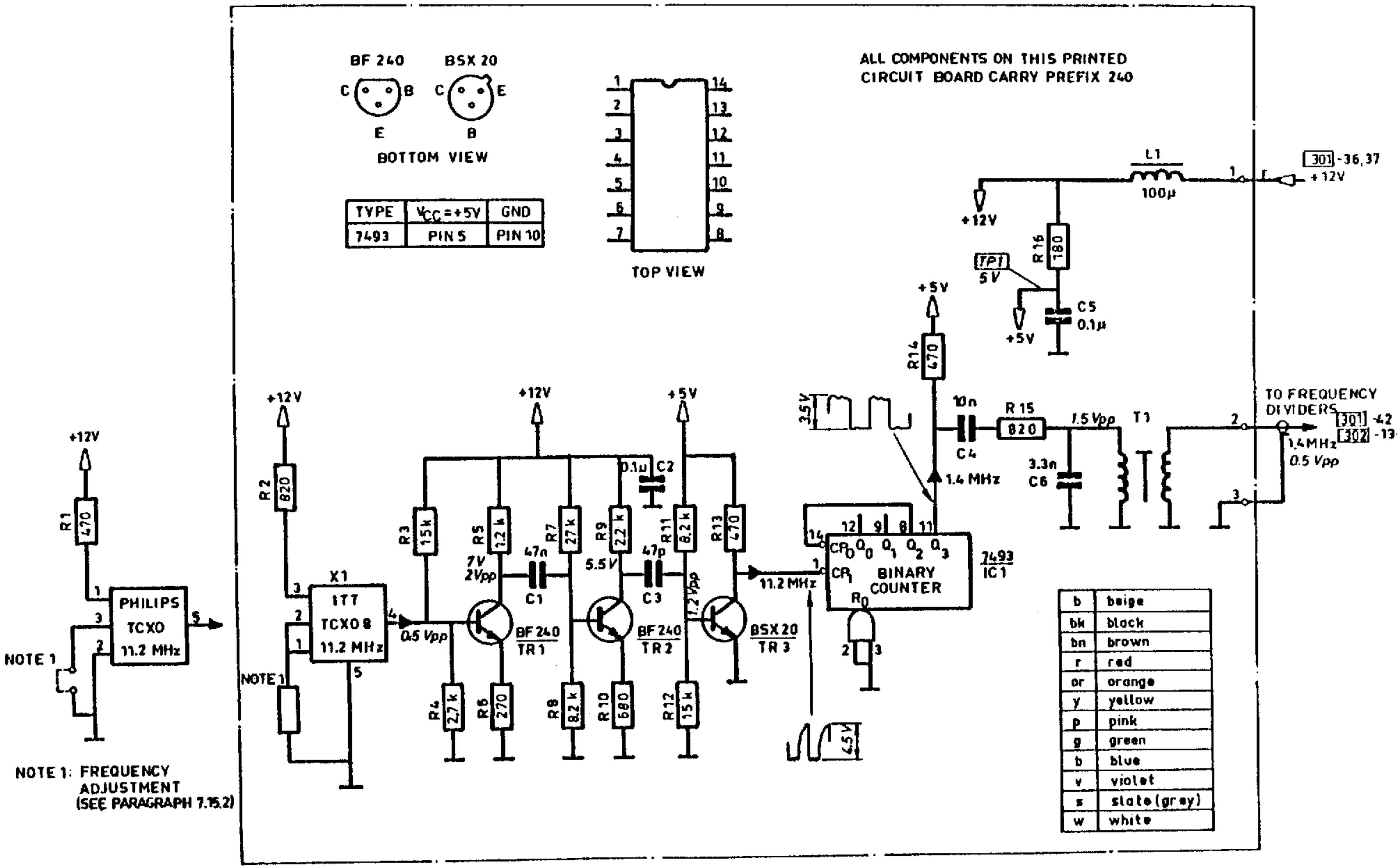


X	Y	Z	VCO3 - FREQUENCY
11V	11V	11V	(38.0985 - 47.9999) MHz
11V	0V	0V	(47.9985 - 57.9999) MHz
0V	11V	0V	(57.9985 - 67.9999) MHz

TYPE	V_{CC} = +5V	GND
74 S 132	PIN 14	PIN 7

VCO3 210

ee 2 245 7 ①



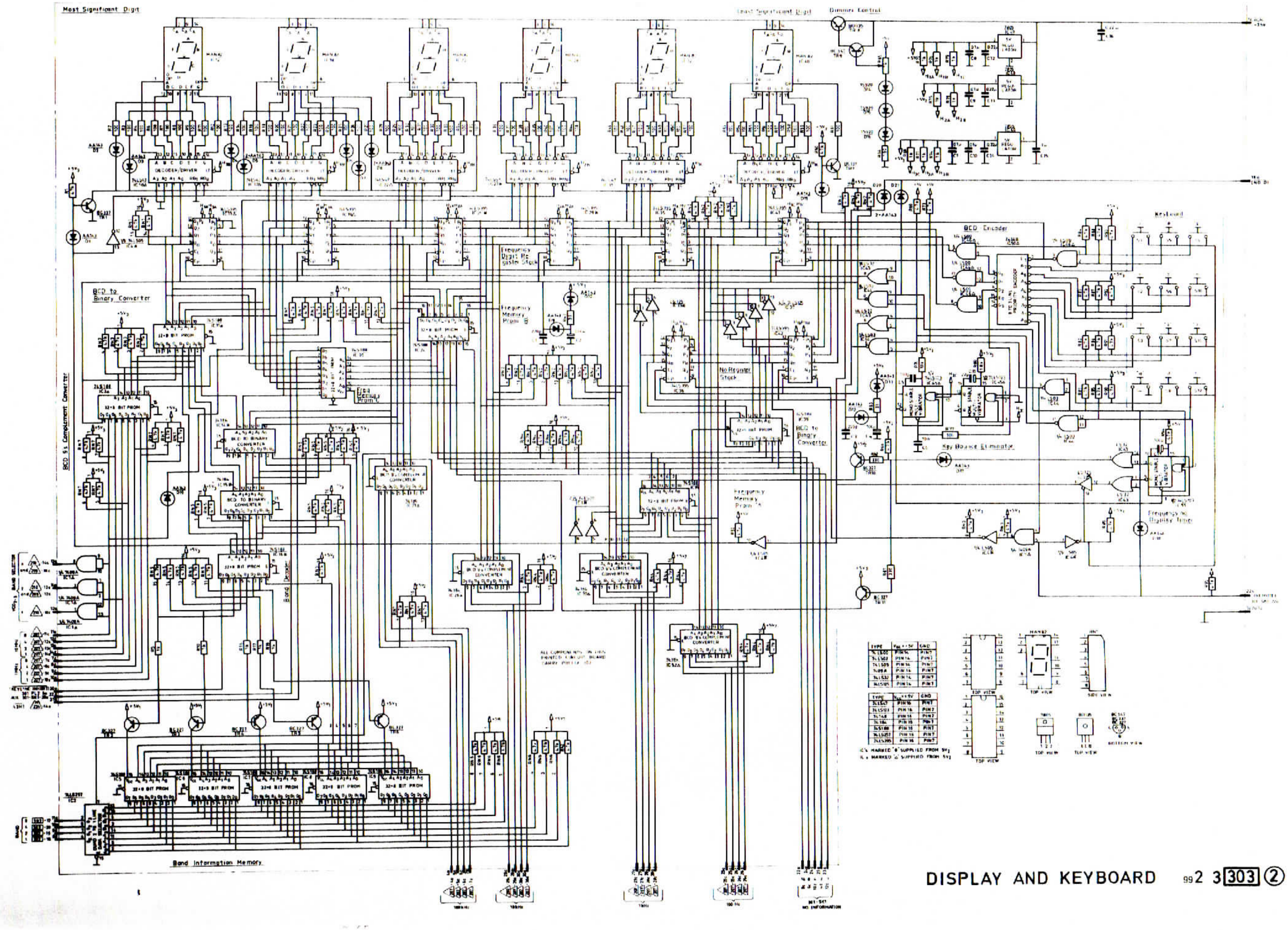
b	beige
bk	black
bn	brown
r	red
or	orange
y	yellow
p	pink
g	green
b	blue
v	violet
s	slate (grey)
w	white

MASTER OSCILLATOR

240

FOR E5002

992 245 9 (2)



DISPLAY AND KEYBOARD 992 3 303 ②

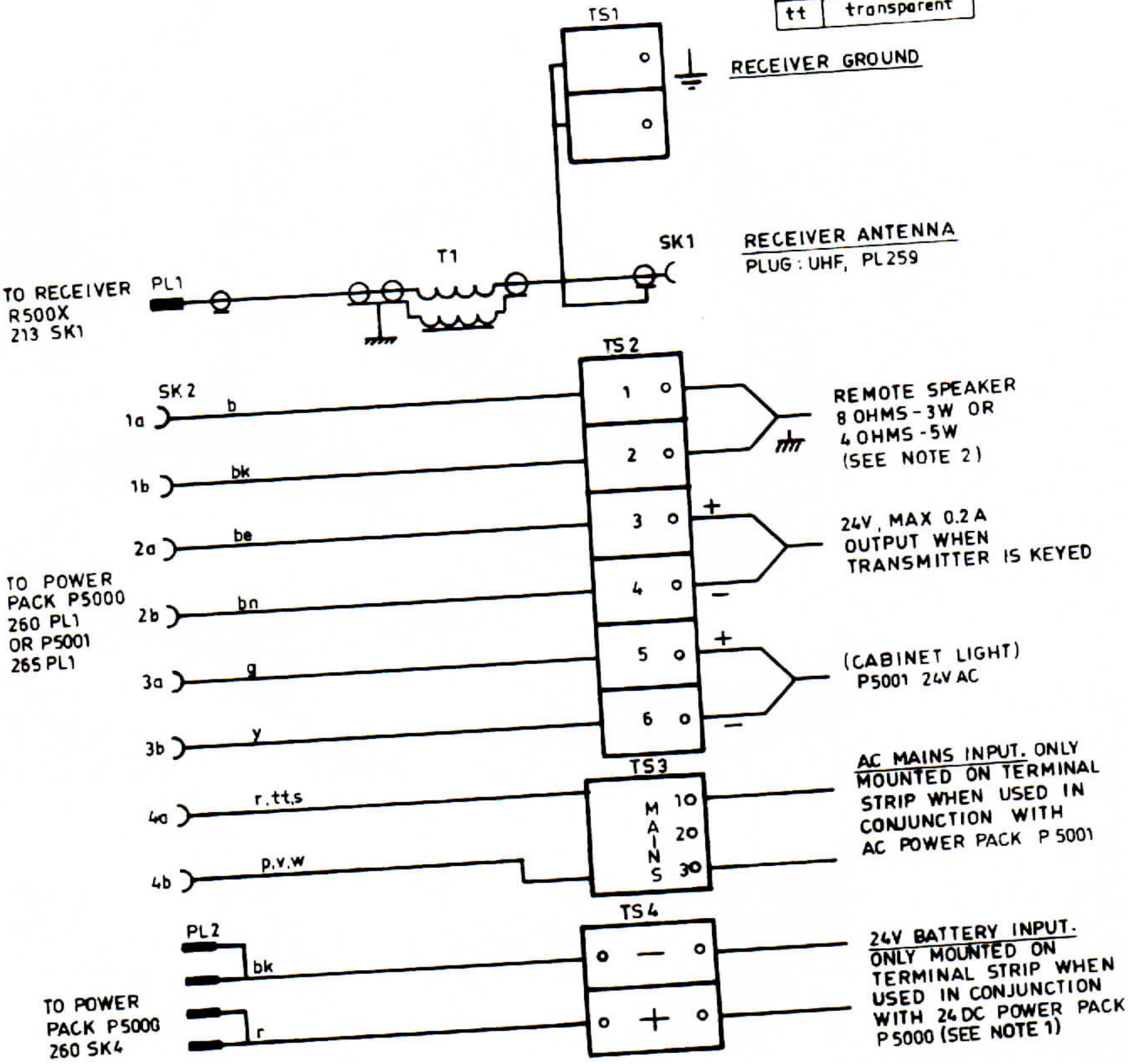
TRP 5002

CABINET WIRING

TERMINAL STRIP A

(mounted on cabinet back wall)

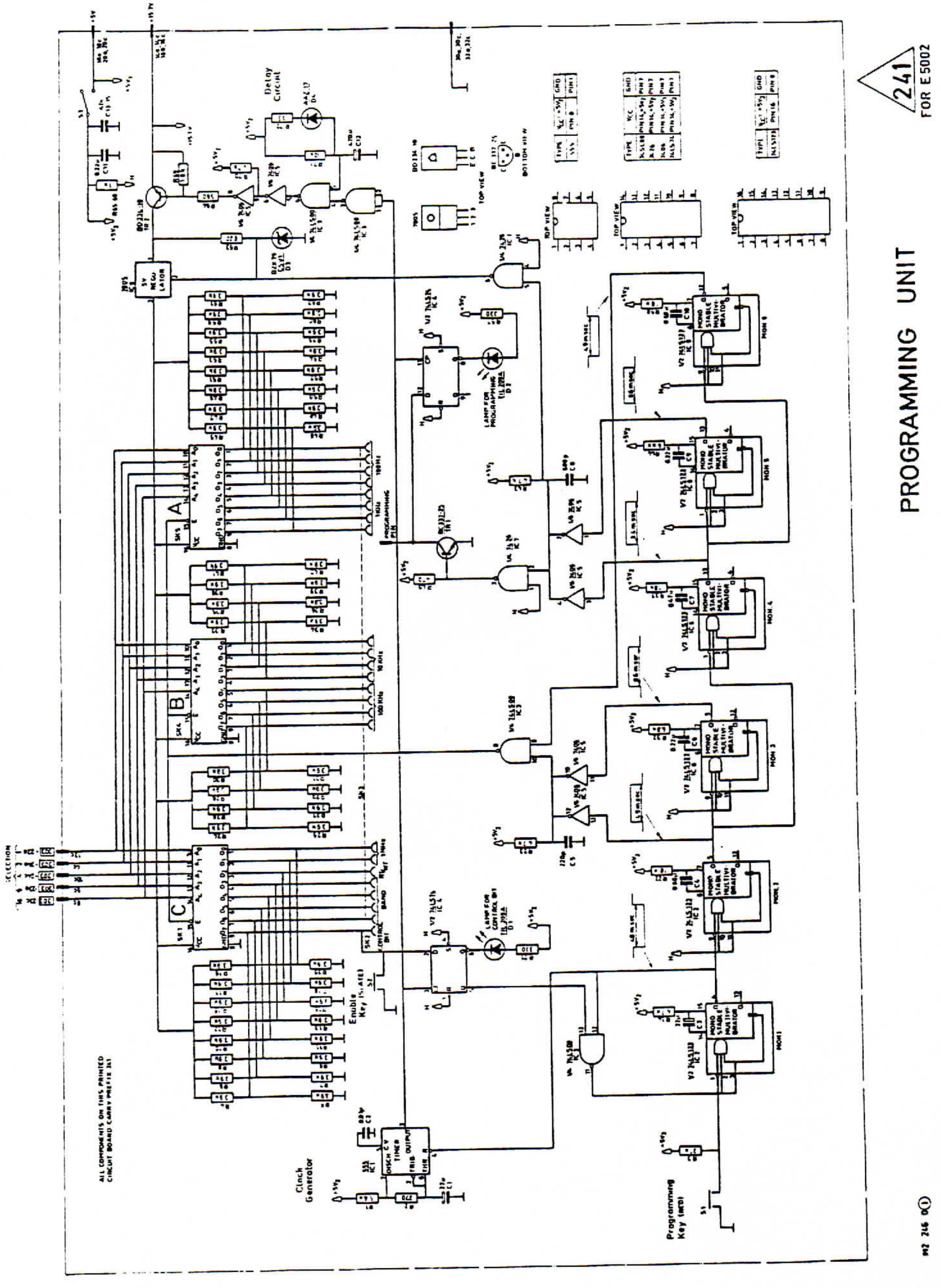
b	blue
be	beige
bk	black
bn	brown
g	green
or	orange
p	pink
r	red
s	slate (grey)
v	violet
w	white
y	yellow
tt	transparent

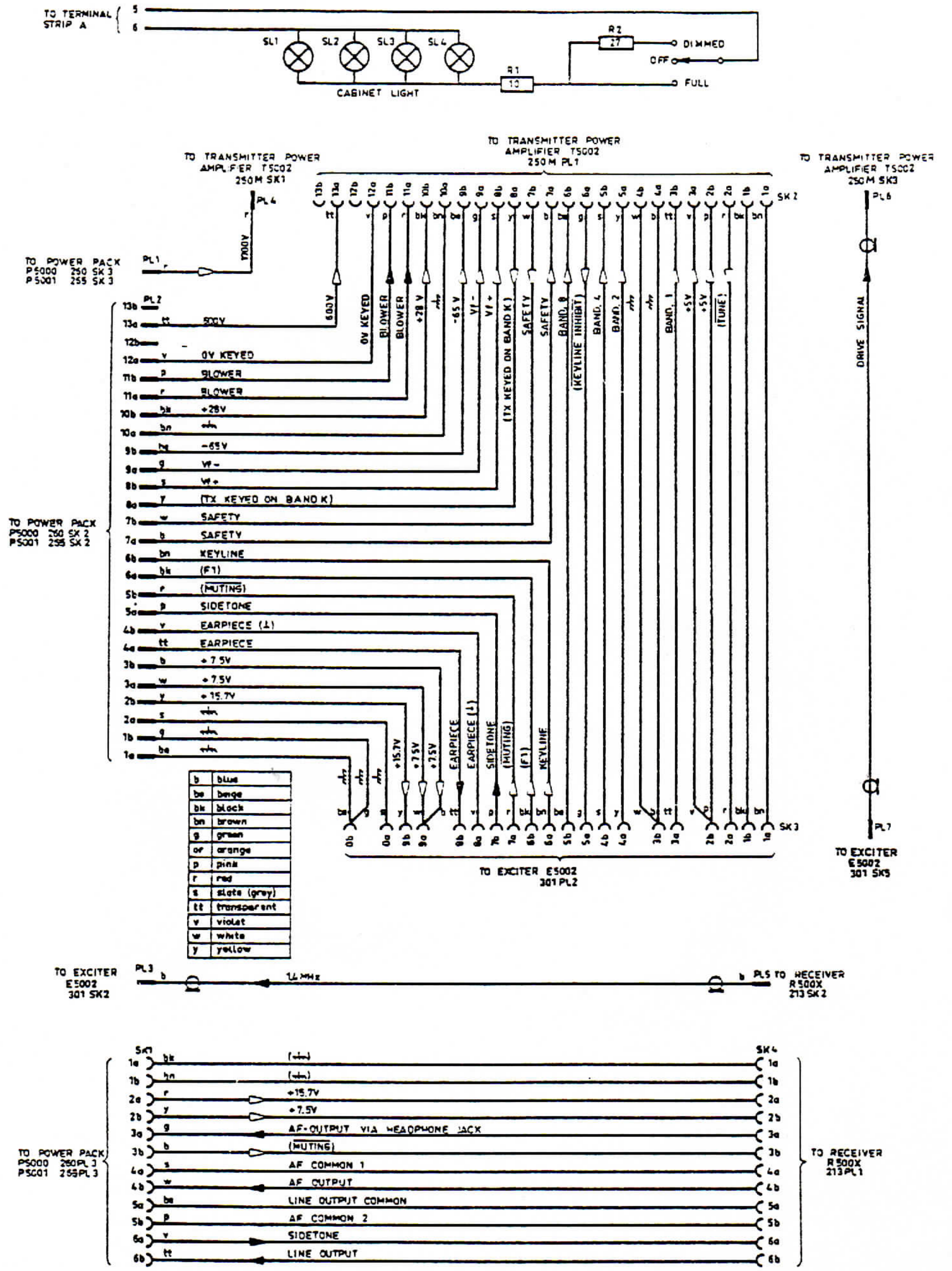


NOTE 1 :

MAX CABLE LENGTH TO BATTERY	MIN. CONDUCTOR AERA
5 m	2x10 mm^2
9 m	2x 16 mm^2
13 m	2x25 mm^2

NOTE 2 : AN AUDIO POWER OF 5 WATTS IS AVAILABLE INTO A 4 OHMS LOAD. THIS POWER CAN BE SHARED BETWEEN SEVERAL LOUDSPEAKERS IF SO DESIRED. THE BUILT-IN SPEAKER IN THE POWER PACK HAS AN IMPEDANCE OF 8 OHMS. WHEN CONNECTING REMOTE SPEAKERS THE MINIMUM VALUE OF THE TOTAL IMPEDANCE SHOULD BE MORE THAN 4 OHMS INCLUDING THE BUILT-IN SPEAKER IN ORDER TO OBTAIN MAXIMUM POWER OUTPUT. IF 5 WATTS IS REQUIRED IN REMOTE SPEAKER(S) THE BUILT-IN SPEAKER MUST BE DISCONNECTED.

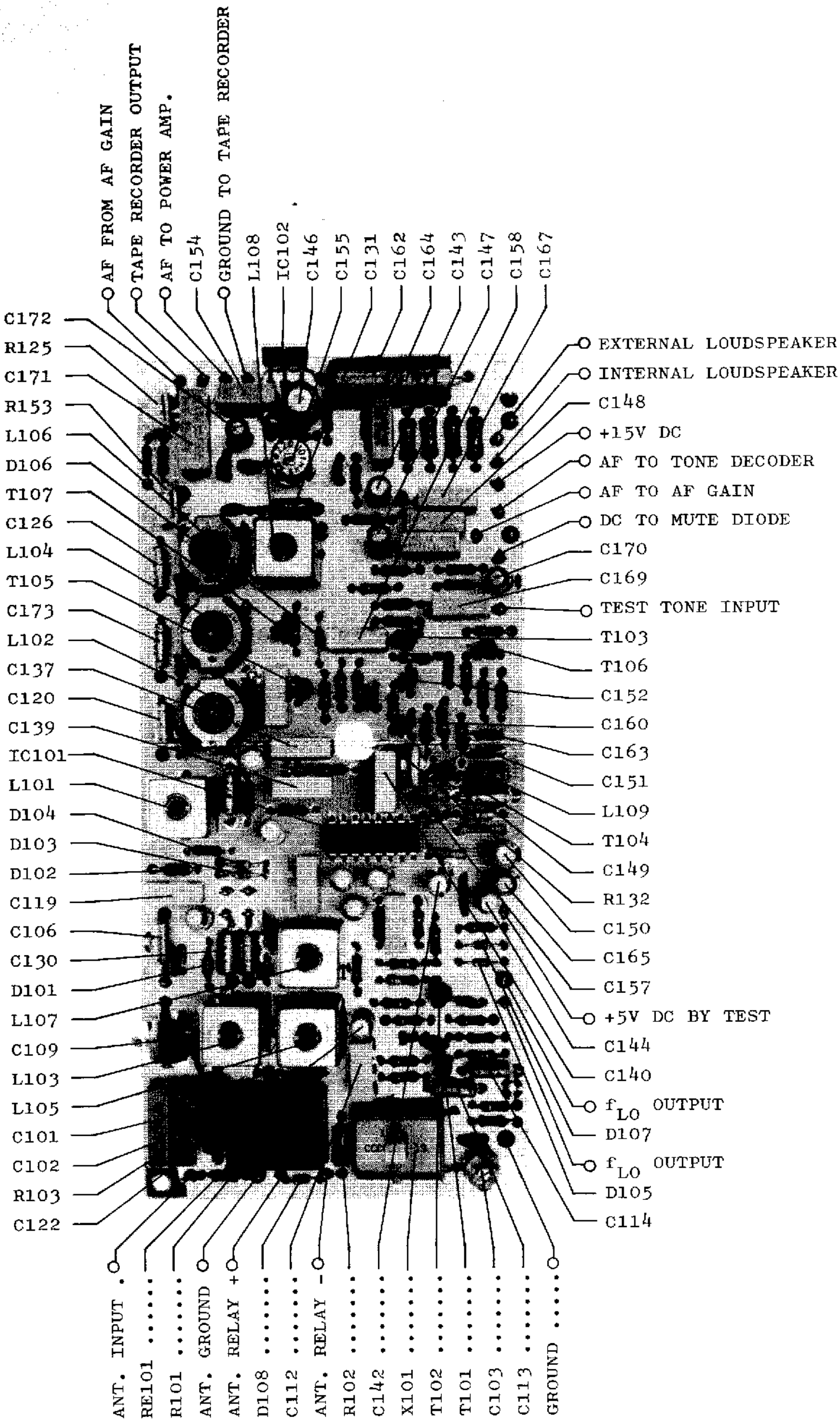

PROGRAMMING UNIT
241
FOR E5002
Delay Circuit
Clock Generator
Programming Key (red)
Enable Key
MONO STABLE MULTIVIBRATOR
5V REGULATOR
TIMER
ALL COMPONENTS ON THIS PRINTED CIRCUIT BOARD CARRY PREFIX 241

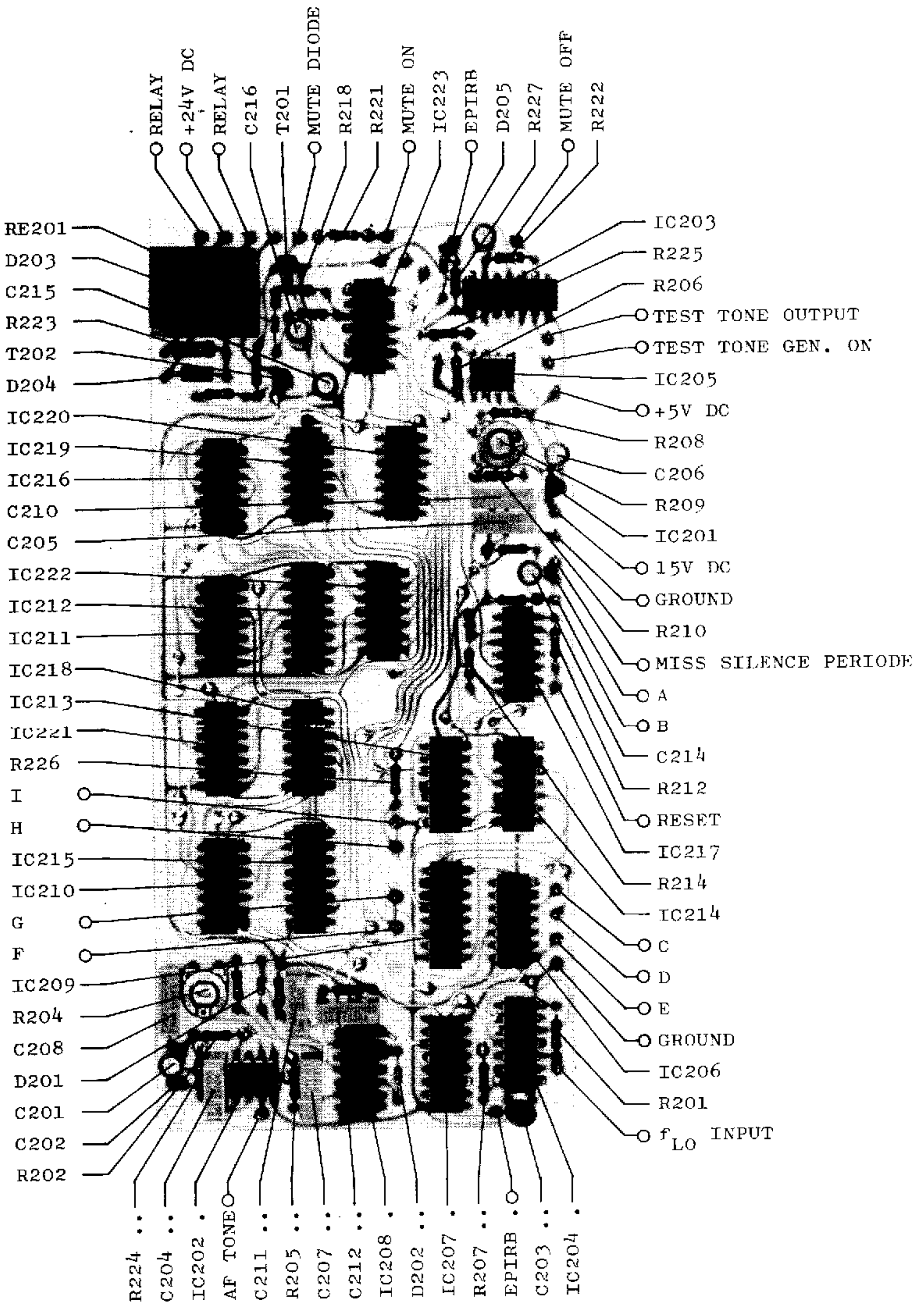


b	blue
be	beige
bk	black
bn	brown
g	green
or	orange
p	pink
r	red
s	slate (grey)
tt	transparent
v	violet
w	white
y	yellow

TRP5002 CABINET WIRING
INTERCONNECTIONS BETWEEN UNITS

991 213 31


AF FROM AF GAIN
TAPE RECORDER OUTPUT
AF TO POWER AMP.
C154
GROUND TO TAPE RECORDER
L108
IC102
C146
C155
C131
C162
C164
C143
C147
C158
C167
C172
R125
C171
R153
L106
D106
T107
C126
L104
T105
C173
L102
C137
C120
C139
IC101
L101
D104
D103
D102
C119
C106
C130
D101
L107
C109
L103
L105
C101
C102
R103
C122
EXTERNAL LOUDSPEAKER
INTERNAL LOUDSPEAKER
C148
+15V DC
AF TO TONE DECODER
AF TO AF GAIN
DC TO MUTE DIODE
C170
C169
TEST TONE INPUT
T103
T106
C152
C160
C163
C151
L109
T104
C149
R132
C150
C165
C157
+5V DC BY TEST
C144
C140
f_{LO} OUTPUT
D107
f_{LO} OUTPUT
D105
C114
ANT. INPUT
RE101
R101
ANT. GROUND
ANT. RELAY +
D108
C112
ANT. RELAY -
R102
C142
X101
T102
T101
C103
C113
GROUND


RELAY
+24V DC
RELAY
C216
T201
MUTE DIODE
R218
R221
MUTE ON
IC223
EPIRB
D205
R227
MUTE OFF
R222
RE201
D203
C215
R223
T202
D204
IC220
IC219
IC216
C210
C205
IC222
IC212
IC211
IC218
IC213
IC221
R226
I
H
IC215
IC210
G
F
IC209
R204
C208
D201
C201
C202
R202
IC203
R225
R206
TEST TONE OUTPUT
TEST TONE GEN. ON
IC205
+5V DC
R208
C206
R209
IC201
15V DC
GROUND
R210
MISS SILENCE PERIODE
A
B
C214
R212
RESET
IC217
R214
IC214
C
D
E
GROUND
IC206
R201
f_{LO} INPUT
R224
C204
IC202
AF TONE
C211
R205
C207
C212
IC208
D202
IC207
R207
EPIRB
C203
IC204