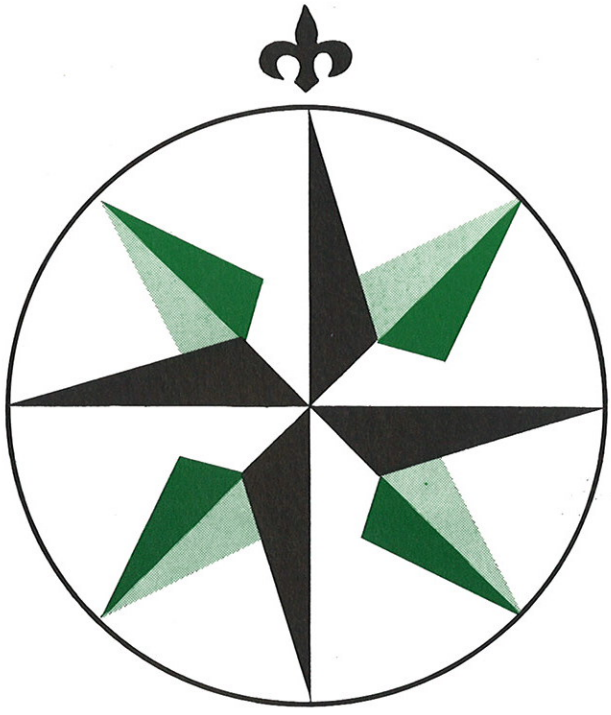


Sailor

Sailor

INSTRUKTIONSBOG FOR
SAILOR TRANSMITTER T2031

INSTRUCTION BOOK FOR
SAILOR TRANSMITTER T2031

INSTRUKTIONSBUCH FÜR
SAILOR TRANSMITTER T2031

INSTRUCTIONS POUR
SAILOR TRANSMITTER T2031

INSTRUCCIONES PARA
SAILOR TRANSMITTER T2031

A/S S. P. RADIO · AALBORG · DENMARK

CONTENTS

CONTENTS

1. INTRODUCTION

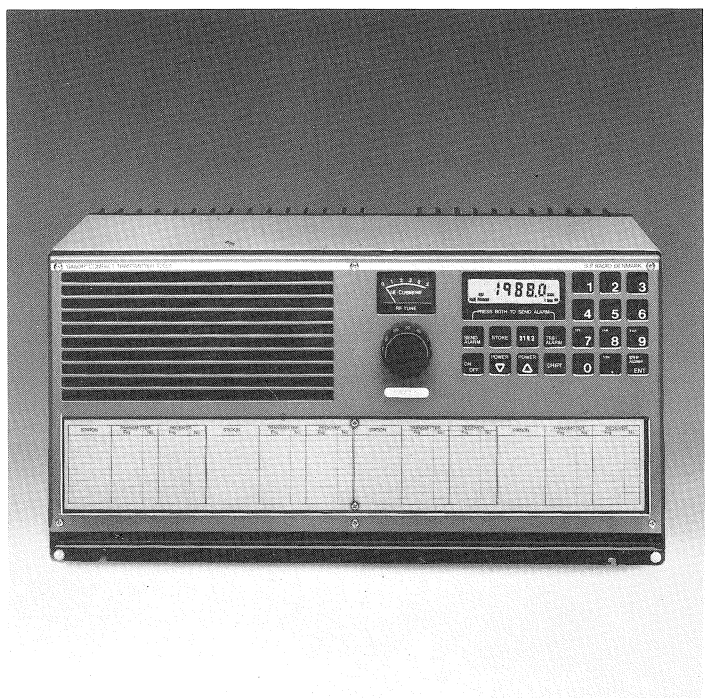
The SAILOR SSB Transmitter T2031 has been designed to be used with the SAILOR Compact 2000 module programme.

The SAILOR T2031 can be installed and operated either as an independent unit or in combination with the other elements of the Compact 2000 programme. These include an SSB receiver with built-in FM and AM bands, a VHF radiotelephone and a Scrambler CRY2001.

The SAILOR T2031 has been designed to withstand the most extreme conditions experienced in small, semi-open boats. Its compact construction ensures a degree of resistance to sea spray. The printed circuits, which have made possible a combination of compactness and exceptional performance, are coated with a special, moisture-repellent lacquer.

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

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



1.1. GENERAL DESCRIPTION FOR SAILOR SSB TRANSMITTER T2031

SAILOR T2031 is an all solid state construction marine 400W SSB duplex telephony transmitter for the frequency range 1600 - 4300 kHz.

SAILOR T2031 has 128 programmed frequencies.

SAILOR T2031 has 94 quick-select frequencies.

SAILOR T2031 has one hand antenna tuning.

SAILOR T2031 has one key operation of the distress frequency 2182 kHz.

SAILOR T2031 is fully synthesized and the frequency stability is controlled from a crystal oscillator.

SAILOR T2031 has two microcomputers controlling the synthesizer, the display and the protection circuit.

SAILOR T2031 can be supplied from 21.6 - 31.2V DC mains.

SAILOR T2031 is provided with membrane switches for controls, easy to use, reliable, and hard-wearing. Cut-outs in the metal front serve as a safe finger guide.

SAILOR T2031 is fitted with night illumination, all lettering can be illuminated.

SAILOR T2031 employs the most modern circuit technology housed in a corrosion resistant aluminium cabinet with a green nylon finish.

1.2. TECHNICAL DATA FOR SAILOR SSB TRANSMITTER T2031

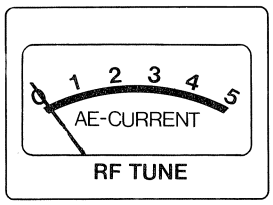
SAILOR T2031 complies with SOLAS - ITU - CEPT - UK MPT - FTZ specifications as well as other national requirements.

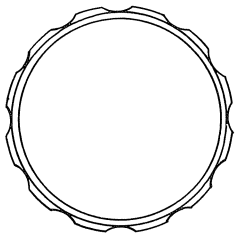
Frequency Range:	1600 - 4300 kHz
Frequencies:	128 programmed frequencies
Quick-Select Register:	94 operator-programmed quick-select frequencies
Frequency Stability:	0-40°C less than +-20 Hz
Modes of Operation:	J3E - H3E - R3E
Distress Call:	Automatic H3E mode on 2182 kHz Two-tone alarm: 1300 and 2200 Hz with a duration of 45 secs
Modulation Bandwidth:	350 - 2700 Hz with compressor
Output Power:	400W PEP $^{+0}_{-1.4}$ dB
Intermodulation:	Better than -34 dB
Hum and Noise:	Less than -60 dB
Harmonic and Spurious:	Better than -50 dB
Output Power Reduction:	Two steps of 4.5 dB each
Power Supply:	24V DC - 10% to +30%
Power Consumption:	Transmitter unkeyed 24 Watt Two-tone 750 Watt J3E normal speech 350 Watt
Operational Temperature Range:	-15°C to +55°C
Aerial Length:	8 - 14 m
Weight:	Transmitter T2031: 18 kg Mounting bracket H2056: 2 kg

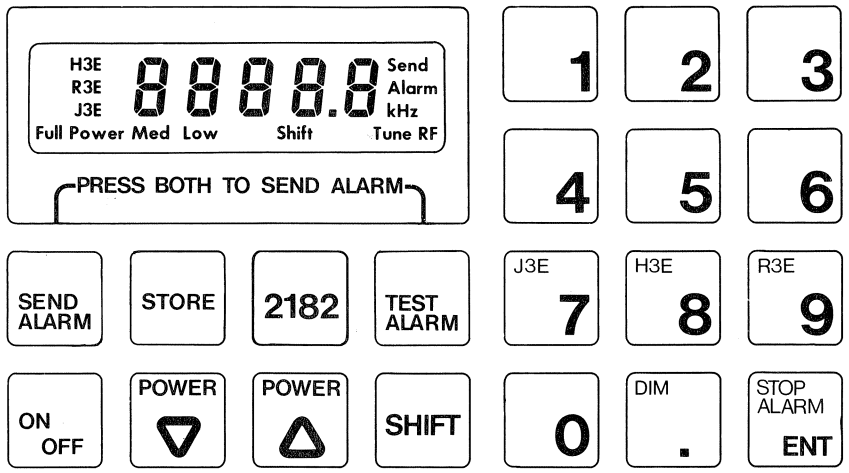
Our products are under continuous research and development. Any technical data may therefore be changed without prior notice.

T2031C

1.3. CONTROLS

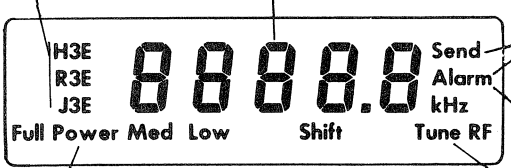






H3E, R3E, J3E indicates the selected mode

Frequency in kHz or channel number read-out.



Send Alarm: indicates that the transmitter is transmitting the alarm signal

Alarm: indicates that test alarm is selected.

Tune RF: indicates that the transmitter has to be tuned.

Power indicates the transmitted power level

T2031A 9-0-24060A

Turns the mains on/off.

Transmits the distress signal when pressed together with test ALARM.

Stores the selected frequency in the selected channel No.

Selects the distress frequency 2182 kHz.

Acoustic check of the alarm signal generator.

Reduces the output power in three steps from Full to Low.

Increases the output power in three steps from Low to Full.

Activates the function marked in orange on the keyboard.

Digits from 1 to 0.

Terminates the keying-in of the frequency or channel etc., and stops the alarm signal.

SHIFT FUNCTIONS

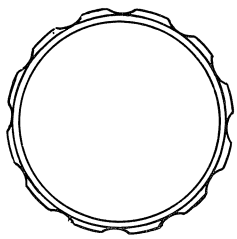
Selects J3E mode (SSB).

Selects H3E mode (AM).

Selects R3E mode.

Switches the panel light on and off.

RF TUNE



1.4. PRINCIPLE OF OPERATION

EXCITER UNIT 1
The microphone signal, the alarm generator or the tune tones are fed to the microphone amplifier where the necessary amplification and amplitude limitation take place. The amplitude limitation is performed by a compressor so that the amplitude will always be kept below a certain max. level. The AF signal and the carrier signal (10.5984 MHz) are fed to the modulator which is double balanced. The output - a double-sideband signal -is fed to the modulation level controller where the right level is determined for J3E, H3E, and R3E mode. The DSB signal is then fed through the 10.5984 MHz LSB filter to the clipper and carrier level control. Here the right carrier level is inserted for J3E, H3E, and R3E mode. The clipper is adjusted so that it will only be in action when an abrupt change in AF level takes place. The output from the clipper and carrier level controller is fed to the drive level attenuator which is controlled from the control computer 5. The max. attenuation is 18 dB. The signal is then fed to the 2nd mixer which is double balanced. The local oscillator signal is higher than the IF so the output signal is a USB signal. The USB signal is then fed to a lowpass filter to suppress spurious emissions above 4.3 MHz. The signal is then amplified in a push-pull amplifier to a power level of approx. 50 mW PEP.

POWER AMPLIFIER 2
The signal from the exciter unit is amplified in the power amplifier to a power level of 500W PEP. The power amplifier consists of two class B push-pull stages. The temperature of the output transistors is measured and information is fed back to the control computer. The input PA OPEN is controlling the bias to the driver and output transistors. When PA OPEN is high, the bias voltage will be zero and an attenuation of 40 dB in the power amplifier is obtained.

FILTER UNIT 3
The output signal from the power amplifier is fed to the directional coupler. From the directional coupler there are two output voltages, one DC voltage proportional to the forward travelling wave, and one DC voltage proportional to the reflected wave. The DC outputs are fed to the control computer. The RF signal is fed through RE2 and RE3 to lowpass filter 1 or 2, or when setting the drive level, through RE2 and RE1 to the two 100 ohm resistors in parallel. The drive setting is controlled by the control computer.
Lowpass filter 1 is used for frequencies lower than 2.7 MHz and filter 2 is used for frequencies from 2.7 MHz and up to 4.3 MHz. The signal from the filter is fed to the load coils. There are four load coils and the selection of the coils is controlled by the keyboard computer. After the local coils, the aerial current detector is located. The aerial current is measured with a current transformer and the rectified output is fed to the control computer.

COIL UNIT 4
The signal from the filter unit is fed to the coil where the aerial matching takes place in the resonance circuit. The necessary components in the resonance circuit are selected from the keyboard computer. From the resonance circuit the signal is fed through the aerial relay. At the aerial there is a circuit which measures the peak aerial relay. At the aerial there is a circuit which measures the peak voltage and feeds this information back to the control computer.

1.4. **PRINCIPLE OF OPERATION** cont.

POWER CONTROL COMPUTER UNIT 5

Power Control Computer

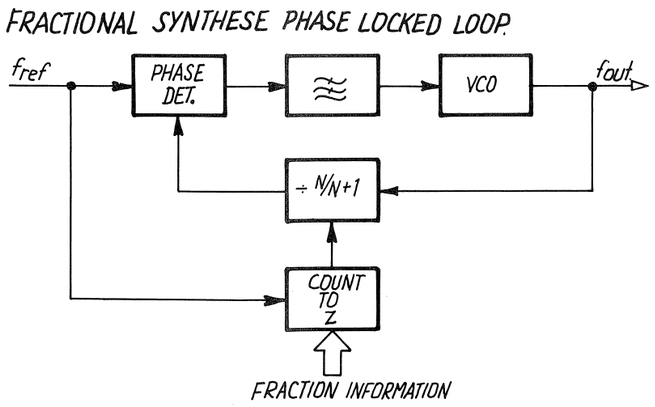
The control computer controls the safety systems, start/stop of the power supply and the power amplifier. When the temperature gets too high in the power supply or power amplifier the input power to the power amplifier and the output voltage from the power supply to the power amplifier are reduced. From V_F/V_R information from the directional coupler the computer calculates the reflection coefficient and then reduces the input to the power amplifier, so that the power amplifier can withstand any SWR. When pressing the tune knob, the control computer - within the first 20 msecs - measures the output power and sets the drive level attenuation in exciter unit 1 to an output power of 500W in 50 ohms. When tuning, the reflection coefficient is displayed in the aerial current meter. When transmitting, the aerial current is measured and displayed in the aerial current meter. While tuning, the aerial voltage is measured and if the voltage reaches the corona voltage, the control computer reduces the output so that no corona will occur.

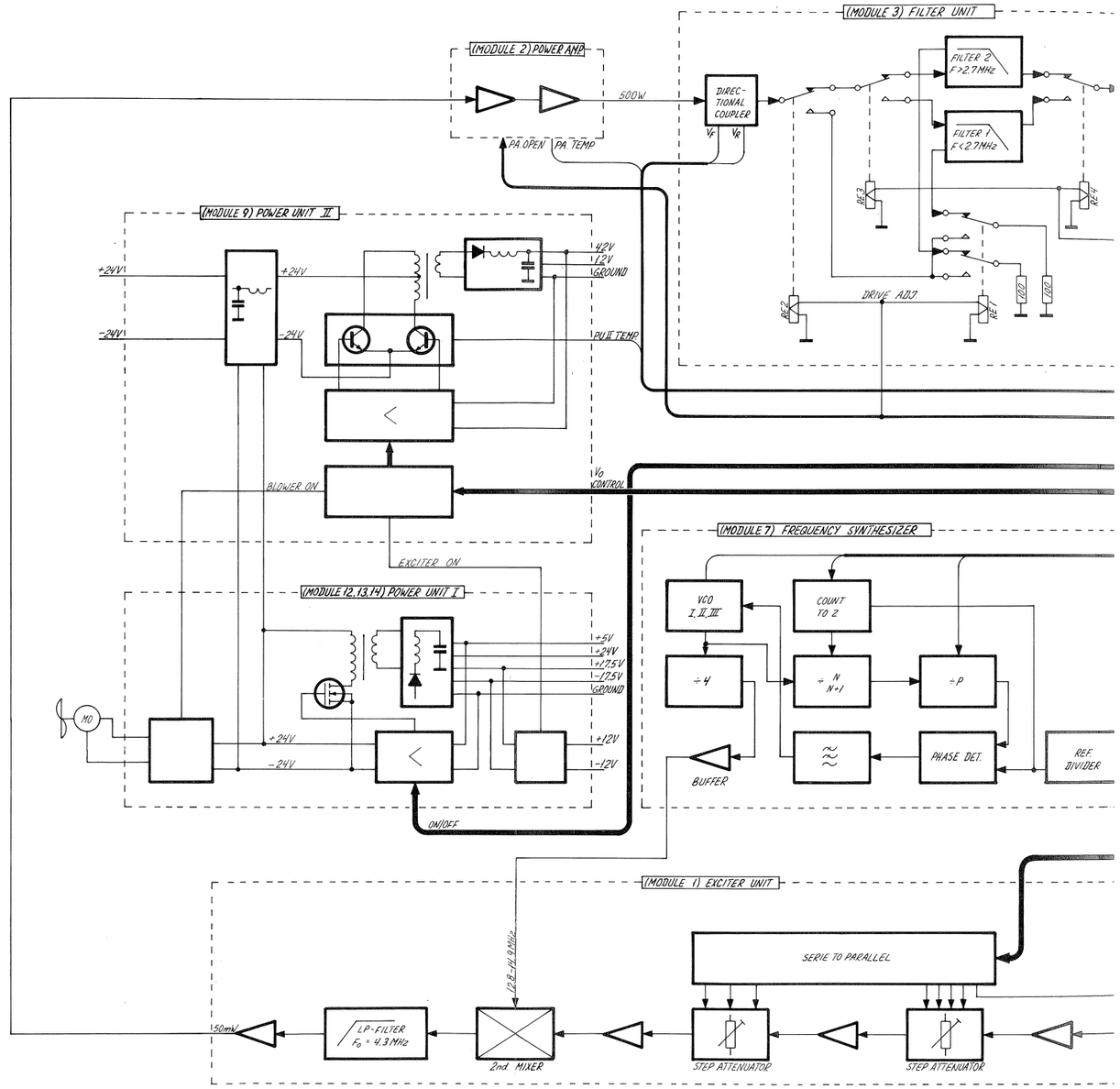
Keyboard Computer

The keyboard computer controls the keyboard and display functions. It also controls the start and stop of the exciter unit 1 and the pre-settings of resonance and load.
It has a memory for permitted frequencies. When selecting a not permitted frequency the transmitter will be blocked and the display will show no.

FREQUENCY SYNTHESIZER 7

The local oscillator and carrier frequencies are generated by the frequency synthesizer which works as a fractional synthesized phase locked loop.
The master frequency is generated in a crystal oscillator on 10.5984 MHz. This frequency is led on to the exciter unit 1 and the reference divider, where it is divided down to 10.24 kHz, which is the reference frequency for phase detector. The output from the voltage controlled oscillators (VCO) is divided by 4 and fed to the 2nd mixer.
The VCO signal is fed to the modulus prescaler where the dividing figure can be changed from N to N + 1 determined by the z register to obtain a fraction in the total dividing figure. The signal is then divided by P and fed to the phase detector, which corrects for frequency offset via the loop filter and the VCO. All the dividing figures are controlled by the keyboard computer 5.





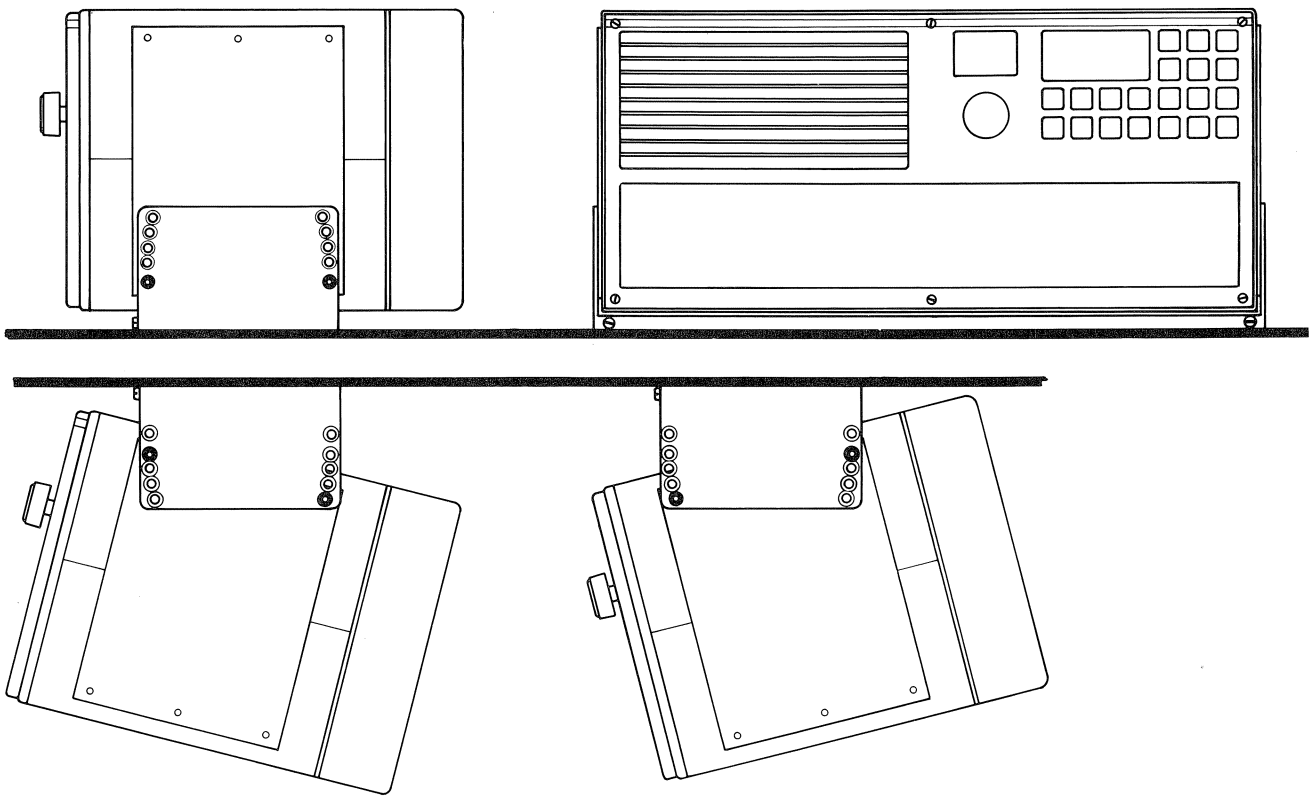
BLOCK DIAGRAM T2031

CONTENTS

T2031

2.1. MOUNTING POSSIBILITIES

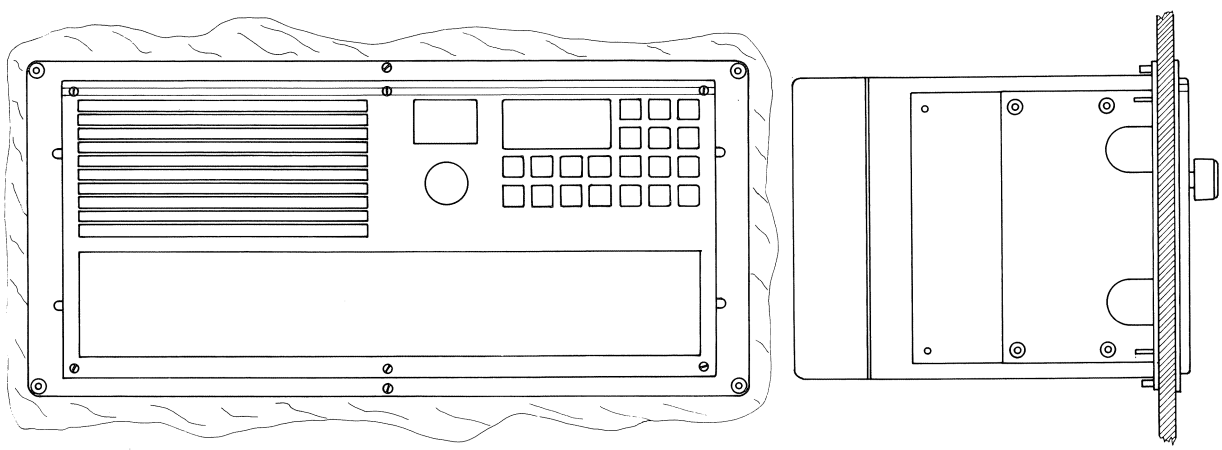
TABLETOP AND DECKHEAD



Mounting bracket H2056.

T2031A 4-0-24792A
4-0-24789

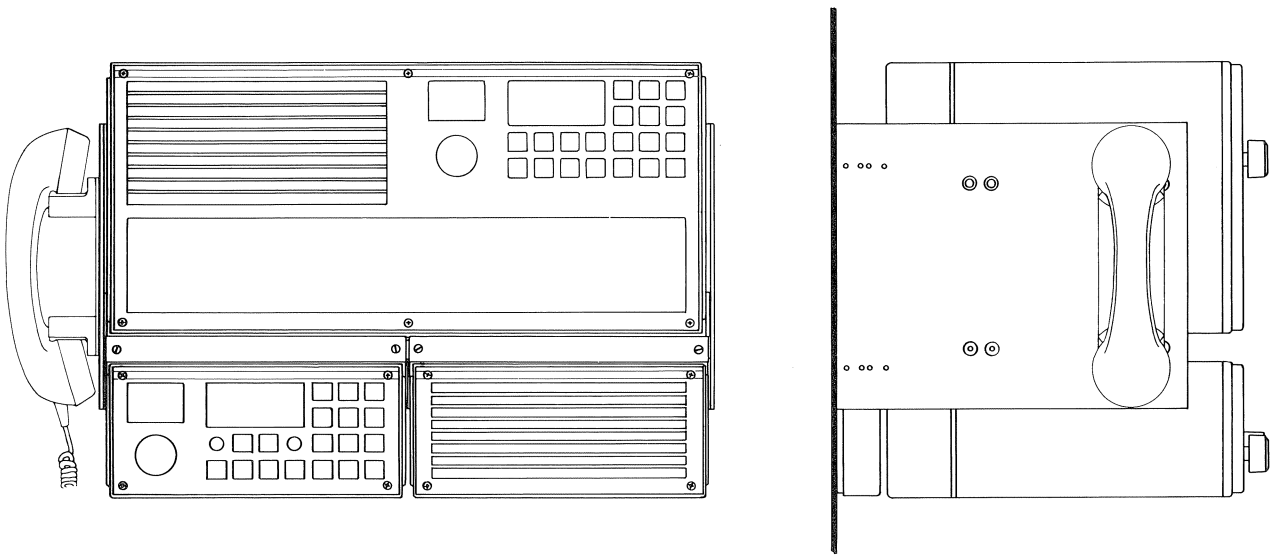
BULKHEAD AND CONSOLE



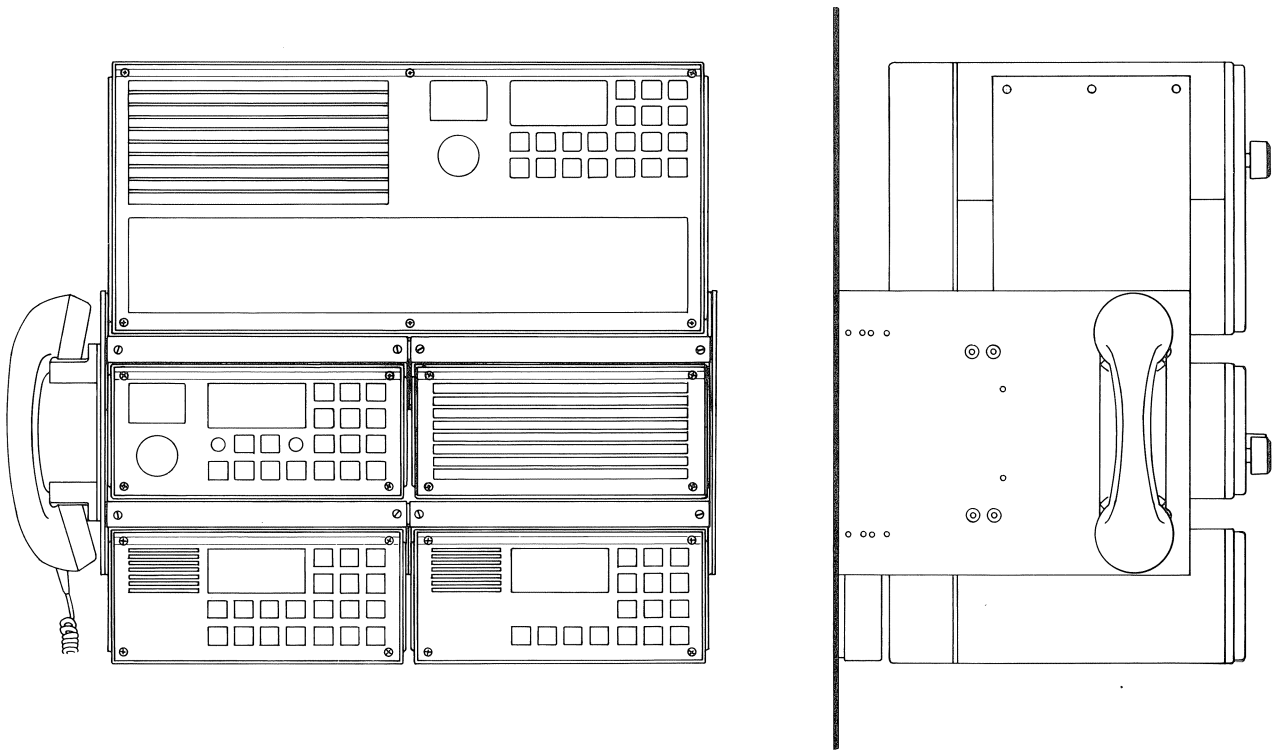
Mounting kit H2065.

2.1. **MOUNTING POSSIBILITIES** cont.

WALL



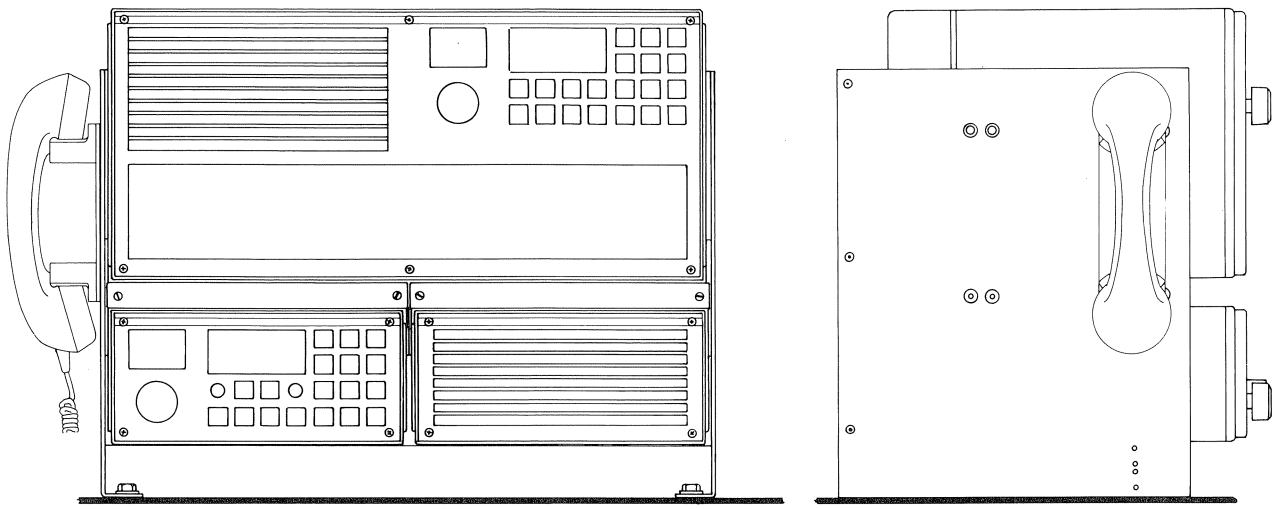
Mounting kit H2060.



Mounting kit H2061.

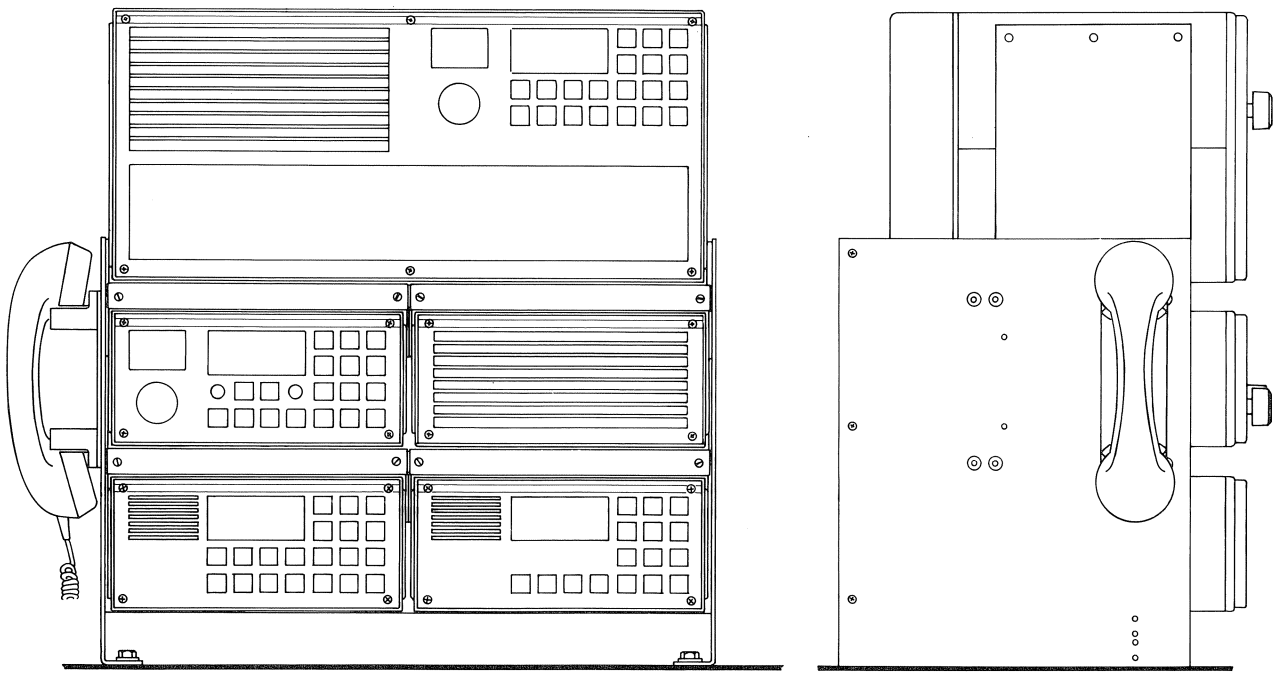
T2031A 4-0-24921
4-0-25105

TABLETOP



Mounting kit H2069.

T2031A 4-0-24922
4-0-25106



Mounting kit H2070.

2.2. PACKING LIST

Packing list for:

Compact Wall Mounting Kit H2060/H2061

and

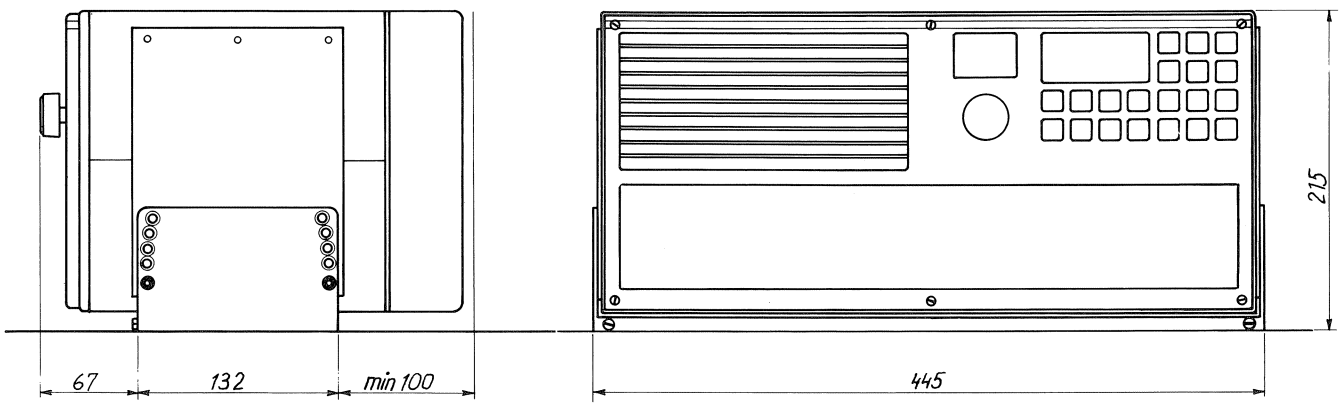
Compact Tabletop Mounting Kit H2069/H2070

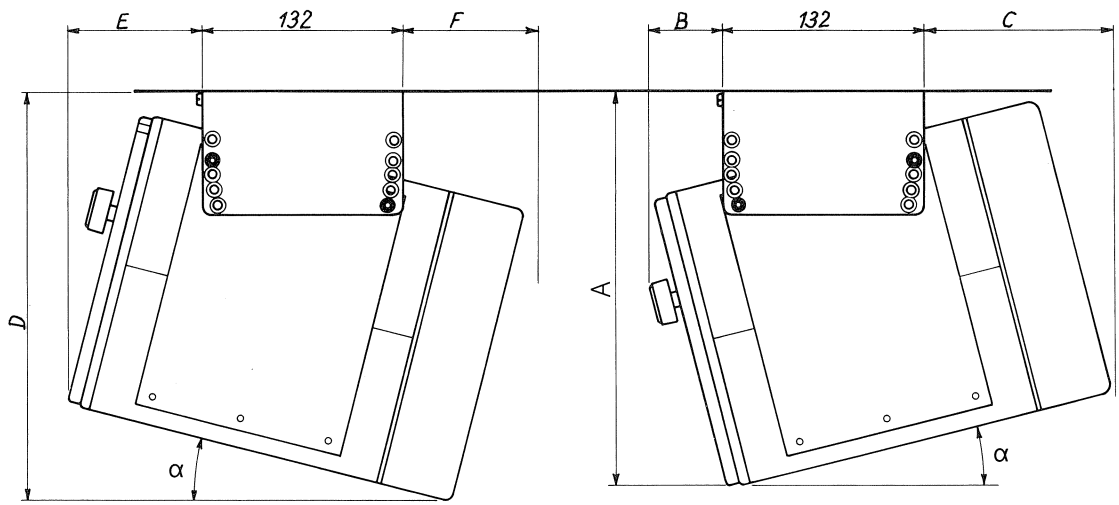
Position (or Mark)	Description	S P Number	Compact Wall Mounting Kit		Compact Tabletop Mounting Kit	
			for 1/1 box and 2 x 1/4 box	for 1/1 box and 4 x 1/4 box	for 1/1 box and 2 x 1/4 box	for 1/1 box and 4 x 1/4 box
			H2060	H2061	H2069	H2070
A	Side plate H2060/61 (green nylon coating)	142.243	2	2		
B	Distance piece (stainless steel)	200629	1	2	1	2
C	2 front lock pieces (green nylon coating), 5 screws M4 x 10 UHR, and 5 lock washers	700666	1	2	1	2
D	Slide bar (stainless steel) 6 pcs. with 14 pcs. M5 x 7 UHR	700667	1		1	
E	Slide bar (stainless steel) 10 pcs. with 22 pcs. M5 x 7 UHR	700668		1		1
F	Left side plate H2069/70 (green nylon coating)	142.245			1	1
G	Right side plate H2069/70 (green nylon coating)	142.246			1	1
H	Rear plate H2069/70 (green nylon coating)	142.247			1	1
I-O	Screws assembly kit		700669	700670	700671	700672

T2031A

2.3. DIMENSIONS AND DRILLING PLAN

UNIVERSAL MOUNTING BRACKET H2056
permits a wide variety of installation possibilities such as on tabletop, bulkhead or deckhead. For other possibilities such as console installation, the SAILOR 19" rack or all units in the Compact programme assembled on the bulkhead, see special information concerning installation of the Compact programme.



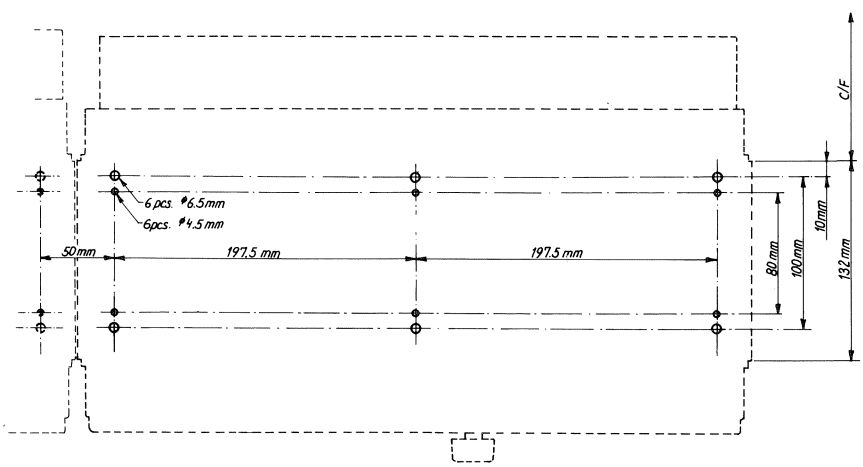


T2031A 4-0-24789
4-0-24790

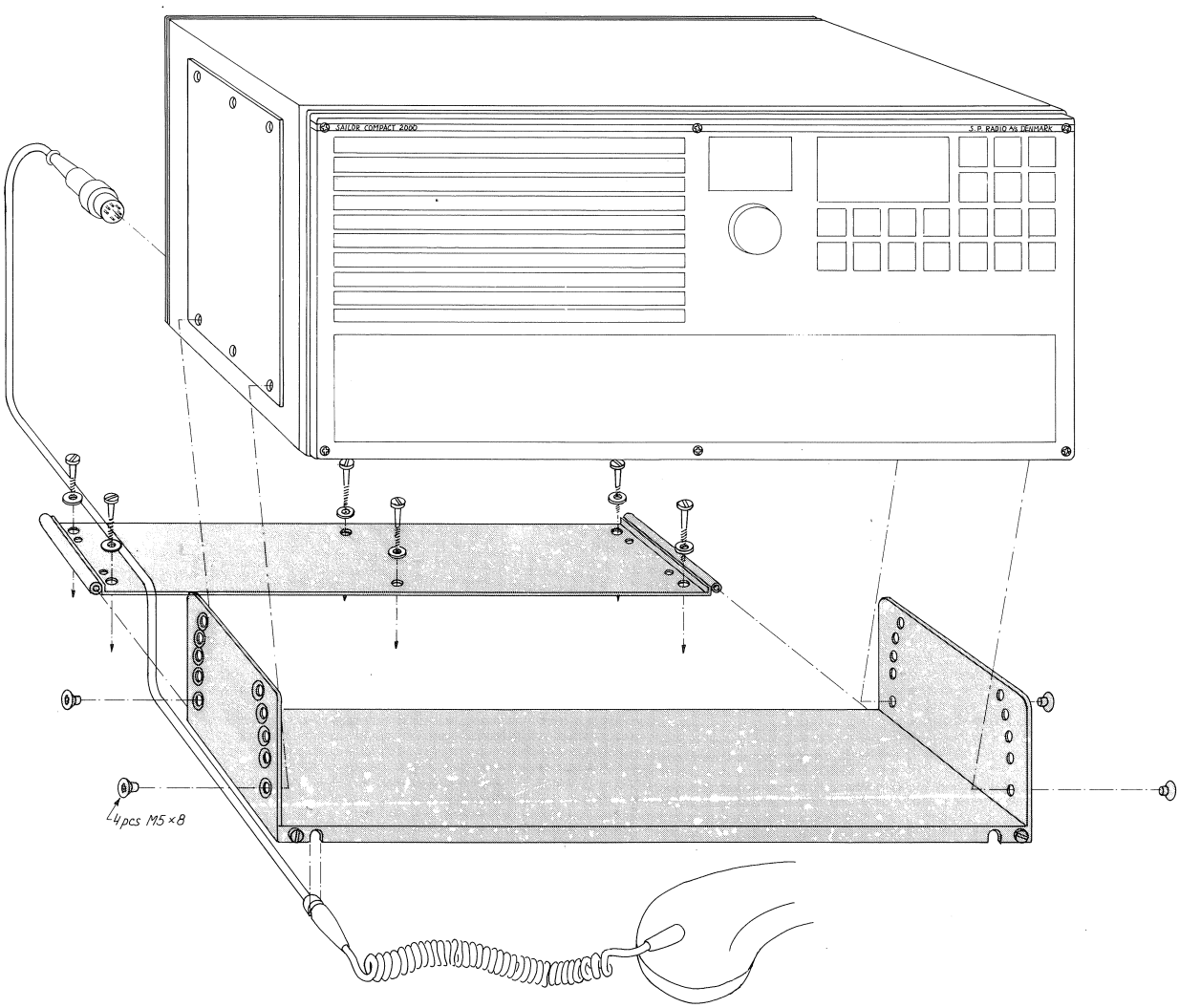
α	A	B	C	D	E	F
0°	230	67	105	230	67	105
4.8°	243	67	117	245	72	105
9.6°	255	65	130	262	78	103
14.4°	265	62	143	270	89	100

Dimensions in mm

WEIGHT
Mounting kit H2056: 2.5 kg
T2031 : 22.0 kg

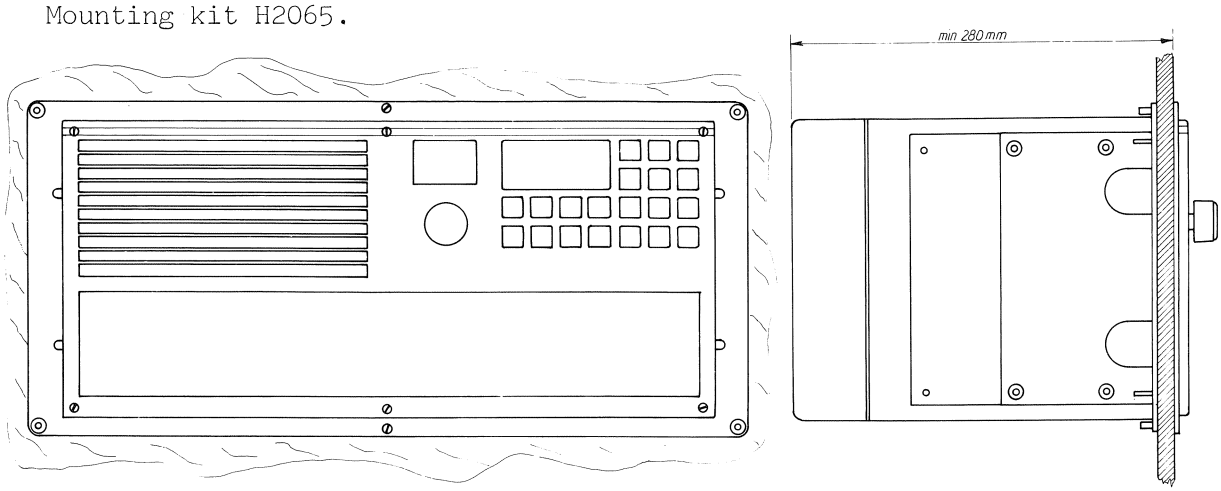


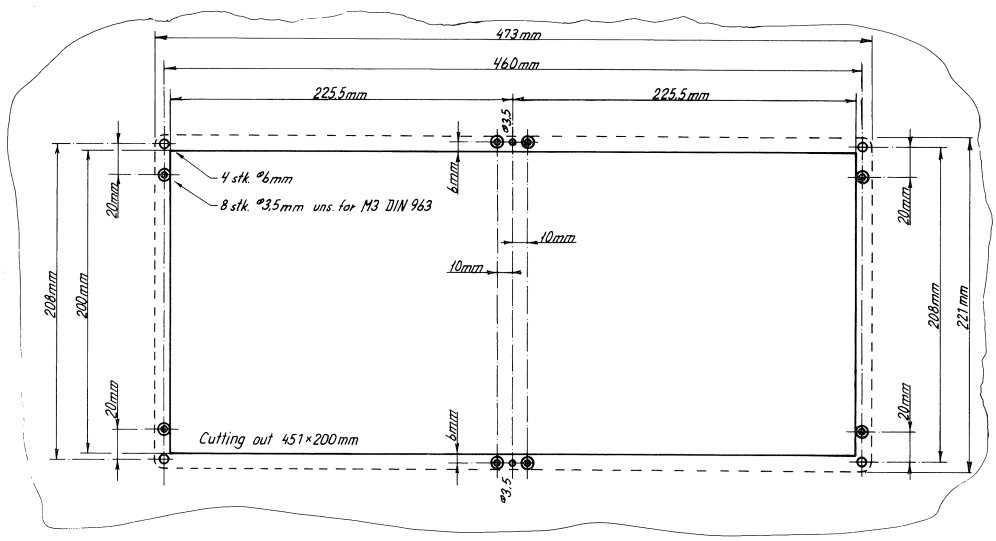
2.3. **DIMENSIONS AND DRILLING PLAN** cont.



2.3. **DIMENSIONS AND DRILLING PLAN** cont.

Mounting kit H2065.

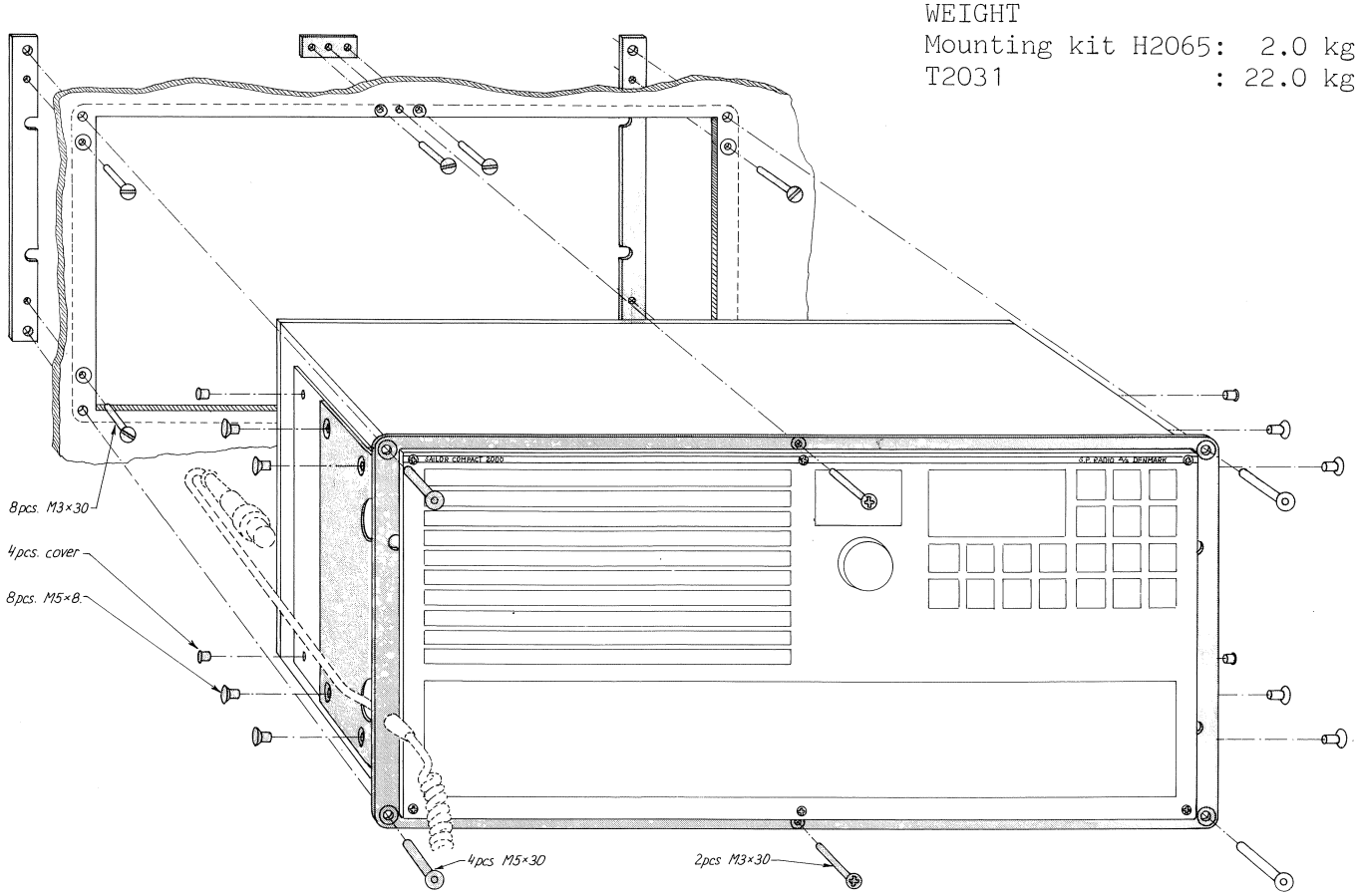




Free distance must be kept to allow free air circulation ambient temperature max. 40°C.

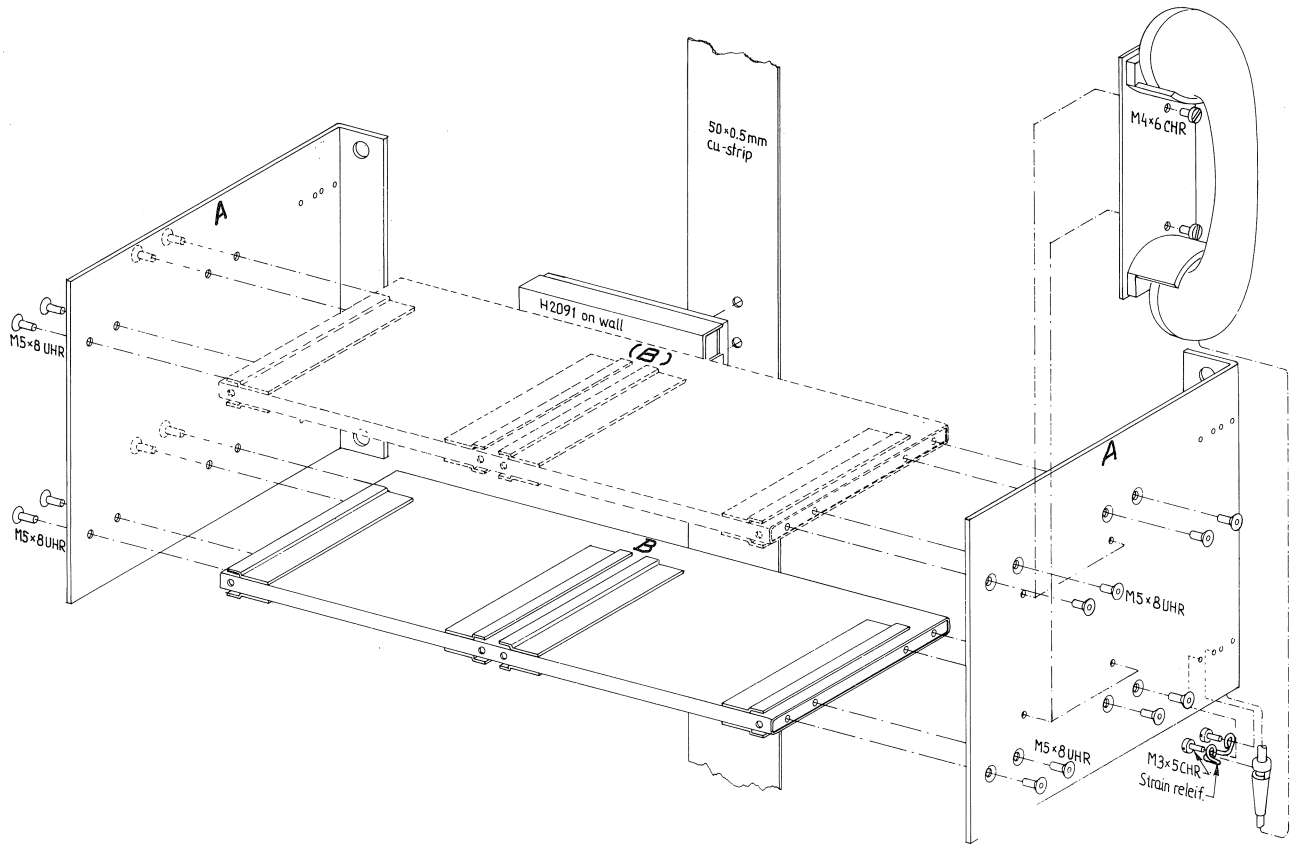
T2031A 4-0-24792A, 4-0-24705, 4-0-24793

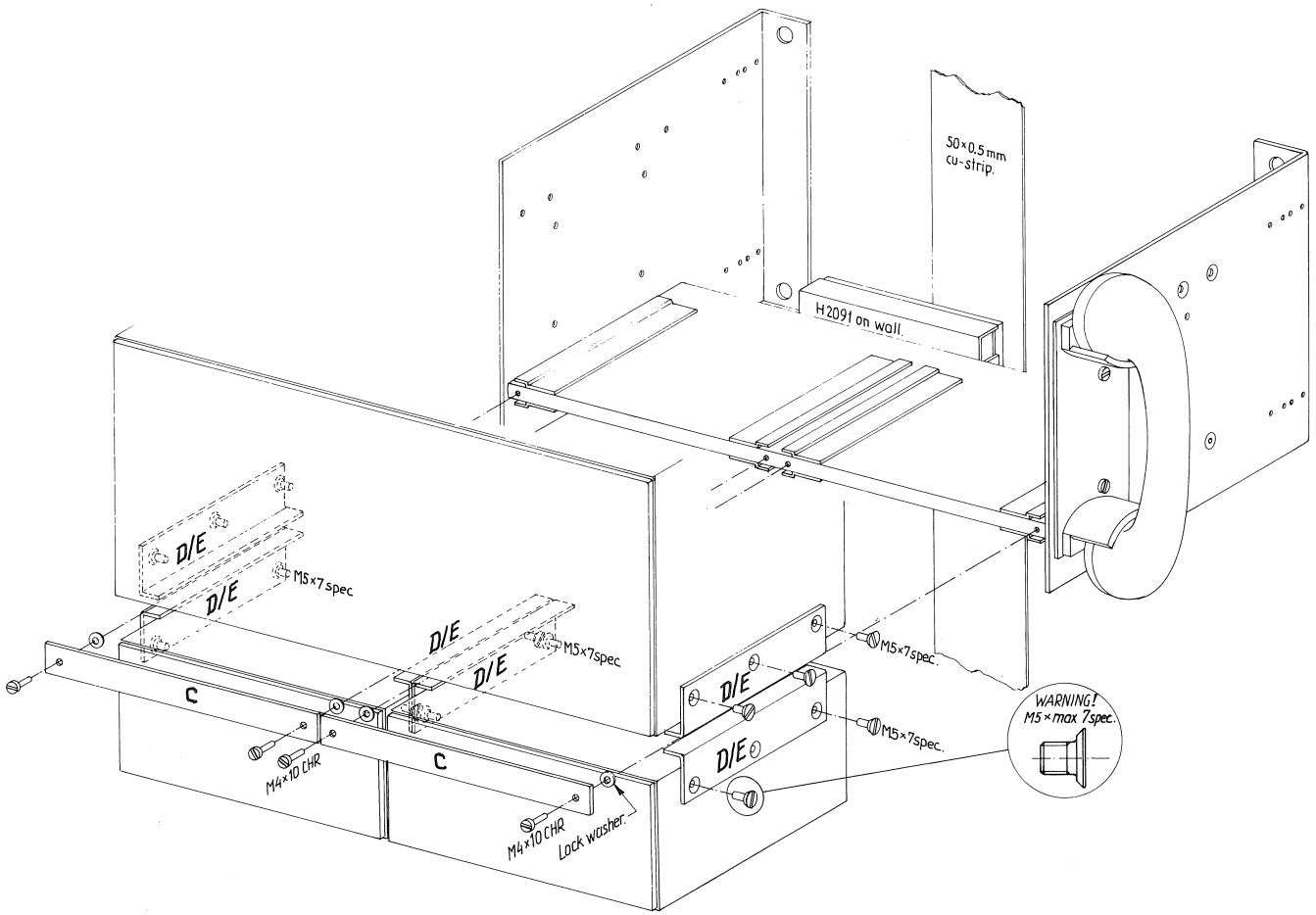
WEIGHT
Mounting kit H2065: 2.0 kg
T2031 : 22.0 kg



2.3. **DIMENSIONS AND DRILLING PLAN** cont.

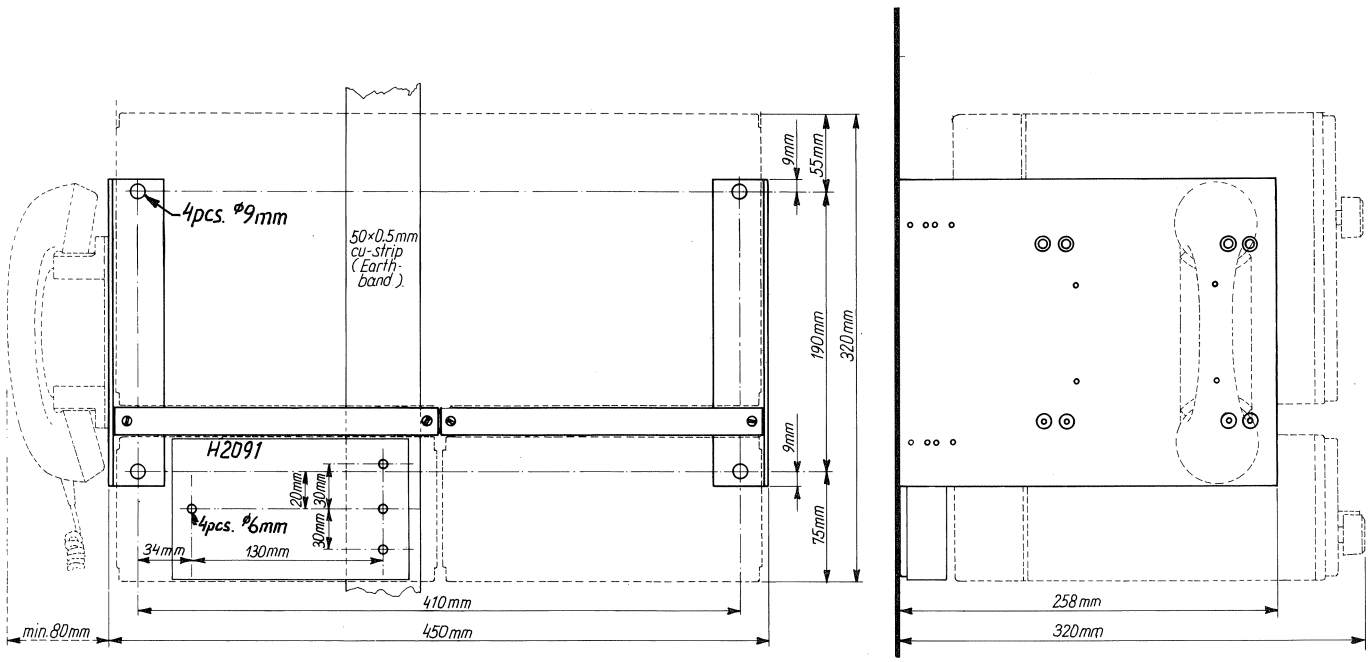
Assembling of H2060 and H2061.



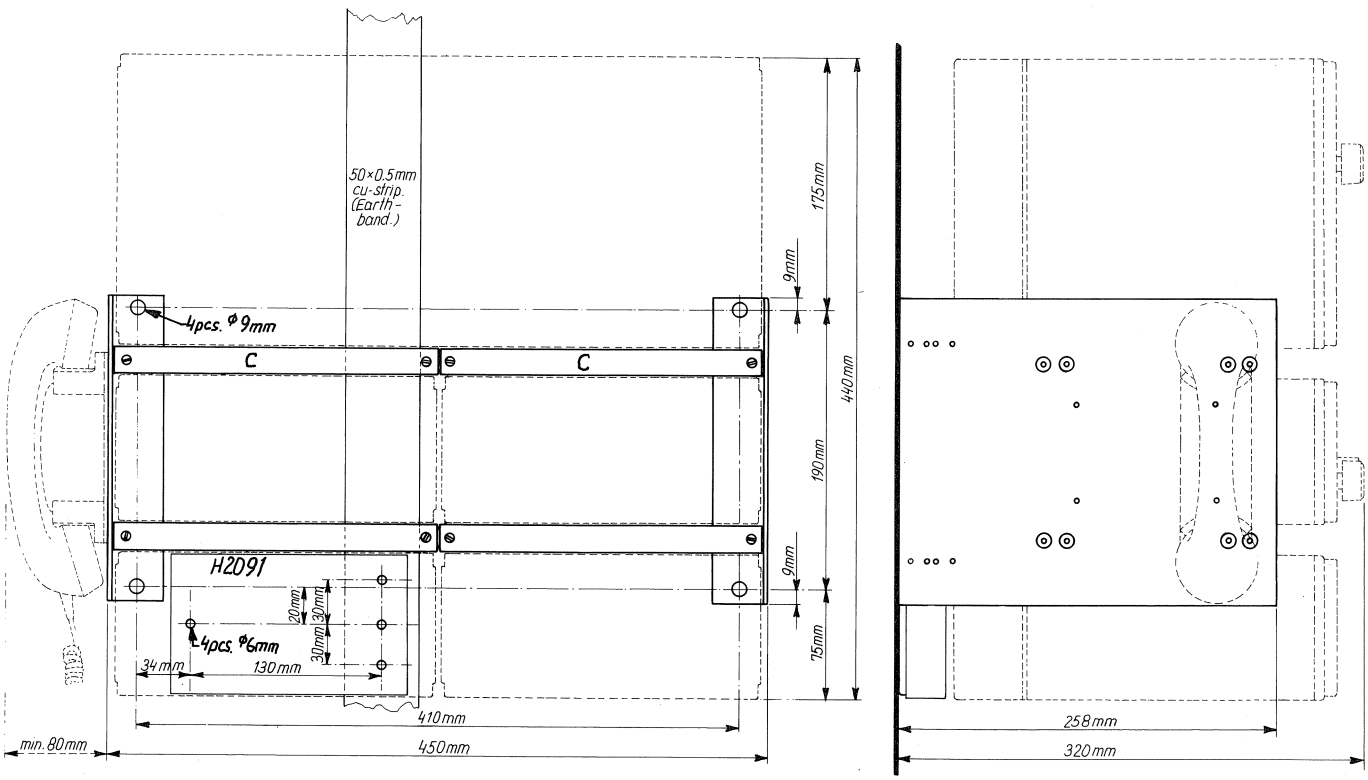


T2031A 4-0-24885
4-0-24886

Drilling Plan H2060.

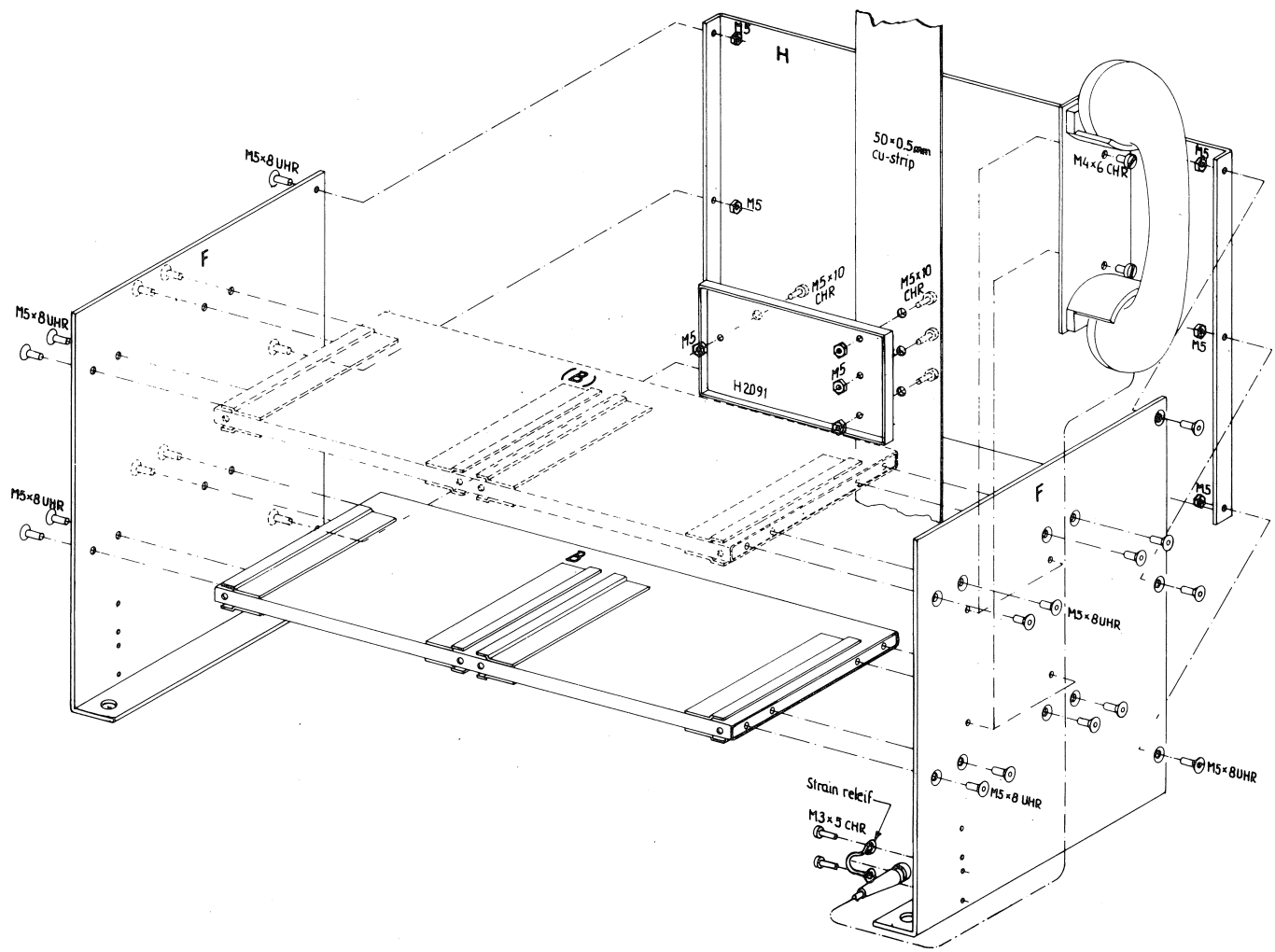


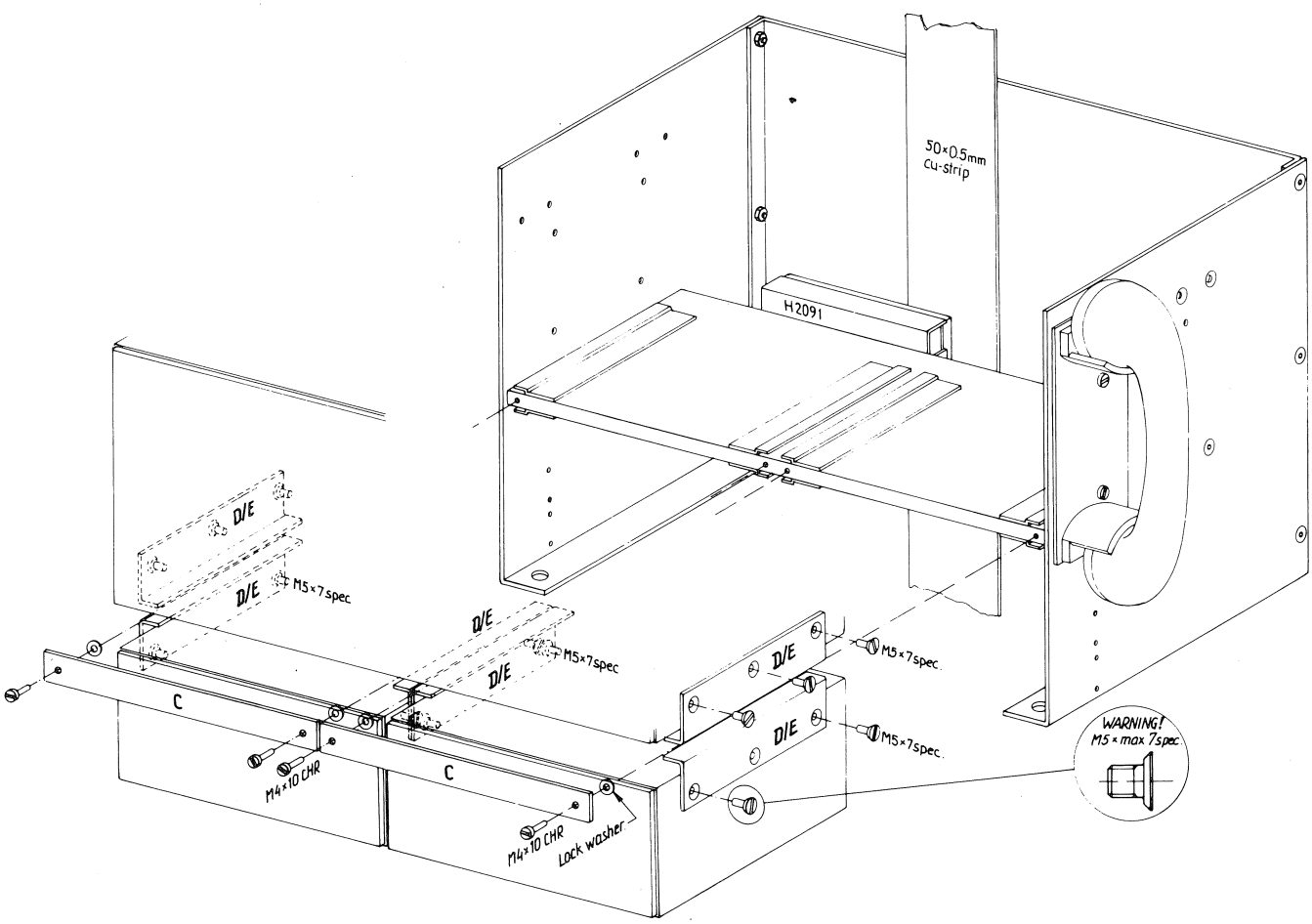
Drilling Plan H2061.



2.3. **DIMENSIONS AND DRILLING PLAN** cont.

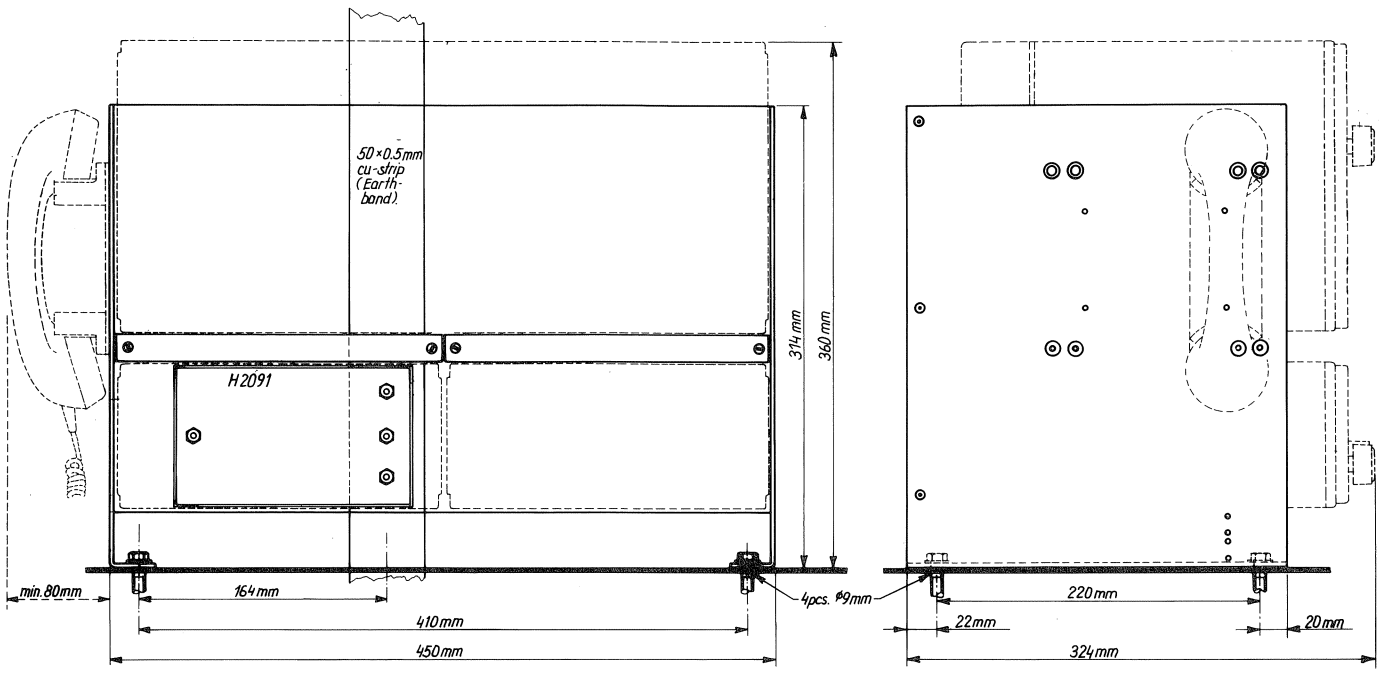
Assembling of H2069 and H2070.





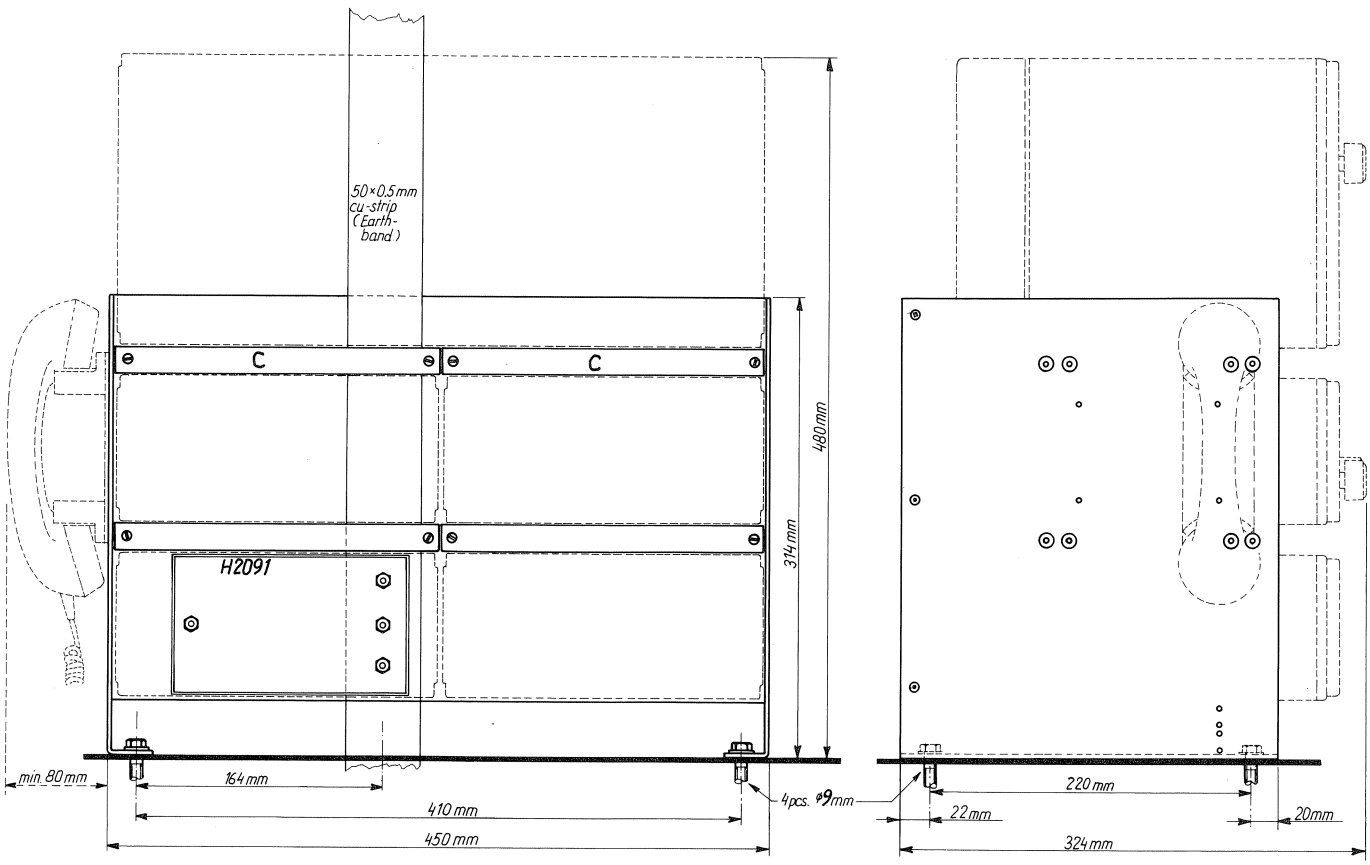
T2031A 4-0-24887
4-0-24888

Drilling Plan H2069.

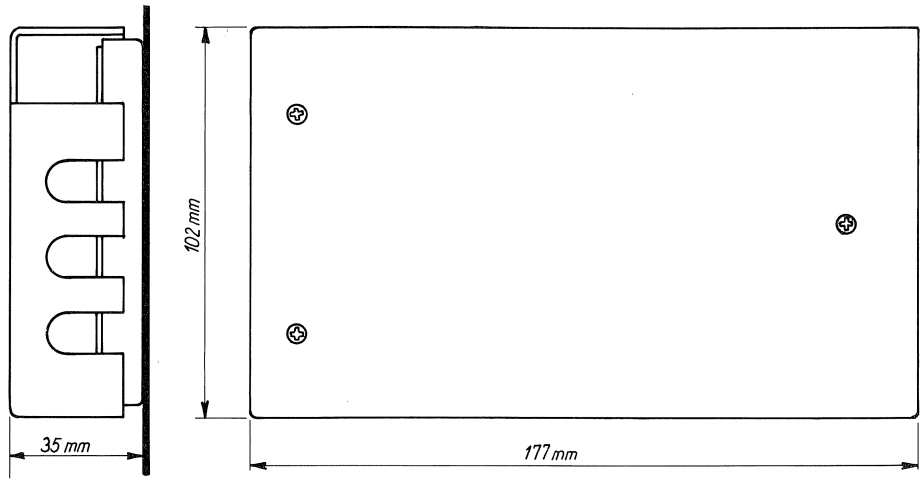


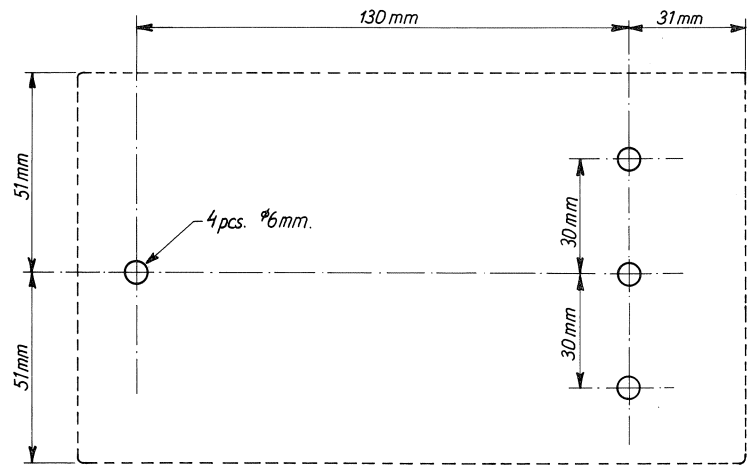
T2031A 4-0-24883
4-0-24884

Drilling Plan H2070.

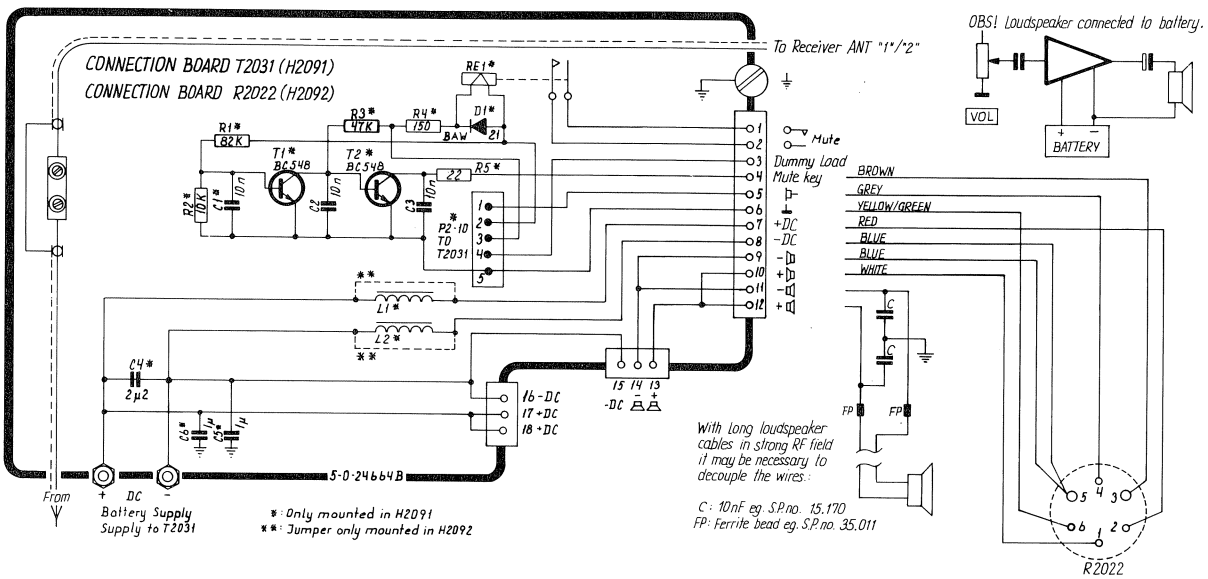


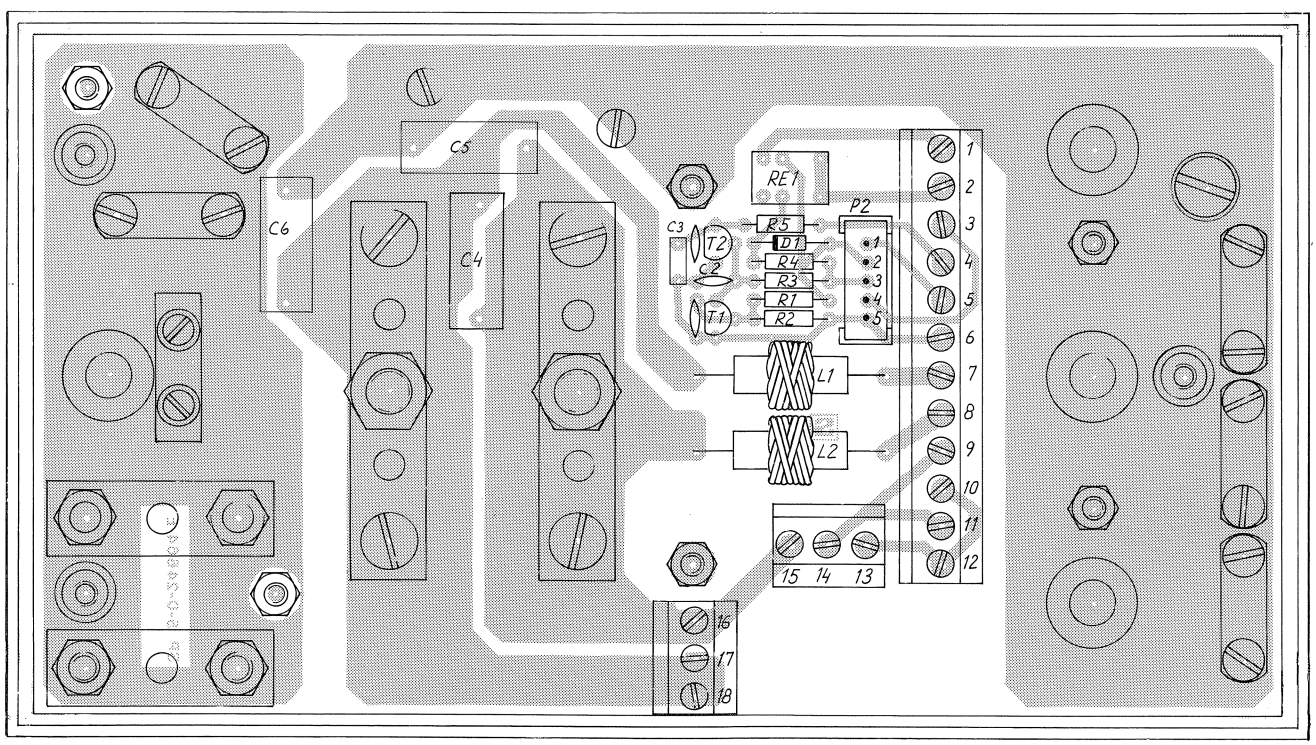
CONNECTION BOX H2091 or H2092





2.4. ELECTRICAL CONNECTIONS AND ASSEMLING

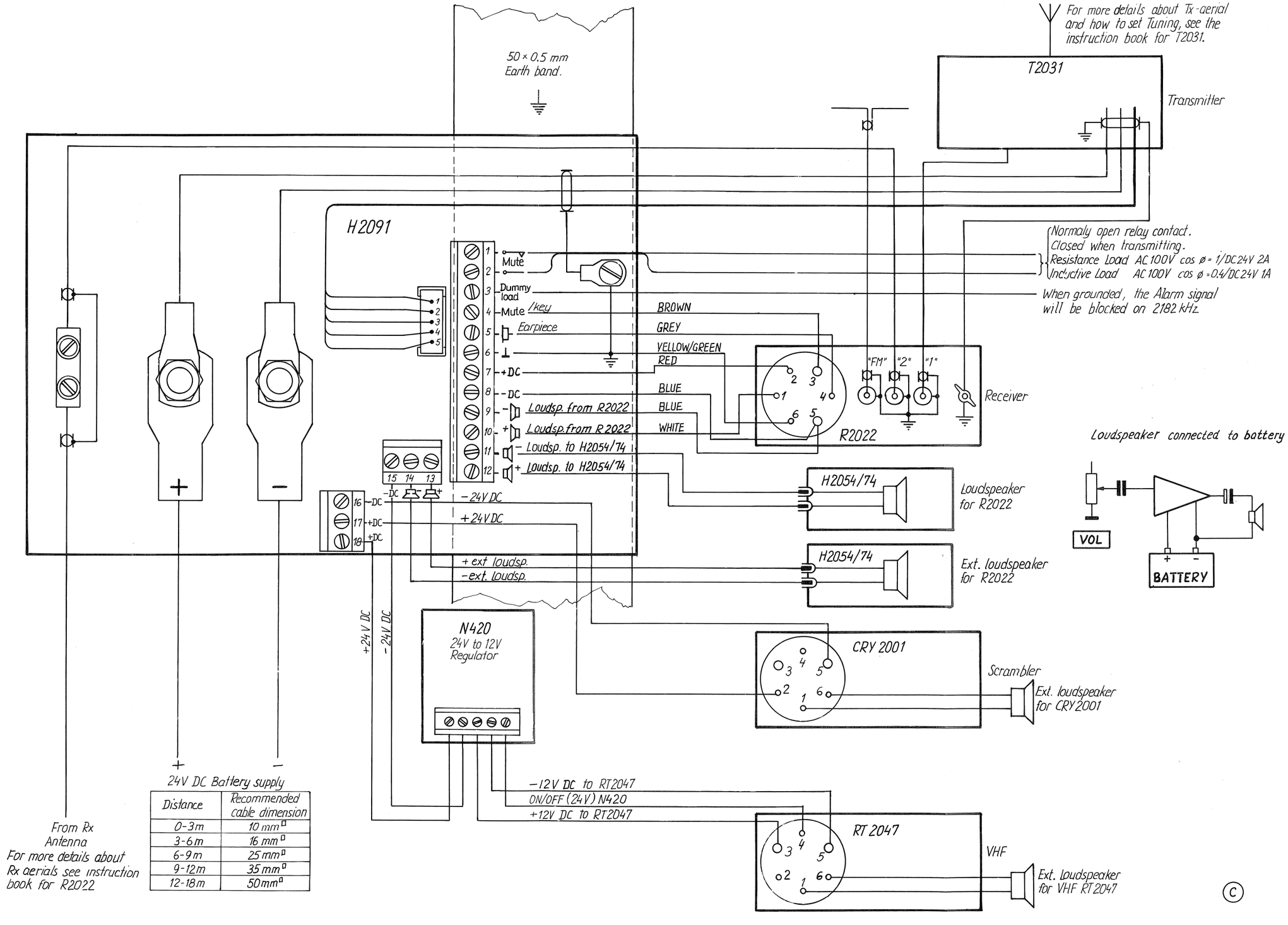




View from component side with lower side tracks.

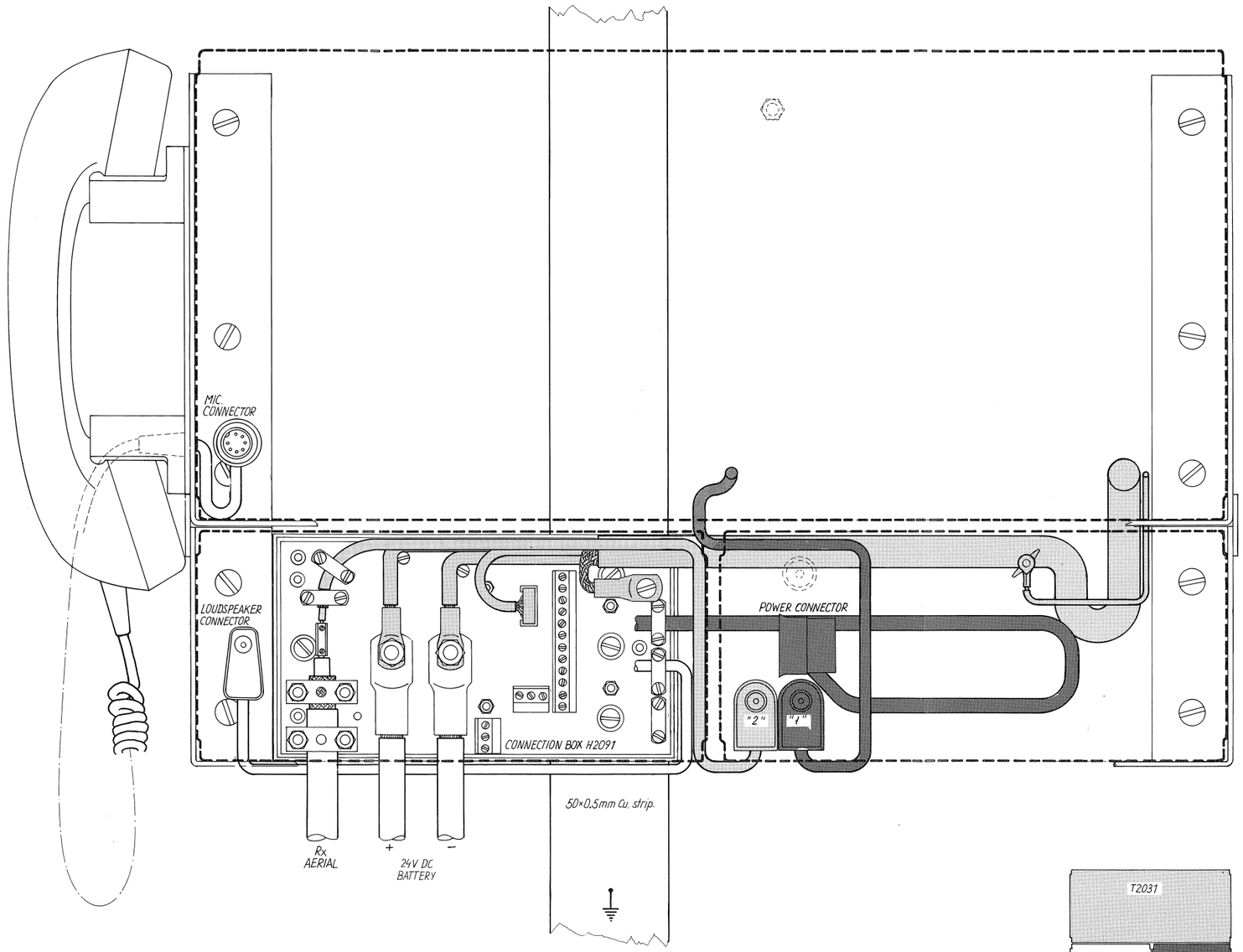
Diagram and component location H2091/H2092

R2022/T2031A
4-0-24664A , 4-6-24664E
9-0-24664E



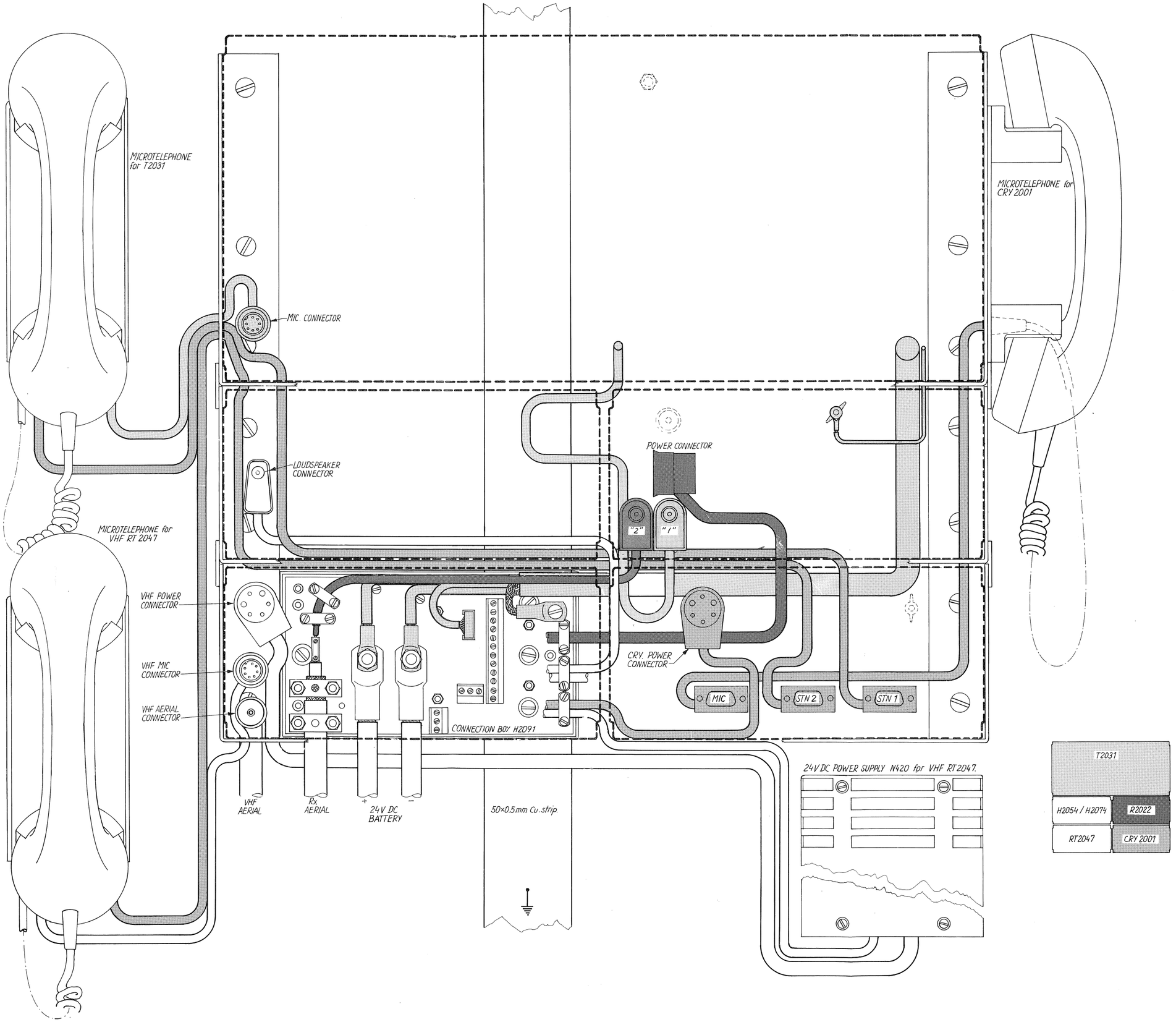
Distance	Recommended cable dimension
0-3m	10 mm²
3-6m	16 mm²
6-9m	25 mm²
9-12m	35 mm²
12-18m	50 mm²

CONNECTION DIAGRAM


MIC. CONNECTOR
LOUDSPEAKER CONNECTOR
POWER CONNECTOR
"2"
"1"
CONNECTION BOX H2091
50×0.5mm Cu. strip.
Rx AERIAL
+
24V DC BATTERY
−

T2031
H2054 / H2074
R2022

2.4. ELECTRICAL CONNECTIONS AND ASSEMBLING cont.



2.5. AERIAL AND EARTH

Most important for good communication is the aerial. The best efficiency of the aerial will be with the transmitter T2031 mounted as close as possible to the foot-point of the aerial (feed-through insulator) and the aerial placed as high and free as possible. The transmitter T2031 has to be grounded carefully.

AERIAL LENGTH
Max. length - 14 metres, min. length - 8 metres.
Aerial length measured from the insulator on T2031 to the top of the aerial.
The best length will be 12 metres.

GROUND
The transmitter T2031 has to be grounded through the connection box H2091.
If a metal wheelhouse, ground the connection box H2091 to the wheelhouse.
If a wooden or fiberglass boat, connect all accessible metal parts together and connect them to the connection box H2091 with a copper strip (100 x 0.5mm) making the copper strip as short as possible.

2.6. AERIAL TUNE-UP PROCEDURE

When installing SAILOR T2031 it has to be tuned for the aerial. To do this read carefully the procedure below.

NOTE the following details before starting the tune-up procedure.

1) All cranes, derricks, and booms etc. have to be in their normal position. Keep the boat free from buildings, masts etc. ashore before starting the tune-up procedure.

2) The settings in band 14L to 16U must not be changed. If you by accident have changed one of the codes you have to contact the general agent in your country or S. P. Radio, Denmark in order to get the correct code.

3) All SAILOR T2031, except for Dutch registered vessels, are programmed for fixed tuning on 2182 kHz and therefore when the transmitter is in normal operating mode (switch S1 in position A) it is not possible to check the tuning by pushing the tune knob.

4) You have to use the same resonance and load number in "L" and "U", e.g. 11L46 and 11U46.

2.6. AERIAL TUNE-UP PROCEDURE cont.

The tune-up procedure has to be executed when the transmitter has been installed or when the aerial has been changed.

The purpose of this tune-up procedure is to match the transmitter to the aerial. To do this it is necessary to select the correct variometers (resonance) and the correct load step (load) for the frequency and aerial in question. Therefore the frequency range from 1.6 MHz to 4.2999 MHz is divided into 12 bands plus one band for 2182 kHz (see table 1). For each of these bands it is necessary to find the right setting of resonance and load.

Remove the frequency table and set switch S1 to B-position, see fig. 1. The display read-out and the keyboard functions are now changed as shown on fig. 1.

1. Select band 1L, resonance 1, load 1.

2. Press the tune knob and tune to max. peak reading on the AE-current meter by means of the 2182 tune screw (see fig. 1) and note the peak reading. **In band 1 (2182 kHz) the resonance setting has to be 1. If resonance is not obtained the antenna has to be changed.**

3. Search for the load step that gives max. peak reading on the AE-current meter. When changing load, the 2182 tune screw has to be set for max. peak reading on the AE-current meter.

4. Select band 2L, resonance 2, load 1.

5. Press the tune knob and tune by means of the tune knob to a peak meter reading on the AE-current meter. If a peak reading is not found, go one step up or down in resonance and tune for peak reading on the AE-current meter.

6. Search for the load step that gives max. peak reading on the AE-current meter. When changing load, tune for peak reading on the AE-current meter.

7. Select band 2U and check if it is possible to tune to a peak reading on the AE-current meter. If not possible, go one resonance step up, select band 2L and go to point 5.

8. Select band 3L, resonance number and load number as previous band and execute 5 and 6.

9. Select band 3U and check if it is possible to tune to a peak reading on the AE-current meter. If not possible, go one resonance step up or down, select band 3L and execute 5, 6, and 9.

10. Execute 8 and 9 on the remaining bands (4L to 13U).

11. **NOTE! This point is only to be executed if variable tune on 2182 kHz is wanted.**
    Please change the programming of band 14 according to the list in IDENTITY AND SERVICE PROGRAMMING OF SAILOR TRANSMITTER T2031.
    The programming of band 1 is changed to resonance 4 instead of resonance 1.

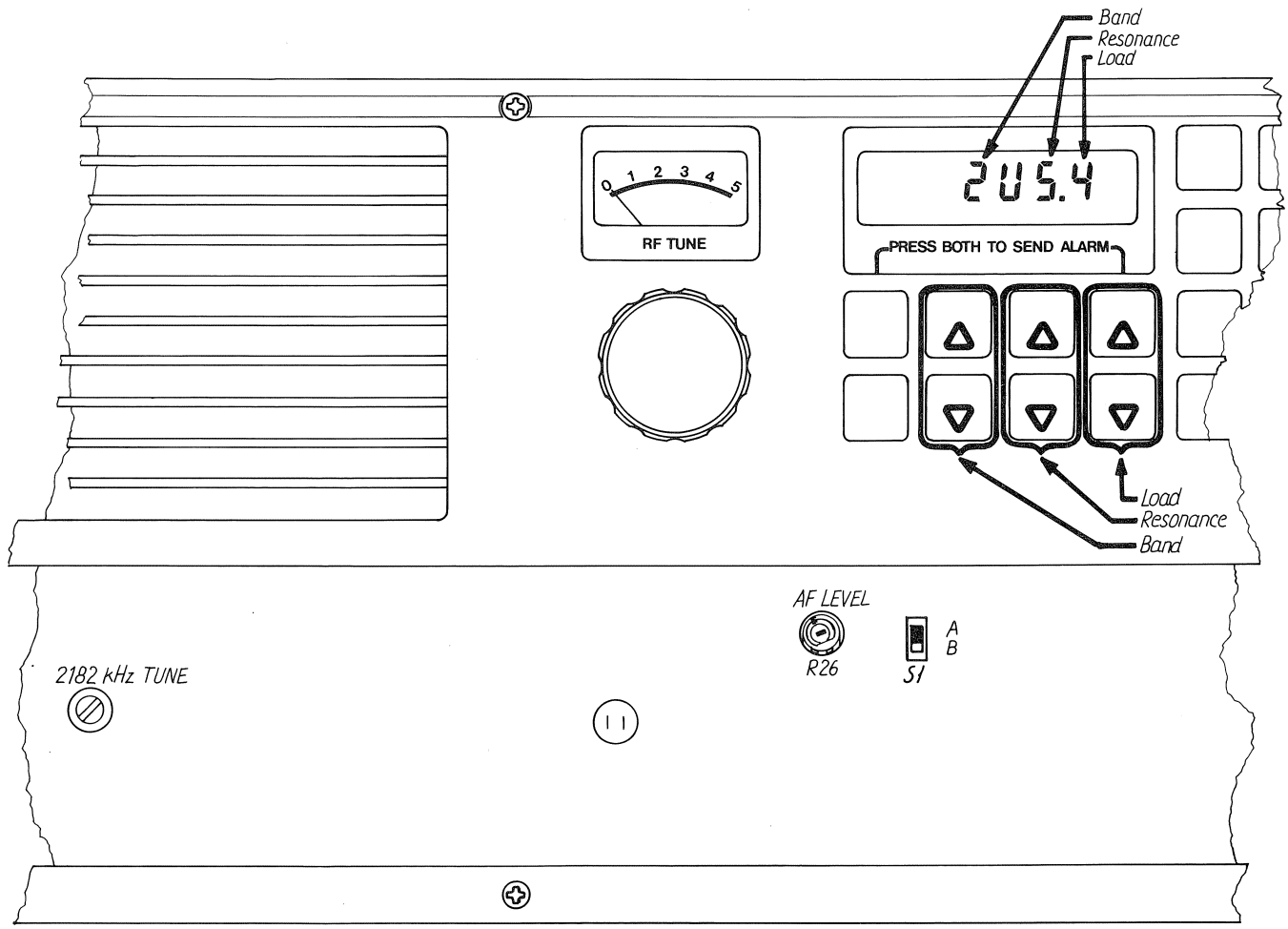
12. Press the key ENT and set switch S1 from B and A (fig. 1). Check that it is possible to tune the transmitter on all programmed frequencies.

2.6. **AERIAL TUNE-UP PROCEDURE** cont.

Table 1.

BAND		BAND	
1L	2.1820 MHz	7U	3.0999 MHz
1U	2.1820 MHz	8L	3.1000 MHz
2L	1.6000 MHz	8U	3.2999 MHz
2U	1.8999 MHz	9L	3.3000 MHz
3L	1.9000 MHz	9U	3.4999 MHz
3U	2.1999 MHz	10L	3.5000 MHz
4L	2.2000 MHz	10U	3.6999 MHz
4U	2.4999 MHz	11L	3.7000 MHz
5L	2.5000 MHz	11U	3.8999 MHz
5U	2.6999 MHz	12L	3.9000 MHz
6L	2.7000 MHz	12U	4.0999 MHz
6U	2.8999 MHz	13L	4.1000 MHz
7L	2.9000 MHz	13U	4.2999 MHz

Fig. 1.



CONTENTS

3.1. MAINTENANCE

PREVENTIVE MAINTENANCE
When the SAILOR TRANSMITTER T2031 has been correctly installed, the maintenance can, dependent on the environments and working hours, be reduced to a performance check at the service workshop at intervals, not exceeding 5 years. A complete performance check list is enclosed in the PERFORMANCE CHECK section.

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

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

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

3.2. NECESSARY TEST EQUIPMENT

OSCILLOSCOPE:	
Bandwidth	DC - 35 MHz
Sensitivity	2 mV/cm
Input impedance	1 Mohm//30 pF
Triggering	EXT-INT-ENVELOPE
E.g. PHILIPS type	PM3216
PASSIVE PROBE:	
Attenuation	20 dB (10x)
Input impedance	10 Mohm//15 pF
Compensation range	10 - 30 pF
E.g. PHILIPS type	PM8925
MULTIMETER:	
Sensitivity DC (f.s.d.)	999 mV
Input impedance	10 Mohm
Accuracy DC (f.s.d.)	1.0%
E.g. PHILIPS type	PM2517X
MULTIMETER:	
Sensitivity DC (f.s.d.)	0.1V and 3.0 Amp.
Input impedance	30 kohm/V
Accuracy (f.s.d.)	1.0%
Current range	50 Amp.
Voltage range	100V
E.g. Unigor type	A43
Shunt type Unigor	GE4275
TONE GENERATOR:	
Frequency range:	200 - 3000 Hz
Output voltage	1V RMS
Output impedance	600 ohm
E.g. PHILIPS type	PM5107
FREQUENCY COUNTER:	
Frequency range	100 Hz - 65.0 MHz
Resolution	1 Hz at f = 10 MHz
Accuracy	$1 * 10^{-6}$
Sensitivity	100 mV RMS
Input impedance	1 Mohm//25 pF
E.g. PHILIPS	PM6667/02
POWER SUPPLY:	
V_{out}	21.6 - 32.0V DC
I_{out}	42.0 Amp.
E.g. 2 pcs. LAMBDA	LES-F-03-0V-V

T2031A

3.2. **NECESSARY TEST EQUIPMENT** cont:

POWER SUPPLY:

V_{out}	2 - 30V DC
I_{out}	1.0 Amp.
E.g. B and O	SN15

RF AMMETER (Thermocioss):

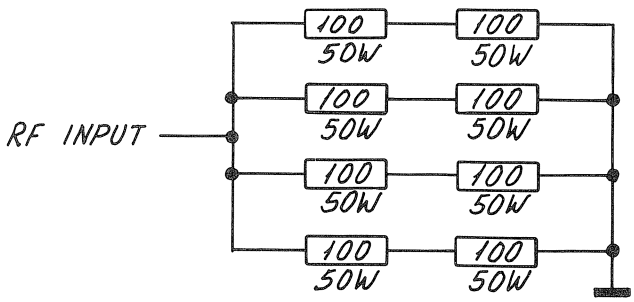
Current range	5 Amp.
E.g. SIFAM PANEL METERS	Monitor 38
From ITT INSTRUMENTS	5A TERMOCUPLE

DUMMY LOAD:

Impedance	50 ohm
Frequency	0 - 5.0 MHz
E.g. 2 pcs. fixed resistors in parallel PHILIPS type	2322 181 13101

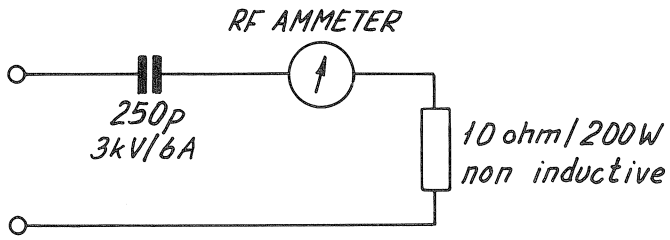
DUMMY LOAD RF:

Impedance	50 ohm
Frequency	0 - 5.0 MHz
Power range	250W
E.g. 8 pcs. 100 ohm 50W connected as shown below	S.P. No. 06.376



T2031

DUMMY LOAD FOR C.T. BAND 1.6 - 4.3 MHz:



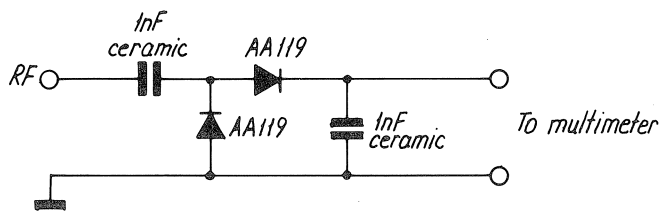
E.g. Draloric type 06-1291TD 20x50L 8KVs 250 pF +-20% R85

E.g. 10 pcs. S.P. No. 06.375, 100 ohm, 5%, 25W

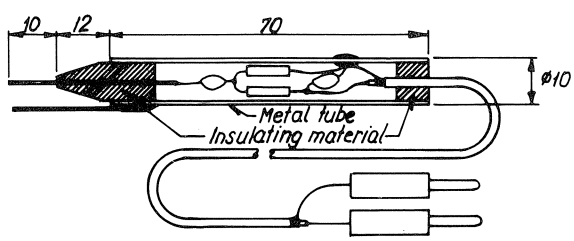
DUMMY LOAD FOR POWER SUPPLY UNIT II:

Resistor:	6.81 kohm +-1% 0.3W	S.P. No. 03.419
	73.2 kohm +-1% 0.3W	S.P. No. 03.445
	12.0 kohm +-5% 0.3W	S.P. No. 01.227
	1.0 kohm +-5% 0.3W	S.P. No. 01.200
Power resistor:	4.0 ohm +-10% 40W 12.0V Load	
E.g. 4 pcs.	1 ohm +-10% 15W	S.P. No. 05.825
	25.0 ohm +-10% 75W 42.0V Load	
E.g. 16 pcs.	100 ohm +-10% 15W	S.P. No. 05.886
	4.2 ohm +-10% 450W 42.0V Load	
E.g. 24 pcs.	100 ohm +-10% 15W	S.P. No. 05.886
	2.3 ohm +-10% 700W 42.0V Load	
E.g. 42 pcs.	100 ohm +-10% 15W	S.P. No. 05.886

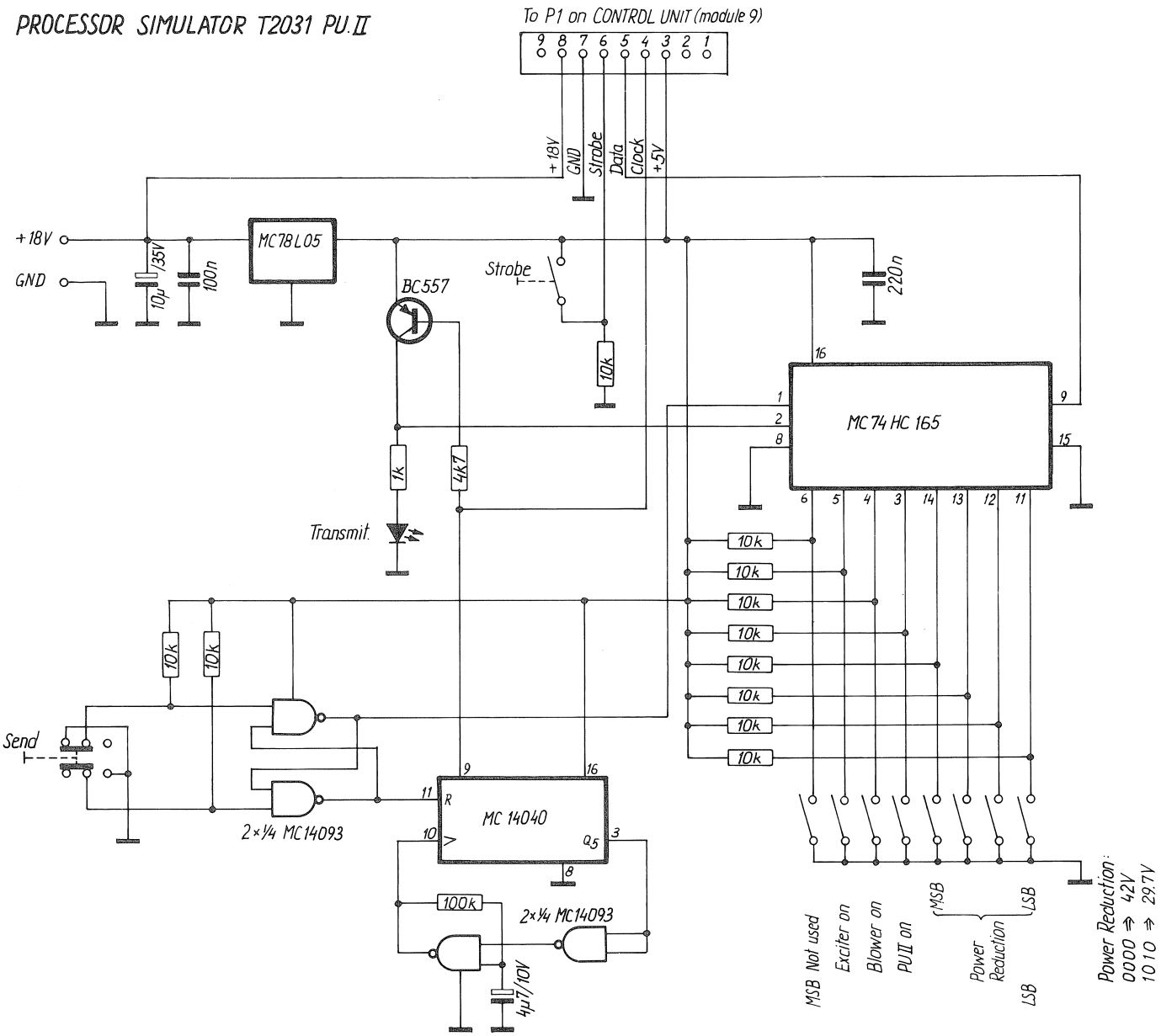
TEST PROBE



LAYOUT OF THE PROBE



Processor simulator for Power Unit II (PUII) T2031.



3.3. TEST PROGRAMMES

SAILOR T2031 has a set of built-in test programmes. These test programmes can be activated during a trouble shooting procedure or during adjustment after repair.

In this manual the test programmes are described as TEST 1.4. meaning that test No. 4 in test group No. 1 is the one to be activated.

The test programmes are selected by the help of the jumpers W2 - W5 placed on the computer control board. When these jumpers show a pattern as described below a test programme is chosen.

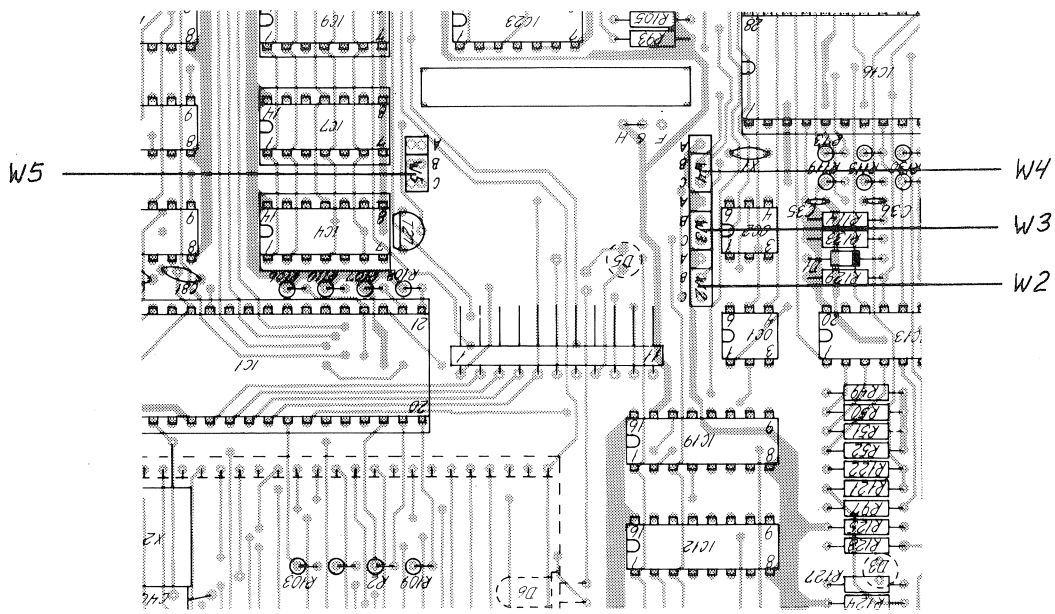
3.3.2. **Test Code Overview**

Jumper W5 mounted in position B-C => normal mode.
Jumper W5 mounted in position A-B => test mode.

	W4	W3	W2		Test Group No. 0	Test Group No. 1
0	J	J	J	Test group No. 0	Exc. step 16 fixed	I_A read out
1	J	J	.	Test group No. 1	Exc. step 15 fixed	V_f read out
2	J	.	J		A/D + D/A conv.	V_r read out
3	J	.	.		Tx step 31 fixed	V_A read out
4	.	J	J		Tx in dummy load	Drive inc.I_A read out
5	.	J	.		Togl exc. PU2 latch	PA temp. read out
6	.	.	J		Step D/A conv's	+5V read out
7	.	.	.		ADC-check	PU temp. read out

J = jumper mounted between position A - B.

. = jumper removed



3.3.3. **Procedure for Selecting a Test in Test Group No. 0**

E.g. select TEST 0.2.

1. Select test group No. 0.

   a) Move jumpers: W2 from position B-C to A-B
   W3 from position B-C to A-B
   W4 from position B-C to A-B

   b) Move jumpers W5 from position B-C to A-B

   The test group No. 0 is now selected, as a control the code on IC16-5 pin 26 and 27 is now "0", "0".

2. Select test No. 2.

   a) Move jumpers: W2 leave the jumpers in position A-B
   W3 remove the jumper
   W4 leave the jumper in position A-B

   b) Remove W5 and mount it again in position A-B.

   The transmitter is now placed in TEST 0.2.
   If it is wanted to change to another test in the same test group it is only necessary to change the pattern of W2, W3, and W4.

   A change to TEST 0.4.
   W2 leave the jumper in position A-B
   W3 to position A-B
   W4 remove the jumper.

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3.3.4. **Procedure for Selecting a Test in Test Group No. 1.**

E.g. select TEST 1.4.

1. Select test group No. 1.

   a) Move jumpers. W2 remove the jumper.
   W3 from position B-C to A-B.
   W4 from position B-C to A-B.

   b) Move jumper W5 from position B-C to A-B.

   Test group No. 1 is now selected, as a control the code on IC16-5 pin 26 and 27 is now "1", "0".

2. Select test No. 4.

   a) Move jumpers: W2 to position A-B
   W3 leave the jumper in position A-B.
   W4 remove the jumper.

   b) Remove W5 and mount it again in position A-B.

   The transmitter is now placed in TEST 1.4.
   If another test inside this group is wanted it is only necessary to change the pattern of W2, W3, and W4.

3.3.5. Procedure for Returning to Normal Mode.

Mount all the jumpers in position B-C, press and release the tune knob. The transmitter is now in normal mode.

3.3.6. Tests in Group No. 0

3.3.6.0. Exciter Turned On on Step 16 Fixed. Test 0.0.

Only the exciter is on.
This test can be used in conjunction with TEST 0.1..

Set the transmitter in H3E mode and measure the exciter output on the collector of T1-1 or T2-1. The measured output must be 0.4 dB less than the output in TEST 0.1. If the measured output difference is different from 0.4 ±0.5 dB, the potentiometer R81-1 has to be adjusted. This adjustment must be carried out as explained in ADJUSTMENT PROCEDURE 3.6. "Adjustment of Step Attenuator and Amplifier".

3.3.6.1. Exciter Turned On on Step 15 Fixed.

Only the exciter is on.
See section 3.3.6.0.

3.3.6.2. Test of A/D and D/A Converters.

Only the exciter is on.
Disconnect the front plate instrument. IC16-5 port A is incremented and fed to the input of the D/A converter. The output from the D/A converter is fed to the A/D converter IC13-1 pin 8. The microcomputer compares the A/D converter output with the bit pattern at port A. If there is match, port A is incremented, if there is no match the test stops and error code No. 3 is read out. IC16-1 pin 26 and 27 become "0", "0".

3.3.6.3. Transmitter Turned On, with the Exciter on Step 31 Fixed.

CAUTION! The internal dummy load R1-15 and R2-15 must be disconnected from the soldering terminals and an external 50 ohm/250W dummy load must be connected to one of the soldering terminals.

The regulating functions in the microcomputer is not working in this test. The exciter attenuator is placed at step 31 fixed and the transmitter is keyed. By applying an AF signal to the microphone input terminals or by switching to H3E mode, the transmitter starts to transmit into the dummy load.
The test can be used to adjust the $V_{reverse}$ output of the SWR-detector to minimum. The adjustment is carried out as explained in ADJUSTMENT PROCEDURE 3.6.3. "Adjustment of SWR-DETECTOR".

3.3.6.4. Adjustment of Nominal Drive Level.

CAUTION! The internal dummy load R1-15 and R2-15 must be disconnected from the soldering terminals, and an external 50 ohm/250W dummy load must be connected to one of the soldering terminals.

When the tune button is pressed the transmitter starts to transmit into the dummy load. The output power level is the nominal power level without temperature or SWR correction and could be equal to 500W PEP.
This level can be continuously adjusted by the potentiometer R99-5.
The adjustment is carried out as explained in ADJUSTMENT PROCEDURE 3.6.4. "Adjustment of Drive Level (Power Output). (R99-5).

3.3.6.5. Toggle the Exciter and PU2 Latches.

Only the exciter is on.
The outputs of the latches IC7-1 and IC5-9 are toggled. The microcomputer writes alternately $ 55 and $ AA into the latch. Use the strobe on IC7-1 pin 1 for triggering an oscilloscope. The clock and the data connections together with the output can be examined.

3.3.6.6. Step the D/A Converters.

Only the exciter is on.
The D/A converters are stepped one after the other.

The output on IC17-5 pin 15 can be used for trigger to an oscilloscope when examining all three D/A converters.

6.1. Step D/A Converter in the Exciter
Select H3E mode. The attenuator is incremented. The exponential output of the exciter can be measured on the collector of T1-1 or T2-1 on the exciter unit.

6.2. Step the D/A Converter to the Meter
The output of port A IC16-5 is incremented and the output of the meter D/A converter can be measured on plug P9-5 pin No. 1.
The output is switched from 0.0V to 5.0V.

6.3. Step of D/A Converter in PU2
The D/A converter IC5-9 is incremented, and the output can be measured on IC6-9 pin No. 7 placed on the PU2 module.

3.3.6.7. Test of ADC-Converter.

Only the exciter is on.
The voltage on PA-temp. IC13-5 pin No. 5 is continuously measured and the binary value is read out on port A IC16-5. The binary value U on port A should be equal to:

$$U = \frac{Vin}{5} \times 255$$

Because all 8 bits are read out on port A IC16-5 the ERROR code will change according to V_{in}. without indicating any error.

3.3.7. Test Group No. 1

The transmitter is turned on with the exciter step attenuator at step 63, which gives maximum attenuation. A two-tone signal must be applied to the microphone input terminals at a level of 1 Vpp, or the transmitter must be switched to H3E mode. In TEST 1.4. the exciter attenuator is incremented until the pattern of W2, W3, and W4 is changed or until the step attenuator reaches minimum attenuation. If this happens in H3E mode, or with two tones applied to the microphone terminals, the power amplifier transistors will probably be destroyed.

CAUTION! Before the transmitter is switched to test group No. 1, choose a frequency and press the tune knob and tune up the transmitter either in the antenna or in a 10 ohm/250pf dummy load.

3.3.7.0.
$I_{antenna}$ is read out on the front plate meter at the level found in 3.3.7.4.

3.3.7.1.
$V_{forward}$ is read out on the front plate meter at the level found in 3.3.7.4.

3.3.7.2.
$V_{reverse}$ is read out on the front plate meter at the level found in 3.3.7.4.

3.3.7.3.
$V_{antenna}$ is read out on the front plate meter at the level found in 3.3.7.4.

3.3.7.4.
The drive is incremented once every 250 msec. The antenna current is read out on the front plate meter. Stop the drive increment by changing the pattern of W2, W3, and W4 as soon as a reasonable valve can be read on the front plate meter.

3.3.7.5.
PA (power amplifier) temperature is read out on the front plate meter.

3.3.7.6.
+5.0V is read out on the front plate meter. R66-5 is adjusted to meter deflection "5".

3.3.7.7.
PU (power supply) temperature is read out on the front plate meter.

3.4. TROUBLE SHOOTING

Trouble shooting should only be performed by persons with a sufficient technical knowledge, who have the necessary measuring instruments at their disposal and who have carefully studied the operation principles and structure of SAILOR T2031.
Start a trouble shooting procedure by investigating whether the fault is somewhere in the antenna circuit, the power source, the handset or other external equipment connected to the transmitter.
If this investigation shows that the fault has to be found in the transmitter, section 1.1. GENERAL DESCRIPTION in this instruction book should be read. By understanding the general working principle of the transmitter it should be possible to locate the fault to a certain module or unit. Please read the section 5. CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS concernng the module or unit where the fault has to be found. The circuit description explains how the module or unit should function and the schematic diagrams show the location of the individual components and their interconnection. In the diagrams typical values of the DC and AC voltages are indicated and also the test points where to measure them.
SAILOR T2031 has a number of trimming cores and trimmers, which must not be touched unless adjustments as specified in section 3.6. ADJUSTMENT PROCEDURE can be made.
A help for trouble shooting is the section 3.3. TEST PROGRAMMES where a description of the built-in test programmes and how to activate them can be found. If the transmitter seems to work ok, but no RF output power will appear, it can be a help to control the error codes on IC16-5 pin 26 and pin 27. An overview of these codes are given below.

IC16-5 pin No.		Control Code from Keyboard Processor IC1-5		
27	26	Stand-by	Tune	Full Power Tx
1	1	No errors	No errors	No errors
1	0	Temp. too high	Temp. too high	Temp. too high
0	1	V_A overflow	V_F too small	V_F too small
0	0	Not used	Dummy load def.	Must be tuned

3.5. PERFORMANCE CHECK

GENERAL

To execute a performance check of a transmitter T2031 it is necessary to dismantle the transmitter cover, connect a 10 ohm/250 pF dummy load to the antenna output terminal and connect a 26.5V DC power supply, which is capable of supplying the transmitter with 35 amps., to the DC mains input terminals of the connection box H2091.

3.5.1. **Check of Power Unit I**

1. Disconnect the jack J1-9 placed at the front of the power supply and switch on the transmitter.

2. Connect a voltmeter to jack J3-14 pin 2 and control the voltage to 25.0V +-0.5V.

3. Connect a voltmeter to jack J3-14 pin 3 and control the voltage to 5.1V +-0.15V.

4. Connect a voltmeter to jack J3-14 pin 6 and control the voltage to -12.3V +-0.3V.

5. Connect a voltmeter to jack J3-14 pin 7 and control the voltage to 18.3V +-0.5V.

6. Connect a voltmeter to jack J3-14 pin 12 and control the voltage to 12.3V +-0.3V.

7. Connect a voltmeter to jack J4-14 pin 4 and control the voltage to -18.3V +-0.5V.

8. Connect the jack J1-9 again.

9. Connect a voltmeter to jack J3-14 pin 6 and control the voltage to -1.25V +-0.1V.

10. Connect a voltmeter to jack J3-14 pin 12 and control the voltage to 1.25V +-0.1V.

3.5.2. **Check of Keyboard and Display**

1. Remove the frequency table and connect the D and E terminals now seen to ground.

2. Press all the digits on the keyboard from 1 to 0 and check that the correct digit is displayed.

3. Press the digit 8 four times, then the POINT key, and then the digit 8. Check that the display now shows 8888.8.

3.5.2. **CHECK OF KEYBOARD AND DISPLAY** cont.

4. Press the digit 2 four times and then the ENT key. Check that the display now shows:

   J3E 2222.0 kHz
   FULL POWER TUNE RF

5. Press the key STORE, and the display will flicker for a moment.

6. Press the keys 9-4 and then the STORE key. The display will show the figures of point 4.

7. Press the keys 9-4 and then the ENT key. The display will show the figures of point 4.

8. Press the key SHIFT and then the key ENT. Check that the display now shows:

   J3E 0000.0 kHz
   FULL POWER TUNE RF

9. Press the keys SHIFT - H3E and check that the J3E in the display is changed to H3E.

10. Press the keys SHIFT - R3E. Check that the H3E in the display is changed to R3E.

11. Press the keys SHIFT - DIM and check that the display background light is turned off.

12. Press the key POWER two times and control that the displayed FULL POWER changes to POWER MED and then to POWER LOW.

13. Press the key POWER two times and control that the displayed POWER LOW changes to POWER MED and then to FULL POWER.

14. Press the key TEST ALARM and control that the alarm tone signal is heard in the handset earpiece. The displayed R3E will change to H3E and ALARM will be read in the display.

15. Press the key STOP ALARM and control that the alarm tone signal is no longer heard in the earpiece. The displayed H3E will change to R3E and the ALARM sign will disappear.

16. Press the keys 1-6-0-0 and ENT. The display now shows:

   J3E 1600.0 kHz
   FULL POWER TUNE RF

17. Press and release the tune knob and check that the displayed TUNE RF disappears.

18. Press both SEND ALARM and TEST ALARM. The alarm tone signal is heard in the earpiece. The displayed J3E is changed to H3E and SEND ALARM will be read in the display.

19. Press STOP ALARM and control that the alarm tone signal is no longer heard in the earpiece. The displayed H3E is changed to J3E and SEND ALARM will disappear.

20. Press the key 2182 and control that the display shows:

   H3E 2182.0 kHz
   FULL POWER

3.5.3. **Check of Control Computer Unit (Module 5)**

The D and E terminals on the front panel are still grounded.

1. Connect a voltmeter to jack J8-5 pin 2 and control the voltage to 2.25V +-0.3V.

2. Connect a voltmeter to jack J1-5 pin 6 and control the voltage to 2.25V +-0.3V.

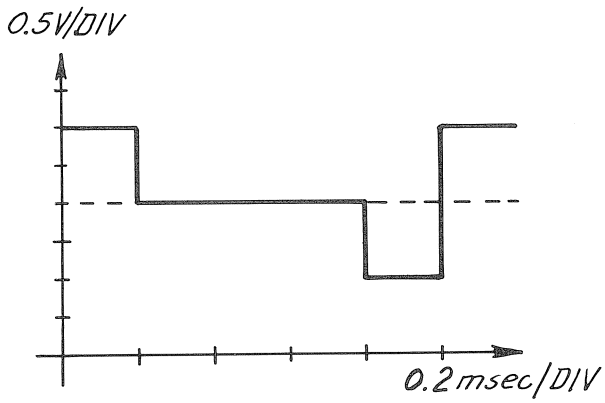
3. Connect an oscilloscope to IC20-5 pin 2 and control that the square wave seen has a 5.0V +-0.5V amplitude, that the duty cycle is approx. 50%, and that the frequency is 40.0 Hz +-5.0 Hz.

4. Connect another oscilloscope probe to the display terminal No. 3 and control that the square wave seen is equal to the square wave seen in point 3 except that the phase is opposite.

5. Disconnect the jack J8-5 and control that the fan starts, and the air flow is into the transmitter. Connect the jack J8-5 again.

6. Press the 1-6-0-0 and ENT.

7. Connect the oscilloscope to jack J5-5 pin 3 and press the tune knob. Control that the wave form seen is approx. equal to the one shown below.



8. Connect a voltmeter to jack J2-15 pin 2. The jack is placed in the connection box H2091. Control that when the tune knob is pressed the voltage is 1.2V +-0.5V and when the tune knob is released the voltage is 18.3V +-0.5V.

9. Connect a voltmeter to the orange/green (DISTRESS) wire in the plug P1-15 connected to the handset jack. Control that the voltage is 0.0V.

10. Press the key 2182 and control that the voltage is 17.0V +-3.0V.

11. Press both SEND ALARM and TEST ALARM. Check that the SEND ALARM sign in the display is on and press the STOP ALARM key.

12. Connect the red/green wire jack J2-15 pin 4 in the connection box H2091 to ground.

3.5.3. **CHECK OF CONTROL COMPUTER UNIT (MODULE 5)** cont.

13. Press both SEND ALARM and TEST ALARM. Check that the SEND ALARM sign in the display is not on. Press the STOP ALARM key and disconnect the grounding of pin 4 in jack J2-15.

14. Press the keys 2-8-9-9-.-9 and ENT.

15. Connect a voltmeter to jack J4-5 pin 12 and control the voltage to 5.1V +-0.3V.

16. Connect a voltmeter to jack J4-5 pin 13 and control the voltage to 0.0V +-0.1V.

17. Press the keys 2-9-0-0 and ENT.

18. Connect a voltmeter to jack J4-5 pin 12 and control the voltage to 0.0V +-0.1V.

19. Connect a voltmeter to jack J4-5 pin 13 and control the voltage to 5.1V +-0.3V.

20. Disconnect the jack J9-5, the meter connection, and connect an oscilloscope probe to pin 1, jack J9-5.

21. Set the transmitter in TEST 0.3 as described in TEST PROGRAMMES.

22. Control that the staircase waveform seen on the oscilloscope reaches approx. 5.0V +-0.3V. If a fault is detected the switching on port A IC16-5 will stop at the level, where the fault was detected.

23. Set the transmitter to normal mode as described in TEST PROGRAMMES.

24. Connect the jack J9-5 again.

25. Set the transmitter in TEST 1.6. as described in TEST PROGRAMMES.

26. Control that the front panel meter pointer shows "5".

27. Set the transmitter to normal mode as described in TEST PROGRAMMES.

3.5.4. **Check of Frequency Synthesizer Output (Module 7)**

1. Switch on the transmitter and key in the frequency 1.6000 MHz and press ENT.

2. Connect an oscilloscope probe to the carrier input terminal on the exciter unit (module 1).

3. Control the voltage to be 400 mV_{pp} +-100 mV_{pp}.

4. Connect a frequency counter to the carrier input terminal on the exciter unit (module 1).

5. Control the frequency to be 10.598400 MHz +-20 Hz.

6. Connect an oscilloscope and a frequency counter to the LO input terminal on the exciter unit (module 1).

3.5.4. **CHECK OF FREQUENCY SYNTHESIZER OUTPUT (MODULE 7)** cont.

7. Control the voltage to be 7.5V_{pp} +-1.5V_{pp} and the frequency to be 12.198400 MHz +-30 Hz.

8. Key in the frequency 1.6128 MHz and press ENT.

9. Control the frequency to be 12.211200 MHz +-30 Hz.

10. Key in the frequency 1.7792 MHz and press ENT.

11. Control the frequency to be 12.377600 MHz +-30 Hz.

12. Key in the frequency 4.2649 MHz and press ENT.

13. Control the frequency to be 14.863300 MHz +-30 Hz.

14. Key in the frequency 4.2626 MHz and press ENT.

15. Control the voltage to be 7.5 +-1.5V_{pp} and the frequency to be 14.861000 MHz +-30 Hz.

3.5.5. **Check of Exciter Unit (Module 1)**

1. Key in the frequency 1.600 MHz, press ENT, and press and release the tune knob.

2. Disconnect the jack J1-9 placed at the front of the power supply.

3. Set the transmitter in TEST 1.4. as described in TEST PROGRAMMES and wait until the step attenuator is set at min. attenuation (wait approx. 30 secs after activating the TEST).

4. Disconnect the coaxial cable between the exciter and power amplifier from the exciter RF output terminal and connect a 50 ohm resistor to these two terminals.

5. Connect a tone generator (1000 Hz) to the violet/white wire in the microphone plug P1-15. A capacitor of 10 uF/25V can be used as interconnection because there is DC on the violet/white wire.

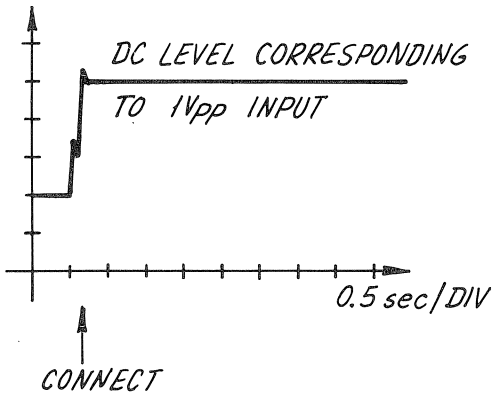
6. Connect an oscilloscope to IC4a-1 pin 1.

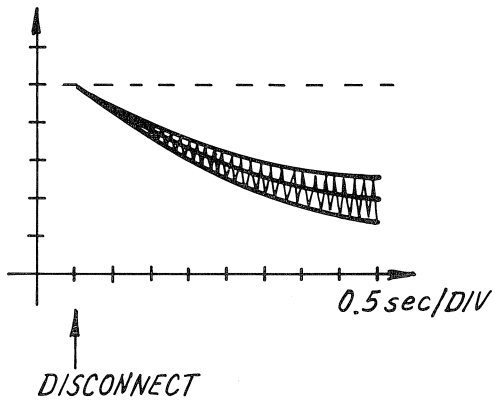
7. Adjust the tone generator output voltage from a minimum until the level at the oscilloscope is just constant. This limitation must happen at approx. 300 mV_{pp} measured at the tone generator input to the microphone wire.

8. Control that the output voltage at IC4a pin 1 stays approx. at the same level when adding 10 dB (1V_{pp}) to the output voltage from the tone generator.

9. The attack- and decay time of the microphone amplifier is measured at the gate of transistor T7-1. Connect this to the oscilloscope.

10. Connect and disconnect the tone generator signal and control that the measured voltage is approx. as shown below:





11. Connect an oscilloscope to the 50 ohm resistor connected across the RF output terminals on the exciter unit.

12. Press the tune knob and connect the cathode of D6-1 to ground. D6-1 is placed near IC4-1.

13. Adjust the oscilloscope gain until full deflection (8 cm) is seen on the screen.

14. Disconnect the grounding of D6-1 and control that deflection now seen is approx. 6.9 +-0.3 cm.

15. Release the tone knob and connect a tone generator (1000 Hz) to the violet/white wire in the microphone plug P1-15.

16. Adjust the tone generator output voltage to 1 V_{pp}.

17. Check that the RF output voltage is approx. 8.5 +-0.7 V_{pp}.

18. Press the tune knob and check that the RF output voltage is approx. the same as the level measured under point 17.

19. Key in the frequency 4,299 MHz and press ENT.

20. Press and release the tune knob.

21. Check that the RF output voltage is approx. 8.5 +-0.7V_{pp}.

22. Release the tune knob and connect the oscilloscope to the emitter of the transistor T10-1.

23. Control the voltage to be 1.7 +-0.3V_{pp}.

24. Connect the oscilloscope to the 50 ohm resistor over the RF output terminals.

25. Adjust the oscilloscope gain until full deflection (8 cm) is seen on the screen.

26. Remove the tone generator from the microphone plug.

27. Set the modulation mode to R3E and then to H3E.

28. Control that the voltage deflection seen on the screen is 1.2 +-0.2 cm in R3E and 4.4 +-0.3 cm in H3E.

29. Connect a frequency counter to the 50 ohm resistor at the RF output terminals.

30. Set the modulation mode to H3E.

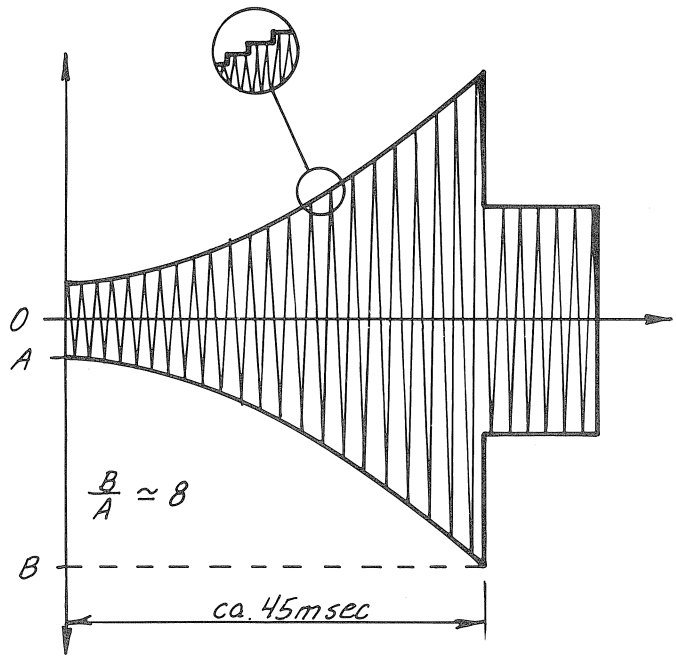
31. Control that the output frequency is 4.299000 MHz +-30 Hz.

32. Change the transmitter from TEST mode to normal mode as described in the TEST PROGRAMMES.

33. Set the transmitter in TEST 0.6 as described in TEST PROGRAMMES.

34. Connect an oscilloscope probe to the RF output terminal in the exciter unit and change the modulation mode to H3E.

35. Check that the stairs and staircase waveform seen on the oscilloscope screen has a continuous growing amplitude as shown below.



36. Change the transmitter from TEST mode to normal mode as described in the TEST PROGRAMMES.

37. Remove the 50 ohm resistor at the exciter output terminals and reconnect the coaxial cable between the RF amplifier and the exciter unit.

38. Reconnect the jack J1-9 placed at the front of the power supply unit.

3.5.6. **Check of Power Unit II**

1. Key in the frequency 4.299 MHz, press ENT and press and release the TUNE knob.

2. Key the transmitter and connect a voltmeter to the red 2.5□ wire at the front of the power supply.

3. Check that the voltage is 42.0 +-1.0V.

4. Connect the voltmeter to the orange 1□ wire at the front of the power supply.

5. Check that the voltage is 12.0 +-0.5V.

3.5.7. **Check of Power Amplifier (Module 2)**

1. Key in the frequency 4,299 MHz, press ENT and press and release the TUNE knob.

2. Disconnect the +12V jumper placed on the power amplifier (module 2) and connect an ammeter to the two free terminals (instead of jumper).

3. Key the transmitter and check that the bias current is 0.18 +-0.02 Amp. on the ammeter.

4. Release the key and connect the +12V jumper again.

5. Insert an ammeter into the red 2.5□ wire at the front of the power supply unit.

6. Key the transmitter and check that the bias current is 0.18 +-0.02 Amp. on the ammeter.

7. Release the key and connect the red 2.5□ wire again.

8. Disconnect the internal dummy loads R1-15 and R2-15 from the soldering terminals on the filter unit (module 3) and connect en external 50 ohm/250 W dummy load to one of these soldering terminals.

9. Set the transmitter in TEST 0.3 as described in TEST PROGRAMMES.

10. Change the modulation mode to H3E.

11. With an oscilloscope the gain in the power amplifier is controlled and it should be 100 +-20 times. The power amplifier input terminal is the same as the exciter output terminal and the power amplifier output signal can be measured at the dummy load input terminals.

12. Change the modulation mode to J3E.

13. Set the transmitter in TEST 0.4 as described in the TEST PROGRAMMES. This is a change between tests inside the same test group.

14. Change the frequency to 2.000 MHz and press ENT.

15. Connect an oscilloscope to the 50 ohm/250 W dummy load.

3.5.7. **CHECK OF POWER AMPLIFIER (MODULE 2)** cont.

16. Press the TUNE knob and check that the voltage measured is 420 +-20V_{pp}.
    CAUTION: The amplitude limitation seen on the output waveform must be small.

17. Remove the jack J8-5.

18. Check that the output power disappears and the fan starts running.

19. Connect the jack J8-5 again.

20. Check that the transmitter power is up again.

21. Release the TUNE knob.

3.5.8. **Check of Filter Unit (Module 3).**

1. Set the transmitter in TEST 0.3. as described in the TEST PROGRAMMES. This is a change between tests inside the same test group.
   Caution: The external dummy load 50 ohm/250W is still connected instead of the internal dummy R1-15 and R2-15.

2. Change the modulation mode to H3E.

3. Connect the oscilloscope probe to IC1-3 pin 7.

4. Control that the DC voltage level is below 0.18V.

5. Connect the oscilloscope probe to IC1-3 pin 1.

6. Control that the DC voltage level is 2.0V +0.5V.

7. Set the transmitter to normal mode as described in TEST PROGRAMMES.

8. Connect the internal dummy loads R1-15 and R2-15 again.

9. Set the transmitter to aerial tune-up mode by means of switch S1 (in position B).

10. Select band 3L, resonance 0 and load 9.

11. Press the TUNE knob.

12. Check that relay Re1-3 and Re2-3 are activated a short moment when the TUNE knob is pressed.

13. Check that Re3-/Re4-/Re5-/Re6-/Re7- and Re8-3 are activated during the time when the TUNE knob is activated.

14. Change the band code to 6L.

15. Press the TUNE knob and control that relay Re3- and Re4-3 are not activated.

16. Release the TUNE knob.

3.5.9. **Check of Coil Unit.**

The transmitter is in tune-up mode and band 6L with resonance 0 and load 9 chosen.

1. Connect the 10 ohm/250 pF dummy load to the antenna terminal.
2. Press the TUNE knob.
3. Check that all the relays in the coil unit are activated. Re1-/Re2-/ Re3-/Re4- and Re5-6.
4. Release the TUNE knob.
5. Execute an AERIAL TUNE-UP PROCEDURE.
6. After the tune-up procedure has been executed, the transmitter mode is changed from tune-up to normal mode.
7. Key in the frequency 2.000 MHz and press ENT. Tune-up the transmitter into the dummy load.
8. Change the modulation mode to H3E.
9. Key the transmitter and check that the aerial current meter shows 3.0 +-0.5.
10. Release the key.

3.5.10. **Check of Antenna Voltage.**

1. Key in the frequency 1.600 MHz and press ENT.
2. Tune-up the transmitter into the dummy load.
3. Change the 10 ohm/250 pF dummy load to a 150 pF dummy load.
4. Turn the variometer L1 (2182 kHz variometer) until the rotor is in horizontal position).
5. Press the tune knob and turn it slowly. When the output voltage is near a maximum the output will be reduced 6 dB.
   The output will now stay reduced until the TUNE knob is released and pressed again for a new tune-up procedure.

3.5.11. **Check of Temperature Protection.**

1. Key in the frequency 2.000 MHz and press ENT.
2. Change the 150 pF dummy load to the 10 ohm/250 pF dummy and tune up the transmitter.
3. Change the modulation mode to H3E

3.5.11. **CHECK OF TEMPERATURE PROTECTION** cont.

4. Connect an oscilloscope probe to the RF output terminals on the exciter unit (module 1).

5. Connect a DC voltmeter to the red 2.5□ wire at the front of the power supply (42.0V).

6. Disconnect the yellow/green wire from the temperature sensor placed at the right side of the power unit.

7. Connect an external power supply to the wire (yellow/green) and to ground.

8. Set the external power supply to 2.0V.

9. Key the transmitter.

10. Adjust the oscilloscope gain until full deflection (8 cm) is seen on the screen.

11. Adjust the external DC power supply between 2.0V to 3.5V.

12. Control that the fan starts, that the output power (exciter output) and the V_{CC} to the power amplifier can be regulated in 9 steps and as a final step the transmitter turns off.

13. Turn the external DC power supply down until the fan stops and control that the transmitter starts again.

14. Release the key and connect the temperature sensor again.

T2031

3.5.12. **Check of the Power Unit II Current Limit.**

1. Change the modulation mode to H3E.

2. Connect a DC voltmeter to red 2.5□ wire at the front of the power supply (42.0V).

3. Key the transmitter.

4. Connect the common point of R66-9 and R73-9 (control unit module 9) to ground through a 560 ohm resistor.

5. Control that the V_{CC} to the power amplifier drops below 30.0V DC.

6. Disconnect the 560 ohm wire and release the key.

3.6. ADJUSTMENT PROCEDURE

GENERAL DESCRIPTION
The transmitter T2031 has a set of built-in test programmes, which will be used to reduce the amount of external test equipment, necessary to carry out the adjustment procedure. To get the transmitter to carry out one of the test programmes, the jumpers W2 to W5 on the computer control board have to make a certain pattern. The procedure is described under the headline TEST PROGRAMMES.
In this section the wanted test programme is described by a test group number and a test number, TEST 1.4., meaning test group number 1 and test number 4 have to be chosen.

The adjustment procedure is worked out in a way which makes it possible to carry out one of the sections, without necessarily having to carry out all the other sections which deal with the P.C.B. in question.
To achieve this in every new section, the conditions under which the test is carried out is indicated as shown below.

Freq: 2000.0 kHz; Mmode: H3E; Power full

This means that 2000.0 kHz is on the display and the frequency is entered. The chosen modulation mode is H3E and full power is chosen.

3.6.1. **Adjustment Procedure Exciter (Module 1)**

Adjustment of Microphone Amplifier (R25-1)

1. Freq.: 2000 kHz, Mmode J3E, Power full, disconnect the jack J1-9 placed at the front of the power supply.

2. Connect a tone generator to the microphone input terminals, 1000 Hz and 300 mVpp measured at jack J2-1 pin 3.

3. Connect an oscilloscope to IC4-1 pin 1.

4. Turn R25-1 fully counter clockwise and then clockwise until the measured level is just constant.

5. Add 20 dB to the tone generator output 3.0Vpp, and control that the measured level is approximately the same as the level measured under point 4.

6. Disconnect the tone generator and connect jack J1-9 again.

Adjustment of Carrier Limit Amplifier (L5-1)

1. Freq.: 2000 kHz, Mmode J3E, Power full, disconnect the jack J1-9 placed at the front of the power supply, press and release the tune knob, and key the transmitter.

2. Connect an oscilloscope to IC5-1 pin 9.

3. Adjust L5-1 to max. reading on the oscilloscope (2.5 $\pm$0.3Vpp).

4. Release the key and connect jack J1-9 again.

Adjustment of Modulator (L4-/R116-/R103-1)

1. Freq.: 2000 kHz, Mmode J3E, Power full, disconnect the jack J1-9 placed at the front of the power supply, press and release the tune knob and key the transmitter.

2. Connect an oscilloscope to the collector of T19-1.

3. Press the tune knob and adjust L4-1 to max. reading on the oscilloscope approximately 5.5 ±0.5 Vpp.

4. Release the tune knob and adjust R116-1 and R103-1 to min. reading on the oscilloscope. Repeat the adjustment of R116-1 and R103-1.

5. Release the key and connect the jack J1-9 again.

6. If this adjustment is the only one executed after repair please execute adjustment of H3E carrier and PEP limiting amplifier.

Adjustment of LSB Filter (L8-/L10-1)

1. Freq.: 2000 kHz, Mmode J3E, Power full, disconnect the jack J1-9 placed at the front of the power supply and key the transmitter.

2. Connect an oscilloscope to the connection between C102-1 and C105-1.

3. Press the tune knob and adjust L8-1 and L10-1 to max. reading on the oscilloscope.

4. Connect a tone generator to the microphone input terminal (mic. plug P1-15 pin 3), measured input level 1.0Vpp at jack J2-1 pin 3.

5. Control of LSB filter response is carried out by changing the frequency of the tone generator and controlling the reading on the oscilloscope. Max. permissible ripple is 2.0 dB in the frequency range 500 - 2500 Hz and the -6.0 dB frequencies are approx. 350 Hz and 2700 Hz.

6. Disconnect the tone generator and connect jack J1-9 again.

7. If this adjustment is the only one executed after repair, please execute adjustment of H3E carrier and PEP limiting amplifier.

Adjustment of H3E Carrier and PEP Limiting Amplifier (L9-/R151-/R78-1)

1. Freq.: 2000 kHz, Mmode H3E, Power full, disconnect the jack J1-9 placed at the front of the power supply and key the transmitter.

2. Connect an oscilloscope to the emitter of the transistor T23-1.

3. Adjust L9-1 to max. H3E carrier.

4. Turn R151-1 fully clockwise.

5. Press the tune knob.

6. Adjust the oscilloscope until there is full deflection (8 cm) on the oscilloscope screen. The signal seen on the oscilloscope is symmetrical clipped.

7. Adjust R151-1 until the deflection seen on the oscilloscope is 7 cm. The signal is not clipped.

8. Adjust the oscilloscope until there is full deflection (8 cm) on the oscilloscope screen.

9. Release the tune knob.

10. Adjust the H3E carrier now seen to 4.4 cm with R78-1.

11. Connect jack J1-9 again.

Adjustment of Step Attenuator and Amplifier (L6-/R81-/R123-1)

1. Freq.: 2000 kHz, Mmode H3E, Power full, disconnect the jack J1-9 placed at the front of the power supply.

2. Connect an oscilloscope probe to the RF output terminals on the exciter unit (module 1).

3. Press and release the tune knob and key the transmitter.

4. Adjust L6-1 to max. H3E carrier and release the key.

5. Set the transmitter in TEST 0.6 as described in TEST PROGRAMMES.

6. Connect an oscilloscope probe to the basis of transistor T11-1. Use this signal as the trigger signal, the oscilloscope must be trigged by the negative transition.

7. Turn the potentiometer R81-1 fully counter clockwise.

8. On the oscilloscope screen is now seen a staircase waveform. When adjusting R81-1 it can be seen that one of the steps changes amplitude.

9. Adjust R81-1 until the step which changes amplitude is approximately equal to the neighbour steps.

10. Change the transmitter from TEST mode to normal mode as described in TEST PROGRAMMES.

11. Connect the oscilloscope probe to the emitter of the transistor T10-1.

12. Set the transmitter in TEST 1.4 as described in TEST PROGRAMMES and wait until the step attenuator is set at min. attenuation (wait approx. 30 secs after activating the TEST).
Take care that jack J1-9, placed at the front of the power supply, is removed; if not, the transmitter will be destroyed.

13. Press the tune knob and adjust R123-1 to 1.7Vpp.

14. Change the transmitter from TEST mode to normal mode as described in TEST PROGRAMMES.

15. Connect jack J1-9 again.

Adjustment of 2nd Mixer (R70-1)

1. Freq.: 2000 kHz, Mmode J3E, Power full, disconnect the jack J1-9 placed at the front of the power supply.

2. Connect an oscilloscope probe to the collector of the transistor T8-1.

3. Adjust R70-1 to min. LO signal.

3.6.1. **ADJUSTMENT PROCEDURE EXCITER (MODULE 1)** cont.

Adjustment of Output Amplifier and Filter (L2-/L3-1)

1. The adjustment of the LP filter, consisting of L2-1 and L3-1 can only be done by means of a signal generator.

2. Freq.: 2000 kHz, Mmode J3E, Power full, disconnect the jack J1-9 placed at the front of the power supply.

3. Disconnect the coaxial cable at the RF output terminals on the exciter unit (module 1) and connect a 50 ohm resistor between the terminals.

4. Connect an oscilloscope probe to the 50 ohm resistor at the RF output teminals.

5. Connect the signal generator to the basis of transistor T8-1 through a 10 nF capacitor.
   Signal generator output level 0 dBm.

6. Disconnect the coaxial cable from the LO input terminals on the exciter unit (module 1).

7. Set the signal generator output frequency to 9.900 MHz and adjust L3-1 to min. output signal, approximately 3 mVpp.

8. Set the signal generator frequency to 4.300 MHz and the output level to -10 dBm.

9. Adjust L2-1 to max. output signal, approximately 4.5 Vpp.

10. Disconnect the signal generator, connect the coaxial cable to the LO input terminals.

11. Set the transmitter in TEST 1.4. as described in TEST PROGRAMMES and wait until the step attenuator is set at min. attenuation (approx. 30 secs). Take care that jack J1-9 placed at the power supply is removed; if not, the transmitter will be destroyed.

12. Press the tune knob and adjust R19-1 to 9.0Vpp.

13. Change the transmitter from TEST mode to normal mode as described in the TEST PROGRAMMES.

14. Connect jack J1-9 again.

3.6.2. **Power Amplifier (Module 2)**

Adjustment of Transistor Bias Current (R3-/R32-2)

1. Freq.: 2000 kHz, Mmode J3E, Power full, press and release the tune knob.

2. Disconnect the +12V jumper placed on the power amplifier (module 2) and connect an ammeter to the two free terminals (instead of jumper).

3. Key the transmitter and adjust R3-2 to 0.18 $\pm$0.01 Amp. on the ammeter.

4. Release the key and connect the +12V jumper again.

3.6.2. **POWER AMPLIFIER (MODULE 2)** cont.

5. Insert an ammeter into the red 2.5□ wire at the front of the power supply unit.

6. Key the transmitter and adjust R32-2 to 0.18 ±1 Amp. on the ammeter.

7. Release the key and connect the red 2.5□ wire again.

3.6.3. **Filter Unit (Module 3)**

Adjustment of SWR-Detector (C2-3)

1. Freq.: 2000 kHz, Mmode H3E, Power full, press and release the tune knob.

2. Disconnect the internal dummy loads R1-15 and R2-15 from the soldering terminals and connect an external 50 ohm/250W dummy load to one of the soldering terminals.

3. Connect an oscilloscope probe to IC1-3 pin 7.

4. Set the transmitter in TEST 0.3. as described in TEST PROGRAMMES.

5. Adjust C2-3 to minimum output voltage.

6. Set the transmitter in normal mode as described in TEST PROGRAMMES.

7. Connect the internal dummy loads R1-15 and R2-15 again.

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3.6.4. **Control Computer Unit (Module 5).**

Adjustment of Temperature Protection (R48-/R54-5)

CAUTION! Do not heat up the transmitter! The temperature of the heat sink at the back of the transmitter must not exceed 40°C when this adjustment is to be made.

1. Freq.: 2000 kHz, Mmode J3E, Power full.

2. Measure the temperature of the heat sink in the neighbourhood of the power amplifier transistors T4-2 or T5-2. If the transmitter has not been used for a long period of time, the ambient temperature is equal to the heat sink temperature.

3. The temperature, now found, is converted to a DC voltage in the table below.

4. Connect a digital multimeter to plug P8-5 pin 2 and to ground.

5. Adjust R48-5 until the DC voltage, found in the table below, can be read on the multimeter.

6. Measure the temperature of the heat sink in the neighbourhood of the power supply transistors T1-/T2-/T3-/T4-15). If the transmitter has not been used for a long period of time, the ambient temperature is equal to the heat sink temperature.

3.6.4. **CONTROL COMPUTER UNIT (MODULE 5)** cont.

7. The found temperature is converted to a DC voltage in the table below.

8. Connect a digital multimeter to plug P1-5 pin 6 and to ground.

9. Adjust R54-5 until the DC voltage found in the table below is read on the multimeter.

10. Convertion Code

Temp. 0^o	DC Voltage V	Temp. 0^o	DC Voltage V	Temp. 0^o	DC Voltage V
10	1.82	20	1.94	30	2.06
11	1.83	21	1.95	31	2.08
12	1.84	22	1.96	32	2.09
13	1.85	23	1.98	33	2.10
14	1.87	24	1.99	34	2.11
15	1.88	25	2.00	35	2.13
16	1.89	26	2.01	36	2.14
17	1.90	27	2.03	37	2.15
18	1.91	28	2.04	38	2.16
19	1.93	29	2.05	39	2.18

Adjustment of Drive Level (Power Output) (R99-5)

1. Freq.: 2000 kHz, Mmode J3E, Power full.

2. Disconnect the internal dummy loads R1-15 and R2-15 from the soldering terminals and connect an external 50 ohm/250W dummy load to one of the soldering terminals.

3. Connect an oscilloscope probe to the dummy load. (Take care that the probe is calibrated).

4. Set the transmitter in TEST 0.4. as described in TEST PROGRAMMES.

5. Press the tune knob.

6. Adjust R99-5 until 420 ±20 Vpp is seen on the oscilloscope.
   CAUTION! If the signal seen on the oscilloscope is amplitude limited please turn down the drive level by means of R99-5, until the amplitude limitation is nearly gone.

7. Release the tune knob.

8. Set the transmitter in normal mode as described in TEST PROGRAMMES.

9. Connect the internal dummy loads R1-15 and R2-15 again.

Adjustment of Meter Deflection (R66-5)

1. Freq.: 2000 kHz, Mmode J3H, Power full.

2. Set the transmitter in TEST 1.6. as described in TEST PROGRAMMES.

3. Adjust R66-5 until the front panel meter shows "5".

4. Set the transmitter in normal mode as described in TEST PROGRAMMES.

3.6.4. **CONTROL COMPUTER UNIT (MODULE 5)** cont.

Adjustment of AF from Rx to Earphone Level (R26-5)

The potentiometer R26-5 is normally adjusted during the installation procedure to a suitable level in the earphone.

The adjustment can be done through a hole in the front panel behind the frequency table.

3.6.5. **Power Unit I (Module 12. 13. 14.)**

Adjustment of 5V DC supply voltage (R16-12)

1. Disconnect jack J3-14 and J4-14.
2. Ground a 1 Watt 27 ohm +-5% resistor to wire jumper placed between plug P4-14 and plug P2-14, this is the 5V supply to the control computer.
3. Connect a voltmeter to the +5V side of the 27 ohm resistor
4. Press the on/off button and adjust R16-12 to 5.2V +-0.05V on the voltmeter.
5. Release the on/off button and disconnect the 27 ohm resistor.
6. Connect the jack J3-14 and jack J4-14.
7. Connect a voltmeter to J3-14 pin 3. (+5.0V DC).
8. Press and release the on/off button (the transmitter is on).
9. Adjust R16-12 until 5.1 +-0.05V is read on the voltmeter.

3.6.6. POWER UNIT II (MODULE 8. 9. 10.)

Adjustment of power unit II.

Disconnect the power supply PUII from the other circuits in the transmitter: 2 mains wires and 2 supply wires to PUI on the filter unit, connector P19 on the control unit and the red and the black 2.5mm^2 and the orange 1.5mm^2 on the transformer unit.
Perform a complete test by following the below steps continuously.

1. Connect the selfmade processor simulator (shown in necessary test instruments) to connector P1 on the control unit (module 9). Connect a +18V DC supply to the processor simulator. The secondary circuit is now powered. Code MSB 00011111 LSB is set up with the switches 8-1. The switch "Send" is then pushed once and the led indicates transmitting. When the led stops flashing the transmitting is completed. The data is now read into IC59. By pushing the "Strobe" switch once, the data is then transferred to the outputs of IC5-9. The exciter and the blower are then turned off, PUII is turned on and the 42V is reduced to minimum.

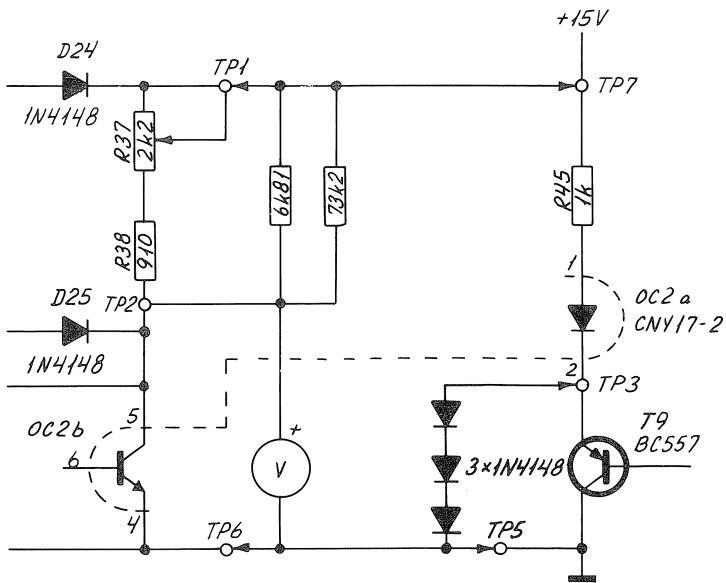
2. Check the +15V DC supply voltage in the secondary circuit. It is supposed to be between 14.25 and 15.75V DC.

3. Disconnect the soldered brown/green wire on the transformer unit (module 10). It is the +24V battery voltage to the control unit.

4. Place the gain adjustment potentiometer R37-9 and the output voltage reduction potentiometer R63-9 in the center position.

5. Turn the current limit potentiometer R65-9 fully counter clockwise (maximum output current) and the output voltage potentiometer R81-9 fully clockwise (minimum output voltage).

6. Make the connections shown below (gain adjustment). The voltage on the voltmeter is adjusted to 1.6V DC +-0.1V by means of R37-9.



VOLTMETER: >20kΩ/V
CONNECTED AS SHOWN AND ADJUST TO VOLTMETER READING 1.6V ±0.1V BY MEAN OF R37-9.

GAIN ADJUSTMENT OF OC2 ON THE CONTROL UNIT (MODULE 9)

7. Code 11111111 is then set up and transmitted and strobed.

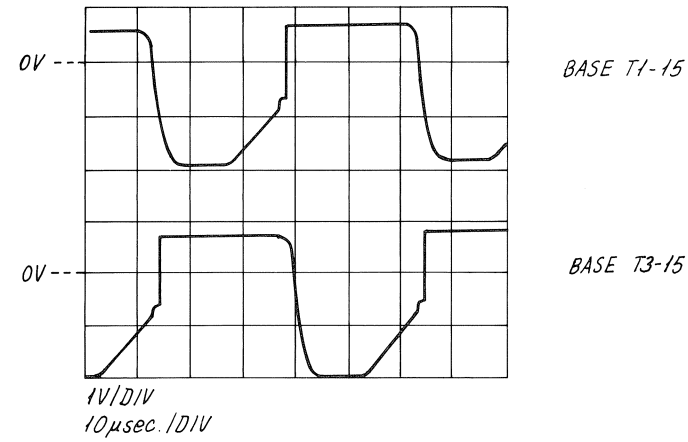
8. Resistor R65-9 is then turned fully clockwise (minimum current).

9. Connect +28V DC +-1V from an external power supply to the disconnected brown/green wire (from step 3) and connect the ground terminal to the -supply input screw on the transformer unit (module 10). The negative terminal on C1-10. There is now power on the primary circuit.

10. Check the primary +15V DC supply voltage. It is supposed to be between 14.25 and 15.75V DC.

11. Connect a dual channel oscilloscope to base on T1-15 and on T3-15 and the common point of R1-15 and R3-15. Then turn R65-9 counter clockwise to maximum ON-time. The current consumption from the +28V will be approx. 0.4A DC. The correct appearance of the signals are shown below.

BASE SIGNALS ON T1-15 AND T3-15 WITH NO COLLECTOR CURRENT. ADJUSTMENT PROCEDURE STEP 11.



It should be noted that overlap of the base signals part over +0.5V is not allowed. The signals should be equal but with a delay of 180°. The period time is 50 uS +-10%.

12. PUII on check.
Data bit no. 5 (PUII on) is then set to "0" and is transmitted and strobed. The base signals stop instantaneously.
Bit no. 5 is then set to "1" and transmitted. When strobing, the base signals should increase the duty cycle slowly from zero, soft start. It takes approx. 200 msecs.

13. Quick primary current trip check.
The common point of R31-9 and R4-9 is then connected through a 12 kohm 5% resistor to the +28V DC. The base signals stop instantaneously and soft starts again when the 12 kohm resistor is disconnected.

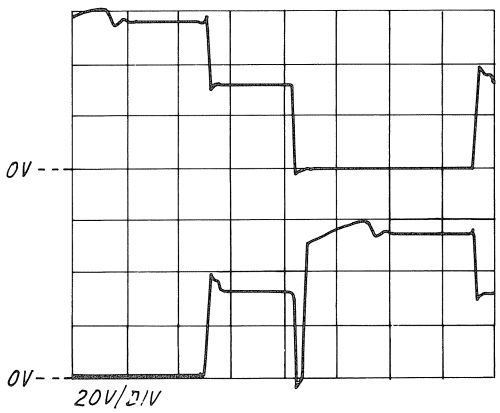
14. Stand-by consumption.
    Disconnect connector P1-9. The current consumption from the +28V DC should be less than 10 mA. Typical 3.7 mA. Connect P1-9 again.

15. Quick secondary current trip check.
    Connect test points TP3 and TP5. The base signals stop and soft starts when disconnecting.

16. Lower the +28V supply voltage to +18V +-0.5V and the base signals stop.

17. The brown/green wire from step 3 and step 9 is now soldered to its original terminal on the transformer unit (module 10). Then load the +42V output with 25 ohm 10% 75W and the +12V output with 4 ohm 10% 40W. A 28V DC +-0.5V supply is then connected to the mains input. Then transmit code 11110000 and strobe. The current consumption will then be approx. 6A DC. The collector voltages of T1-15 and T3-15 should look as shown below. The +42V output voltage is then adjusted to +42V +-0.1V by means of R81-9. The +12V is then checked, it should be between 11.0 and 13.0V DC.

COLLECTOR OF T1-15 AND T3-15



18. Connect a 1 kohm 10% 0.3W between pin 8 and pin 1 on connector P1-9. Code 11110000 is then transmitted and strobed. The voltage on pin 1 should be between 0 to 1V DC, blower on/off. The voltage on pin 2 should be 5V +-0.5V DC exciter on/off.
    Then transmit and strobe code 00011010. Then check pin 1 to be nearly the +18V external. Pin 2 should be 0 - 0.7V DC.

19. Still with code 00011010 the +42V output is adjusted to 29.7V DC +-0.3V by means of R63-9, voltage reduction.

20. Transmit and strobe code 11110000. The signal from the current transformer TR2-10 is measured on the control unit where the orange wire from pin 3 on P2-10 is soldered on. The brown wire will show the same signal, but with a 180 degrees phase delay. The peak values should be symmetrical referring to ground. The difference in the numerical peak voltages is allowed to be max. 0.5V.

21. Lower the +42V load to 4.2 ohm 10% 450W. Check that the voltage between the mains connections on the filter unit is still 28V +-0.5V. Adjust the +42V DC with R81-9 to +42V +-0.1V.

22. The load on the +42V output is again lowered to approx. 2.3 ohm 700W. The output current is adjusted to 17A +0.5A/-0 at an output voltage between 39.5 and 40.5V DC by means of the load resistor and the current limiter resistor R65-9. Still with +28V +-0.5V between the supply terminals on the filter unit. The power supply PUII is now tested and can be connected to the other circuits in the transmitter.

3.7. NECESSARY ADJUSTMENTS AFTER REPAIR

When a fault has been found and repaired it may be necessary to do some adjustments. The range of these adjustments can only be decided by the person who has done the repair and the below mentioned range of adjustments must only be looked upon as a guide.
Any repair must as mentioned previously be followed by a function check.

EXCITER UNIT (MODULE 1)
A change of the module must be followed by a function check.

Repair in Microphone Amplifier

Execute 3.6.1. Adjustment of microphone amplifier, and perform 3.5.5. Check of exciter unit, sections 1-2 and 5 to 10.

Repair in Carrier Limit Amplifier

Execute 3.6.1. Adjustment of carrier limit amplifier and adjustment of H3E carrier and PEP limiting amplifier.

Repair in Modulator

Execute 3.6.1. Adjustment of modulator, adjustment of H3E carrier and PEP limiting amplifier and perform 3.5.5. Check of exciter unit sections 1 to 4, section 11 and sections 15 to 28.

Repair in LSB Filter

Execute 3.6.1. Adjustment of LSB filter, adjustment of H3E carrier and PEP limiting amplifier and perform 3.5.5. Check of exciter unit sections 1 to 4, section 11 and sections 15 to 28.

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Repair in H3E Carrier and PEP Limiting Amplifier

Execute 3.6.1. Adjustment of H3E carrier and PEP limiting amplifier and perform 3.5.5. Check of exciter unit sections 1 to 4, section 11 and sections 15 to 28.

Repair in Step Attenuator

Execute 3.6.1. Adjustment of step attenuator and amplifier.

Repair in 2nd Mixer

Execute 3.6.1. Adjustment of 2nd mixer and perform 3.5.5. Check of exciter unit sections 1 to 4, section 11 and sections 15 to 23.

Repair in Output Amplifier

Execute 3.6.1. Adjustment of output amplifier and filter sections 2 to 4 and 11 to 14 and perform 3.5.5. Check of exciter unit sections 1 to 4, section 11 and sections 15 to 23.

Repair in Output Filter

Execute 3.6.1. Adjustment of output amplifier and filter sections 2 to 10 and perform 3.5.5. Check of exciter unit sections 1 to 4, section 11 and sections 15 to 23.

3.7. NECESSARY ADJUSTMENTS AFTER REPAIR cont.

POWER AMPLIFIER (MODULE 2)

Repair in Driver Circuit

Execute 3.6.2. Adjustment of power amplifier sections 1 to 4 and perform 3.5.7. Check of power amplifier section 1 and 8 to 21.

Repair in Power Amplifier Circuit

Execute 3.6.2. Adjustment of power amplifier sections 1 and 5 to 7 and perform 3.5.7. Check of power amplifier section 1 and 8 to 21.

Repair in Power Amplifier Bias Circuit

Perform 3.5.7. Check of power amplifier section.

FILTER UNIT (MODULE 3)

Repair in the SWR-Detector Cuircuit

Execute 3.6.3. Adjustment of SWR DETECTOR and 3.6.4. Adjustment of drive level. Perform 3.5.8. Check of filter unit.

AERIAL VOLTAGE DETECTOR (MODULE 4)

Repair in the Aerial Voltage Detector

Perform 3.5.10 Check of antenna voltage.

CONTROL COMPUTER UNIT (MODULE 5)

When the module is changed all the adjustments mentioned in section 3.6.4. CONTROL COMPUTER UNIT have to be done.
A change of one of the microprocessors IC1-5 or IC16-5 will not demand any adjustments to be done, but the sections 3.5.2. and 3.5.3. Check of keyboard and display and check of control computer unit must be performed.
A change of the EEPROMS IC4-5, IC7-5 and IC9-5 will not demand any adjustments to be done, but all the frequency and channel information has to be restored and an aerial tune-up procedure is to be performed.
A change of the FRONT PANEL METER must be followed by an adjustment of meter deflection section 3.6.4.
A change of the DISPLAY must be followed by a check of keyboard and display section 3.5.2.

TEMPERATURE SENSORS

A change of the temperature sensors must be followed by the section 3.6.4. Adjustment of temperature protection.

COIL UNIT (MODULE 6)

If it has been necessary to change one of the components C1-/C2-/L1-/L2-6 an aerial tune-up procedure must be performed.

FREQUENCY SYNTHESIZER (MODULE 7)

Only minor faults located to the frequency synthesizer unit can be repaired. Faults which demand any adjustment can only be repaired by replacing the whole module by a new factory adjusted module.

POWER UNIT II

Repair in Filter Unit (Module 8)

No adjustment is necessary after repair, a function check must be performed.

Repair in Control Unit (Module 9)

Execute 3.6.6. Adjustment of power unit II.

Repair in Transformer Unit (Module 10)

Check the signals from TR2-10 on the control unit (module 9). The peak values should be symmetrical with reference to ground. The difference in the peak voltages is allowed to be maximum 0.5V.
If the shunt resistor R3-10 has been changed, it is necessary to adjust the current limiter as described in the adjustment procedure (adjustment of power unit II 3.6.6. step 22.

Repair in the Snupper Unit (Module 11)

No adjustment is necessary after repair, a function check must be performed.

Repair in the Chassis Mounting (Module 15)

No adjustment is necessary after repair. It is advisable to check the power unit II as described in the adjustment procedure (Adjustment of power unit II 3.6.6. step 17, but the adjustment of R81-9 must be left out.

POWER UNIT I

Repair in Converter Unit (Module 12)

Execute 3.6.5. Adjustment of 5.0V DC supply voltage and perform 3.5.1. Check of power unit I.

Repair in Filter Board (Module 13)

No adjustments.

Repair in Regulator Unit (Module 14)

Perform 3.5.1. Check of power unit I and perform the following.

1. Press and release the on/off button and control that the power unit I stays on.

2. Press and release the on/off button and control that the power unit I is off.

3. Switch on power unit I again.

4. Disconnect the jack J8-5 (on the control computer) and control that the fan starts running.

5. Connect the jack J8-5 again and control that the fan stops running.

3.8. FUNCTION CHECK

To carry out the function check following equipment is necessary:

Power supply: 26.5V DC 35A
Dummy load: 250 pF in series with 10 ohm, e.g. SAILOR H1228.

Oscilloscope:

If installed with an aerial then use the aerial instead of dummy loads.

3.8.1.
Remove the frequency table and set the switch S1 into position B.

3.8.2.
Connect a 10 ohm/250 pF dummy load to the aerial output or use the aerial.

3.8.3. **Check of Tuning and Power**
Execute the AERIAL TUNE-UP PROCEDURE 2.5. and check that it is possible to tune to a peak meter reading of 4.5 to 5.
If a dummy load is used then also check that the aerial current is more than 3.5 Amps.

3.8.4.
Select band 15L and note resonance and load settings. Then select 04 and press **ENT**. It will now be possible to transmit H3E on all frequencies.

3.8.5.
Set S1 to position A.

3.8.6.
Select a frequency and tune for max. AE-meter reading. Pick up the signal from the dummy load or the aerial with an oscilloscope and note the peak to peak value when tuning.

3.8.7. **Check of Modulator**
Key the transmitter by the microtelephone key and check that it is possible to modulate it to the same p-p value as when tuning.

3.8.8. **Check of H3E**
Press **H3E** and key the transmitter without modulation. Check that the p-p value is 50% to 56% of the tune p-p value.

3.8.9. **Check of Reduced Power**
With the transmitter keyed in H3E check:
Med. power: 63% to 56% of the p-p value measured at point 3.8.8.
Low power: 59% to 53% of the med. power p-p value.

3.8.10. **Check of R3E**
Press **R3E** and key the transmitter without modulation. Check that the p-p value is 12.5% to 17.5% of the tune p-p value.

3.8.11. **Check of Fixed 2182 kHz**
Press **2182,** then key the transmitter and check that it is possible to modulate to full PEP.

3.8.12. **Check of Distress Output**
Check that the distress output at the microphone plug P1-15 pin 4 is 16-18V.

3.8. **FUNCTION CHECK** cont.

3.8.13.
Then select another frequency and check that the voltage at pin 4 is now zero.

3.8.14. **Check of the Alarm Generator**
Press **2182**, then **TEST ALARM** and **SEND ALARM** at the same time.
Check that the two-tone alarm signal is transmitted with the same p-p value as the tune signal and that it is heard in the microtelephone. Then press **ENT STOP** and check that the alarm signal stops.

3.8.15. **Check of Dummy Load Input**
When dummy load input on connection board in H2091 is grounded, then it is impossible to transmit the alarm signal on 2182 kHz.
Connect "dummy load" pin 3 in H2091 to ground. Press **TEST ALARM** and **SEND ALARM** at the same time.
Check that the alarm signal is not transmitted.

3.8.16. **Check of RX Mute**
Select a frequency. Check that the relay contact "mute" 4 in H2091 is open. Then press the tune knob and check that the mute contact is now closed. Then press the handset key and check that the mute contact is closed.

3.8.17. **Check of Power Consumption**
Tune to max. and check that the current on the 24V DC mains is 25-35 Amps. depending on the supply voltage.

3.8.18. **Blower Check**
Key the transmitter in H3E full power. The blower must start after 2-4 min.

3.8.19. **Check of Earpiece Level**
Check that the earpiece sound level is ok with a receiver R2022 connected.

3.8.20. **Check of Blocking on Illegal Frequency**
Key in an illegal frequency and check that it is not possible to start the transmitter on this frequency.

3.8.21. **Check of STORE.**
Key in a frequency, then press **ENT - 9 - 0 - STORE.** Check that the frequency will be displayed again when pressing **9 - 0 - ENT.**

3.8.22. **Check of DIM.**
Press **DIM** and check that the panel light is switched off.

3.8.23. **Check of all Digits**
Press all digits from 1 to 0 and check that the right digit is displayed.

3.8.24.
Set jumper W1 to position B and select band 15L and set resonance and load as noted in point 4. Then press **ENT** and set W1 to position A.

3.9 PIN CONFIGURATIONS, TRANSISTORS.

BOTTOM VIEW

BC548B
BC557B
BC547B
BC338-25
BC328
BC337-16
BC618
BF506
BC559B

BOTTOM VIEW

BC640
BC635

BOTTOM VIEW

BFY50
BFW17A

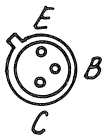
BOTTOM VIEW

BF494
BF199
MPS3640

BOTTOM VIEW

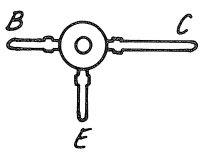
BC373

BOTTOM VIEW



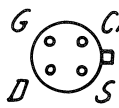
2N2369A

TOP VIEW



BFW92A

BOTTOM VIEW

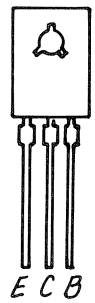


SD210DE

BOTTOM VIEW

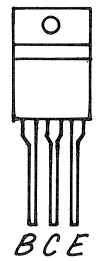
TM00044-3
TM00044-1
} TIS88A

FRONT VIEW



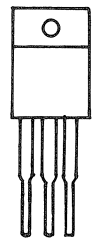
BD140-10
BD139

FRONT VIEW



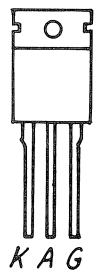
BUV26
BDX53

FRONT VIEW



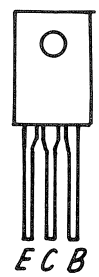
RFP12N10

FRONT VIEW



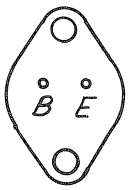
BT151-500R

FRONT VIEW



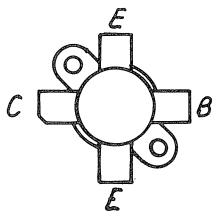
2N5190

T2031A



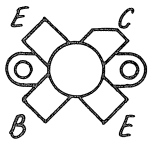
BUV19

BOTTOM VIEW



TH430

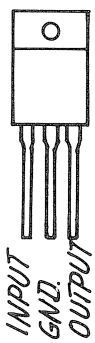
TOP VIEW



MRF433

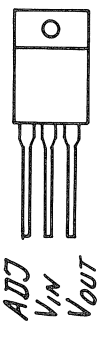
TOP VIEW

3.9.1 PIN CONFIGURATIONS, IC's.



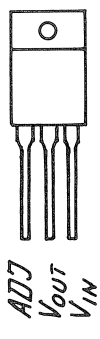
LM340T-15

FRONT VIEW



LM337T

FRONT VIEW



LM317T

FRONT VIEW

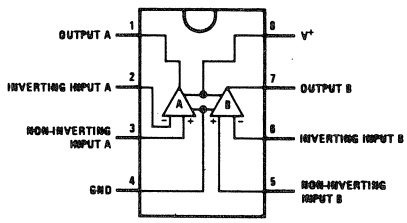
LM78L15ACZ
LM78L12ACZ
MC78L05ACP

BOTTOM VIEW

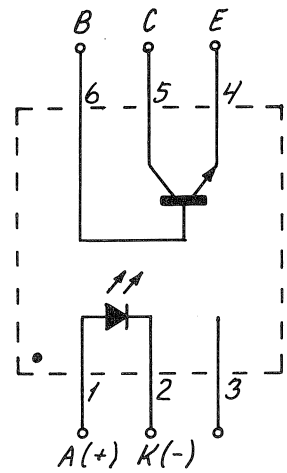
LM317LZ
LM337LZ

BOTTOM VIEW

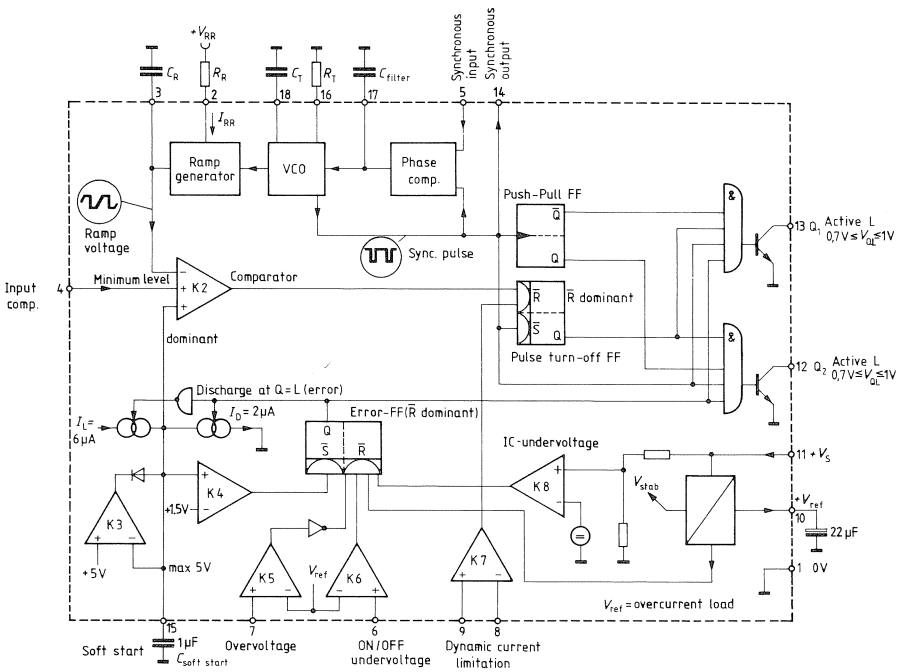
LM358N/MC1458CP



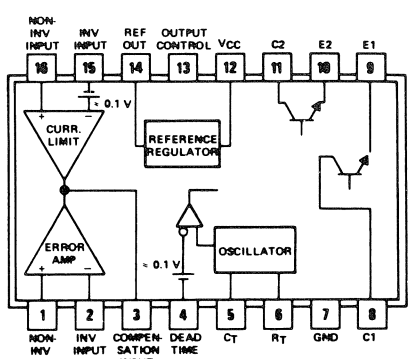
CNY17



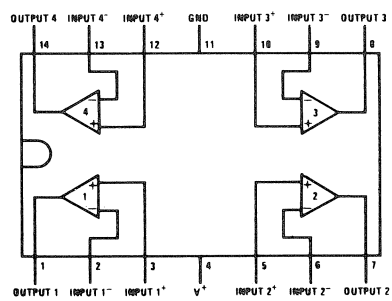
TDA4718A



TL494CN

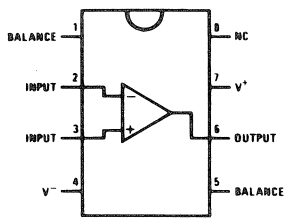


LM324

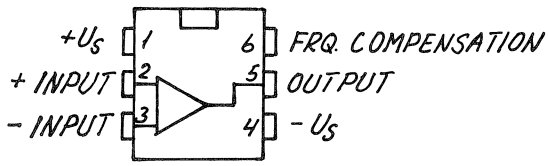


T2031

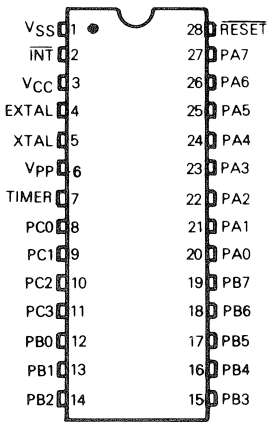
LF356N

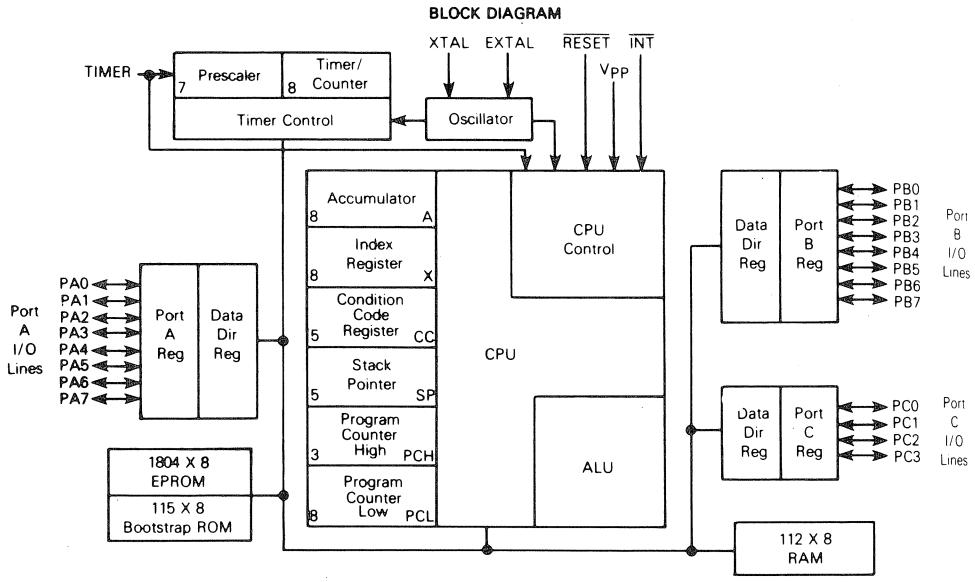


TAA761A, TAA765A

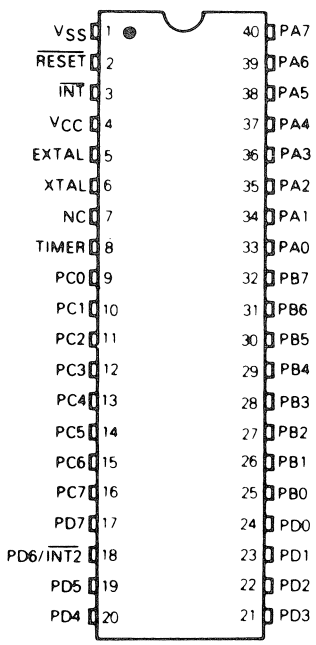


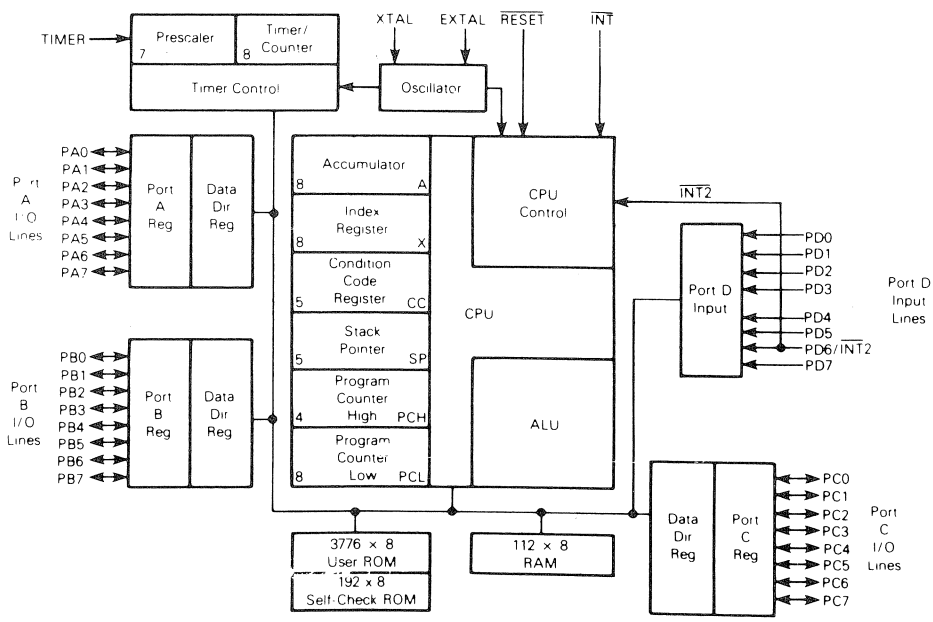
MC68705P3



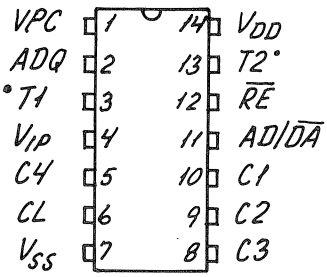


MC68705U3





MCM2802 EEPROM

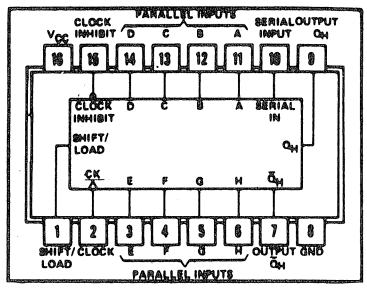


* For normal operation, hardwired to V_{SS}.

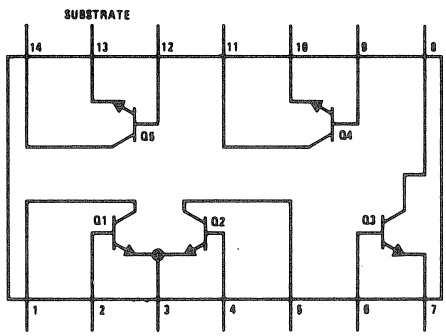
PIN NAMES

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

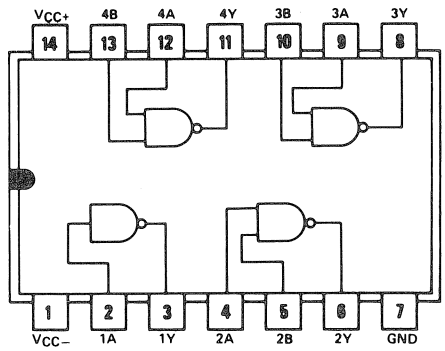
SN74LS165



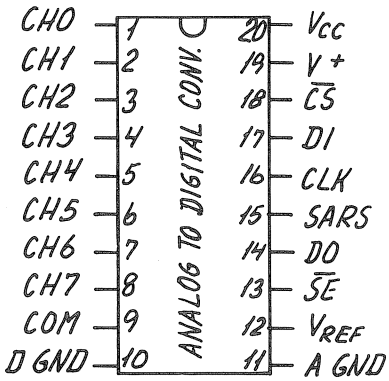
LM3046N



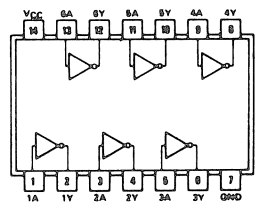
SN75188N



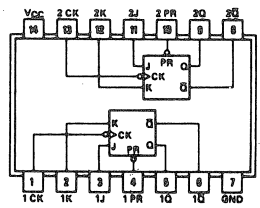
ADC0838CCN



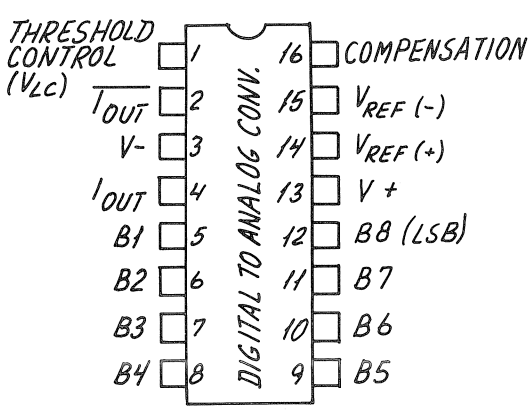
SN7406N



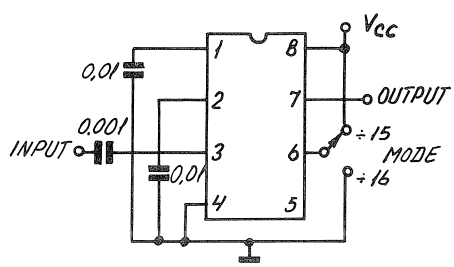
SN74LS113AN



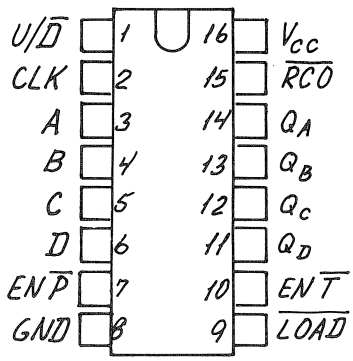
DAC-08HP



MC3393P

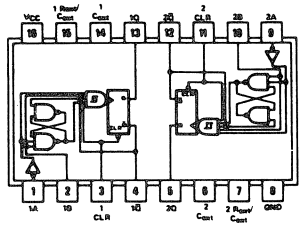


SN74LS669N

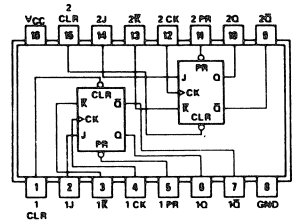


4 BIT UP/DOWN COUNTER

SN74LS221N



SN74LS109AN



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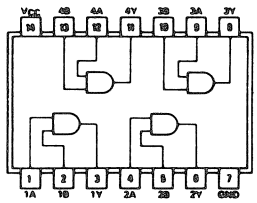

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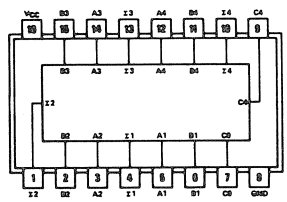
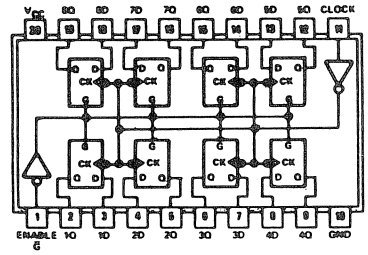
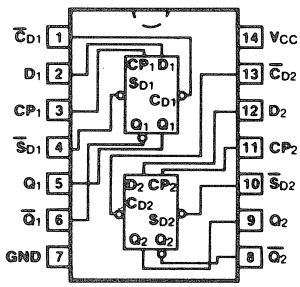


4 BIT BINARY
FULL ADDER

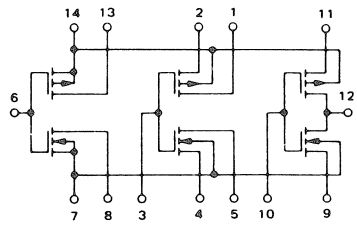
SN74LS377N



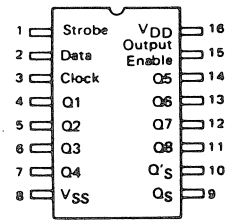
74F74



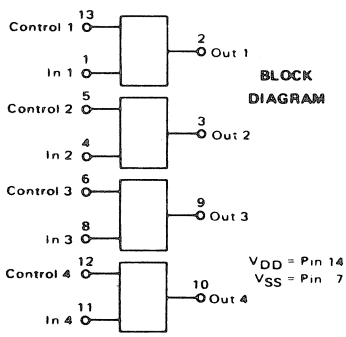
MC14007UB



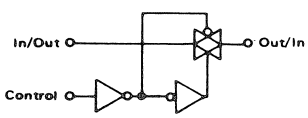
MC14094BCP



MC14066BCP



LOGIC DIAGRAM AND TRUTH TABLE
(1/4 OF DEVICE SHOWN)

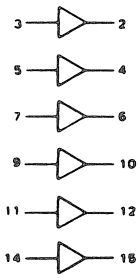


Control	Switch
0	OFF
1	ON

Logic Diagram Restrictions
$V_{SS} \leq V_{in} \leq V_{DD}$
$V_{SS} \leq V_{out} \leq V_{DD}$

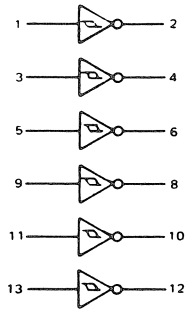
$V_{control}$	V_{in} to V_{out} Resistance
V_{SS}	$>10^9$ Ohms typ
V_{DD}	3×10^2 Ohms typ

MC14050B



NC = Pin 13, 16
V_{SS} = Pin 8
V_{CC} = Pin 1

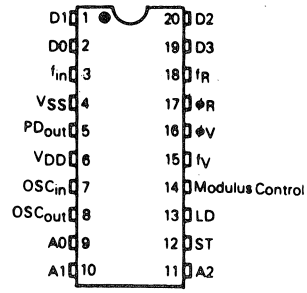
MC14584BCP

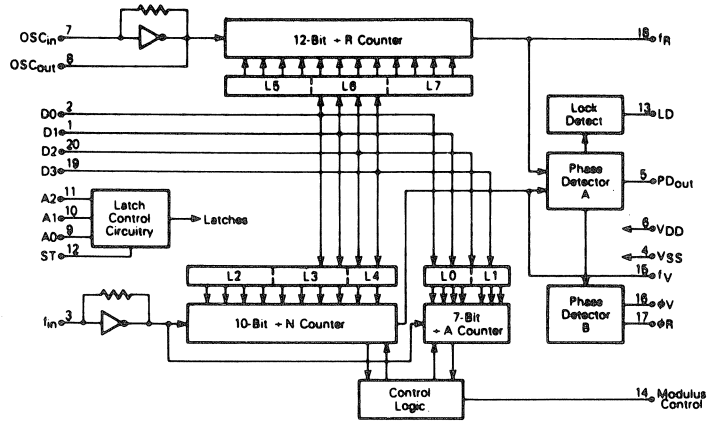


V_{DD} = Pin 14
V_{SS} = Pin 7

T2031

MC145146





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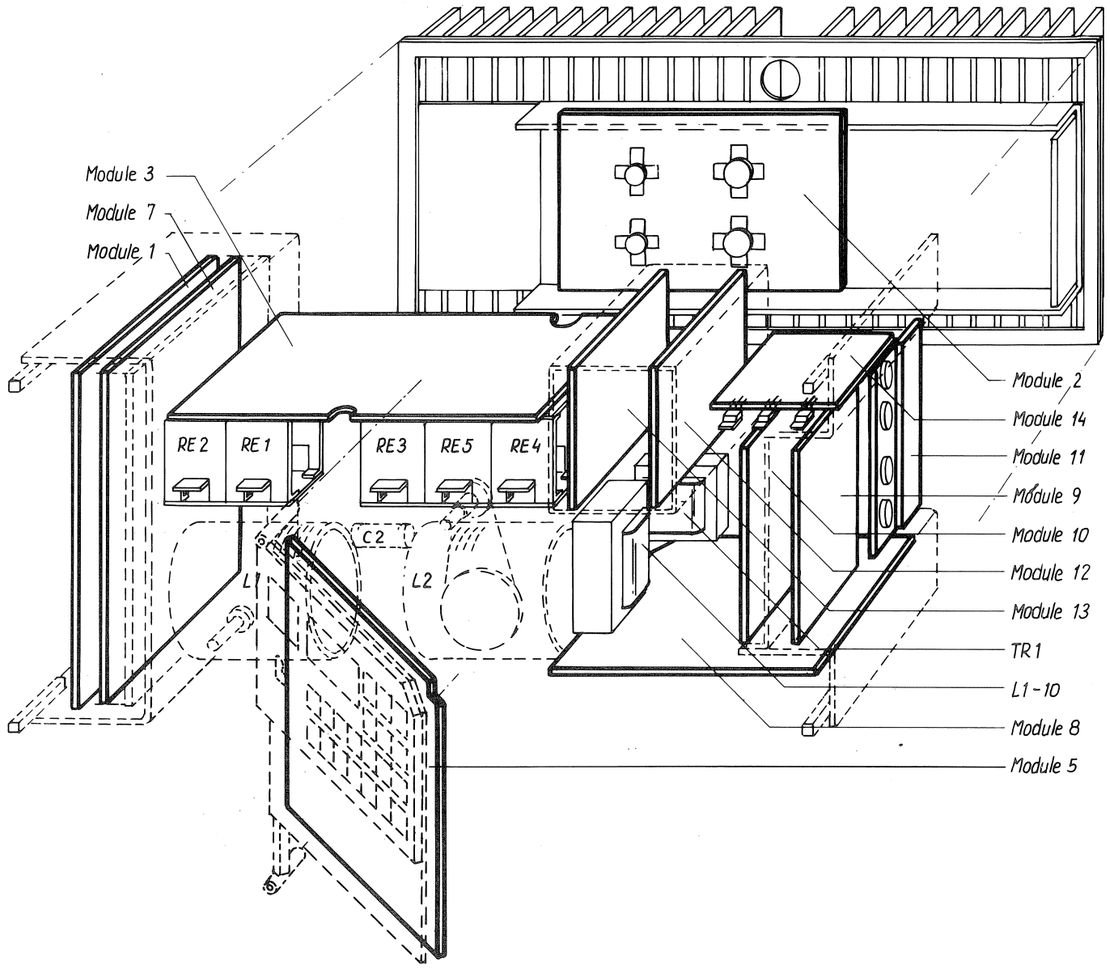
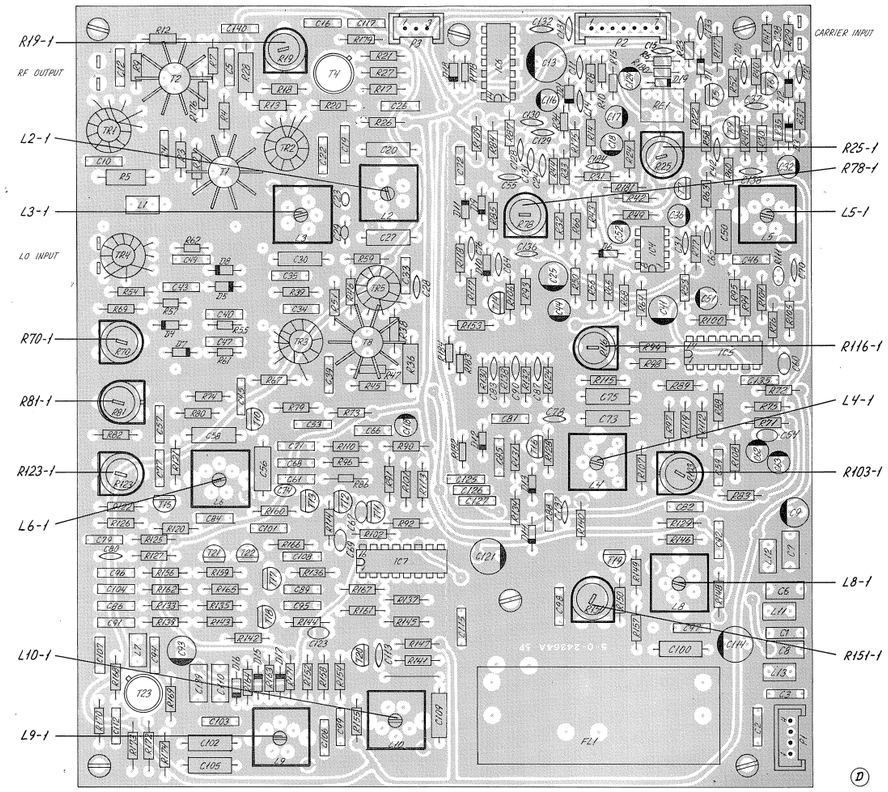
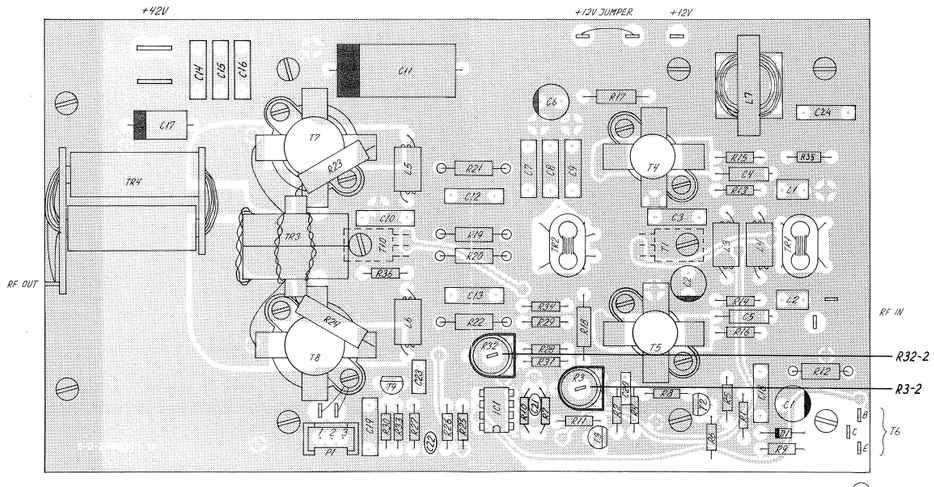
3.10. ADJUSTMENT AND MODULE LOCATIONS.



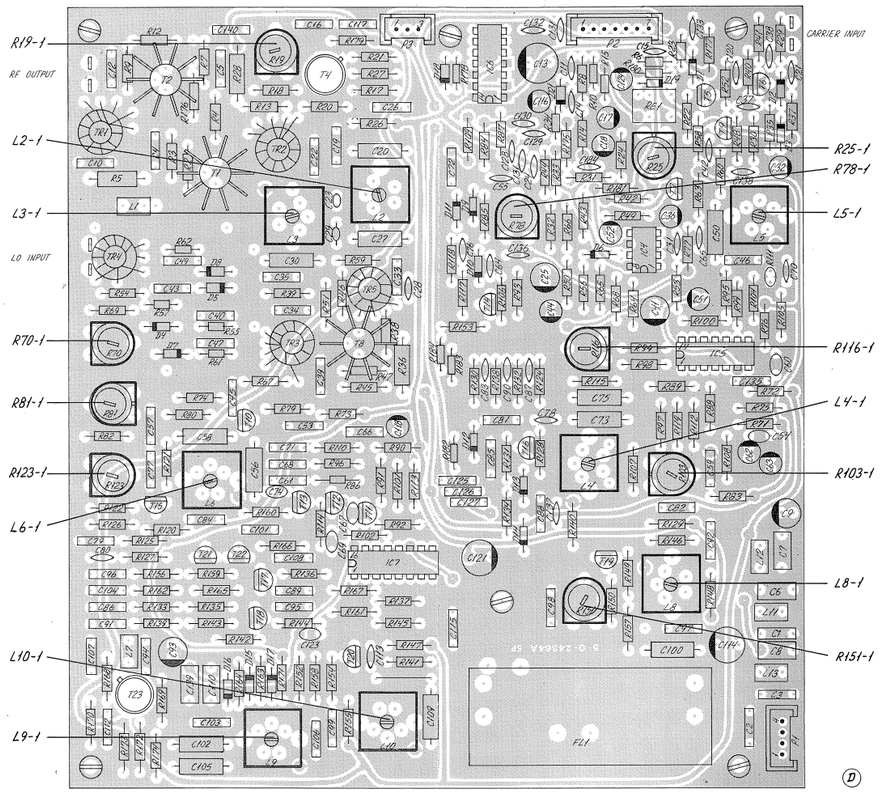


EXCITER UNIT (MODULE 1)

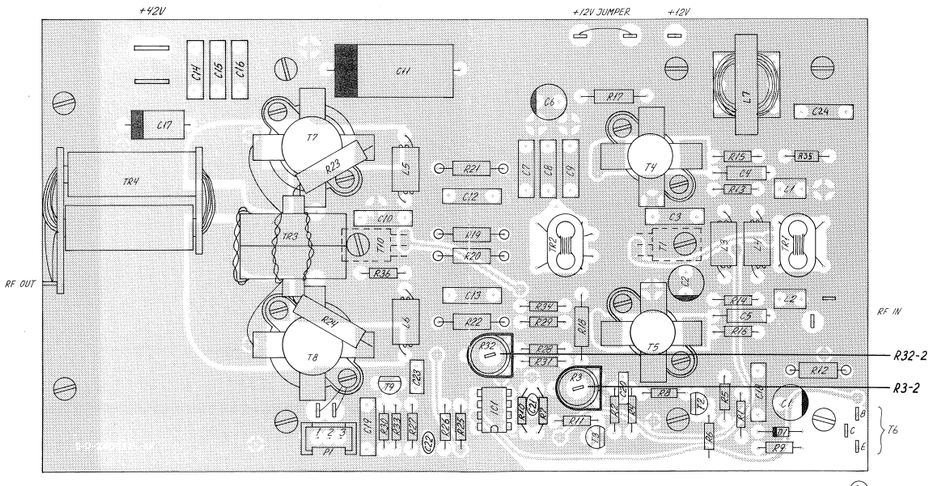


POWER AMPLIFIER (MODULE 2)

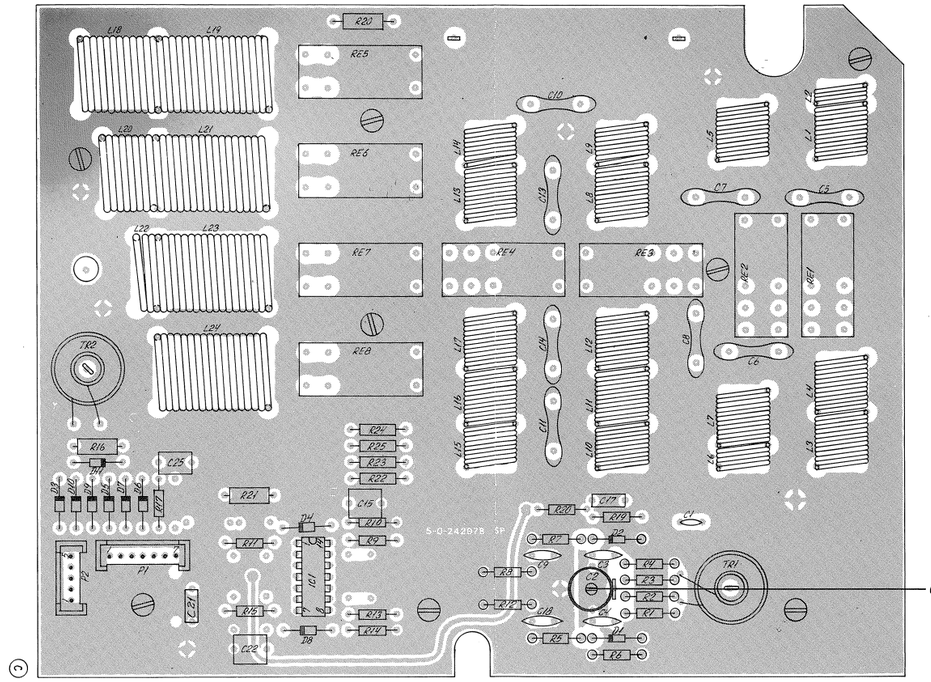
T2031B 4-6-25078A 4-6-24364D
4-6-24031B 4-6-24297C
4-6-24440B



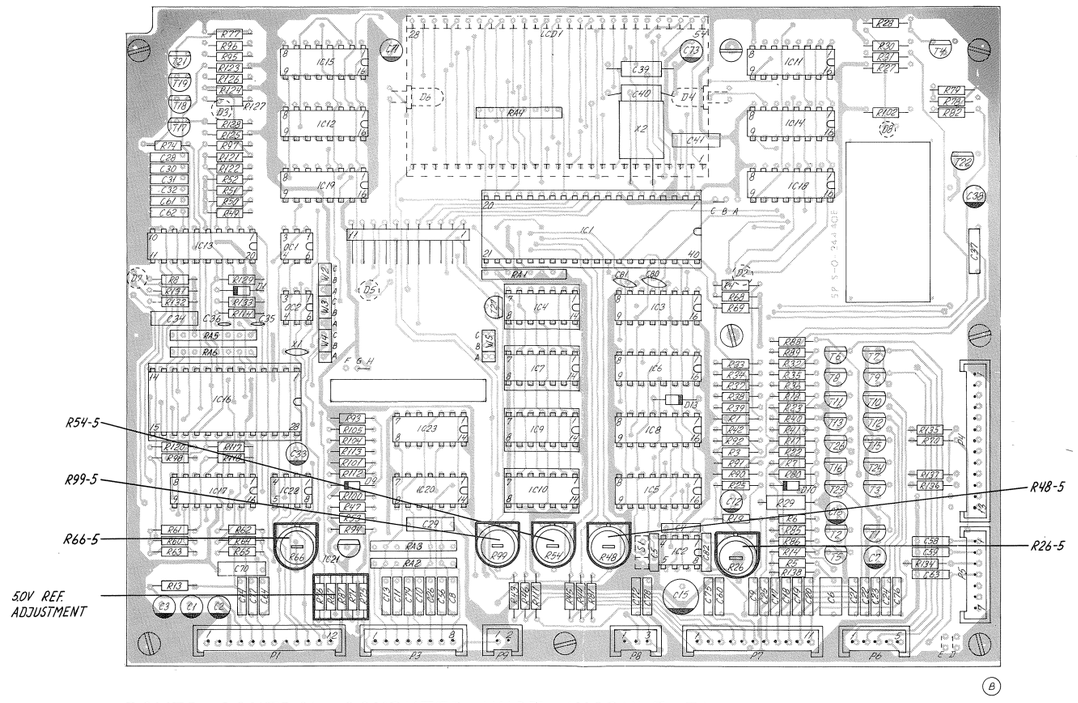
EXCITER UNIT (MODULE 1)



POWER AMPLIFIER (MODULE 2)



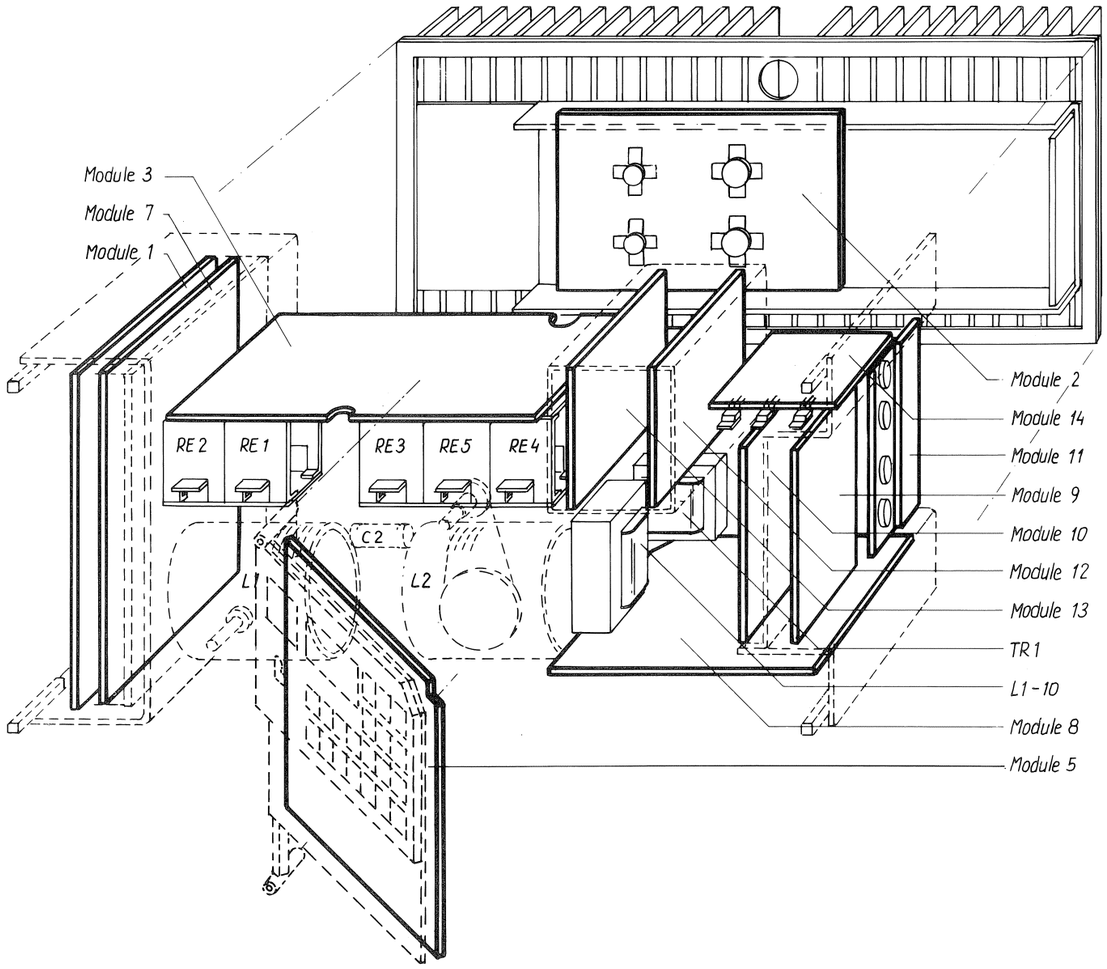
FILTER UNIT (MODULE 3)

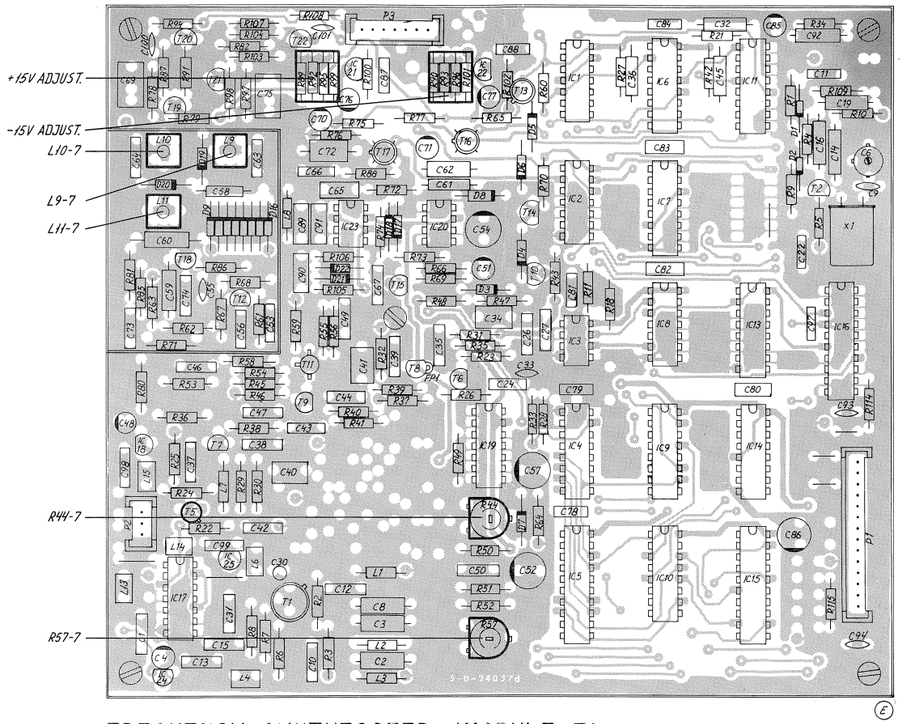


POWER CONTROL COMPUTER UNIT (MODULE 5)

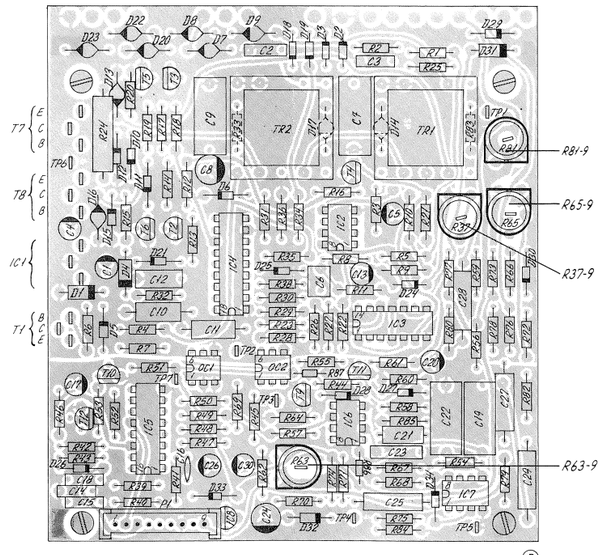
ADJUSTMENT AND MODULE LOCATIONS

T2031A 4-6-24078A, 4-6-24057E
4-6-24529D, 4-6-24695A





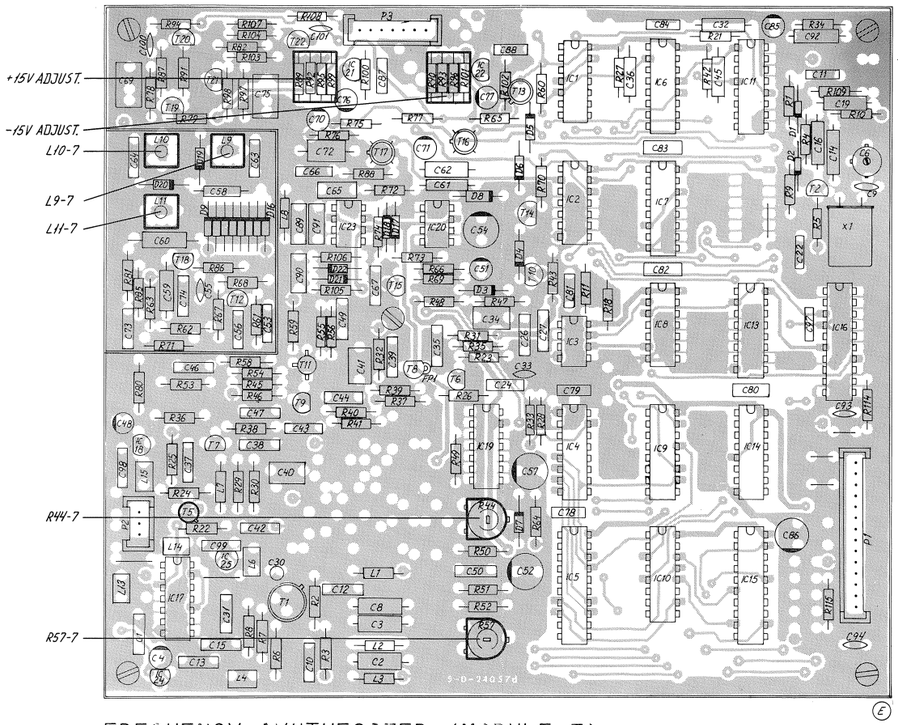
FREQUENCY AYNTHESIZER (MODULE 7)



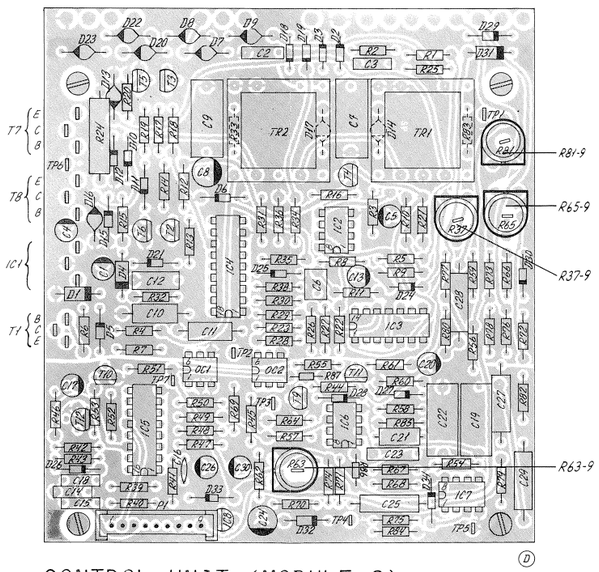
CONTROL UNIT (MODULE 9)

ule 2
ule 14
ule 11
ule 9
ule 10
ule 12
ule 13

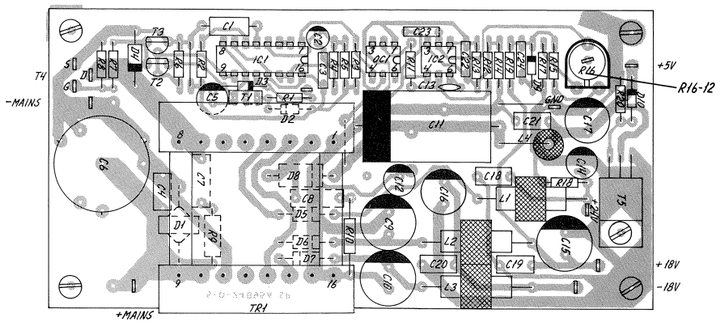
10
ule 8
ule 5



FREQUENCY AYNTHESIZER (MODULE 7)



CONTROL UNIT (MODULE 9)



CONVERTER UNIT (MODULE 12)

ADJUSTMENT AND MODULE LOCATIONS

CONTENTS

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4. MECHANICAL DISASSEMBLING

FIG. 1

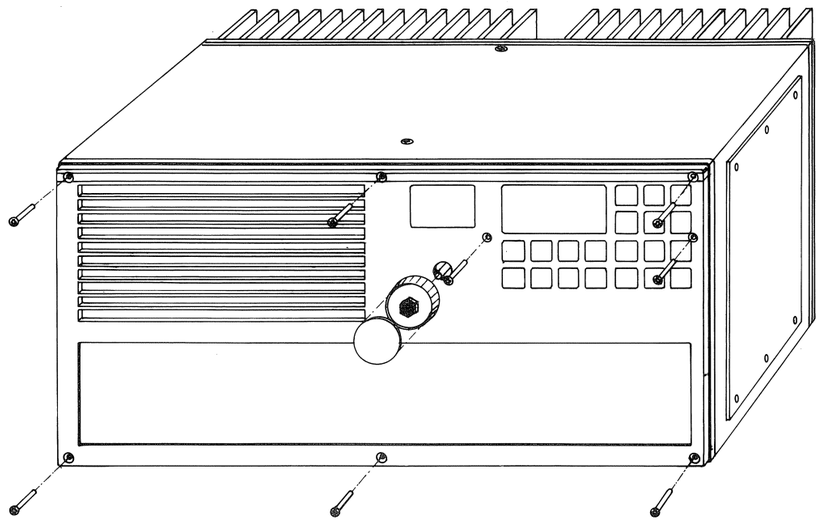


FIG. 2

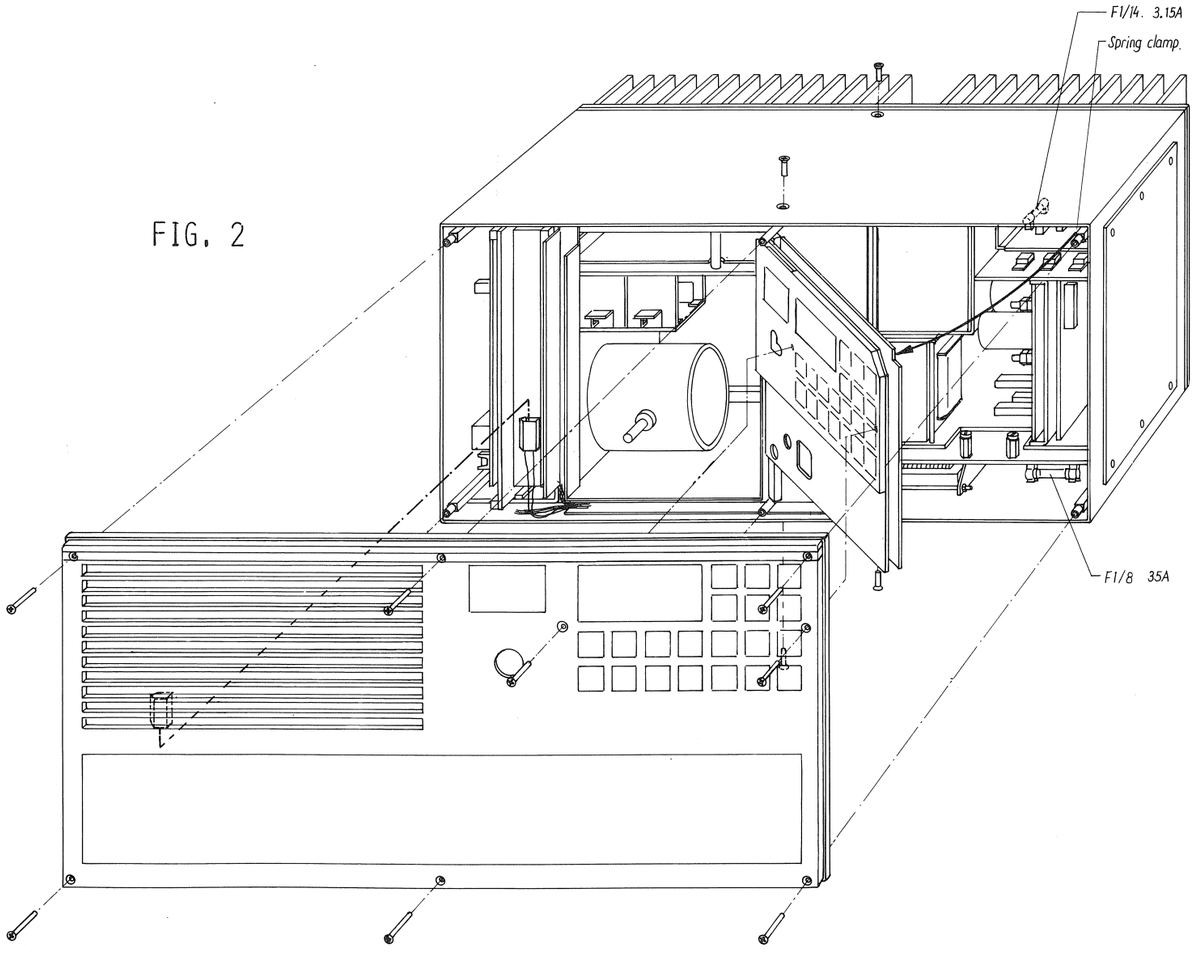
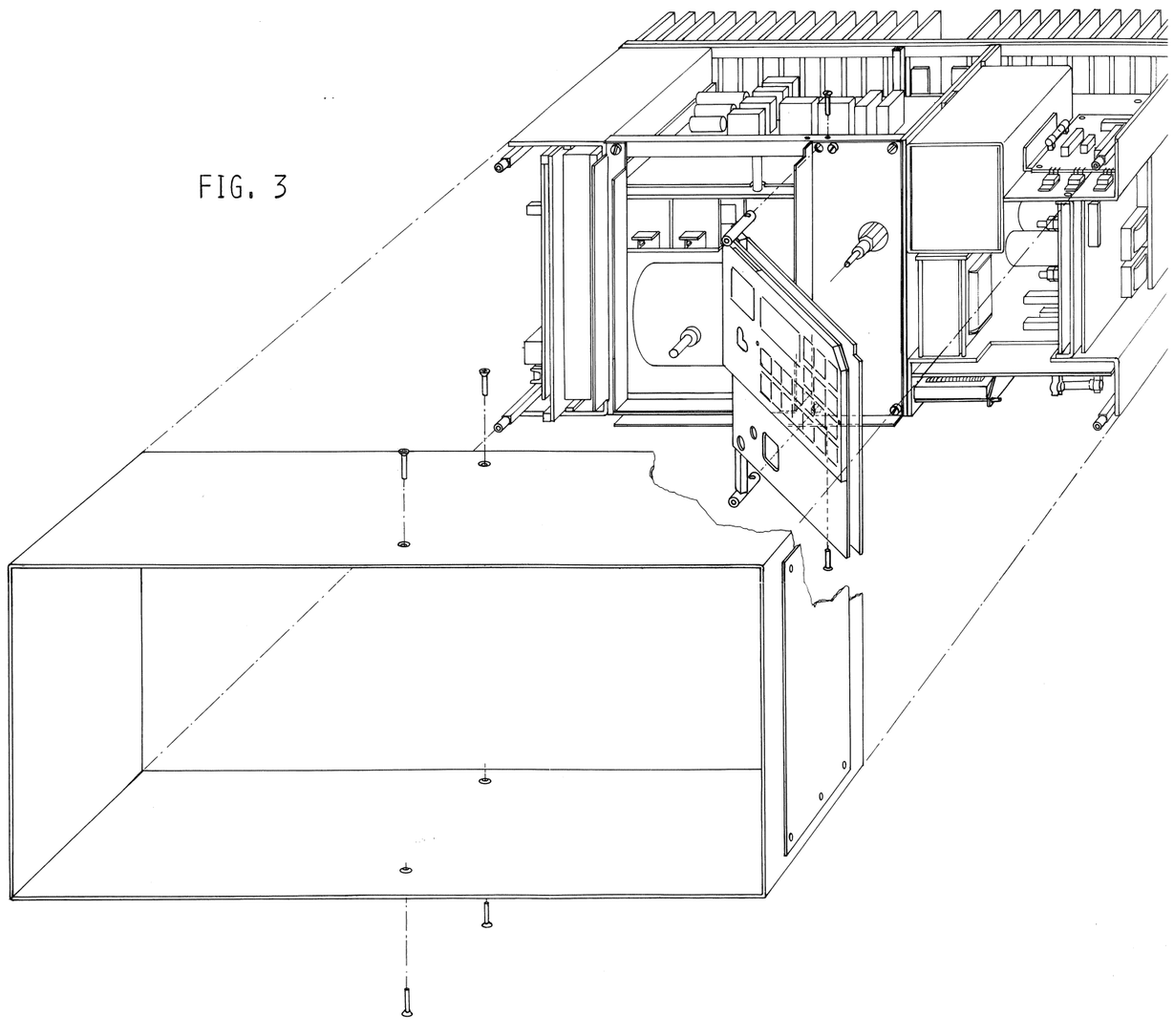


FIG. 3



'14. 3.15A

ing clamp.

3 35A

FIG. 3

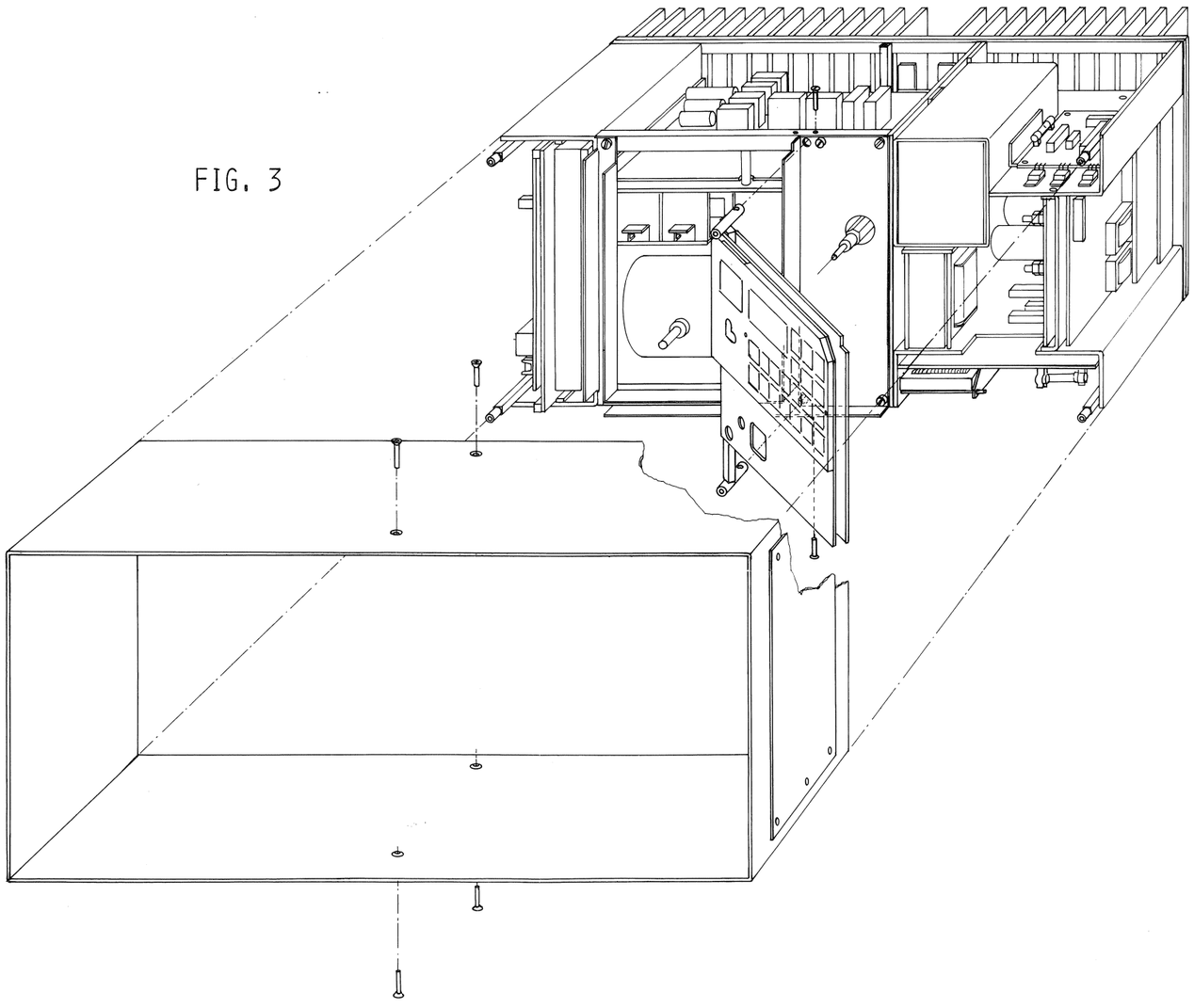


FIG. 4

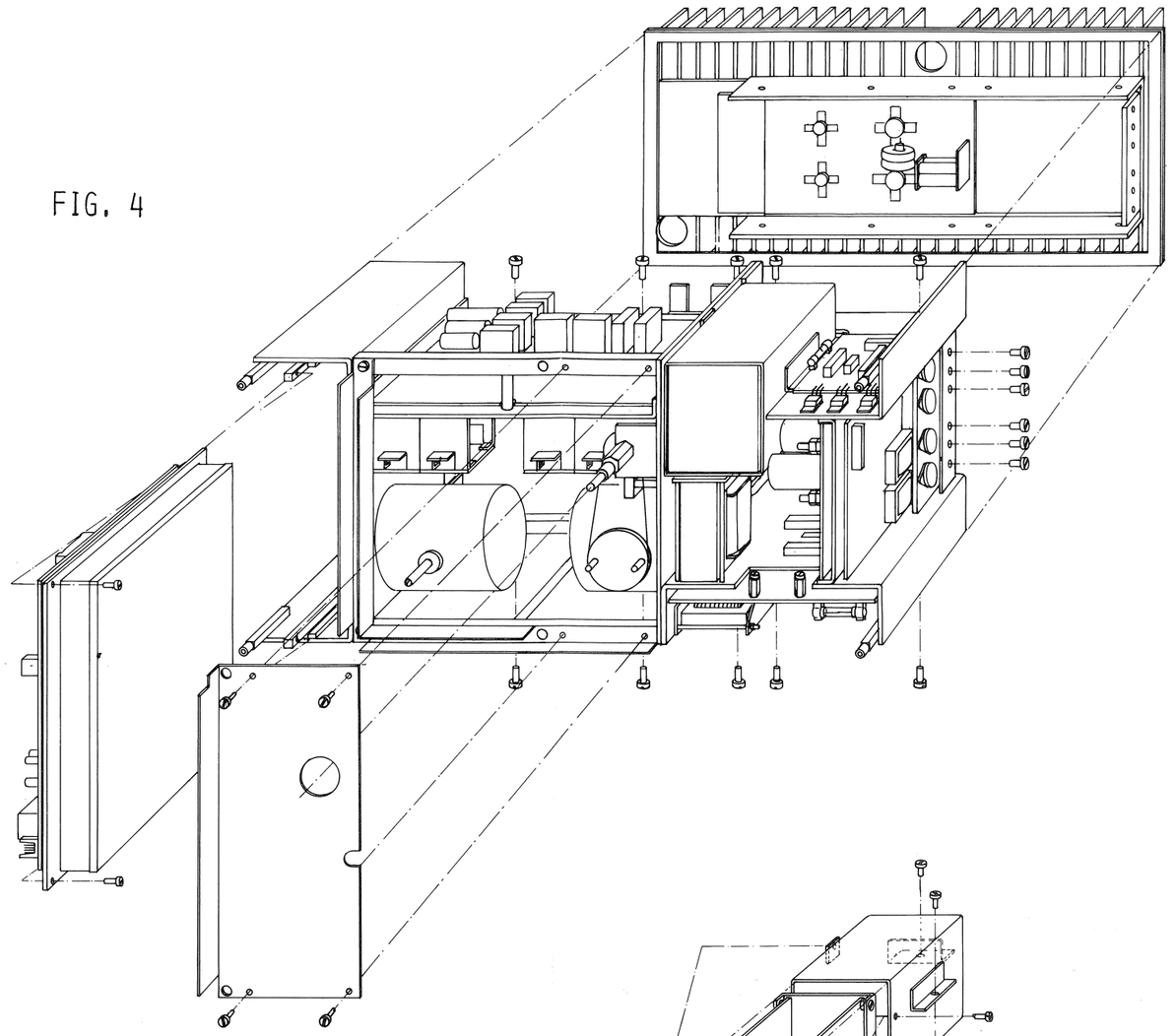
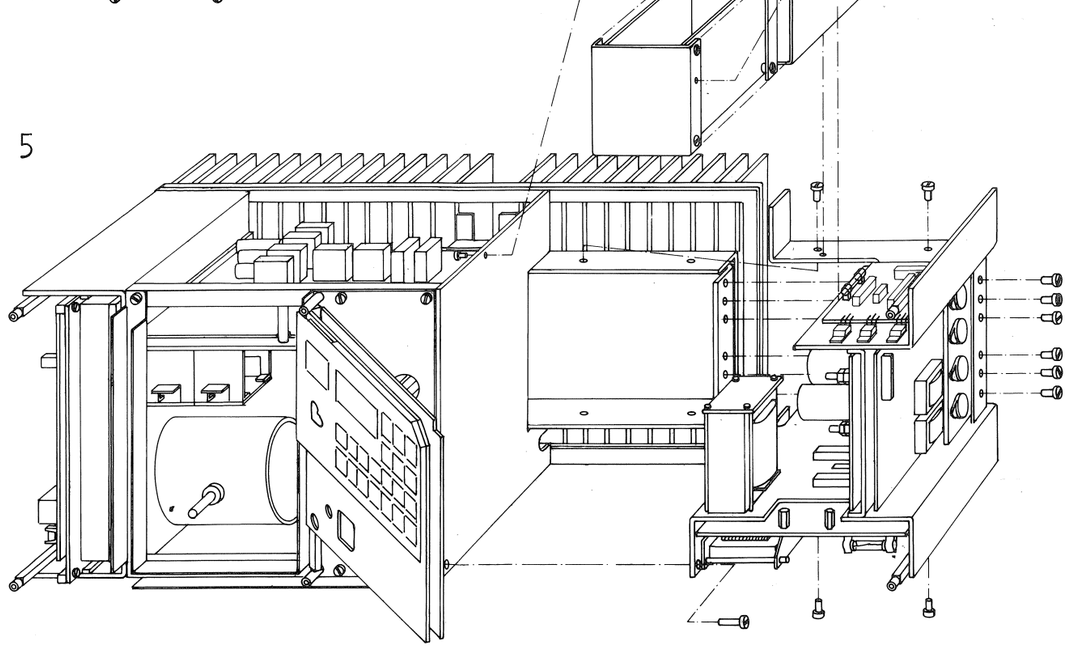


FIG. 5



MECHANICAL DISASSEMBLING

CONTENTS

5. CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS

5.1. EXCITER UNIT (MODULE 1)

The circuit receives an audio signal from the handset microphone, the test tone signal or the alarm tone signal. This signal is mixed with the carrier signal and the local oscillator signal, and the result is a ready-to transmit SSB signal, which is the output signal from the exciter unit.

MICROPHONE AMPLIFIER

This unit processes all the AF signals used by the module.
The audio signal from the handset microphone is applied to pin 3 of plug P2. This audio signal is fed through a level regulating potentiometer R25 to the electronic attenuator consisting of the resistor R31 and the FET T7. The amount of attenuator is controlled by the voltage applied to the gate of T7.
The FET is biased in the off condition by the 5V6 zener diode D21 and with 0.5 applied to the gate; in this condition no attenuation takes place. With a control voltage of 5V6 applied to the gate, max. attenuation is obtained.

From the electrical attenuator the audio signal is fed to the amplifier IC4a, gain 33 dB. The output of this amplifier is fed to the modulator and to the level comparing comperator consisting of IC4b.
IC4b is biased with approximately one Volt less on input pin 5 than on input pin 6, meaning that the output pin 7 is normally low (1.0V) when no AF signal is applied.
When the amplitude of the AF signal applied to pin 6 reaches a level of 1.0V peak, the output of IC4b will switch to high level and start to charge capacitor C44. The voltage of capacitor C44 is applied to the gate of the FET T7 and therefore controlling the electrical attenuator, meaning that the output of IC4a, when reaching a level of 1V peak, will be kept at this amplitude.

The capacitor C25 is used to keep the gate control voltage on a constant level during a short speech break.
RE1 is activated to block the microphone signal when transmitting the test tones (tune) and the alarm tones. These signals are applied to plug P2 pin 4 and fed through the electrical attenuator to the amplifier IC4a.

Because the test tones and the alarm tones are square wave signals and because the first harmonic of a square wave has a higher peak amplitude, it is necessary to change the DC bias of IC4b. This is done through the network R180, R181, and R6 connected to pin 5 of IC4b.

CARRIER LIMITER AMPLIFIER

The transistors T6 and T9 amplify the input carrier signal and T9 is limiting the amplitude. The bias voltage of T6 and T9 are applied through transistor T5, which is controlled by IC7.
With transistor T5 conducting, diode D2 is forward biased and D3 is reverse biased, with T5 non conducting D2 is reverse and D3 is forward biased.

MODULATOR
From the carrier amplifier T9 the (10.5984 MHz) carrier signal is applied to IC5 pin 9. The audio signal from IC4a is applied to IC5 pin 6. The audio signal on pin 2 and 4 of IC5 are equal in amplitude but opposite in phase. These two audio signals are multiplied by the carrier signal applied to pin 3 of IC5. The resulting modulated signals on pin 1 and pin 5 of IC5 are added in the coil L4, and the output signal on the basis of T16 is a double sideband signal with suppressed carrier. The carrier balance is controlled by R116 and R103.

MODULATION LEVEL AMPLIFIER
The DSB signal on basis of T16 is fed to the voltage divider R131, R134, and R140. The wanted modulation level is controlled by the DC voltage applied to the diodes D12, D13, and D14, meaning that in the modulation mode J3E, D12 is forward biased and D13 and D14 are reverse biased.

LSB FILTER
Transistor T19 amplifies the DSB signal using the impedance matching coil L8 as collector impedance. This collector signal is fed through the signal sideband crystal filter to remove the unwanted upper side of the DSB signal. At the output of the crystal filter is another impedance matching coil L10.

CARRIER LEVEL AMPLIFIER
The carrier signal on collector of T9 is fed through the potentiometer R78 to voltage dividers R85 and R93. The wanted carrier insertion is controlled by the DC voltage applied to the diodes D9, D10, and D11. In modulation mode H3E, D9 is forward biased and D10 and D11 are reverse biased and in modulation mode J3E, the diodes D9 and D10 are reverse biased and D11 is forward biased.

CARRIER INSERTION AND LIMITING AMPLIFIER
The SSB signal from the crystal filter is fed to transistor T20. The wanted amount of carrier signal is added to the modulated SSB signal on the collector of T20. The output of L9 is connected to a peak to peak limiting network, consisting of the diodes D15 and D16 biased by the zener diode D17. The signal is from L9 fed to the buffer amplifier T23, which is working as an input buffer to the step attenuator.

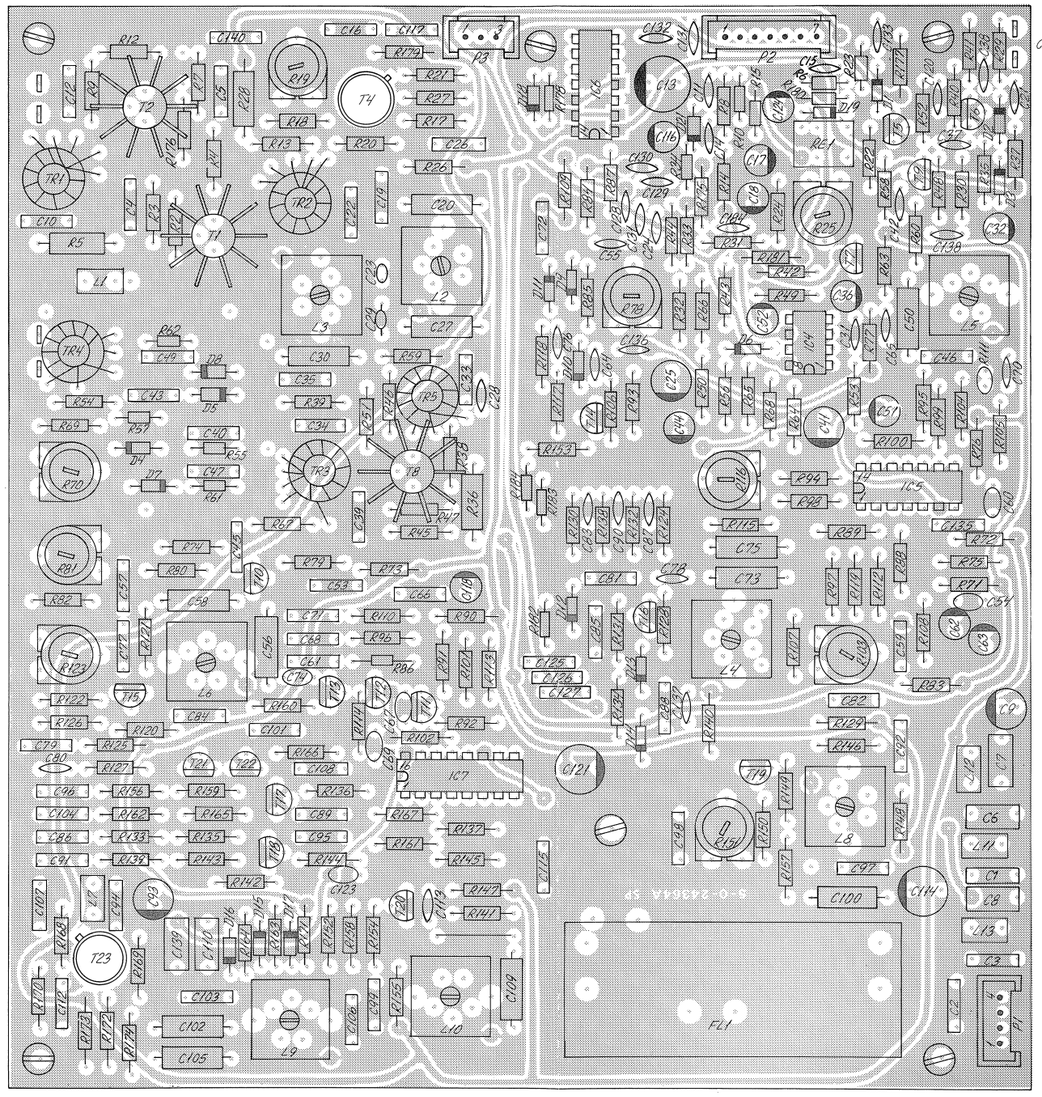
STEP ATTENUATOR AND AMPLIFIER
The step attenuator is divided in two parts. Part one consisting of the transistor T17, T18, T21 and T22 is divided in steps of 0.3 $\pm$0.1 dB, and part two, consisting of the transistors T11, T12, and T13 is divided in steps of 4.6 dB.
Part one of the step attenuator is working as a voltage divider, where the SSB signal on the emitter of T23 is divided by R168 and the parallel connection of the resistors R133, R139, R156 and R162, depending on which of them is grounded. The grounding of the resistors in this attenuator takes place in a normal binary code, meaning (0000) is equal to non attenuation and (1111) is equal to full attenuation. In part two of the attenuator the voltage gain of transistor T15 will be changed according to the wanted attenuation step.

5.1. **EXCITER UNIT (MODULE 1)** cont.

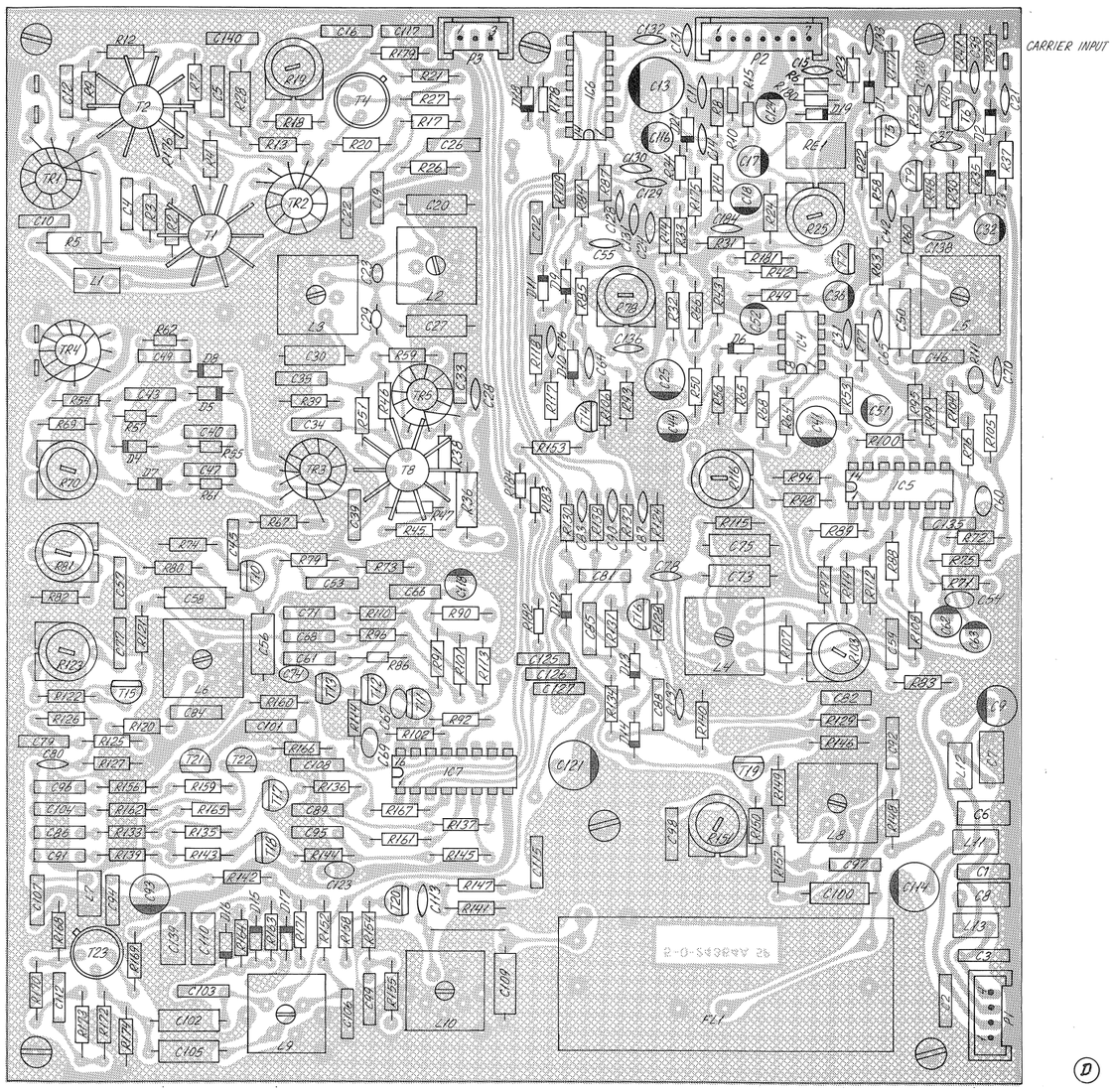
From attenuator step 16, R110 will be grounded; from attenuator step 32, R110 and R96 will be grounded, and from attenuator step 48, R110, R96 and R86 will be grounded. The wanted attenuator step is controlled by IC7, which converts the received input serial code to an output parallel code which controls the grounding of the transistors in the attenuator.
The output of the attenuator is fed to the buffer transistor T10. The potentiometer R81 on the basis of T10 is used to adjust the attenuation at step 16 to be 0.35 dB higher than the attenuation at step 15.

OUTPUT MIXER
The SSB signal on the emitter of transistor T10 is fed through R67 to the IF input port of the output mixer, which consists of the coils TR3 and TR4 and the diodes D4, D5, D7, and D8.
The local oscillator signal is applied to the LO input port of the mixer. To obtain good local oscillator signal balance of the mixer output, the potentiometer R70 can be adjusted.

OUTPUT AMPLIFIER AND FILTER
The mixer output signal is fed to transistor T8, where it is amplified and fed to the low pass filter (L2, L3) with a pass band from 1.6 MHz to 4.3 MHz, meaning that only the wanted RF signal will pass through, The RF signal is fed through amplifier transistor T4 to the final output amplifier transistors T1 and T2. The collector signals of these transistors are added in TR1 and fed to the RF output terminals.



View from component side with upper side tracks.



View from component side with lower side tracks.

EXCITER UNIT (MODULE 1)

T2031C 4-6-24364D

TEST CONDITIONS:

Frequency:	2076 kHz
Mode:	TUNE (transmitter turned to max. output power) or transmitter placed in test group No. 0, test 4 (tx in dummy load).
▲(xxx V_{pp}):	Measured with oscilloscope and passive probe 10 Mohm// 11 pF. (measured value V_{pp}).
◉xxx V:	Measured with diode probe.
DC Voltmeter:	Voltage without brackets in diagram meter input impedance 10 Mohm.

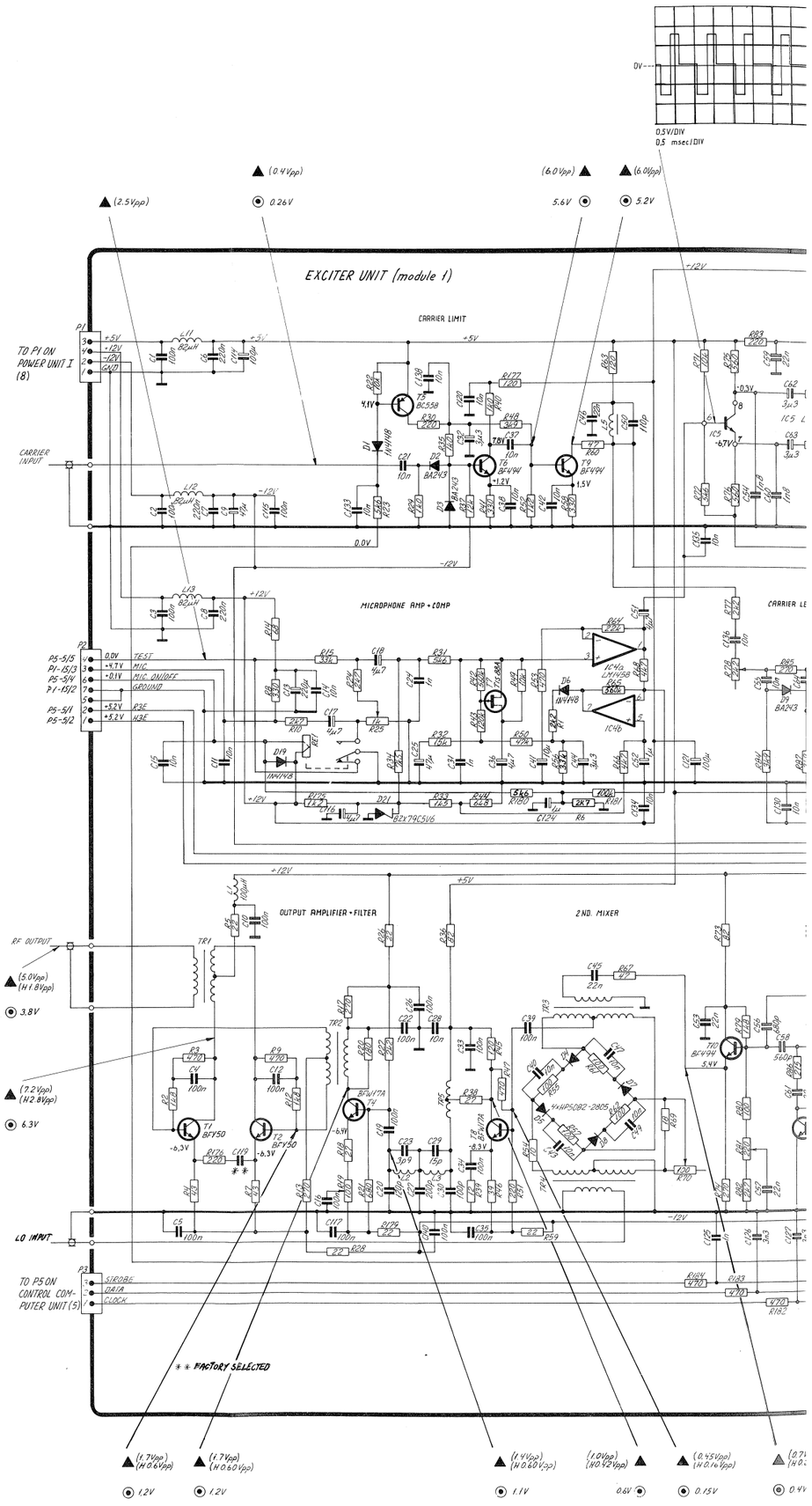
Test conditions changed to measure the carrier levels.

Frequency:	2076 kHz
Mode:	Transmitter placed in test group No. 0 test 3 (tx step 31 fixed) and modulation mode is H3E.
▲(H xxx V_{pp}):	Measured with oscilloscope.
◉H xxx V:	Measured with diode probe.

This diagram is valid for transmitters with serial numbers higher than 316006.

In transmitters with a lower serial number the following components are changed:

R46 is 3.9 kohm
R62 is 1.0 kohm



5.2. POWER AMPLIFIER (MODULE 2)

From the exciter unit the signal is fed to the power amplifier and here amplified 40 dB to 500W PEP.
The power amplifier consists of two push-pull stages each working in class B.
The bias circuit for T4 and T5 consists of T3, IC1a, T1 and T2. The bias circuit for T7 and T8 consists of T_6, IC1b, T9 and T10. The two bias circuits are identical. T1 and T10 are placed beneath the printed circuit board and work as temperature compensating of the bias to the amplifier.
When T2 and T9 are driven into saturation from PA open the bias will be 0V and the power amplifier will give an attenuation of approx. 50 dB.
R3 and R32 are for adjustment of the bias to T4, T5 and T7, T8.

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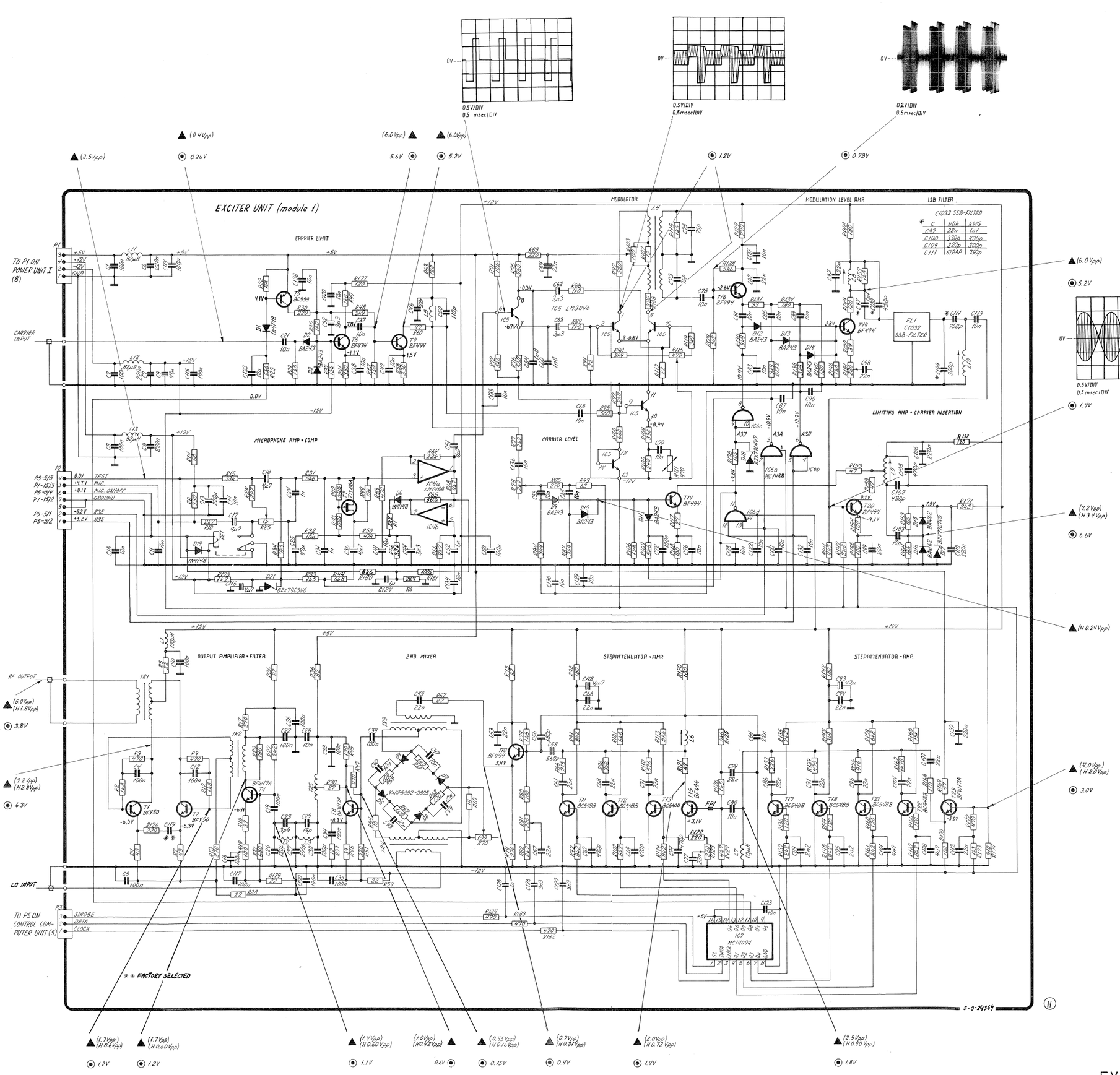

EXCITER UNIT (MODULE 1)

5.2. POWER AMPLIFIER (MODULE 2)

From the exciter unit the signal is fed to the power amplifier and here amplified 40 dB to 500W PEP.
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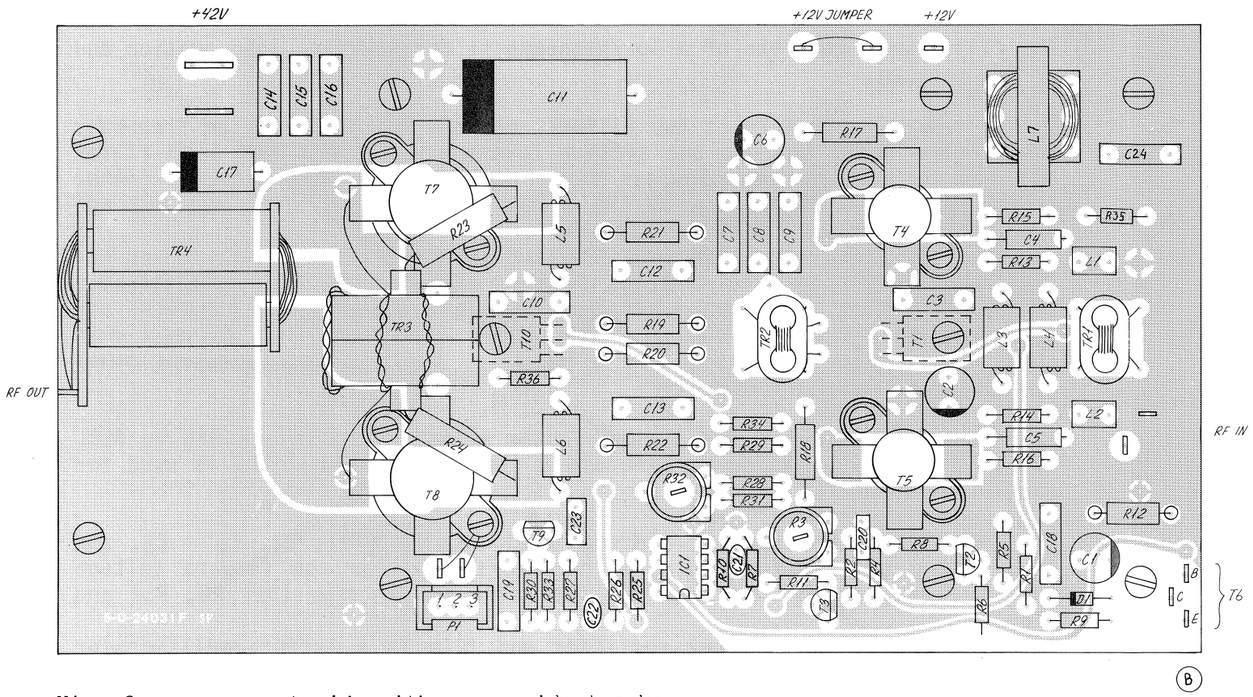
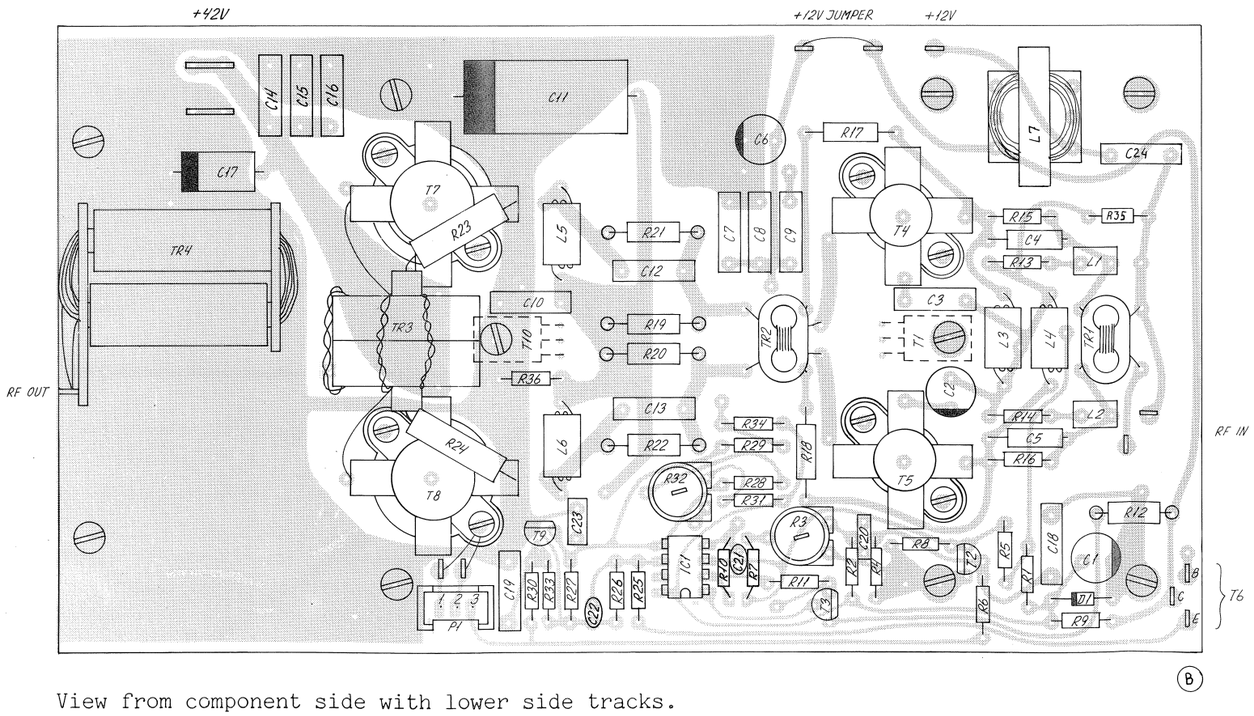
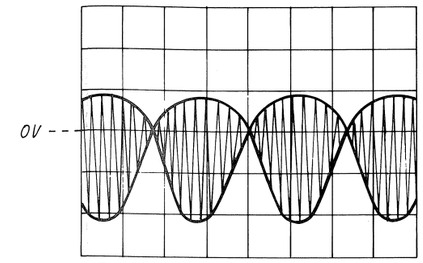
When T2 and T9 are driven into saturation from PA open the bias will be OV and the power amplifier will give an attenuation of approx. 50 dB.
R3 and R32 are for adjustment of the bias to T4, T5 and T7, T8.

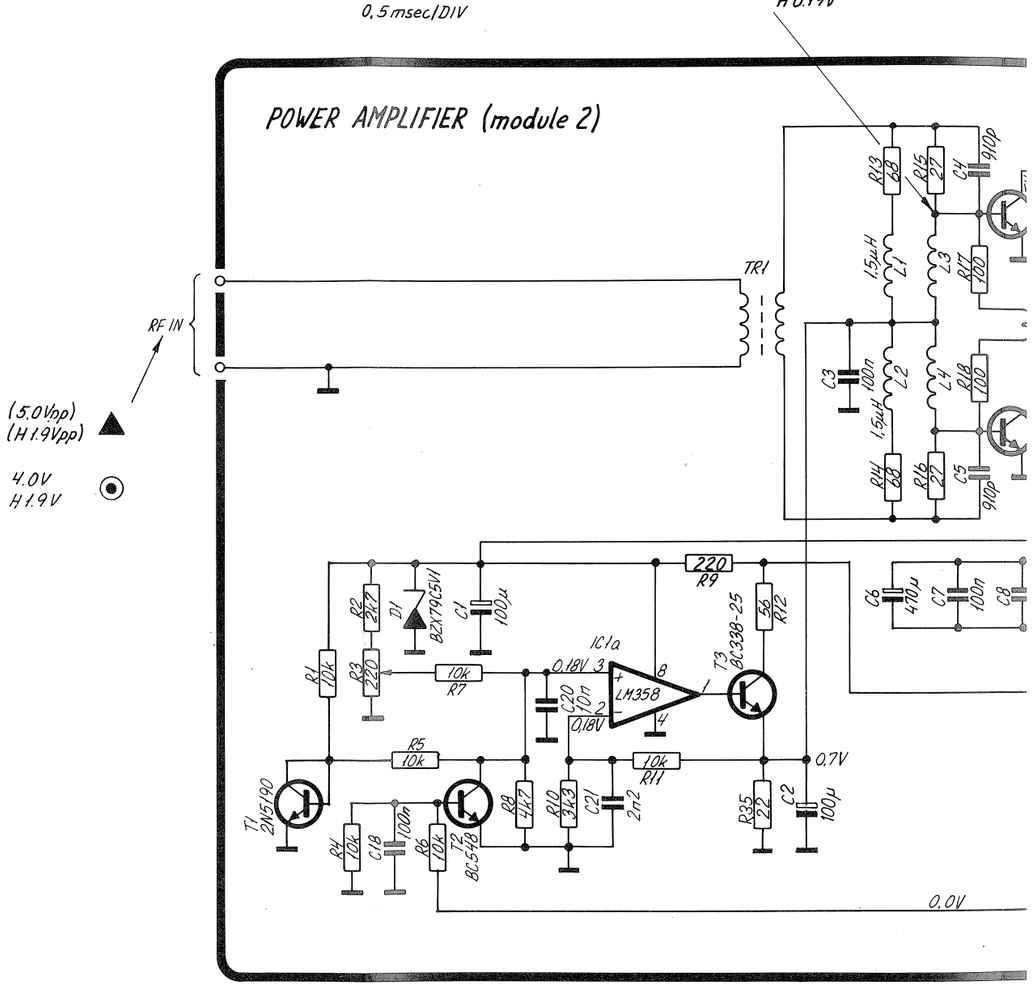


View from component side with upper side tracks.



View from component side with lower side tracks.





TEST CONDITIONS:

Frequency:	2076 kHz	Test conditi
Mode:	TUNE (transmitter turned to max. output power) or transmitter placed in test group No. 0, test 4 (tx in dummy load).	Frequency: Mode:
▲(xxx V_{pp}):	Measured with oscilloscope and passive probe 10 Mohm// 11 pF. (measured value V_{pp}).	▲(H xxx V_{pp}
⦿xxx V:	Measured with diode probe.	⦿H xxx V:
DC Voltmeter:	Voltage without brackets in diagram meter input impedance 10 Mohm.	

5.3. FILTER UNIT (MODULE 3)

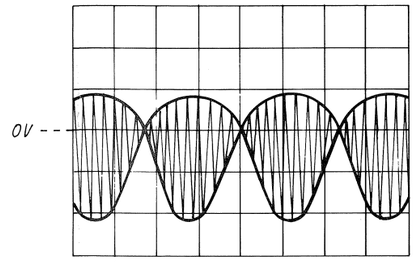
The filter unit consists of a low/highpass filter section, load section and an SWR section.

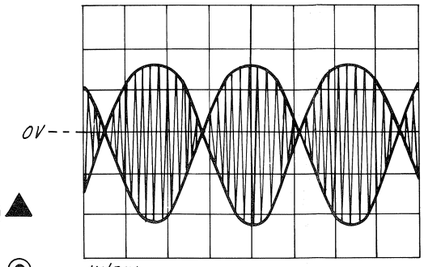
The filter unit consists of two filters, one section covering the frequency range 1.6 - 2.499 MHz and one section covering 2.5 - 4.3 MHz. Each filter consists of a third order lowpass filter and a third order highpass filter loaded with 100 ohm (R1-15, R2-15) filter selection is done with RE3 and RE4 which are controlled from module 5.
When RE1 and RE2 are not activated the two 100 ohms resistors R1-15 and R2-15 are connected to each highpass filter. When RE1 and RE2 are activated the two 100 ohms resistors R1-15 and R2-15 are connected in parallel and connected direct to the output of the power amplifier. This is used when the microprocessor is setting the drive level required for an output power of 500 W.

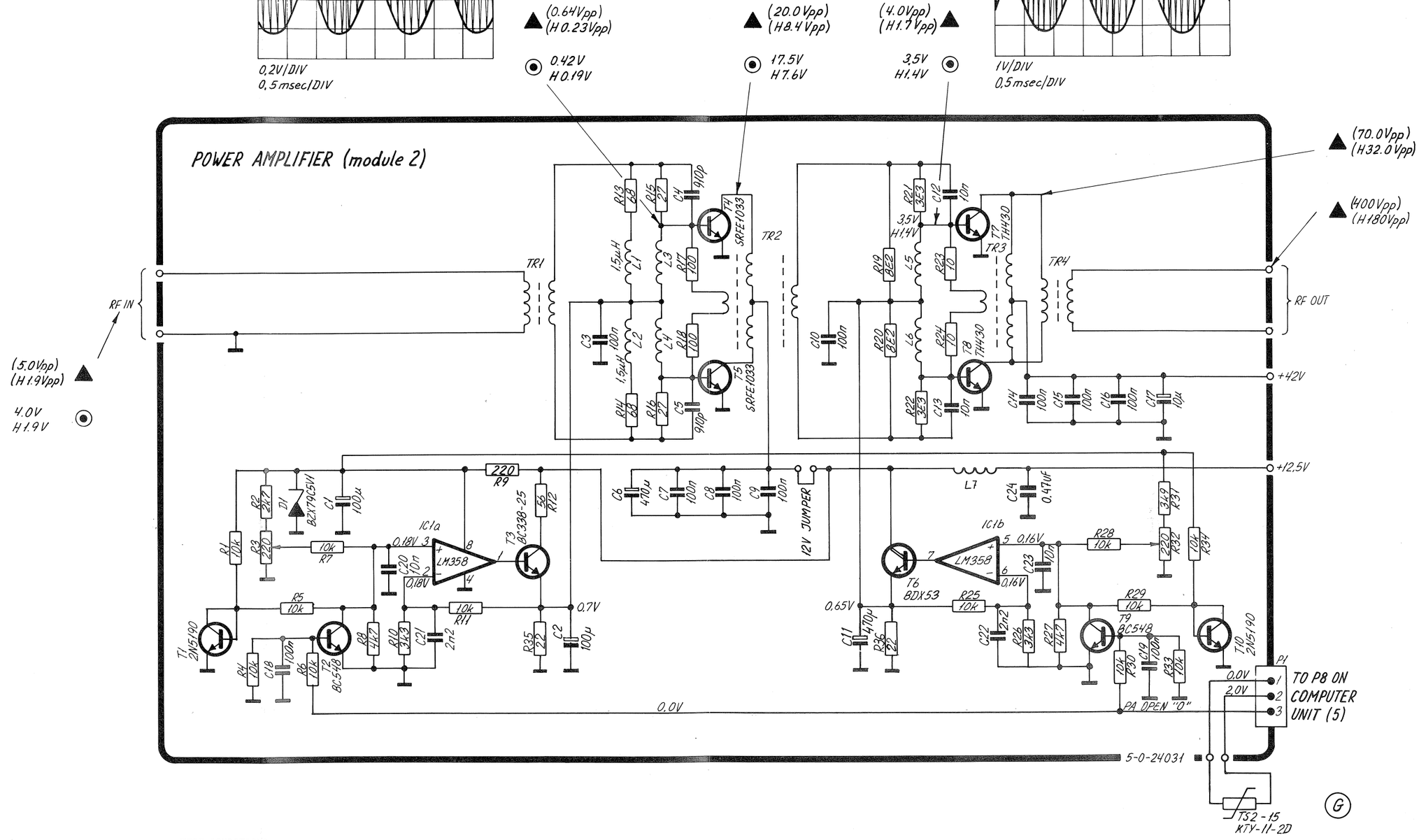
The load coils are switched in and out by means of the relays RE5 to RE8. The relays are controlled from module 5 (see table below). TR2 is used for measuring the aerial current.

The SWR circuit consists of a directional coupler (TR1, C1, C_2 - C_4, and R1-R4). Two quasi effective value detectors, one for the forward voltage (D2, R7, R8, and C9) and one for the reflected voltage (D1, R5, R12 and C18).
IC1d, D4 and C15 are a peak rectifier and IC1a is a buffer amplifier for V_F.
IC1c, D8, and C22 are a peak rectifier and IC1b is a buffer amplifier for V_R.

LOAD	RE5	RE6	RE7	RE8
0				
1	x			
2		x		
3			x	
4				x
5	x	x	x	
6		x	x	
7	x	x	x	
8		x	x	x
9	x	x	x	x







TEST CONDITIONS:

Frequency:	2076 kHz
Mode:	TUNE (transmitter turned to max. output power) or transmitter placed in test group No. 0, test 4 (tx in dummy load).
▲(xxx V_{pp}):	Measured with oscilloscope and passive probe 10 Mohm// 11 pF. (measured value V_{pp}).
⊙xxx V:	Measured with diode probe.
DC Voltmeter:	Voltage without brackets in diagram meter input impedance 10 Mohm.

Test conditions changed to measure the carrier levels.

Frequency:	2076 kHz
Mode:	Transmitter placed in test group No. 0 test 3 (tx step 31 fixed) and modulation mode is H3E.
▲(H xxx V_{pp}):	Measured with oscilloscope.
⊙H xxx V:	Measured with diode probe.

POWER AMPLIFIER (MODULE 2)

5.3. FILTER UNIT (MODULE 3)

The filter unit consists of a low/highpass filter section, load section and an SWR section.

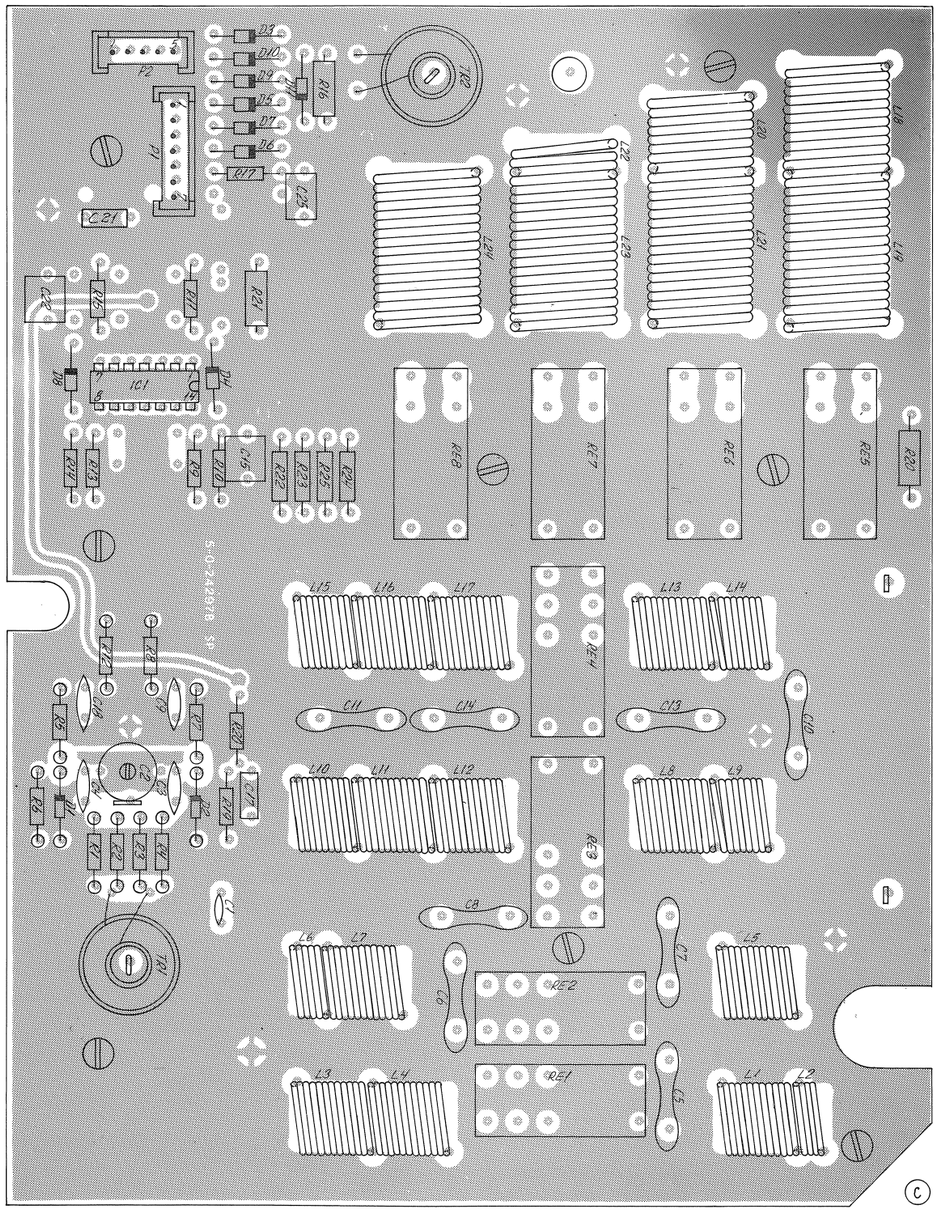
The filter unit consists of two filters, one section covering the frequency range 1.6 - 2.499 MHz and one section covering 2.5 - 4.3 MHz. Each filter consists of a third order lowpass filter and a third order highpass filter loaded with 100 ohm (R1-15, R2-15) filter selection is done with RE3 and RE4 which are controlled from module 5.
When RE1 and RE2 are not activated the two 100 ohms resistors R1-15 and R2-15 are connected to each highpass filter. When RE1 and RE2 are activated the two 100 ohms resistors R1-15 and R2-15 are connected in parallel and connected direct to the output of the power amplifier. This is used when the microprocessor is setting the drive level required for an output power of 500 W.

The load coils are switched in and out by means of the relays RE5 to RE8. The relays are controlled from module 5 (see table below). TR2 is used for measuring the aerial current.

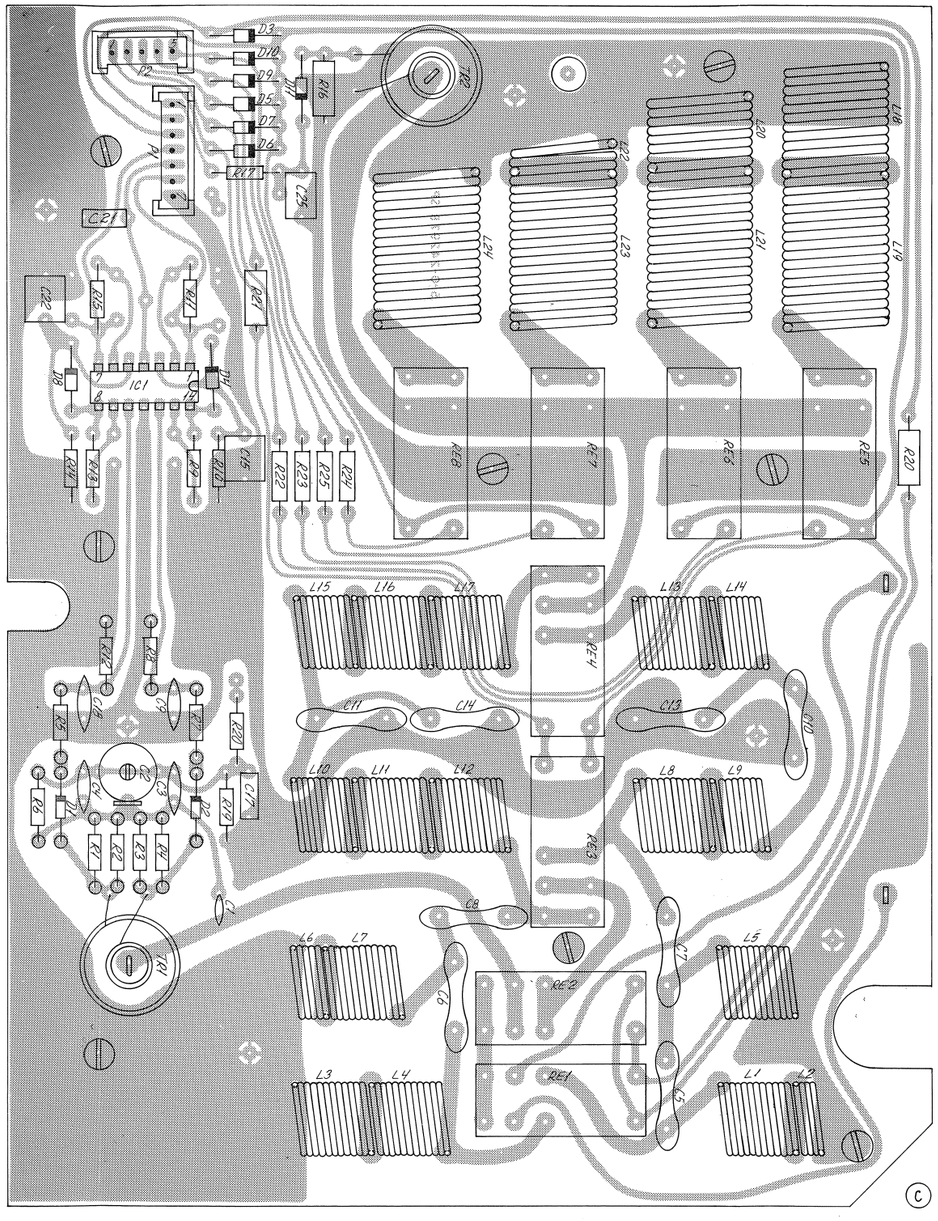
The SWR circuit consists of a directional coupler (TR1, C1, C_2 - C_4, and R1-R4). Two quasi effective value detectors, one for the forward voltage (D2, R7, R8, and C9) and one for the reflected voltage (D1, R5, R12 and C18).
IC1d, D4 and C15 are a peak rectifier and IC1a is a buffer amplifier for V_F.
IC1c, D8, and C22 are a peak rectifier and IC1b is a buffer amplifier for V_R.

LOAD	RE5	RE6	RE7	RE8
0				
1	x			
2		x		
3			x	
4				x
5	x	x	x	
6		x	x	
7	x	x	x	
8		x	x	x
9	x	x	x	x

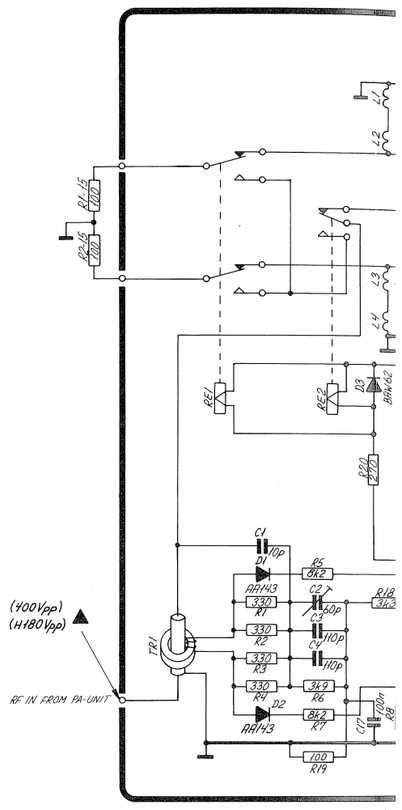
T2031D 4-6-24297C 4-0-24297G



View from component side with upper side tracks.



View from component side with lower side tracks.



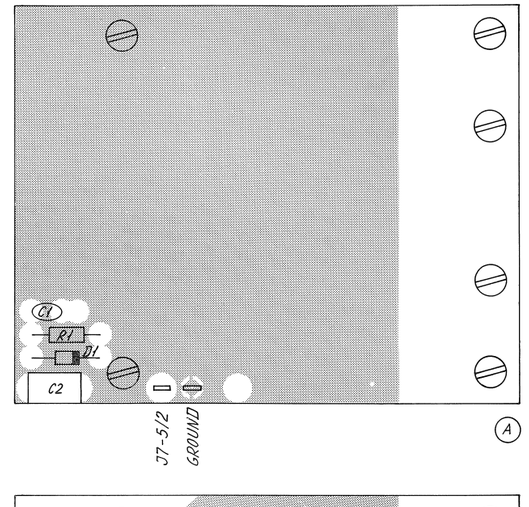
TEST CONDITIONS:

Frequency:	2076 kHz
Mode:	TUNE (tran transmitter dummy load)
▲(xxx V_{pp}):	Measured wi 11 pF. (mea
◉xxx V:	Measured wi
DC Voltmeter:	Voltage wit dance 10 Mo

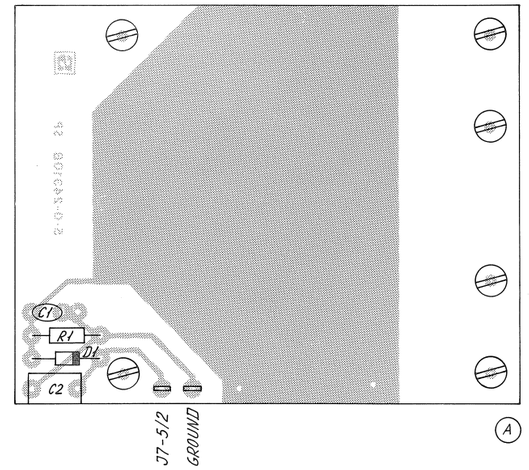
5.4. AERIAL VOLTAGE DETECTOR (MODULE 4)

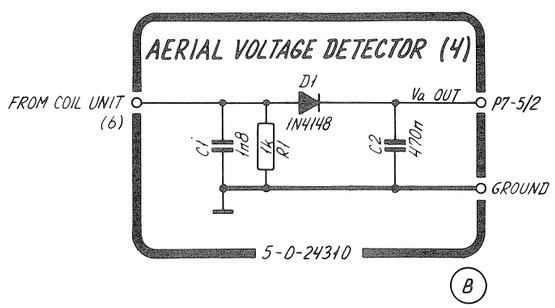
The aerial voltage detector is connected to the aerial via a 5 pF capacitor. The detector is a peak detector and its output voltage is proportional to the aerial peak voltage. The output is connected to the control computer unit (500). When the aerial voltage reaches the max. allowed value (the corona voltage) the computer will reduce the output power.

View from component side with upper side tracks.

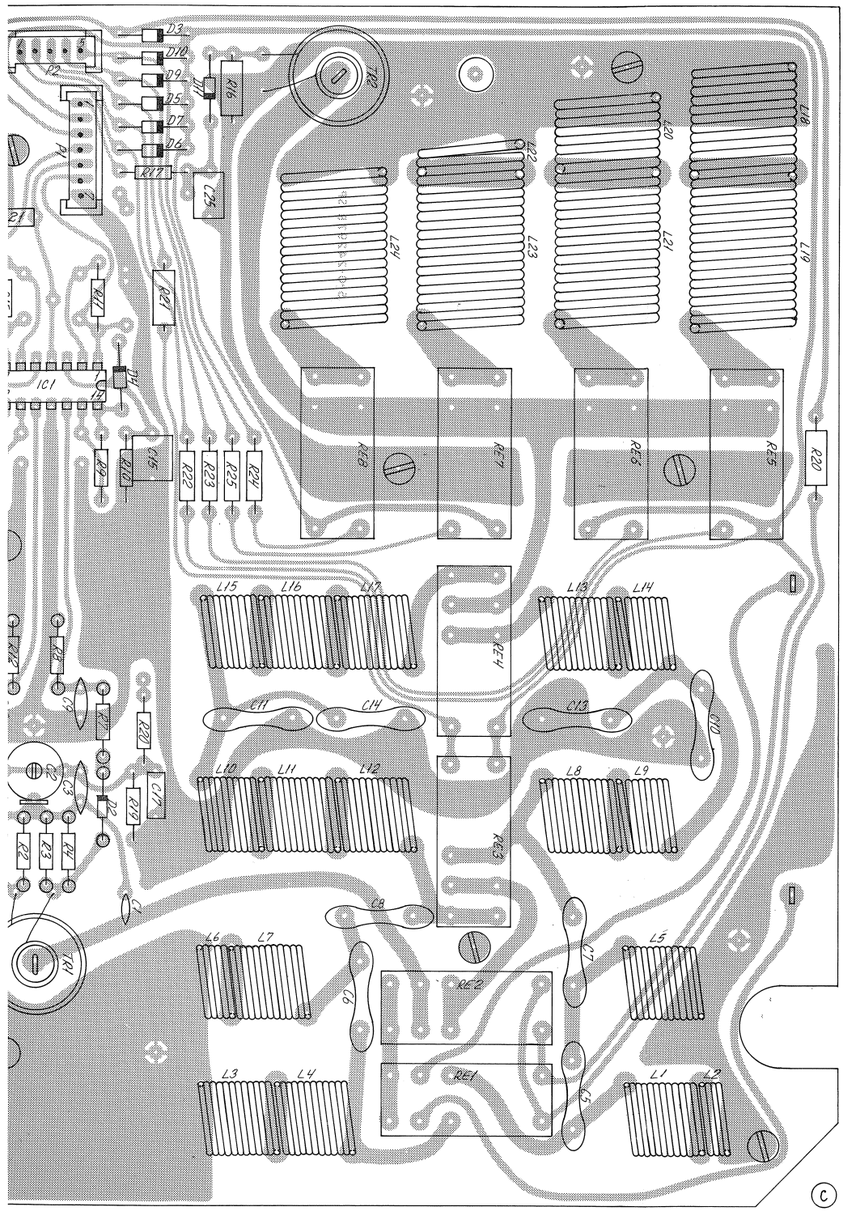


View from component side with lower side tracks.





AERIAL VOLTAGE DETECTOR (MODULE 4)



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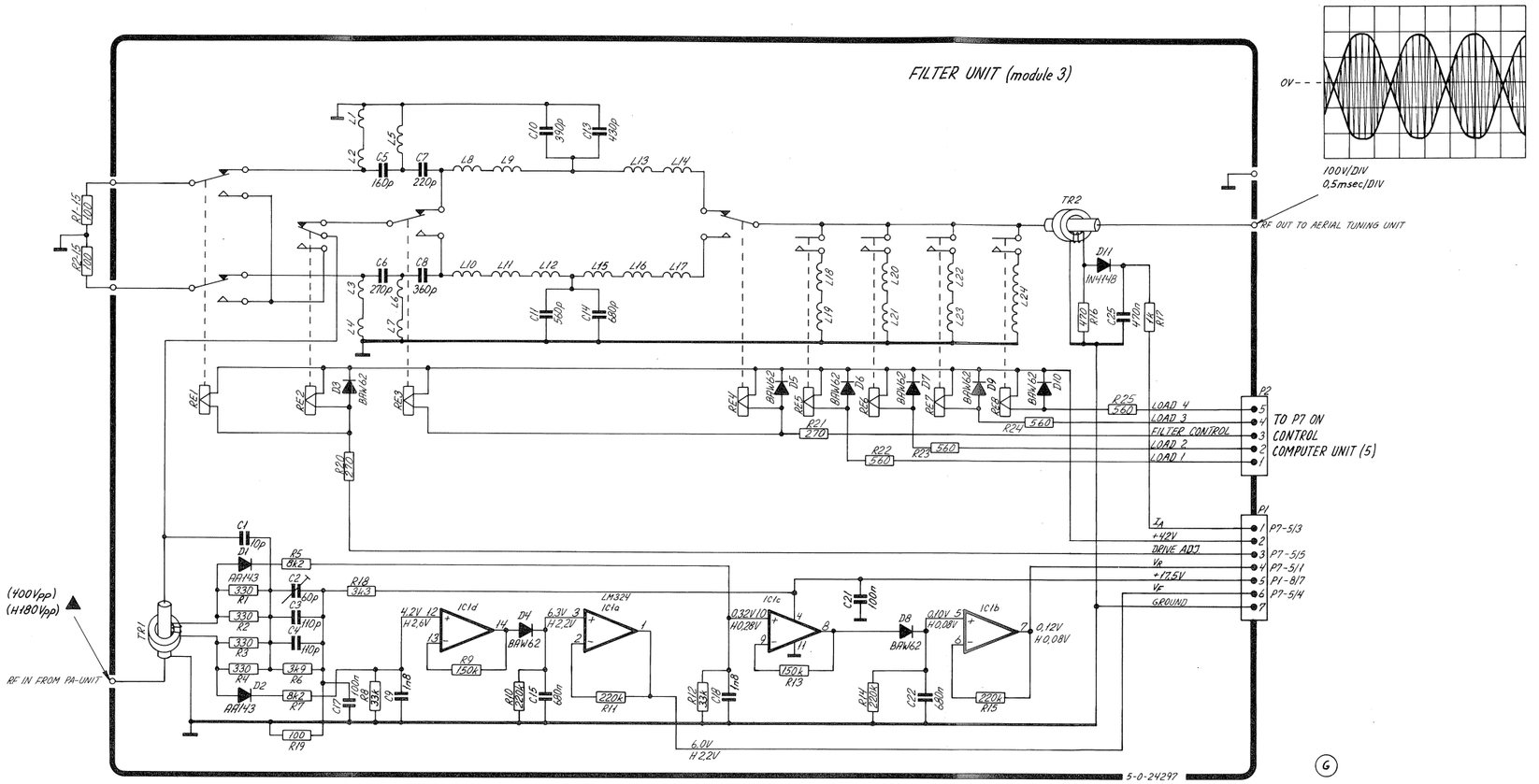


TEST CONDITIONS:

Frequency:	2076 kHz
Mode:	TUNE (transmitter turned to max. output power) or transmitter placed in test group No. 0, test 4 (tx in dummy load).
▲(xxx V_{pp}):	Measured with oscilloscope and passive probe 10 Mohm// 11 pF. (measured value V_{pp}).
◉xxx V:	Measured with diode probe.
DC Voltmeter:	Voltage without brackets in diagram meter input impedance 10 Mohm.

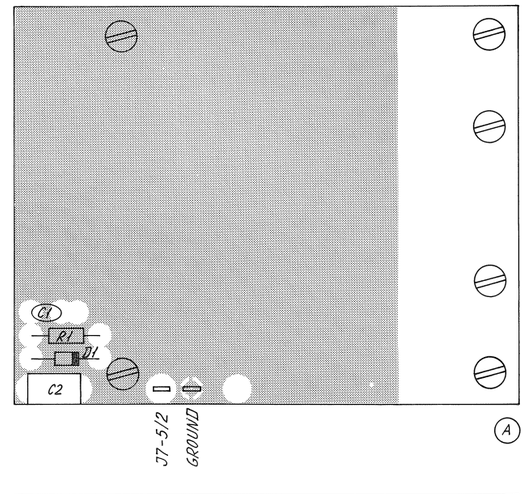
Test conditions changed to measure the carrier levels.

Frequency:	2076 kHz
Mode:	Transmitter placed in test group No. 0 test 3 (tx step 31 fixed) and modulation mode is H3E.
▲(H xxx V_{pp}):	Measured with oscilloscope.
◉H xxx V:	Measured with diode probe.

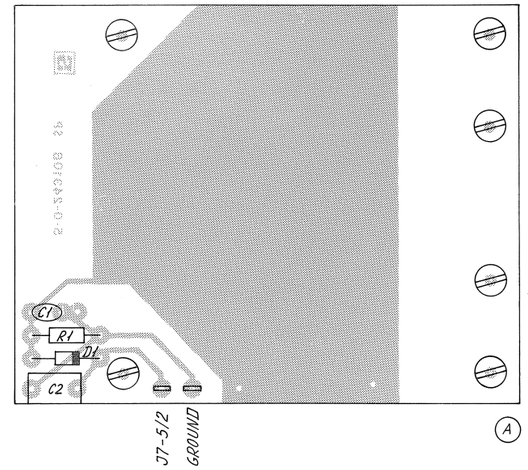
5.4. AERIAL VOLTAGE DETECTOR (MODULE 4)

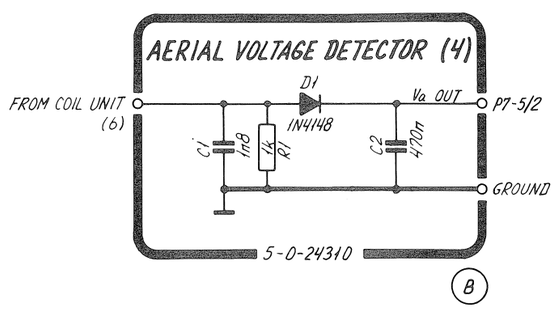
The aerial voltage detector is connected to the aerial via a 5 pF capacitor. The detector is a peak detector and its output voltage is proportional to the aerial peak voltage. The output is connected to the control computer unit (500). When the aerial voltage reaches the max. allowed value (the corona voltage) the computer will reduce the output power.

View from component side with upper side tracks.



View from component side with lower side tracks.





AERIAL VOLTAGE DETECTOR (MODULE 4)

5.5. POWER CONTROL COMPUTER (MODULE 5)

KEYBOARD CONTROL COMPUTER

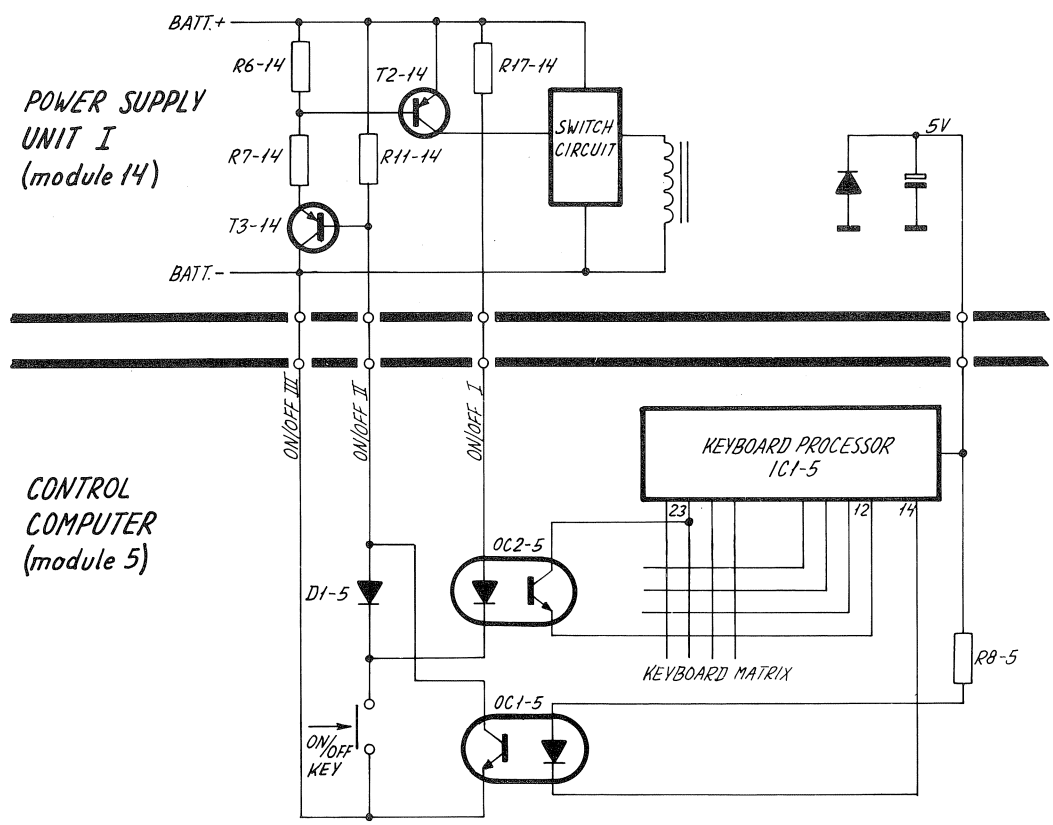
The microprocessor IC1-5 is called the keyboard processor because this processor transfers the input from the keyboard to an understandable information to the remaining electronic circuits. The main functions are as follows:

- on/off control of the power supply (PUI)
- keyboard matrix scanning
- display driving
- frequency setting of the synthesizer
- communication with EEPROMS
- scanning of external inputs
- control of the load, resonance and the 2.7 MHz filter
- control of exciter mode (H3E, R3E and J3E), the microphone on/off and generation of the tune and alarm tones.
- control code to power control processor IC16-5.

ON/OFF CONTROL OF THE POWER SUPPLY (PUI)

When the on/off key is pressed the transistors T3-14 and T2-14 and hereby the switch circuit in power unit I are switched on supplying 5V DC to the microprocessor IC1-5. The processor is reset and a start-up procedure takes place. During this procedure the processor checks if the diode in OC2-5 is still on. If this is the case the diode in IC1-5 is switched on and hereby keeping the power unit I on when the on/off key is released. The status of the on/off key is checked via OC2-5, and if the key is activated the microprocessor switches off the diode in OC1-5 and by releasing the key again the power unit I is switched off.
If the 5V DC voltage disappears or gets below 4.1V DC, the microprocessor will turn off the diode in OC1-5 and hereby switch off power unit I. This reset function is attended by the voltage comparator IC2b-5 and the transistor T22-5 which is connected to the microprocessor reset terminal.

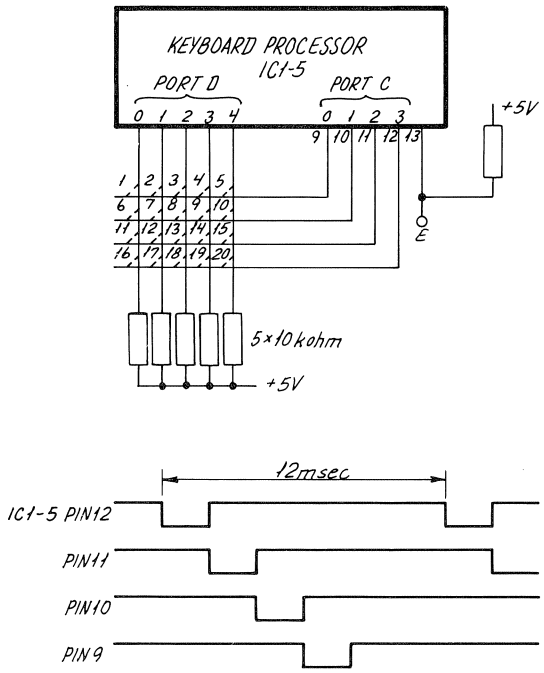
FIG. 1



KEYBOARD MATRIX SCANNING

The keyboard is a 4*5 matrix which is scanned every 12 msecs. The output pins at port C are turned low as shown in fig. 2. During every low period the microprocessor scans the port D input pins. If they are all high the keyboard is not activated. If one of the port D input pins is low, one of the keyboard buttons is pressed and the microprocessor leaves the scanning sequence and performs the command indicated by the activated button.
When the alarm tone generator is started it is not possible for the microprocessor to scan the full keyboard matrix. The scanning takes place during the pause between the two alarm tones and because the pause is 3 msecs only the keyboard buttons ENT, TEST ALARM and SEND ALARM are scanned. ENT is used to stop alarm tone generator. TEST ALARM and SEND ALARM are scanned to make it possible to start transmitting the alarm tone signal when the TEST ALARM is chosen.

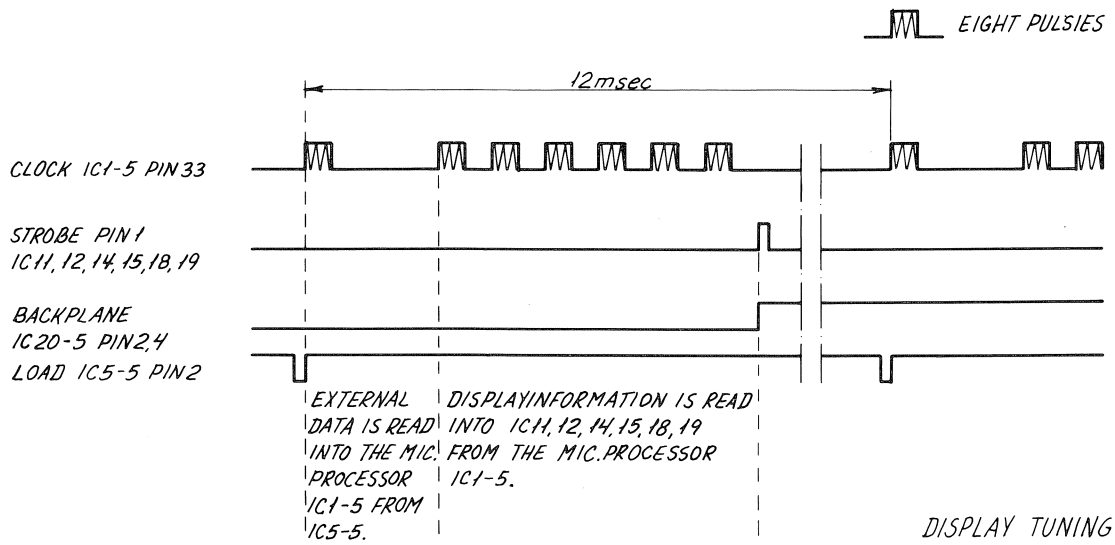
FIG.2



1. POWER DOWN
2. SEND ALARM
3. 1
4. 2
5. 3
6. POWER UP
7. STORE
8. 4
9. 5
10. 6
11. TEST ALARM
12. FIX. 2182
13. 7
14. 8
15. 9
16. SHIFT
17. ON/OFF
18. 0
19. POINT
20. ENT.

DISPLAY DRIVING

The LCD display is supplied with an alternating voltage accross the segments. The display drive data from IC11-, 12-, 14-, 15-, 18-, and 19-5 is alternated in a 12 msecs sequence and the display backplane from IC20-5 pin 2 and 14 is alternated in the same sequence. A segment is illuminated when the phase between the display backplane and the display drive data is opposite and it is not illuminated when the two signals are in phase.
The display drive latches IC11, 12, 14, 15, 18, 19 are loaded with serial data from the microprocessor IC1-5 and the display backplane is via the buffer IC20-5 driven from IC1-5 too. The timing sequence is illustrated below:



When the microprocessor IC1-5 is generating the alarm tones, the display drive data is only alternated every 250 msec.

FREQUENCY SETTING OF THE SYNTHESIZER

When the ENT button, after keying-in a new frequency, is activated, the microprocessor IC1-5 will calculate and load the data for the synthesizer. This data consists of nine 8-bit words divided in four groups (fraction F, integer A, dividing figure N, and a reference dividing part). The fraction is loaded as an eight bit data word. The other words are divided in a four bit data word and a three bit address word. The loading order is shown in figure 4.

Fig. 4.

DATA TO SYNTHESIZER

IC1-5	Port B bit 7 6 5 4 3 2 1 0	Port C bit 7 6	
Fraction F	8 bit data		F loaded
Integer A	Addrs. DATA A		A loaded
	Addrs. DATA A		
Dividing Figure N	Addrs. DATA N		
	Addrs. DATA N		N loaded
	Addrs. DATA N		
	Addrs. DATA REF		
	Addrs. DATA REF		REF loaded
	Addrs. DATA REF		

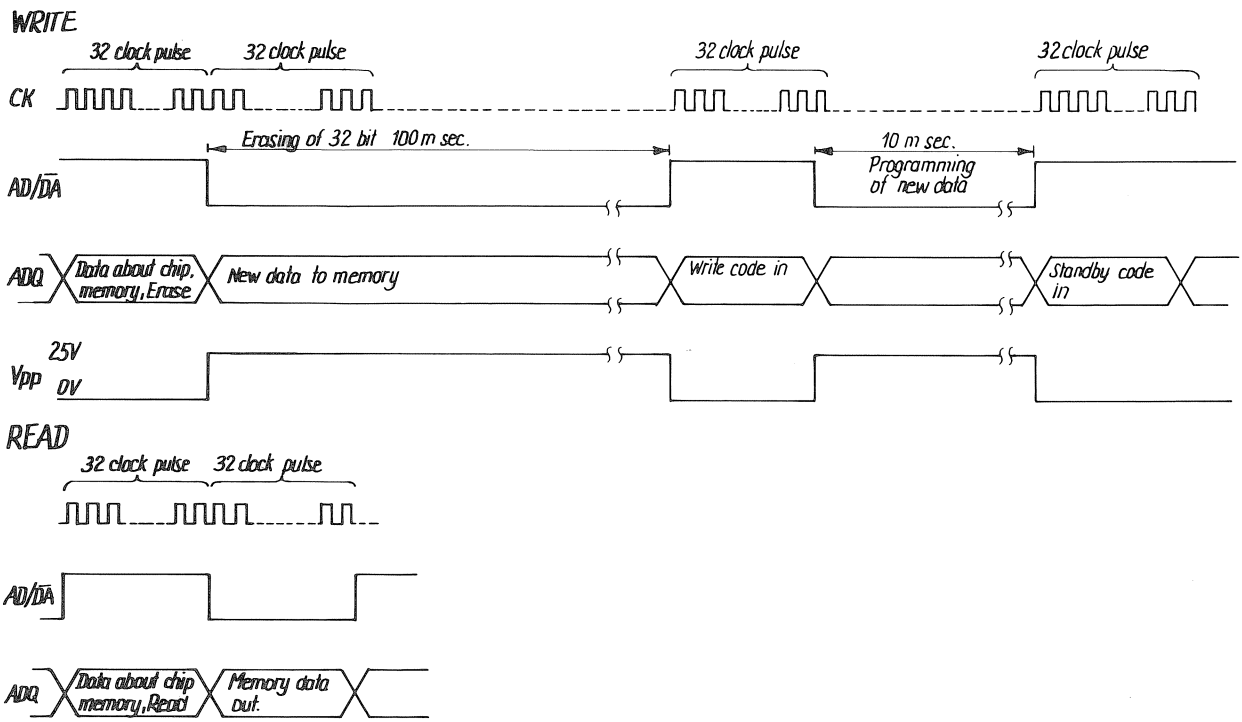
VCO selection via IC3-5

	Pin 4	5
Frequency range 1.6000 - 2.8999 MHz	0	1
2.9000 - 4.2999 MHz	1	0

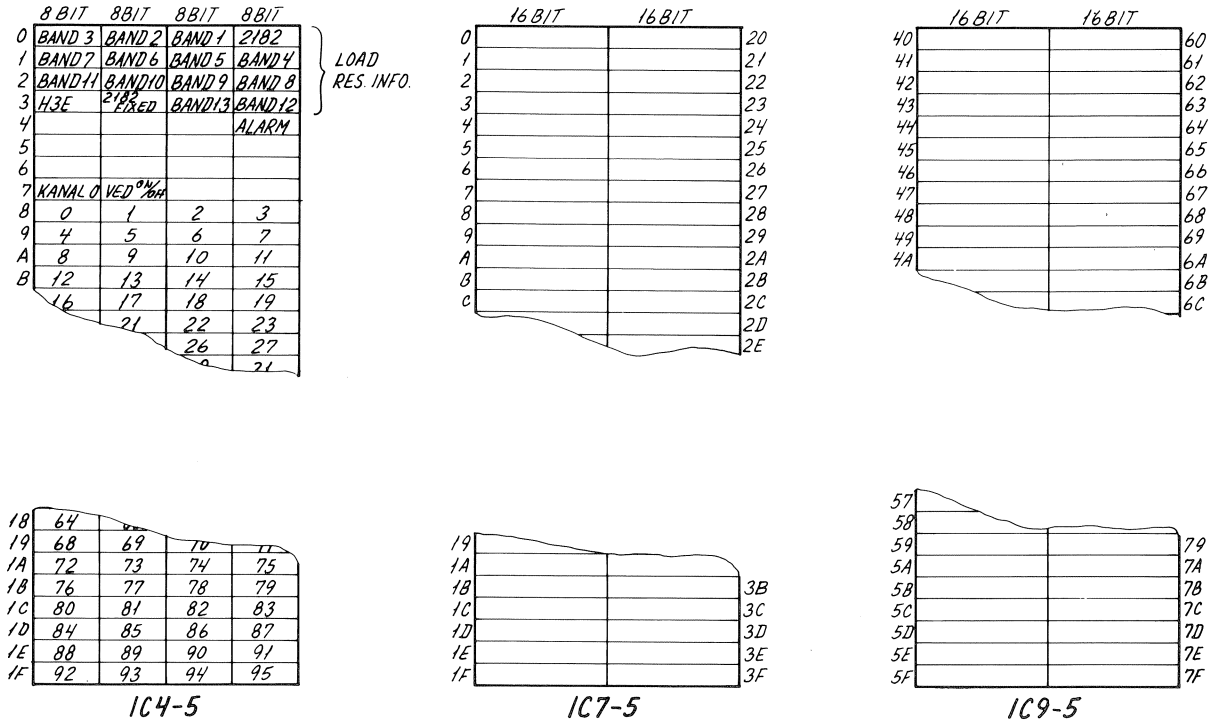
EEPROM COMMUNICATION

In the EEPROM's IC4-, IC7- and IC9-5 the frequency information, the quick select register, the load, the resonance, and the information to band 14, 15, and 16 are stored. The information exchange between the EEPROM's and the microprocessor IC1-5 takes place on three control lines named ADQ, CK, and AD/DA.

The ADQ line is the data exchange line controlled by the clock pulses on the CK line. The AD/DA line controls the data direction, the READ, WRITE or ERASE information. As the control lines to the three EEPROMS are the same it is necessary to address to which EEPROM access is wanted. This is done at the beginning of a READ or WRITE sequence. The chip address is hard wired on pin 5, 8, 9, and 10.
If an EEPROM is addressed with an erase or write sequence, pin 1 will turn low and cause transistor T27-5 to connect pin 4 to 24.5V DC, which is necessary to write or erase into the EEPROMS.
The EEPROM used is organized as 32 words by 32 bits meaning that all data exchange is formed as 32 bit words. The actual timing of the data transfer is shown below.



The data stored in the EEPROMS are arranged as shown below. In IC4-5 the data concerning the load, resonance, the band 14, 15 and the quick select register information are stored. In IC7- and IC9-5 the frequency information is stored.



SCANNING OF EXTERNAL INPUTS

Because of the limited number of inputs to the microprocessor IC1-5, some of the external inputs are connected to IC5-5. In IC5-5 the input data are transformed from parallel to serial data, which is loaded into the microprocessor (pin 17) every 12 msecs from the Q7 (pin 9) of IC5-5.
The external inputs connected to IC5-5 consist of:

Dummy load (IC5-5 pin 12) must be connected to ground when the dummy load is connected to the antenna output terminal. When this is the case it is not possible to send the alarm tone signal on the frequency 2182 kHz.

Handset key (IC5-5 pin 14) is connected to ground when the handset key is activated.

Tune knob (IC5-5 pin 3) is connected to ground when the tune knob is activated.

Tune-up mode (IC5-5 pin 6). When the jumper W1 is placed in position A-B, IC5-5 pin 6 is grounded and the transmitter is switched to tune-up mode. The tune-up mode is chosen when it is wanted to match the transmitter output impedance to the aerial.

CONTROL OF LOAD, RESONANCE AND THE 2.7 MHz FILTER

When a new frequency is entered the load and resonance data from the EEPROMS are read into the microprocessor IC1-5. From the microprocessor these data together with the data to choose the right lowpass filter, are fed to the latches IC3-, IC6- and IC8-5. The output of these latches are connected to the buffer transistors T6-, T13-5, which drive the relays in the COIL UNIT (resonance) and the relays on the FILTER UNIT (load and lowpass filter).

CONTROL OF EXCITER

The exciter control outputs are read from the microprocessor IC1-5 into IC3- and IC8-5 when a change in the information has taken place. From the latches IC3 and IC8 the control information is fed to the exciter unit via the buffer transistors T24-, T25- and T26-5.
In tune mode or during send alarm, transistor T26-5 is switched on, the handset microphone is disconnected from the exciter unit. The transmit modulation mode is chosen via IC3-5 pin 7 and 14.

IC3-5	pin 7	14	Mode
	0	0	J3E
	0	1	R3E
	1	0	H3E

The two tune tones are generated from the microprocessor IC1-5. When the tune knob is pressed the processor starts to generate the tones, one on pin 39 and the other on pin 40. These two tones are added on the basis of transistor T1-5 and the signal is fed to the exciter. The alarm tones are generated on pin 40 and fed via transistor T1-5 to the exciter unit. The audio signal from the receiver (R2022) or the alarm tone signal is amplified in IC2a-5 and transistor T5-5 before it is connected to the handset earpiece.
The transistors T2- and T3-5 control which audio signal is connected to the earpiece and the transistors are controlled by IC8-5 pin 13 and 14.

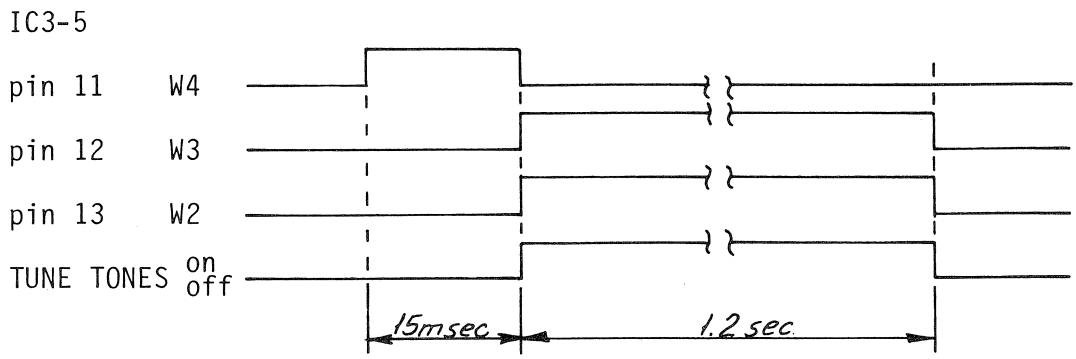
IC8-5	pin 13	14	
	0	0	
	1	0	ALARM
	1	1	TUNE and TRANSMIT
	0	1	RECEIVE

CONTROL CODE TO POWER CONTROL PROCESSOR IC16-5

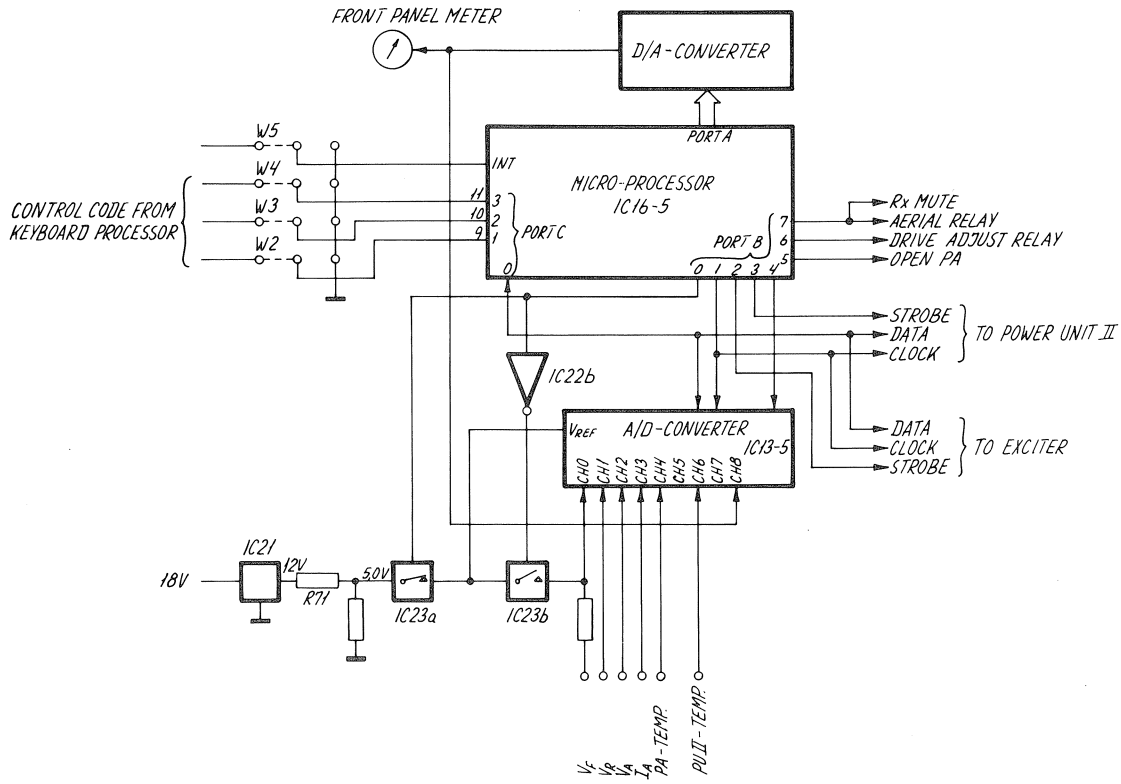
When the microprocessor IC1-5 receives a HANDSET KEY, a SEND ALARM, a TUNE or a 2182 kHz FIXED message the control code IC3-5 pin 11, 12, and 13 are changed to activate the microprocessor IC16-5 in the correct transmit mode.

IC3-5	pin 11	12	13	
	0	0	0	STAND BY
	0	0	1	TRANSMIT LOW POWER
	0	1	0	TRANSMIT MED. POWER
	0	1	1	TRANSMIT FULL POWER
	1	0	0	TUNE

When the keyboard button 2182 kHz FIXED is activated the control codes change as shown below. The reason for this is that the transmitter executes a drive level adjustment procedure to get the transmitter ready to transmit the alarm message.



POWER CONTROL COMPUTER



The microprocessor IC16-5 is called the power control computer because the microprocessor controls the RF output power level. The output power level is a function of the following input signals $V_{Forward}$, $V_{Reverse}$, $V_{Antenna}$, power unit II temperature, power amplifier temperature and the control code supplied from the keyboard processor IC1-5.
These inputs are fed direct to the microprocessor IC16-5, and so is the control code, or fed to an analog to digital converter IC13-5 which is controlled by the power control computer. These inputs are vectorial added in the power control computer and converted to an RF output power level by the serial data to the exciter attenuator and by the serial data to the power unit II, regulating the supply voltage to the power amplifier transistors.
The input signals to the analog to digital converter IC13-5 are connected to pin 1 to 8. The voltage applied to the reference input pin 12 defines the voltage span of the analog input difference between which the 256 possible output codes apply, meaning that the binary value U is equal to $U = \frac{Vin}{Vref} \cdot 255$. IC23a and b are analog switches which are controlled by the power control processor making it possible to change the reference input pin 12 to a fixed 5.0V DC or to $V_{Forward}$.
The front panel meter is supplied from the digital to analog converter consisting of the resistors R60-R65, R66, R94 and IC17-5. The digital to analog converter is connected to port A on the power control computer. The converter has 64 steps and the maximum output voltage is 5.0V DC meaning that each step is approx. 75 mV. From the digital to analog converter a wire is connected to the analog to digital converter IC13-5 pin 8. This connection makes it possible to form a loop to control that the analog to digital converter, the power control processor, and the digital to analog converter work properly.

V_{T-PUII}, expresses the temperature of the switch transistors T1-, T2-, T3-, T4-15 in power unit II. The voltage at the input terminals of the analog to digital converter is approximately equal to V_{TPUII} $T_{PUII} * 12.7 * 10^{-3} + 1.7$.
When the temperature of the power unit transistors exceeds 90°C the fan will start and it will not stop before the temperature is below 80°C. A temperature rise above 90°C will cause the RF power output and the supply voltage V_{CC} to be reduced in the same manner as explained above.

CONTROL CODE: The keyboard processor and the power control processor communicate through the control code. When the control code shows a pattern as described below, the following power modes are chosen.

	Port C 3 W4	2 W3	1 W2	Power Mode
0	0	0	0	Stand-by
1	0	0	1	Low power Tx (-10 dB output power)
2	0	1	0	Med. power Tx (- 5 dB output power)
3	0	1	1	Full power Tx
4	1	0	0	Tune

The interrupt pin (W5) is connected to the keyboard processor, but is not used to any communication (is always high).

Port B of the power control processor IC16-5 is used as a data output port.

Bit no. 0: controls the reference voltage to the analog to digital converter, 5.0V DC or $V_{Forward}$.

Bit no. 1: controls the clock pulse to the exciter attenuator latch, to the power unit II latch, and to the analog to digital converter IC13-5.

Bit no. 2: controls the strobe pulse to the exciter unit II latch.

Bit no. 3: controls the strobe pulse to the power attenuator latch.

Bit no. 4: controls the chip select to the analog to digital converter IC13-5 and is pulled low at the beginning of every convertion period.

Bit no. 5: switches on/off the RF power amplifier through the transistor T21-5.

Bit no. 6: controls the drive adjust relay through the transistor T19-5. This relay connects the RF power amplifier terminals to the built-in 50 ohm dummy load.

Bit no. 7: controls the aerial relay through the transistor T18-5 and the receiver mute output through the transistor T17-5.

Port C, bit no. 0 is used as data input for the analog to digital converter and as a data output port to the exciter attenuator latch and the power unit II latch.

Port A, bit no. 6 and 7 are used as an error code output. This error code can explain if the transmitter will not give any RF output signal where to start trouble shooting.

5.5. **POWER CONTROL COMPUTER (MODULE 5)** cont.

Below is a summary of the inputs to the analog to digital converter and of the control codes from the keyboard processor.

$V_{Forward}$, expresses the forward output power level.
$V_{Reverse}$, expresses the reverse output power level, when the reference input to the analog to digital converter is changed to $V_{Forward}$, the binary output value RHO is equal to $RHO = \frac{Vreverse}{Vforward} \cdot 255.$
From this value the power control processor can calculate the standing wave ratio (SWR) which is equal to $SWR = \frac{1 + RHO}{1 - RHO}$.
When the SWR exceeds two it is necessary to reduce the output power level as shown below.

SWR	Output Power Reduction
<1.98	0.00 dB
<2.05	0.35 dB
<2.13	0.70 dB
<2.21	1.05 dB
<2.29	1.40 dB
<2.38	1.75 dB
<2.47	2.10 dB
<2.57	2.45 dB
<2.68	2.80 dB
<2.78	3.15 dB
<2.89	3.50 dB

$V_{Antenna}$, expresses the peak voltage measured at the antenna output terminal. When the antenna voltage exceeds 3360 V the power is reduced 3.5 dB and will stay reduced until the tune knob is pressed and released. The voltage at the input terminal of the analog to digital converter, which is equal to an antenna peak voltage of 3360 V, is 2.5V DC.

$I_{Antenna}$, expresses the antenna output current.

V_{T-PA}, expresses the temperature T-PA of the power amplifier transistors T7-2 and T8-2. The voltage at the input terminals of the analog to digital converter is approximately equal to $V_{T-PA} = T_{PA} * 12.7 * 10^{-3} + 1.7$.
When the temperature of the power amplifier transistors exceeds 80°C the fan will start and it will stop when the temperature gets below 70°C. If the start of the fan cannot stop the temperature rising, the RF output power will be reduced by a 1.0 dB step and the supply voltage V_{CC} to the power transistors will be reduced by a 1.0 V step.
If the temperature continues to rise the RF output power and the V_{CC} will be reduced by another step. This will continue until the temperature is steady or the output power and V_{CC} is reduced by 10 steps. If the temperature keeps on rising the RF power output will be turned off until the temperature is below 70°C (the fan stops) and the transmitter wil automatically be switched on again.

Below is an error code overview:

IC16-5 pin no. 27	26	Control Code from Keyboard Processor IC1-5 Stand-by	Tune	Full power Tx
1	1	No errors	No errors	No errors
1	0	Temp. too high	Temp. too high	Temp. too high
0	1	V_A overflow	V_F too small	V_F too small
0	0	Not used	Dummy load def.	Must be tuned

DESCRIPTION OF A TUNE PROCEDURE

Shown below is a time diagram which explains in what order a tune procedure takes place.

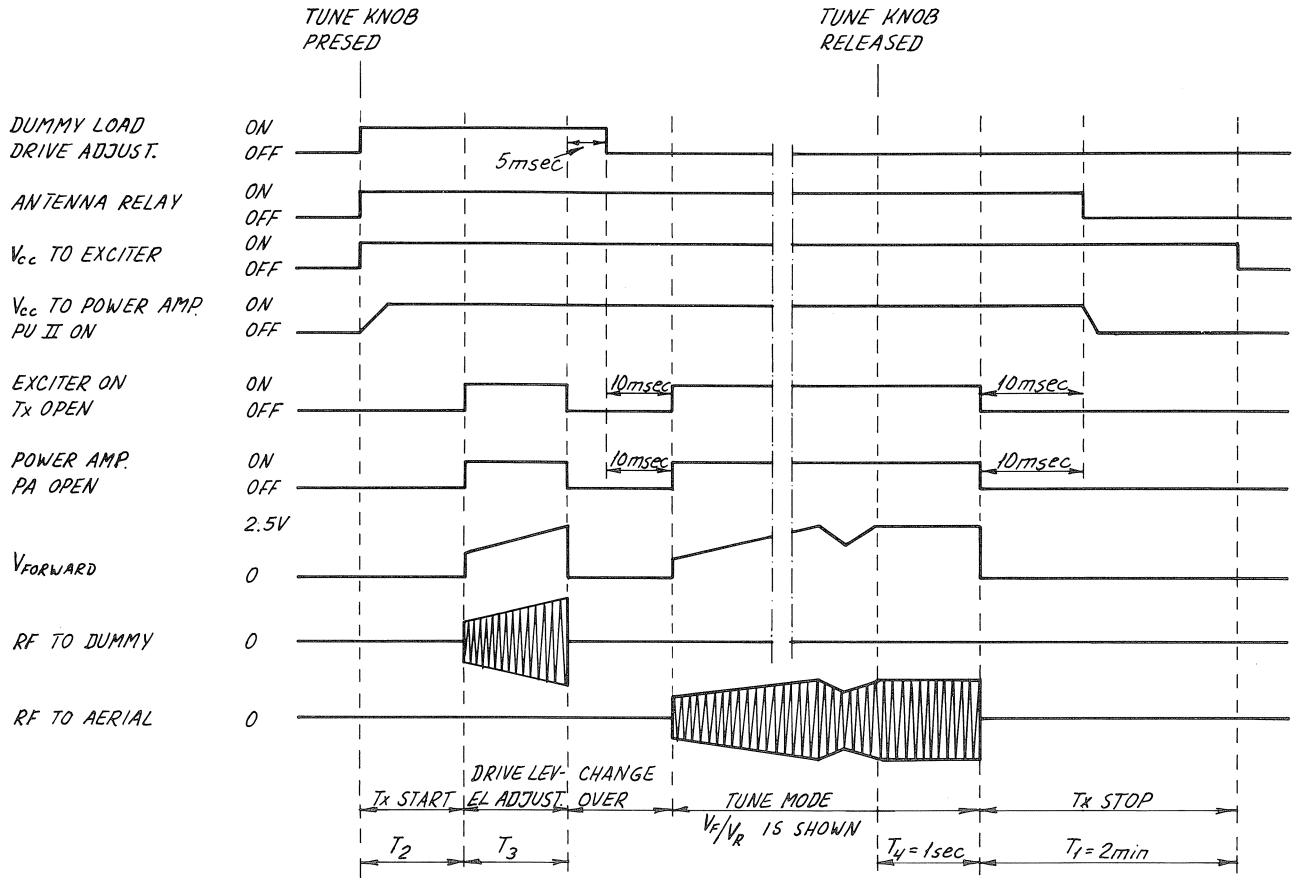
When the tune button is pressed, IC1-5 the keyboard processor starts the tune tones, activates the mic. relay, and changes the control code to IC16-5 the power control processor from stand-by to tune.

The power control processor now activates the power supply to the exciter unit and to the RF power amplifier. The antenna relay connects the aerial to the coil unit and the drive adjust relay connects the RF power amplifier to the built-in 50 ohm dummy load.

After a pause, leaving time to start the power unit II, the RF power amplifier and the exciter unit are switched on and the exciter attenuator is set at a reduced RF level (Step 31). The RF power level is now increased one exciter attenuator step and V_F is measured. If V_F is below 2.5V DC, measured at the analog to digital converter IC13-5 input terminal, the RF output to the dummy load is increased another attenuator step. When V_F is 2.5V DC the exciter and the power amplifier are switched off and the exciter attenuator level is stored in the power control processor as a drive level reference vector.

The drive adjust relay now connects the RF power amplifier to the coil unit, the exciter and the RF power amplifier are switched on again and by turning the tune knob the coil unit can be adjusted to match the aerial. During this procedure the front panel meter will show the ratio V_F/V_R, meaning that maximum meter deflection indicates the best aerial match.

When the tune button is released the transmitter continues in tune mode for approximately one sec. before the control code to the power control processor is changed to stand-by. The exciter is turned off and after 10 msecs the RF power amplifier, the power supply to the RF power amplifier and the antenna relay are turned off. After another period of approximately 2 min. the power supply to the exciter unit is turned off.

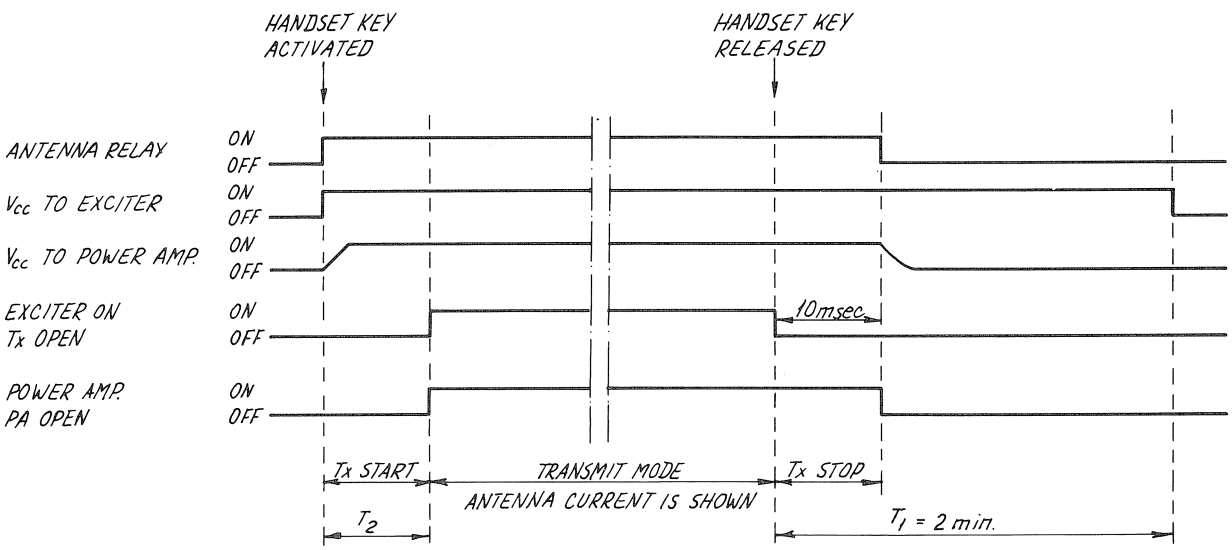


The time T_2 can either be 255 msecs or 765 msecs. If the tune knob is pressed when (PUII) V_{CC} to RF power amplifier is on, T_2 is equal to 255 msecs, and if PUII is off, T_2 is equal to 765 msecs.
The time T_3 is dependent of how many steps the exciter attenuator has to go before full power is obtained. T_3 is typical 100 msecs and can be a maximum of 300 msecs.

DESCRIPTION OF A KEY ON AND KEY OFF PROCEDURE
Shown below is a time diagram which explains in what order a key on/off procedure takes place.
When the key is activated IC1-5 the keyboard processor changes the control code to IC16-5 the power control processor from stand-by to one of the TX on codes (full, med. or low power).

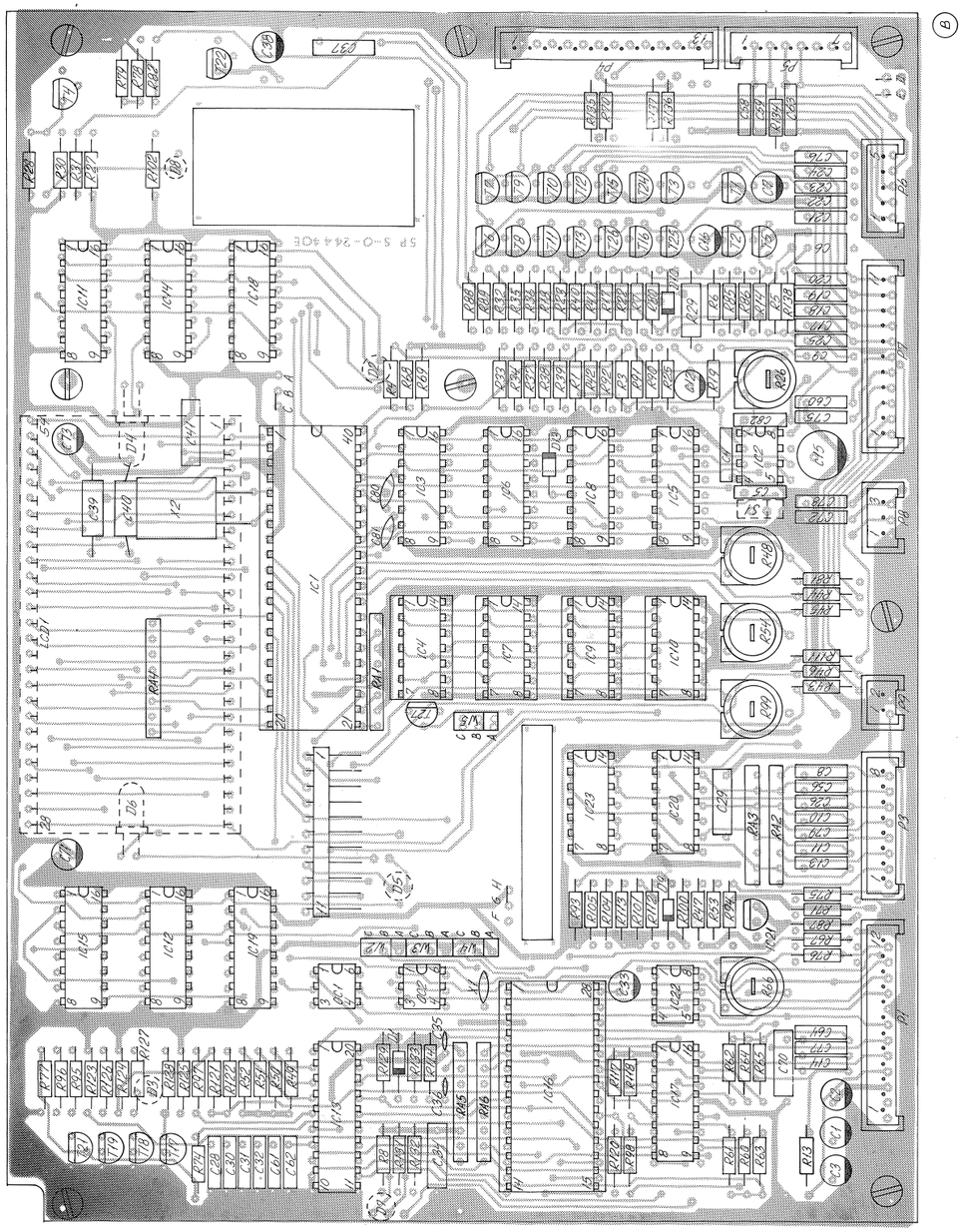
5.5. **POWER CONTROL COMPUTER (MODULE 5)** cont.

The power control processor activates the power supply to the exciter unit and to the RF power amplifier. The antenna relay connects the aerial to the coil unit.
After a pause, leaving time to start the power unit II, the RF power amplifier and the exciter unit are switched on. The exciter attenuator is set to a RF output level found as the vectorial sum of the reference drive level, the standing wave ratio (SWR), the antenna voltage V_A and the temperature at the power amplifier transistors and at the power unit II transistors. It must be pointed out that the RF output power will be reduced if the SWR, V_A, T_{PA} and T_{PU} exceed the limits explained before.
When the key is released the exciter unit is switched off and 10 msecs later the power supply to the power amplifier is switched off.
If the key is not activated the power supply to the exciter is switched off after 2 minutes.

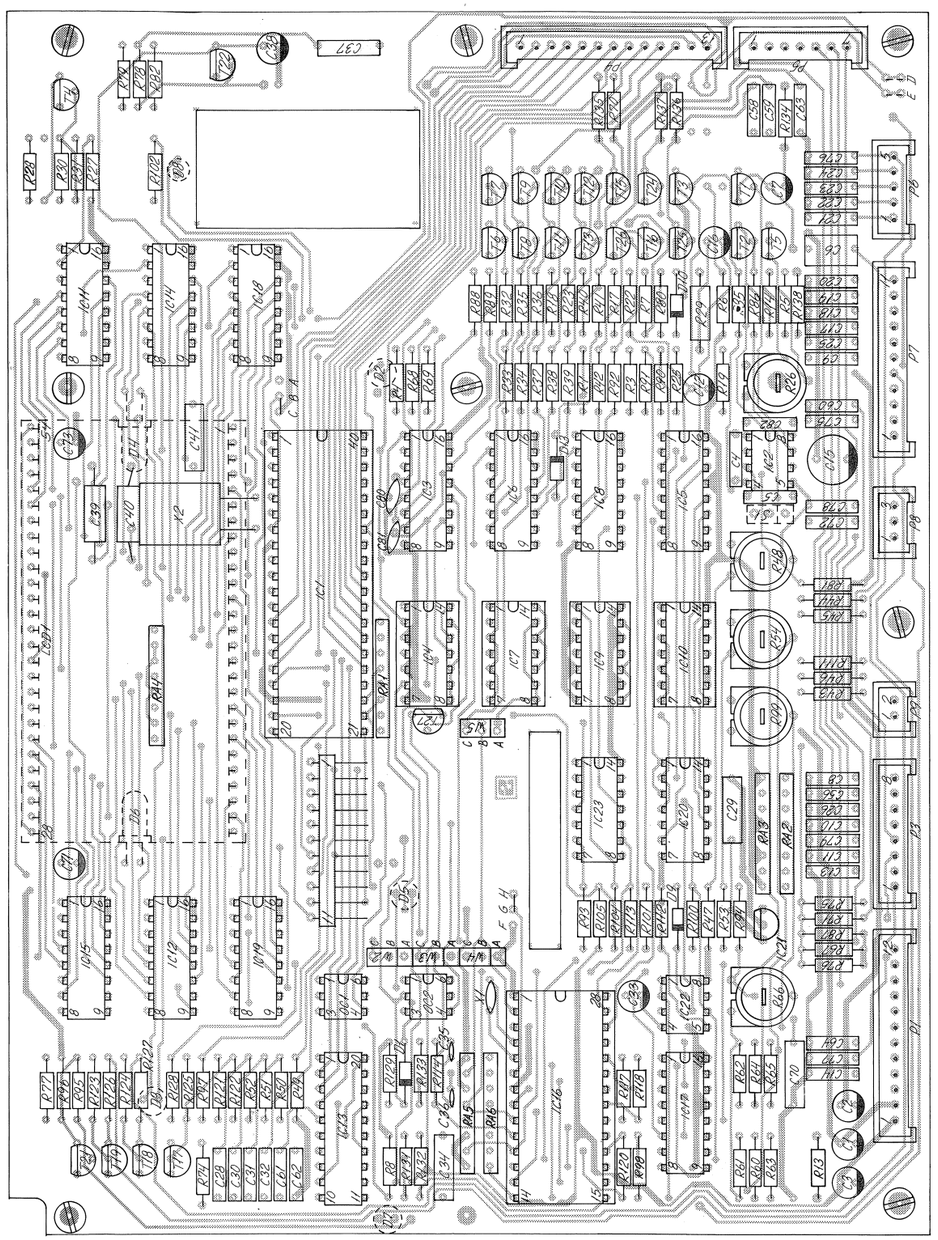


T20-31

COMPONENT LOCATION FOR POWER CONTROL COMPUTER UNIT (MODULE 5)



View from component side with upper side tracks.



View from component side with lower side tracks.

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POWER CONTROL COMPUTER UNIT (MODULE 5)

TEST CONDITIONS:

Frequency:	2076 kHz
Mode:	TUNE (transmitter turned to max. output power) or transmitter placed in test group No. 0, test 4 (tx in dummy load).
▲(xxx V_{pp}):	Measured with oscilloscope and passive probe 10 Mohm// 11 pF. (measured value V_{pp}).
⊙xxx V:	Measured with diode probe.
DC Voltmeter:	Voltage without brackets in diagram meter input impedance 10 Mohm.

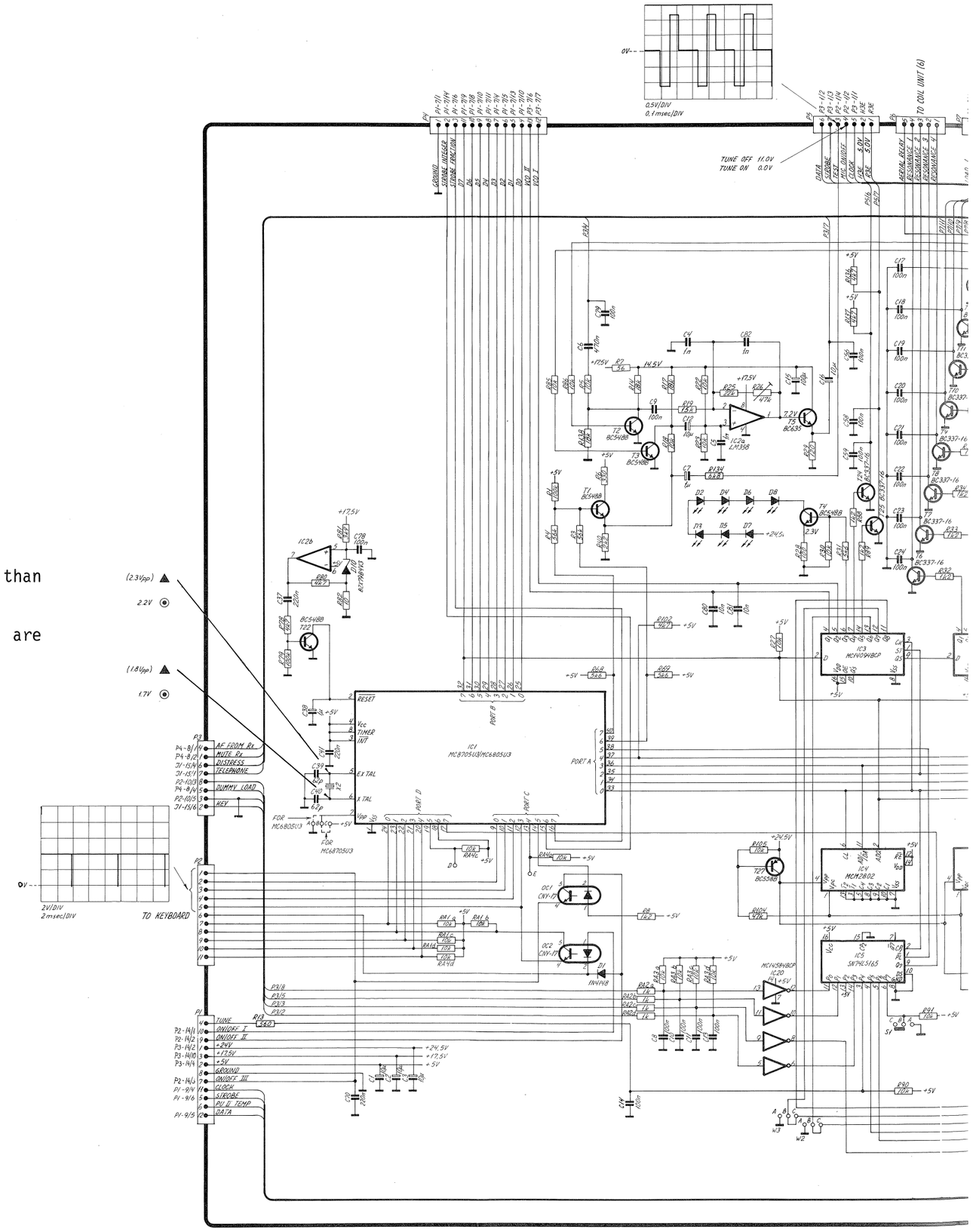
Test conditions changed to measure the carrier levels.

Frequency:	2076 kHz
Mode:	Transmitter placed in test group No. 0 test 3 (tx step 31 fixed) and modulation mode is H3E.
▲(H xxx V_{pp}):	Measured with oscilloscope.
⊙H xxx V:	Measured with diode probe.

This diagram is valid for transmitters with aerial numbers higher than 316006.

In transmitters with a lower serial number the following components are changed:

R46 is 3.9 kohm
R62 is 1.0 kohm

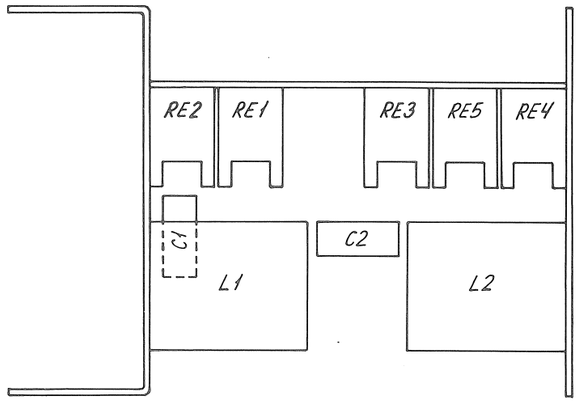


5.6. COIL UNIT (MODULE 6)
(PART OF MAIN CHASSIS)

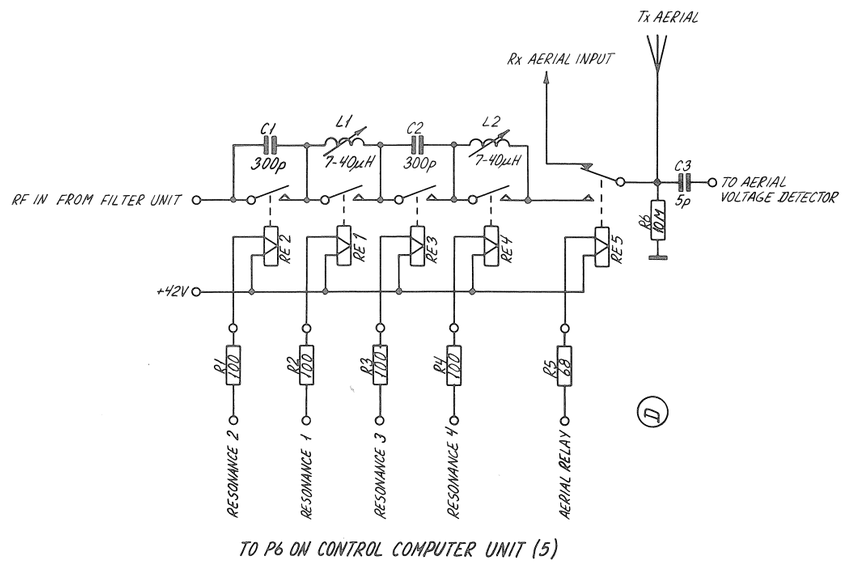
The purpose of the coil unit is to cancel the imaginary part of the aerial. The relays RE1 to RE4 are controlled from the control computer unit. When performing the tune-up procedure you select the settings of the relays.

RESONANCE	RE1	RE2	RE3	RE4
0	x	x	x	x
1		x	x	x
2		x	x	
3		x		
4	x	x	x	
5	x		x	
6	x			

RE5 is the aerial relay and it is activated when the transmitter is keyed. R6 is discharging the aerial.



TOP VIEW



TO P6 ON CONTROL COMPUTER UNIT (5)

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POWER CONTROL COMPUTER UNIT (module 5)

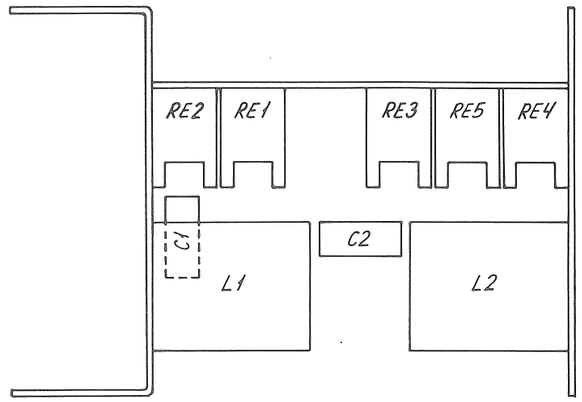
POWER CONTROL COMPUTER UNIT (MODULE 5)

5.6. COIL UNIT (MODULE 6)
(PART OF MAIN CHASSIS)

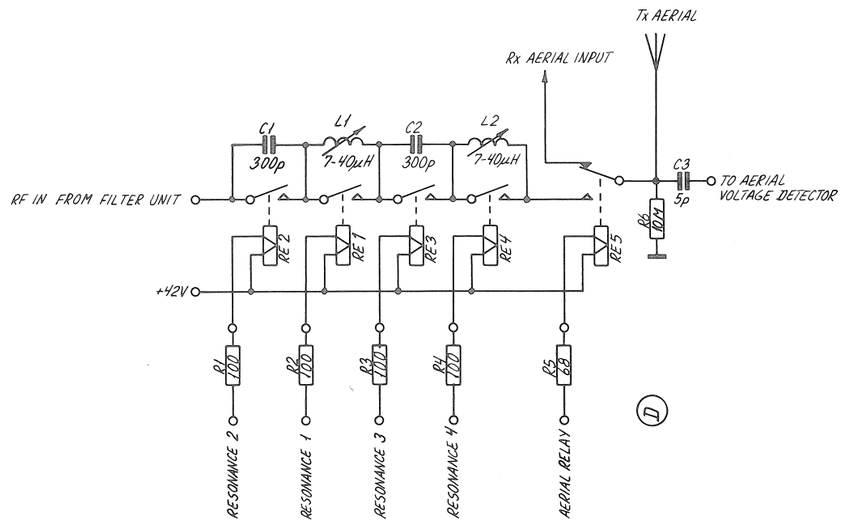
The purpose of the coil unit is to cancel the imaginary part of the aerial. The relays RE1 to RE4 are controlled from the control computer unit. When performing the tune-up procedure you select the settings of the relays.

RESONANCE	RE1	RE2	RE3	RE4
0	x	x	x	x
1		x	x	x
2		x	x	
3		x		
4	x	x	x	
5	x		x	
6	x			

RE5 is the aerial relay and it is activated when the transmitter is keyed. R6 is discharging the aerial.



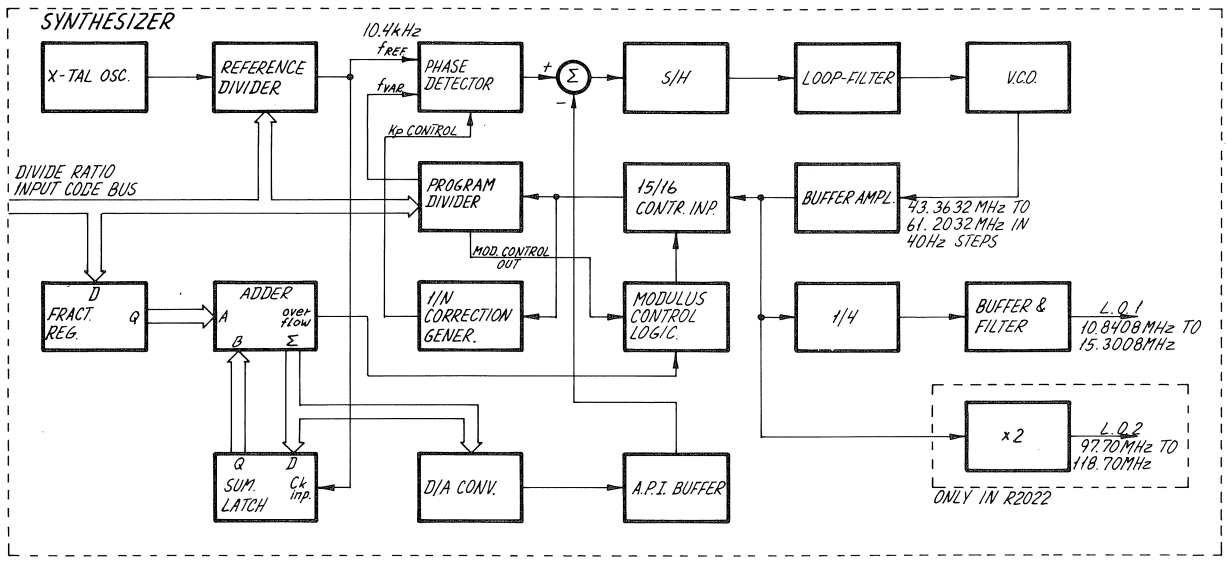
TOP VIEW



TO P6 ON CONTROL COMPUTER UNIT (5)

T2031 C 4-6-24444
4-0-24444D

5.7. FREQUENCY SYNTHESIZER (MODULE 7)



T2031 4-0-25050

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

The loop reference frequency is generated by means of the crystal controlled oscillator built around T2 and the reference divider in IC16. So the reference output for the loop will be at pin 18 on IC16.

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

VOLTAGE CONTROLLED OSCILLATOR

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

DIVIDER CIRCUIT

The programmable divider consists of a dual modulus divider IC3, dividing by 15/16 and a programmable divider included in IC16. The output pulses will be at pin 15 on IC16.
The integer part of the division ratio is determined by the number latched into IC16 and the fractional part by the number latched into IC15.

When the division ratio is an integer, the divider works as a conventional dual modulus divider with the modulus control output from IC16 controlling IC13. When the division ratio includes a fractional part called F, the fraction accumulator IC5, 9, 10, and 15 in conjunction with IC7 increase the division ratio with 1 for every 1/F reference cycles, which means that the mean division ratio will be increased with the fraction F. By using an 8 bit accumulator and a reference frequency of 10.24 kHz = 40 x 2^8 Hz, a synthesizer resolution of 40 Hz is reached.
The increase in division ratio by 1 is done by pulling the modulus control input, pin 6, on IC3 low for one output cycle of this divider; IC7 secures a correct timing in this cycle.

PHASE DETECTOR CIRCUIT
The phase/frequency detector is of the sample and hold type.
IC20 with C61, C62 forms an integrator. When a constant current is drawn through diode D8, the output voltage at pin 6 of IC20 will increase linearly with time. Diodes D6 and D8 constitute a switch controlled by flip-flop 1 in IC1 and level shifting transistor T13. When the output from the reference divider (pin 8 on IC12) goes high, the Q1 output (pin 5 on IC1) goes low, turning T13 off, so the constant current drawn by T14 is forced to flow through D8 with a linearly increasing output voltage of IC20 as a result. When the programmable divider delivers an output pulse, the flip-flop output (pin 5, IC1) changes back high, turning T13 on, which forces the current drawn by T14 to flow through D6, resulting in a constant output voltage at the integrator. The output voltage reached by IC20 is sampled by the sampling circuit formed by T17, C72, and IC23, every reference cycle.
The output voltage will be a measure of the phase difference between the reference signal and the variable divider output signal. If the input frequency/phase of the divider input increases, the integrator output voltage decreases, and vice versa.
The phase detector constant, V_{out}/ O_{in}, is determined by C61, C62 and the current drawn through T14. Increasing current means increasing phase detector constant.
The current drawn through T14 is determined by the constant current sink, formed around IC19, and the diode switch with D3 and D4. The switch is controlled by counters IC13, 14 through flip-flop 2 in IC1 and level shifting transistor T10. By counting a constant number of output pulses from the prescaler IC3, in every reference cycle, the synthesizer output frequency variation is converted linearly to a duty-cycle variation of the square wave produced at pin 9 on IC1. By controlling the diode switch D3 and D4, and so the current through T14, with this square wave, the phase detector constant will increase proportional to the synthesizer output frequency, or the loop division ratio as you wish, and so keeping loop gain constant over the entire frequency range. The nominal value of the phase detector constant is adjusted by means of potentiometer R44.
IC6 and IC11 generate the necessary control pulses for the phase detector, which includes a short delay from the integrator has ramped up to the sample pulse to T17 is generated, followed by a short-circuit of integrating capacitors C61, C62 via T16, preparing the integrator to the next cycle.

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

ANALOG PHASE INTERPOLATOR
When a non-integer division ratio is used in the loop, some unwanted spurious sidebands, caused by the digitizing process, will appear at the VCO output. To reduce the level of these sidebands, a socalled A.P.I. (Analog Phase Interpolator) formed by the phase accumulator IC5, 9, 10 and 15 and D/A-converter IC4, generates a correction signal to the phase detector output.
The VCO control voltage is corrected by drawing the correction-current from IC4 through R73 via T15. The reference current for the D/A-converter is taken from the current-mirror formed around IC19, to get the correction term matched to the phase detector constant over the entire temperature range. The nominal value of the reference current is adjusted by means of the potentiometer R57.

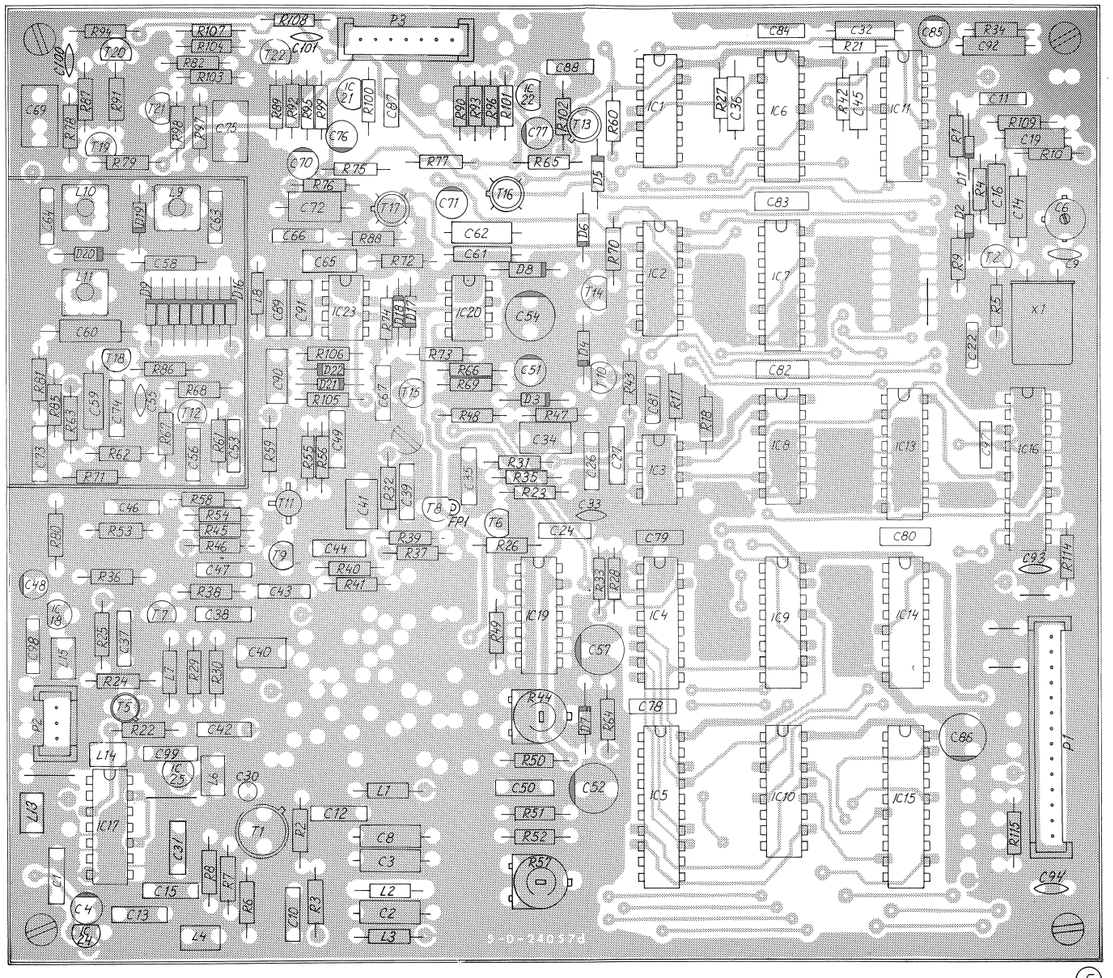
OUTPUT SIGNAL CIRCUITS
The VCO signal is fed to the common buffer amplifier formed around T9 and T11. The amplifier output is split into two signal paths, i.e. to the loop divider through T6 and T8 and to the L.O.-1 output divider through T5 and T7.

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

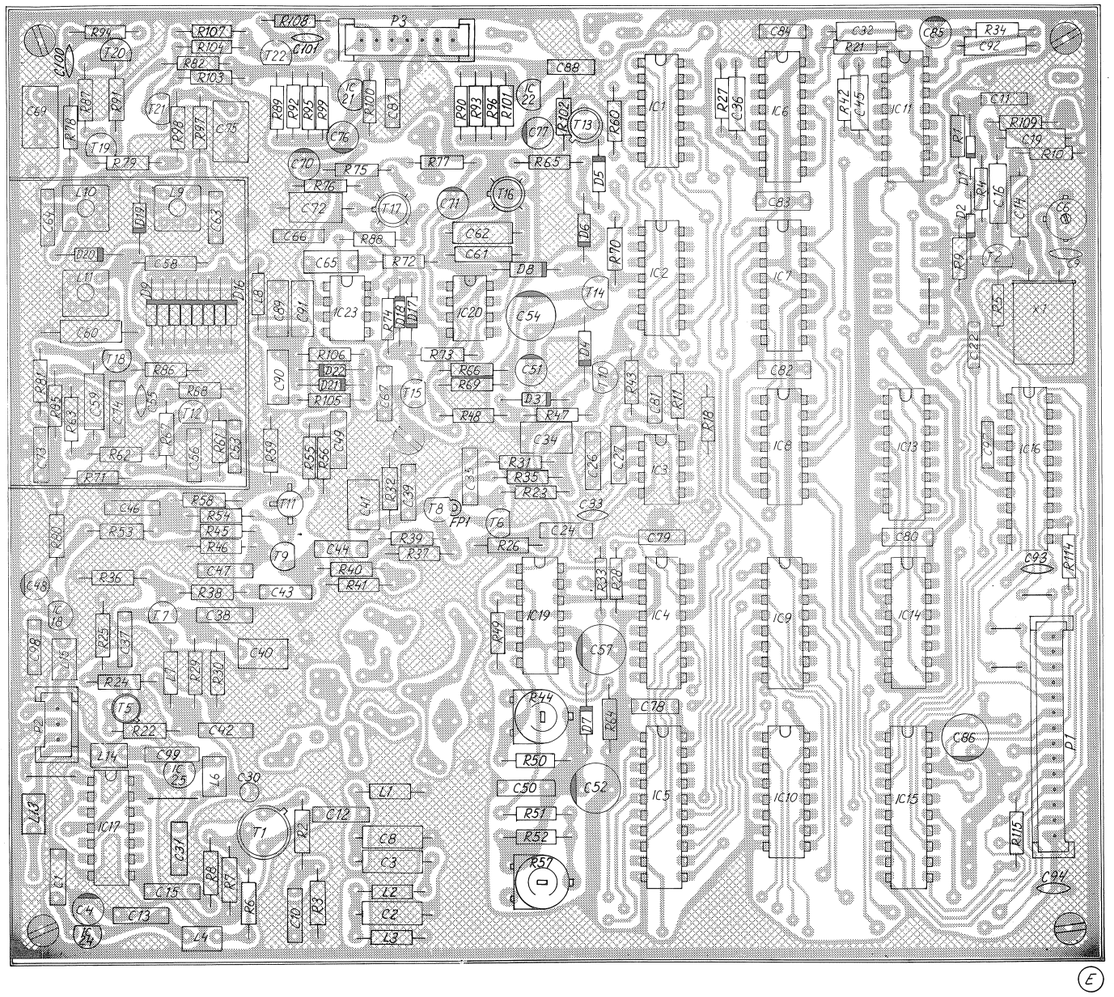
The divider output is amplified in T1 before the final filtering.

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

INTERNAL POWER SUPPLIES
Besides the above mentioned function determined blocks, the synthesizer board includes several internal voltage regulators with the filtering belonging to them.
IC18, 24 and 25 are fixed regulators supplying respectively, VCO with buffer amplifier, L.O.-1 output amplifier and the fixed output divider.
IC21 and 22 are adjustable regulators, generating the internal ±15.0V DCsupply. By means of the resistor-sets R89, R92, R95, and R99 respectively R90, R93, R96, and R101, the appropriate resistor combination is selected to get an output voltage error below 1%.



View from component side with upper side tracks.



View from component side with lower side tracks.

FREQUENCY SYNTHESIZER (MODULE 7)

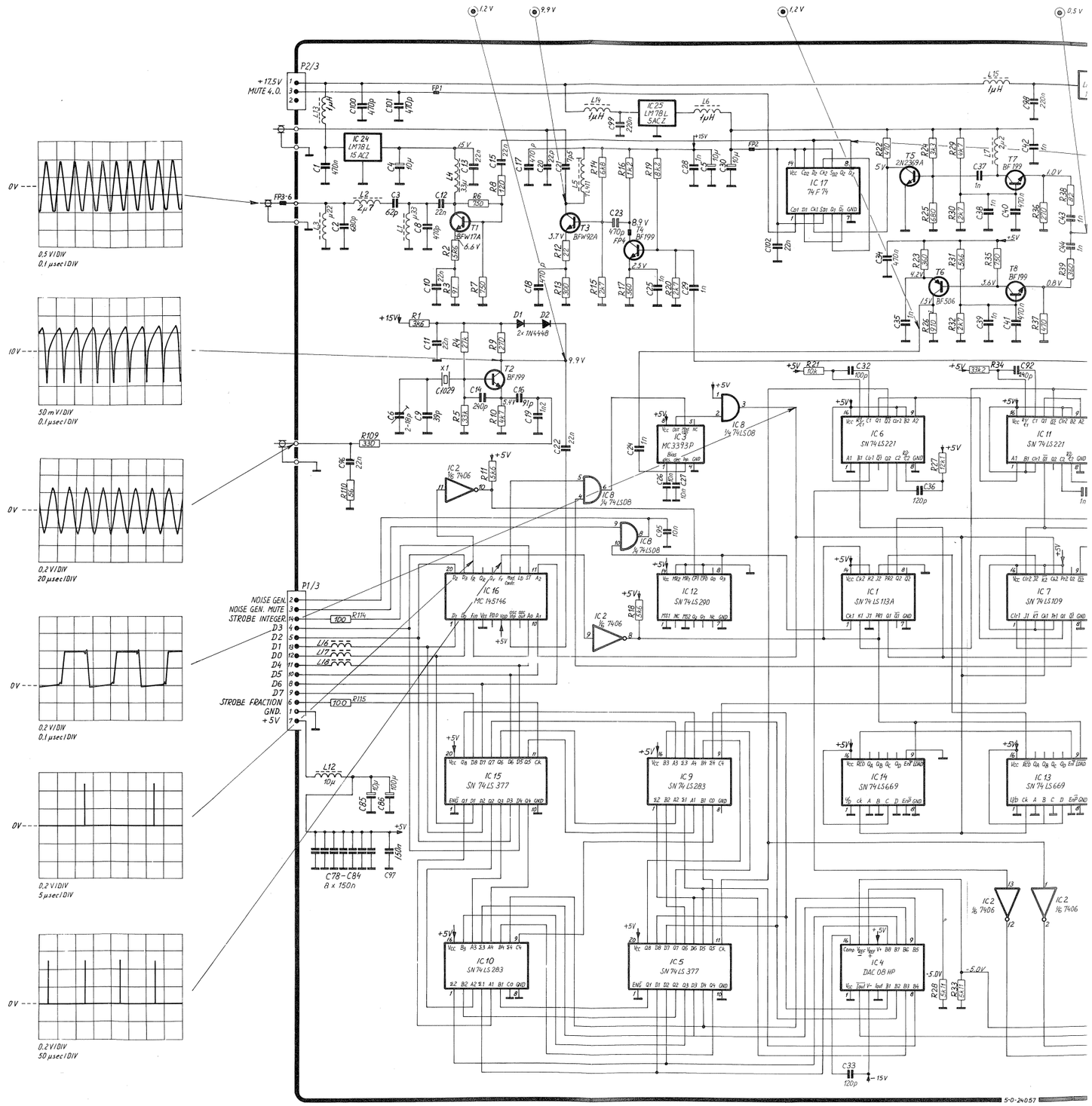
T2031A 4-6-24057E

TEST CONDITIONS:

Frequency:	2076 kHz
Mode:	TUNE (transmitter turned to max. output power) or transmitter placed in test group No. 0, test 4 (tx in dummy load).
▲(xxx V_{pp}):	Measured with oscilloscope and passive probe 10 Mohm// 11 pF. (measured value V_{pp}).
⦿xxx V:	Measured with diode probe.
DC Voltmeter:	Voltage without brackets in diagram meter input impedance 10 Mohm.

Test conditions changed to measure the carrier levels.

Frequency:	2076 kHz
Mode:	Transmitter placed in test group No. 0 test 3 (tx step 31 fixed) and modulation mode is H3E.
▲(H xxx V_{pp}):	Measured with oscilloscope.
⦿H xxx V:	Measured with diode probe.



FREQUENCY SYNTHESIZER (module 3)

FREQUENCY SYNTHESIZER (MODULE 7)

5.8. GENERAL DESCRIPTION FOR POWER UNIT II

The converter converts the battery voltage nom. 24V DC to two different voltages used by the RF power amplifier. 42V DC to the output stage and 12V DC to the driver stage. The converter is controlled by a microprocessor which can turn on/off and reduce the output voltage of the converter.

TECHNICAL DATA

Input Voltage:	21.6 to 31.2V DC
Input Current:	max. 45A DC (tuning)
Output Voltage:	42V DC ±10% 12V DC ±1V
Output Current:	42V DC: 17A current limited. The output current is limited to 17A when the output voltage is between 42V and 10.5V. For voltages lower than 10.5V the current limiter action is foldback. 12V DC: 3A not protected.
Operation Temperature Range:	-20°C to +55°C
Fuse:	40 Amp. 7.14 x 32
Noise on Input:	Less than Chispr level K

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PRINCIPLE OF OPERATION

The converter is an insulated forward push-pull converter working at 20 kHz. It is provided with a serial interface to a processor. The processor can turn the converter on/off and regulate the output voltage from 42V DC to 25V DC in 15 steps. The processor can turn on/off the blower and the exciter too. An input from PUI delivers the necessary power to the secondary control circuit. The converter cannot work without the processor and PUI connected.

CIRCUIT DESCRIPTION "THE PRIMARY SECTION"

The Output Stage

The circuit operates as an insulated forward push-pull converter. The two pairs of transistors T1-15, T2-15 and T3-15, T4-15 feed current into the main transformer TR1-15. The ON time of these transistors is controlled by IC4-9. The two pairs of transistors operate in anti-phase to achieve equal voltsec. in the main transformer TR1-15 and thus avoiding DC magnetizing of TR1-15. The output current from TR1-15 is full wave rectified by D3-15 and D4-15 and fed to the inductor L1-15. The energy is stored in this inductor and passed to the load during the T1-15, T2-15 or T3-15, T4-15 ON period. When T1-15, T2-15 or T3-15, T4-15 are OFF, L1-15 has a reverse voltage and forces D3-15 and D4-15 into conduction and TR1-15 into saturation, so energy continues to be supplied to the load, because the diodes and TR1-15 allow a prolonged circulation of the inductive current in L1-15. C8-10 reduces the output ripple voltage produced by the raising and falling of the current in L1-15. The input/output voltage ratio

is determinated by the on/off time (duty-cycle) of the transistors T1-15, T2-15 and T3-15, T4-15 and the turns ratio of the transformer TR1-15. Of these parameters the turns ratio is fixed, so the output voltage is regulated by regulating the duty-cycle.

The Duty-cycle Control

The IC4-9 is an integrated pulse width regulator, where the pulse width is controlled by the voltage on the control input (pin 4). An internal generated saw tooth signal is compared with the control voltage by a comperator. If the control voltage is higher than the saw tooth signal the comperator output is high, else it is low. Thus the output pulse width is controlled by the control voltage. The output from the comperator is alternated between the two outputs (pin 12, 13) by a flip-flop.

The Driver Stage

The output signal from IC4-9 is amplified by T2-9, T8-9 and T3-9, T7-9. The combinations D11-9, T6-9 and D10-9, T5-9 speed up the shift time for T8-9 and T7-9. T7-9 and T8-9 act as constant current sources to ensure that the base currents to the output transistors always are high enough. The signal is then led to the output transistors by the transformers TR1-9 and TR2-9. A Baker clamp connection (D7-9, D8-9, D9-9 and D20-9, D22-9, D23-9) and emitter resistors are used to ensure fast shift speed and current sharing in the output transistor pairs.

The Soft Start

When the converter is turned on the capacitor C12-9 ensures a soft start, and D21-9 works as a fast discharged of C12-9 when the converter is tuned off.

The Undervoltage Control

The IC4-9 has an undervoltage input pin 6. If the voltage is lower than 2.5V the converter is stopped, when the voltage again is higher than 2.5V the converter is soft started. The input voltage is divided by R35-9 and R36-9 and if it is lower than 16.5V DC the converter stops. The undervoltage trip is in addition controlling OC2b-9 via D25-9. If OC2b-9 goes into saturation the converter stops too.

The Fast Current Control

A current transformer TR2-10 is used to measure the currents in the output transistors. The output signal is rectified (D18-9, D19-9) and divided (R31-9, R34-9) and led to the overvoltage input (pin 7), trip level 2.5V. If the transistor current is too high the converter is instantly turned off and soft starts.

The Symmetry Control

The signal from TR2-10 is peak rectified by D2-9, C3-9 and D3-9, C2-9 too. The difference between the two peak currents of the output transistors is amplified by IC2-9 and led to IC3-9. IC3-9 works as a switch controlled by input pin 3, 6. The slope of the saw tooth generator in IC4-9 is controlled by the current running R30-9.
If the current is made higher, the slope of the saw tooth become more steep and the crossing of the control voltage comes earlier resulting in a smaller "on" time for the output transistors. If the current is made smaller the opposite happens.

The current in R30-9 is controlled by the stabilized primary supply voltage and the resistors R27-9, R28-9, R29-9. The resistor R26-9 can be connected to either a fixed voltage established by R22-9, R23-9 or the current error signal from IC2-9 by means of the control input pin 3, 6 on IC3-9. Thus R26-9 shunts more or less current round R28-9 and R29-9. The switching is controlled by one of the output transistor drive signals (D6-9, R16-9, T4-9, R21-9).
When the control voltage is low the connection between R26-9 and the fixed voltage R22-9, R23-9 are established, (T1-15, T2-15 ON). If the input voltage is constant, the "on" time for T1-15, T2-15 is constant, but the "on" time for T3-15, T4-15 is regulated up or down slowly to obtain equal peak currents in the two pairs of output transistors. In this way we get equal voltsec. in the main transformer TR1-15 and avoid DC-current and in the worst case saturation in TR1-15. This circuit cancels out mismatch in the output transistors and the rectifying diodes.
The symmetry control circuit can be disabled by connecting the base of T4-9 to test point TP6, the output transistors will then get equal on-time.

The Primary Control

The primary voltage supply is turned on/off by OC1-9 and T1-9. T1-9 is normally in saturation but in case of a voltage transient on the mains input, it has a current limit action (because of R4-9 and D5-9) to protect the transient absorber D1-9, IC1-9 stabilizes the supply voltage to 15V DC.

D14 and D17

D14-9 and D17-9 are de-magnetizing diodes.

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The Reverse Input Protection

D1-8 is a reverse polarizing short-circuit and blows the fuse in case of reverse polarizing of the mains connections.

The Input Filter

C1-8, C2-8 - C5-8, L1-8, L2-8, L3-8, C1-10 - C6-10 are the input filter to reduce noise on the mains.

The Peak Current Limiter

TR1-10 is a saturation inductor, it is used to prevent current peaks in the output transistors during the turn on caused by stray capacitance. After approx. 1 us it goes into saturation. When the transistors turn off, the energy stored in TR1-10 will be fed back to the capacitors C1-10 - C6-10 by D1-10 to reduce the power loss.

The Snupper Circuits

D1-11, R1-11, R2-11, C1-11, C2-11 and D2-11, R3-11, R4-11, C3-11, C4-11 are snuppers to keep the output transistors in their safe operating area.
R25-9, C7-9 and R33-9, C9-9 are snuppers to prevent ringing on the base currents.

The other Components

C8-9 is a decoupling of the internal voltage reference in IC4-9.
R32-9 and C10-9 control the switching frequency of IC4-9.
C11-9 and R30-9 control the saw tooth peak to peak voltage and slope.
D24-9 prevents current running to the primary control circuit during the gain adjustment procedure of OC2-9 (factory adjustment).

CIRCUIT DESCRIPTION "THE SECONDARY CIRCUIT"

The Secondary Supply

The power to the secondary circuit comes from PU1 (17.5V DC).
When the power is on, OC1-9 is turned on and the primary supply is on.
The voltage is stabilized by IC8-9 to 15V DC.

The Output Current Amplifier

IC7b-9 is connected as a common mode amplifier to get it less sensitive to noise. It measures the output current by means of R3-10. The output signal from IC7b-9 is or'ed together with the voltage error signal and amplifier by T9-9. T9-9 controls the current in OC2a-9 and thus the control voltage to IC4-9. The current limit levels are set by R65-9. This level is normally produced from the secondary power supply by R65-9, R66-9 and R73-9, but if the output voltage (42V) is lower than approx. 10.5V, D30-9 and R72-9 start to conduct and reduce the output current (foldback). R86-9 and R87-9 offset the input voltages to IC7b-9 to keep it into its common mode voltage range.

The Output Voltage Amplifier

IC7a-9 is connected as a common mode amplifier to get it less sensitive to noise. It measures the 42V output voltage. IC6a9 compares this signal with the voltage on IC6a-9 pin 3. The error signal is then fed to IC2a-9 by T99 and to the control input on IC4-9 (pin 4). The output voltage is adjusted by R81-9. D34-9 protects IC7a-9 pin 3 against too high voltage during turning on PUII.

The Output Voltage Reducing Circuit

IC5-9 is a serial to parallel interface. The output Q1 - Q4 are used to reduce the output voltage of PUII. If Q1 -Q4 are low then the output voltage of IC6b-9 will be approx. 5V and there will be nearly zero current running in R62-9, R63-9, and R70-9 because the voltage on TP4 is 5.1V. The reference voltage on IC6a-9 pin 3 is then 5.1V. If Q1 - Q4 are stepped up binary the output voltage of IC6b-9 will decrease linearly and the reference voltage on IC6a-9 pin 3 will decrease and the output voltage too. R63-9 is used to set the minimum output voltage 42V - 3 dB = 29.7V with a code 1010 (10 decimal).

The PUII Turn ON/OFF Circuit

Output Q5 on IC5-9 is used to turn PUII on/off. When the output is high T10-9 is turned on and T11-9 off. When low, T11-9 is turned on and current runs in OC2a-9 by passing T9-9. This current is so high that it brings OC2b-9 into saturation and D25-9 starts to conduct. The result of this is that the under voltage detector is trigged and the converter stops. When Q5 goes high, the converter starts up in a soft start mode.

The Blower Exciter Turn ON/OFF Circuit

Output Q6 on IC5-9 controls T12-9. T12-9 is an open collector output used by PUI to start the blower.
Output Q7 on IC5-9 is used to control the exciter on/off via PUI.

5.8. **GENERAL DESCRIPTION FOR POWER UNIT II** cont.

The Turn On Delay Circuit

The C17-9, R42-9 and R43-9 combination is connected to delay the output enable input on IC5-9. This is necessary because the serial data bus is not well defined during turn on of the T2031.
D26-9 works as a fast discharge of C17-9, when the T2031 is turned off.

The Diode Snupper Circuit

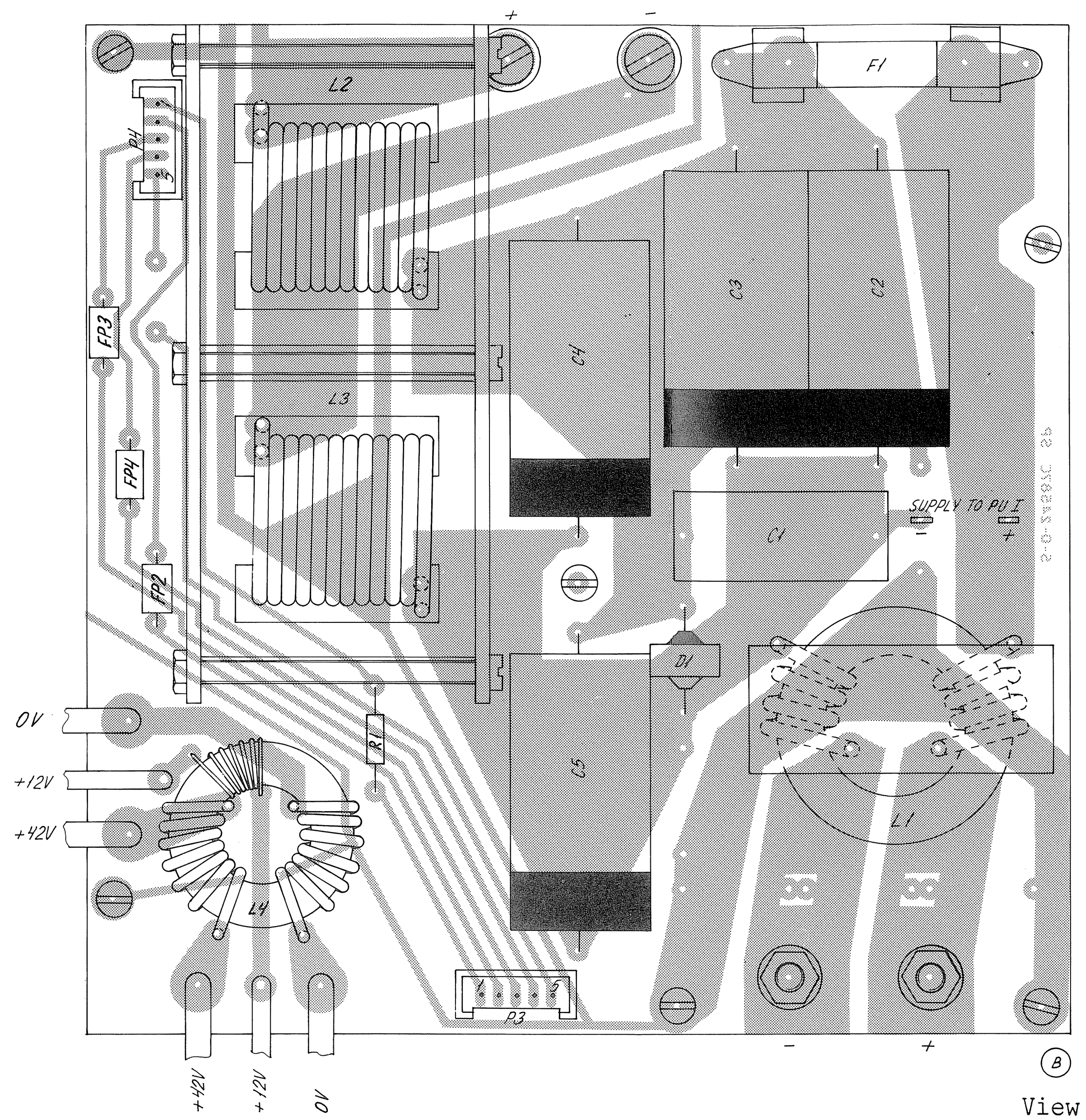
R5-15, C1-15 and R6-15, C2-15 are used to prevent RF-oscillation caused by the diode capacitance and the leakage inductance of the power transformer. This connection is not used on D2-10 and D3-10 because they are not very fast recovery diodes.

The Output Filter

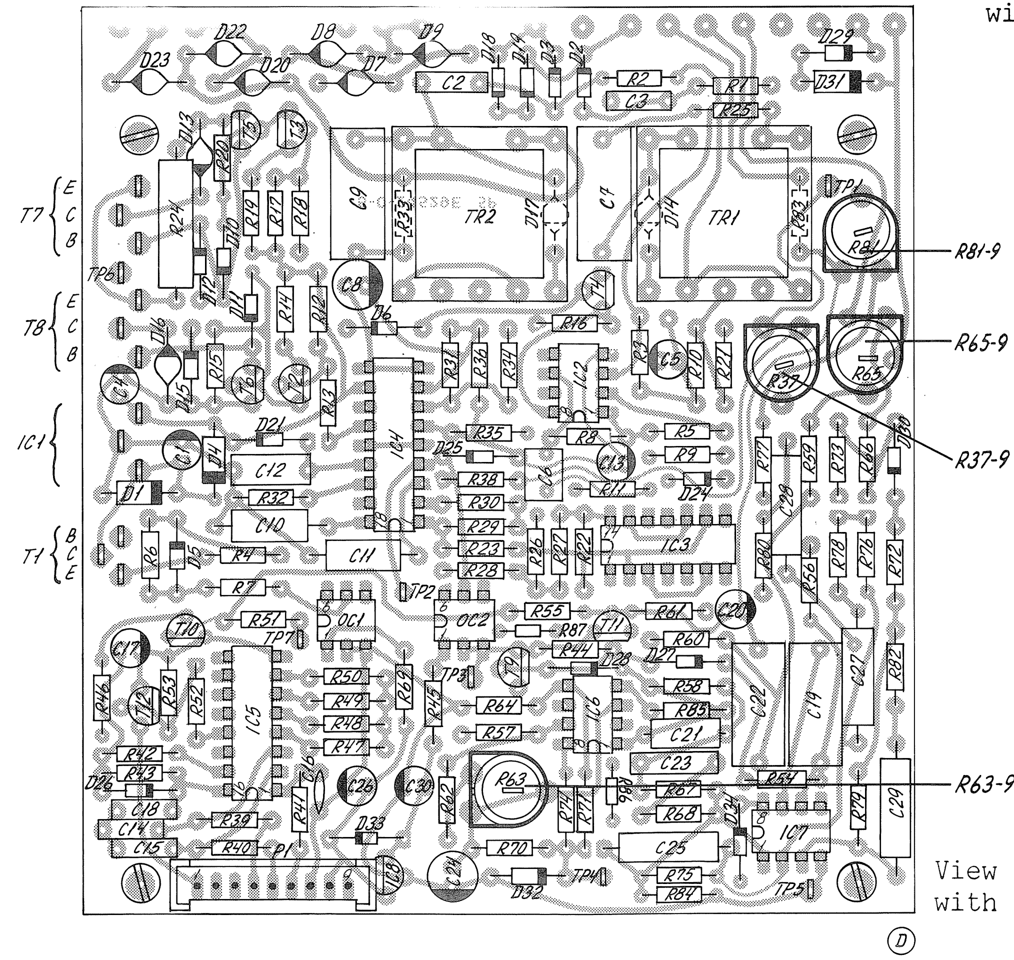
C9-10, C10-10, C11-10 and L4-8 are the RF output filter.

The Other Components

R2-10 is a bleeder resistor to prevent voltage peak up on the 12.5V output.
R83-9 prevents that the high output current runs in the P1 connector.
R85-9 and R84-9 are used to avoid cross-over distortion in IC6a-9 and IC7a-9.



View from component side
with lower side tracks.



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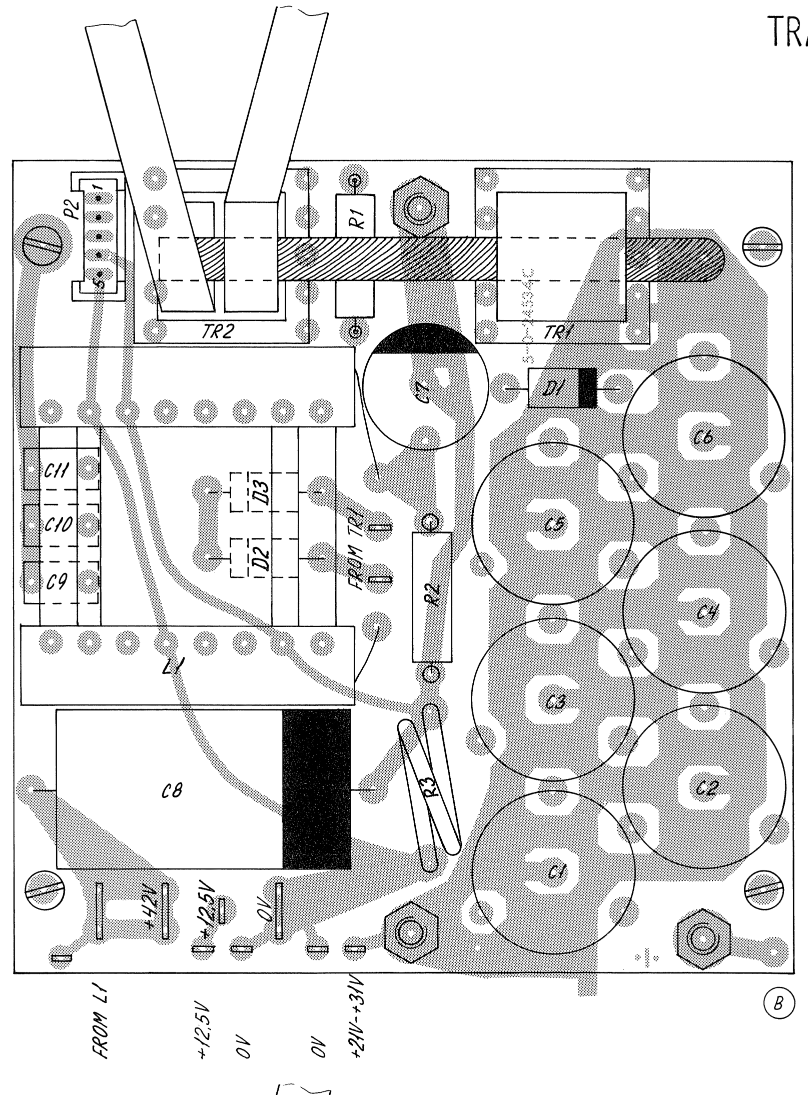

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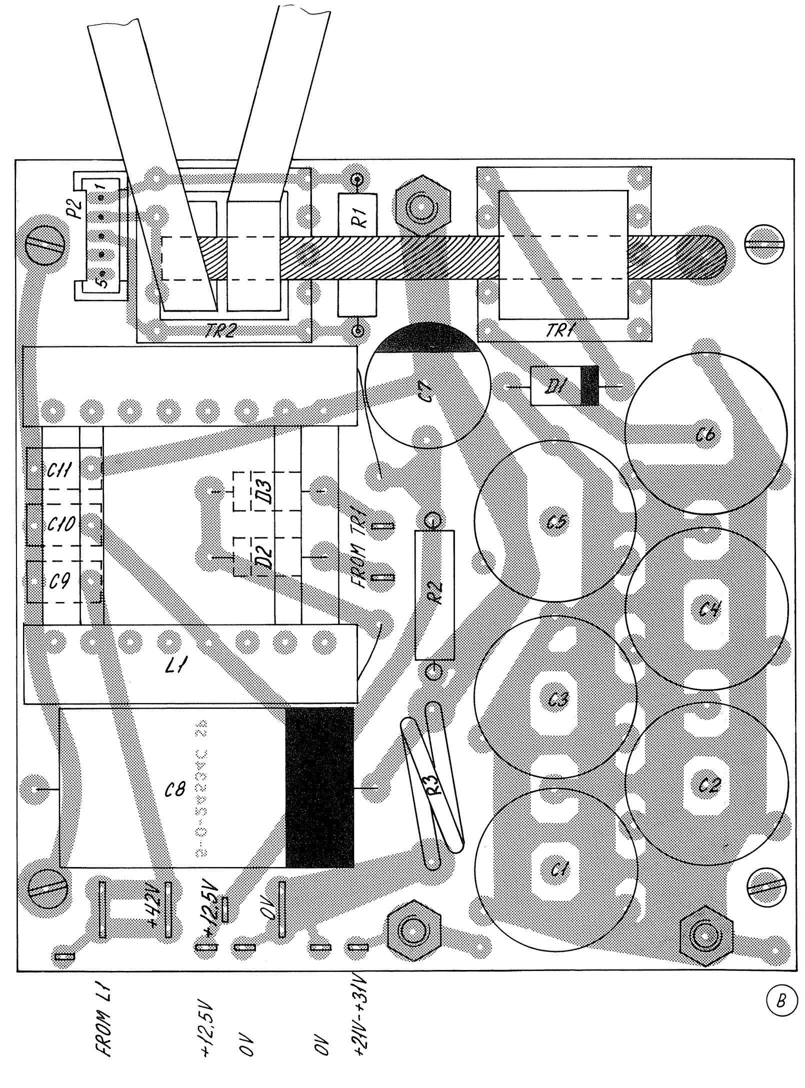
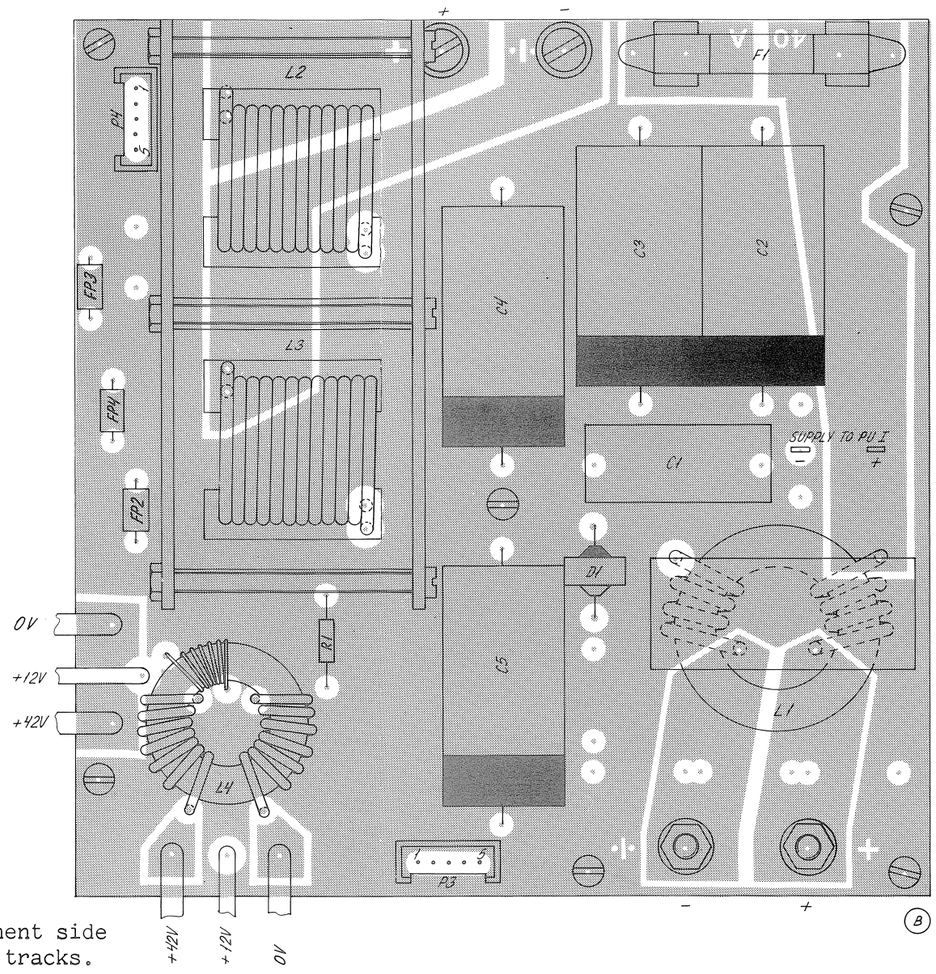


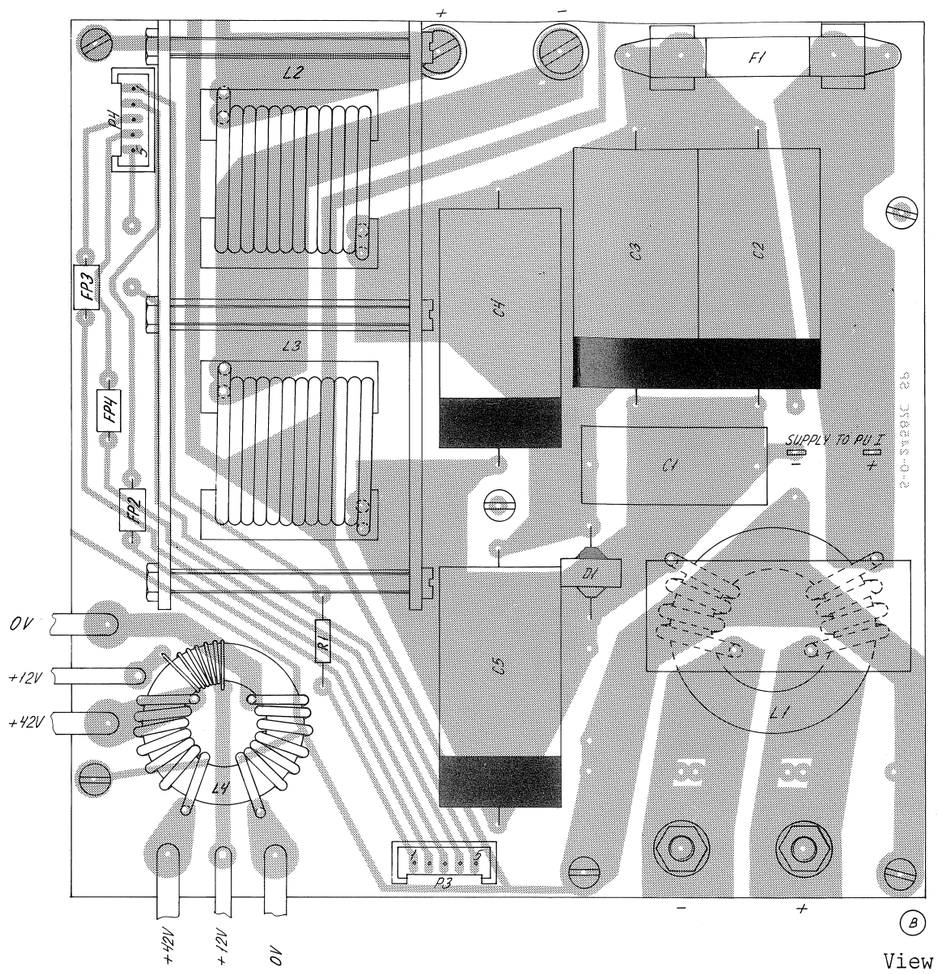
View from component side
with lower side tracks.

T2031B 4-6-24587B, 4-6-24529D
4-6-24534B

FILTER UNIT (MODULE 8)

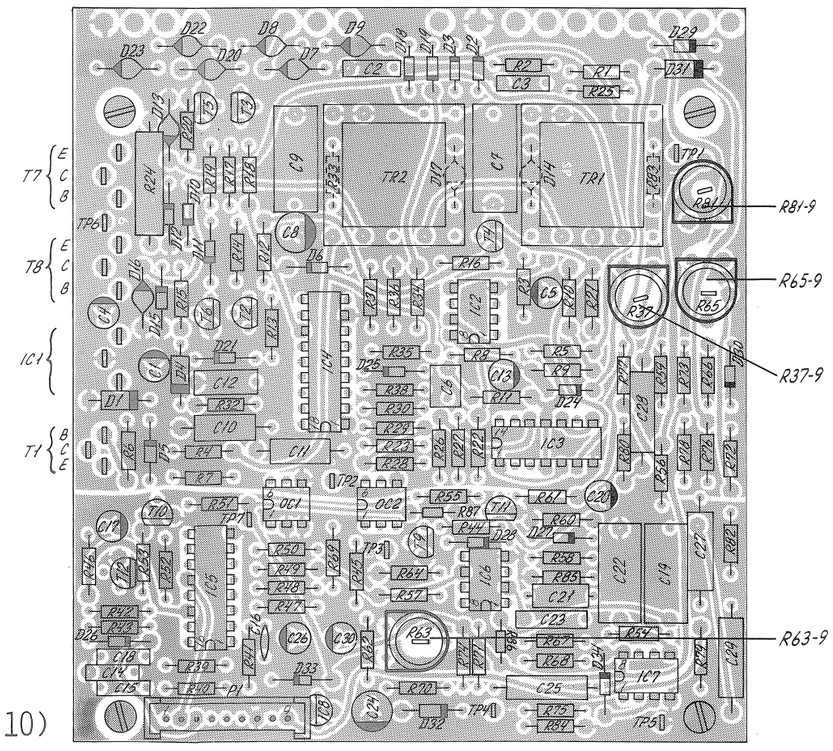


View from component side with upper side tracks.

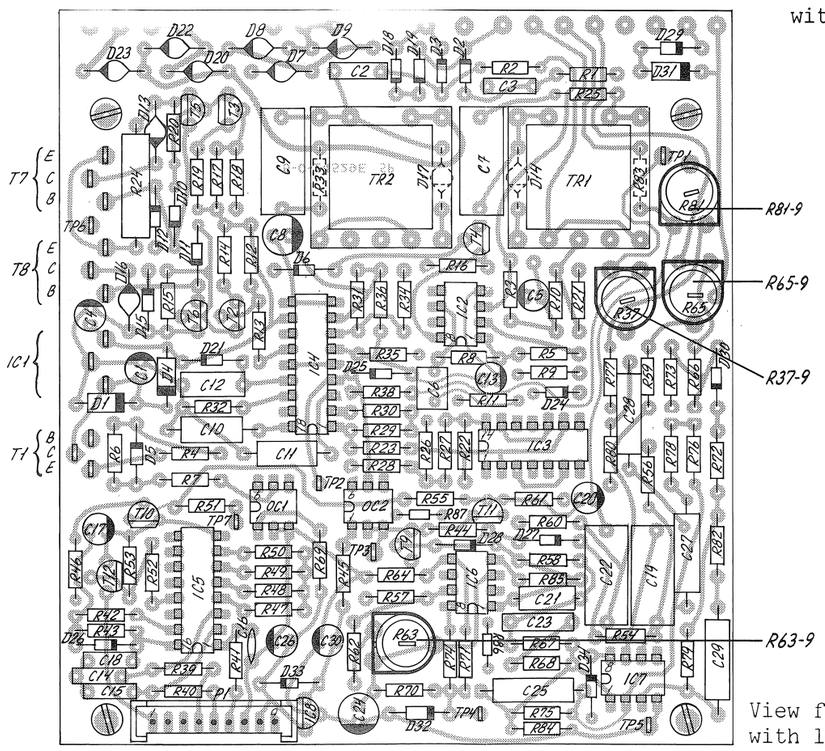


View from component side with lower side tracks.

CONTROL UNIT (MODULE 9)



View from component side with upper side tracks.



View from component side with lower side tracks.

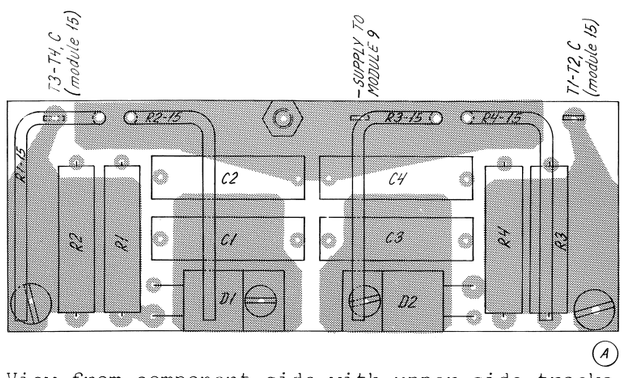
FILTER UNIT (MODULE 8)

CONTROL UNIT (MODULE 9)

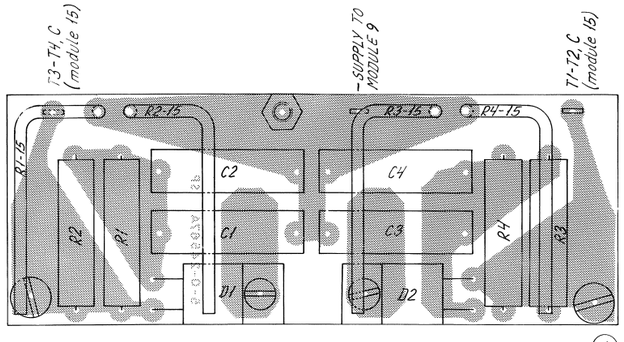
TRANSFORMER UNIT (MODULE 10)

T 2031B 4-6-24567A, 4-6-24645
4-0-24529E

SNUPPER UNIT
(MODULE 11)

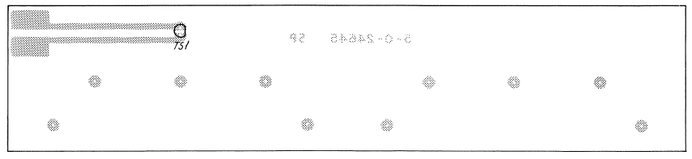


View from component side with upper side tracks.



View from component side with lower side tracks.

THERMAL PROTECTION
UNIT (MODULE 15)



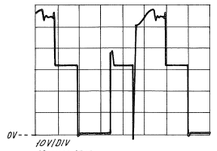
View from component side with lower side tracks.

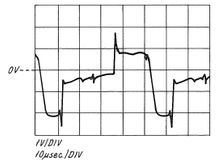
TEST CONDITIONS:

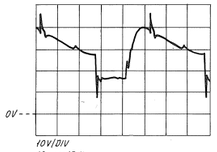
Frequency:	2076 kHz
Mode:	TUNE (transmitter turned to max. output power) or transmitter placed in test group No. 0, test 4 (tx in dummy load).
▲(xxx V_{pp}):	Measured with oscilloscope and passive probe 10 Mohm// 11 pF. (measured value V_{pp}).
◉xxx V:	Measured with diode probe.
DC Voltmeter:	Voltage without brackets in diagram meter input impedance 10 Mohm.

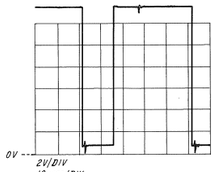
Test conditions changed to measure the carrier levels.

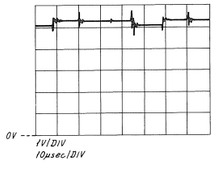
Frequency:	2076 kHz
Mode:	Transmitter placed in test group No. 0 test 3 (tx step 31 fixed) and modulation mode is H3E.
▲(H xxx V_{pp}):	Measured with oscilloscope.
◉H xxx V:	Measured with diode probe.

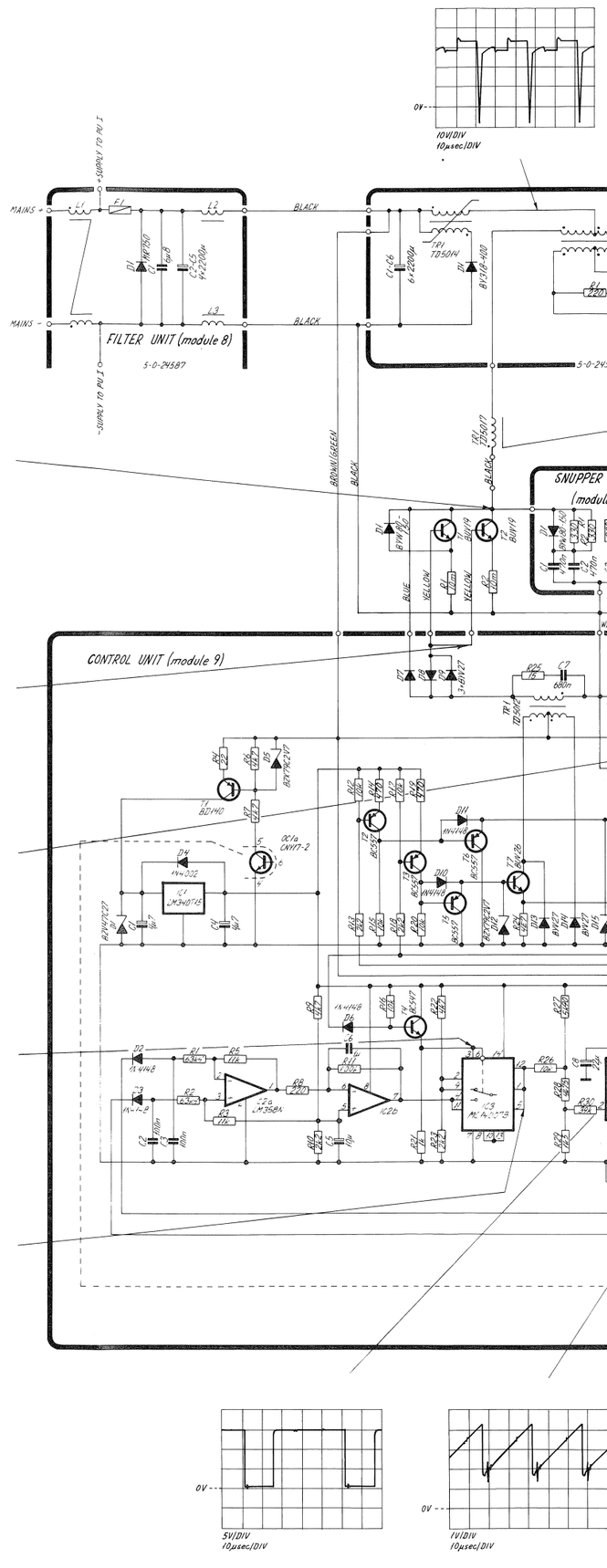












POWER UNIT II (MODULE 8, 9, 10, 11, (15))

TRANSFORMATOR UNIT (module 10)

5-0-24534

FILTER UNIT (module 8)

5-0-24587

SNUPPER UNIT (module 11)

5-0-24567

CONTROL UNIT (module 9)

5-0-24529

FILTER UNIT (module 8)

P2-15/1 AF FROM Rx
P2-15/2 MUTE Rx
P2-15/3 +12.5V
P2-15/4 DUMMY LOAD
P2-15/5

P3-5/4
P3-5/1
P3-14/11
P3-5/5
P3-5/3

PU II TEMP. P1-5/6
GROUND , P1-5/18

P2-14/4
P2-14/5
P3-14/3
P1-3/6
P1-5/12
P1-5/5
P3-14/9

MEASUREMENT CONDITIONS : INPUT VOLTAGE 28V DC
OUTPUT } 42V 25 Ω
LOAD } 12.5V 4 Ω

10V/DIV
10 µsec/DIV

10V/DIV
10µsec/DIV

1V/DIV
10µsec/DIV

10V/DIV
10µsec/DIV

2V/DIV
10µsec/DIV

1V/DIV
10µsec/DIV

5V/DIV
10µsec/DIV

1V/DIV
10µsec/DIV

1V/DIV
10µsec/DIV

10W/DIV
10µsec/DIV

20W/DIV
10µsec/DIV

5.9. GENERAL DESCRIPTION FOR POWER SUPPLY POWER UNIT I

Power unit I is a part of the power pack which is constructed for supplying the SAILOR Transmitter T2031 from 24V DC. In order to obtain high efficiency, the power unit I is a flyback switch mode converter.

TECHNICAL DATA

Input Voltage:	20 - 32V DC	
Power Consumption without Blower:	typ. 24 W	
Output Voltage:	+5V	$I_{max.}$ = 700 mA
	+17.5V	$I_{max.}$ = 650 mA
	-17.5V	$I_{max.}$ = 200 mA
	+12V	$I_{max.}$ = 25 mA
	-12V	$I_{max.}$ = 25 mA
	+24.5V	$I_{max.}$ = 30 mA
Switch Frequency:	Approx. 55 kHz	
Operating Temp.:	-15°C to +55°C	

T2031A

CONVERTER UNIT

Circuit Description

The regulation takes place after the Pulse Width Modulation principle. The switch transistor T4 is controlled by IC1, which produces a square wave signal. The "ON-time" (duty-cycle) mainly depends upon the input voltage.

The windings of the transformer TR1 are connected in such a way that the output diodes are reverse-biased when the transistor T4 is conducting. Because of this, a current is established in the primary windings which increases linearly in relation to time; and energy is stored in the primary inductors. When T4 is ON the load current is supplied from the output capacitors. The switch-off of the transistor T4 produces polarity inversion of the voltage across the secondary windings. The output diodes conduct and the energy stored in the transformer TR1 is fed to the output capacitors and through the filters to the load.

The switch transistor T4 is a power mosfet and for protecting it against electrostatic discharge and transient overvoltage a zener diode D4 is placed across the transistor T4.

The resistors R9 and R10 and the capacitors C7 and C8 form two RC snuppers which reduce the overvoltage transients and unwanted oscillations on primary and secondary windings.

Transistor T1 is producing a regulated voltage for the drivers T2 and T3.

The frequency of the Pulse Width Modulator IC1 is determined by resistor R2 and capacitor C1. The duty-cycle is limited by resistors R4 and R5 to 50%. In order to limit the inrush current during switching on the converter, a capacitor C2 is charged through resistor R5 and gives a soft start of 50-250 ms depending on the input voltage.

The converter output voltage is controlled by the error amplifier IC2.

Reference voltage is taken from diode D9 and output voltage is adjusted by means of resistor R16. The feed-back regulation signal is via OC1 led back to IC1 in order to regulate the duty-cycle. If regulation should fail, output voltage will increase and cause damage to sensitive circuits. A "crowbar" consisting of resistor R20, diode D10, and thyristor T5 is connected across 5V output. If 5V output comes over approx. 5.7V, thyristor T5 turns on and pulls down the voltage. This is detected by the "watchdog" in the computer unit which then turns off the converter.

REGULATOR UNIT

Circuit Description

The 24V DC mains supply is fed through the 32V limiting regulator consisting of T8, T9, T10 and the Z-diodes D8, D9 and D10. The resistors R26 - R31 are emitter ballast resistors, and the resistors R18 - R23 together with transistor T7 are a 3.7 Amp. current limiter. The transistor T11 and the Z-diode D11 will start conducting when the DC mains input voltage exceeds 60V. This will cause the current limiter to limit the input current of a lower value than the 3.7 Amp. From this voltage and current limiting circuit the mains DC voltage is fed through the CISPR filter consisting of L1 and surrounding capacitors to the switching regulator on converter unit (module 12).

When the ON/OFF button on the front panel is pressed, the base of T3 will go "low" through the ON/OFF II line and turn on T3 and T2. The converter will start and supply the microprocessor which will control the ON/OFF control circuit on the processor unit.

This starting-up procedure is the reason why it is necessary to keep the ON/OFF button pressed for a short moment.

If the ON/OFF button is pressed when the set is switched on, the microprocessor will control through the ON/OFF control circuit that T3 and T2 are turned off and switch off the set when the ON/OFF button is released.

The blower is turned off and on by means of OC1, T5, and T6. The current through the blower motor is limited by means of resistor R14 and the diodes D2 and D3.

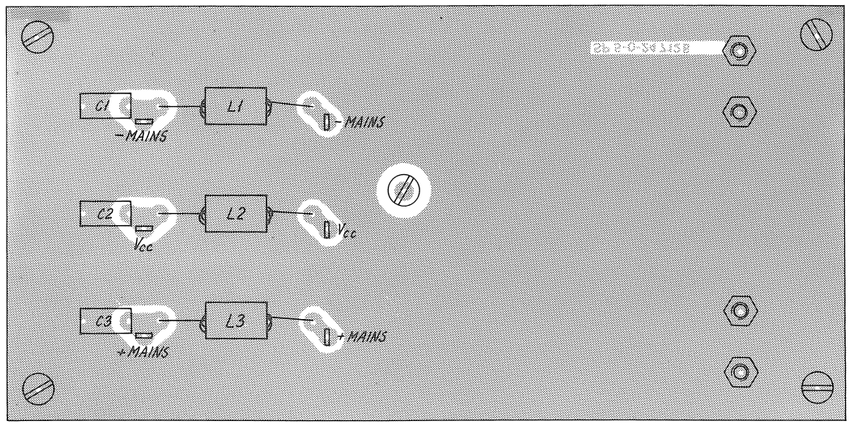
The positive and negative voltage to the exciter is created by the voltage regulators IC1 and IC2. The output voltage is determined by the resistors R4, R9 and R5, R10 as long as the transistors T1 and T4 are off.

If "Exciter on" wire is pulled high, transistor T1 is on and pulls down the IC1 pin 1. The output voltage from IC1 is reduced to 1.2V. Current through diode D1 stops and transistor T4 is turned on by the resistor R3. IC2 pin 1 is then pulled to ground and output voltage from IC2 is reduced to -1.2V.

If "Exciter on" wire is pulled down, transistor T1 is off. Output voltage is determined by R9 and R4. The voltage across D1 delivers negative bias for transistor T4 which then is off and the negative voltage from IC2 is determined by the resistors R5 and R10.

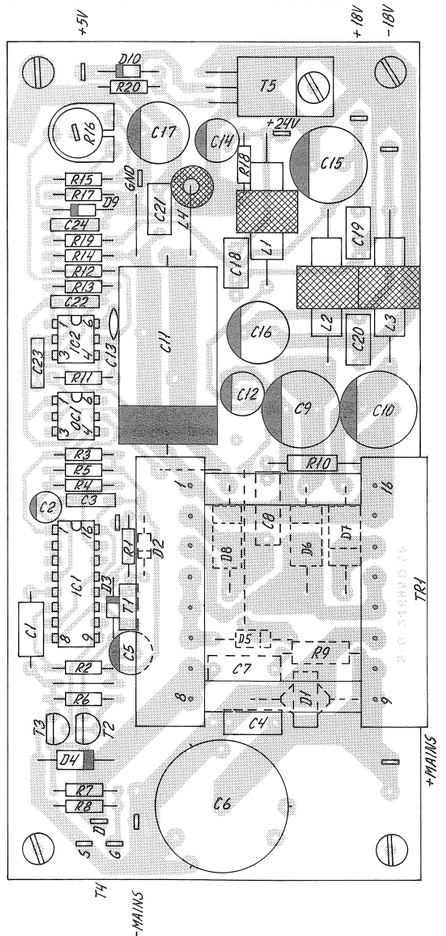
T2031 E 4-6-24712C 4-6-24695B
4-6-24696D 4-0-24696E

FILTER BOARD (MODULE 13)



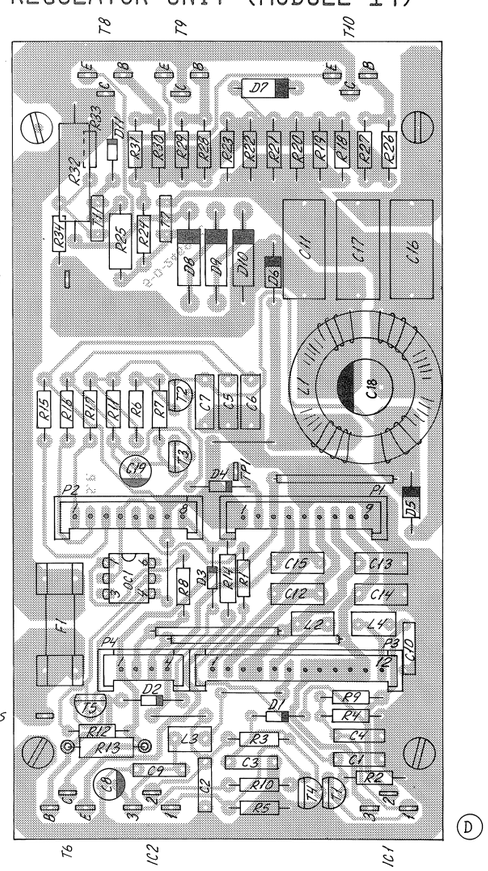
View from component side with lower side tracks.

CONVERTER UNIT (MODULE 12)

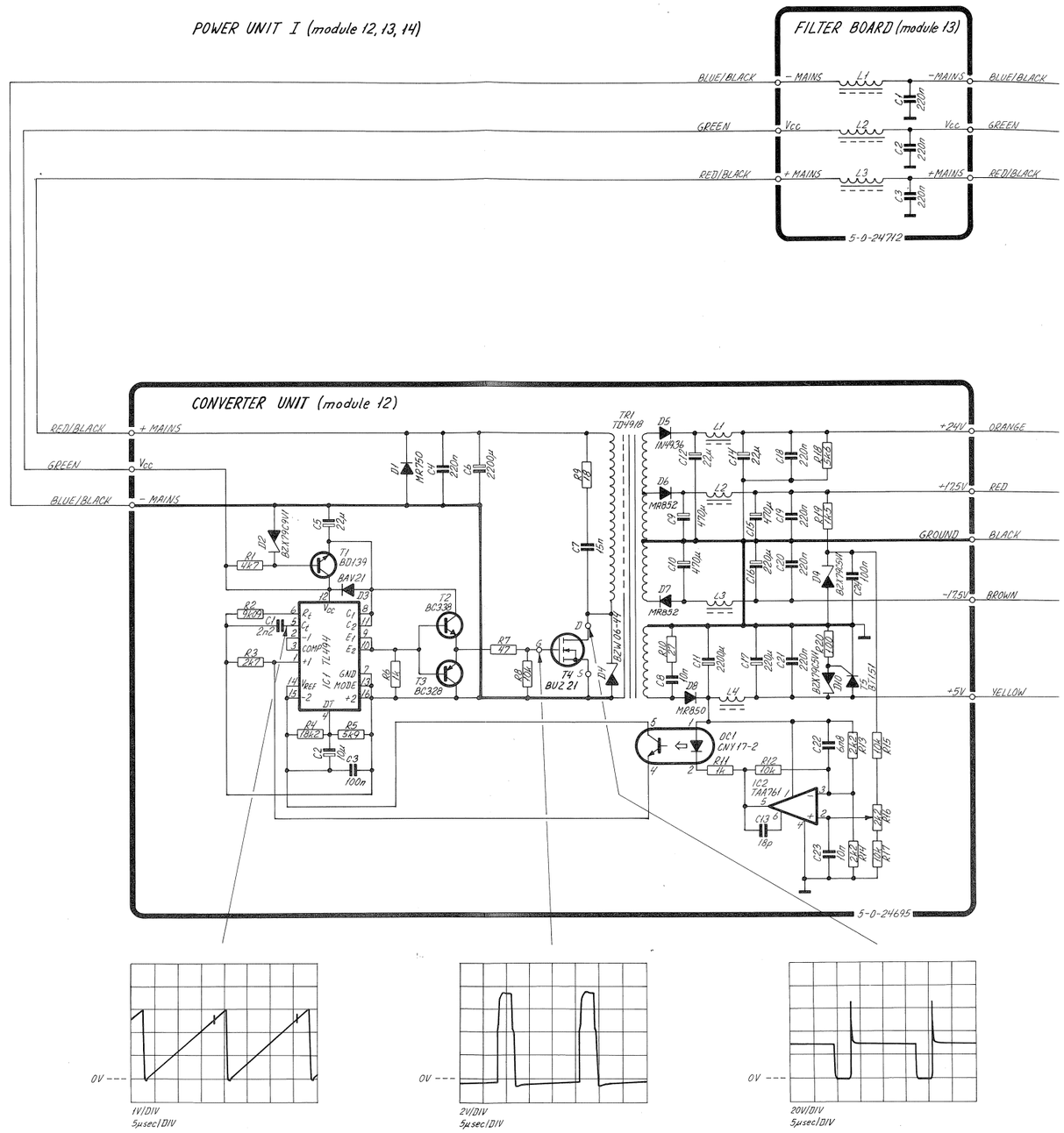


View from component side with lower side tracks.

REGULATOR UNIT (MODULE 14)



View from component side with lower side tracks.

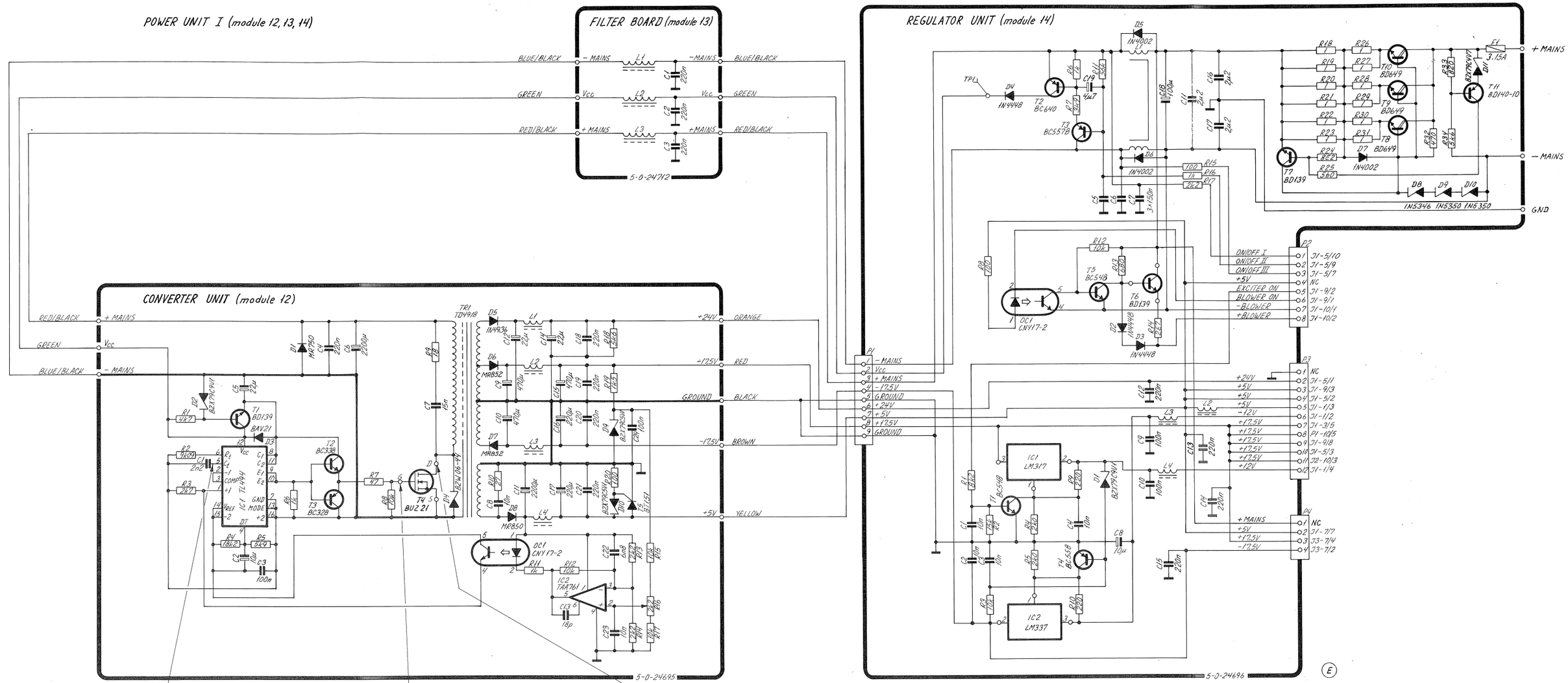


TEST CONDITIONS:

Frequency:	2076 kHz
Mode:	TUNE (transmitter turned to max. output power) or transmitter placed in test group No. 0, test 4 (tx in dummy load).
▲(xxx V_{pp}):	Measured with oscilloscope and passive probe 10 Mohm// 11 pF. (measured value V_{pp}).
⦿xxx V:	Measured with diode probe.
DC Voltmeter:	Voltage without brackets in diagram meter input impedance 10 Mohm.

Test conditions changed to measure the car

Frequency:	2076 kHz
Mode:	Transmitter placed in 31 fixed) and modulati
▲(H xxx V_{pp}):	Measured with oscillos
⦿H xxx V:	Measured with diode pr



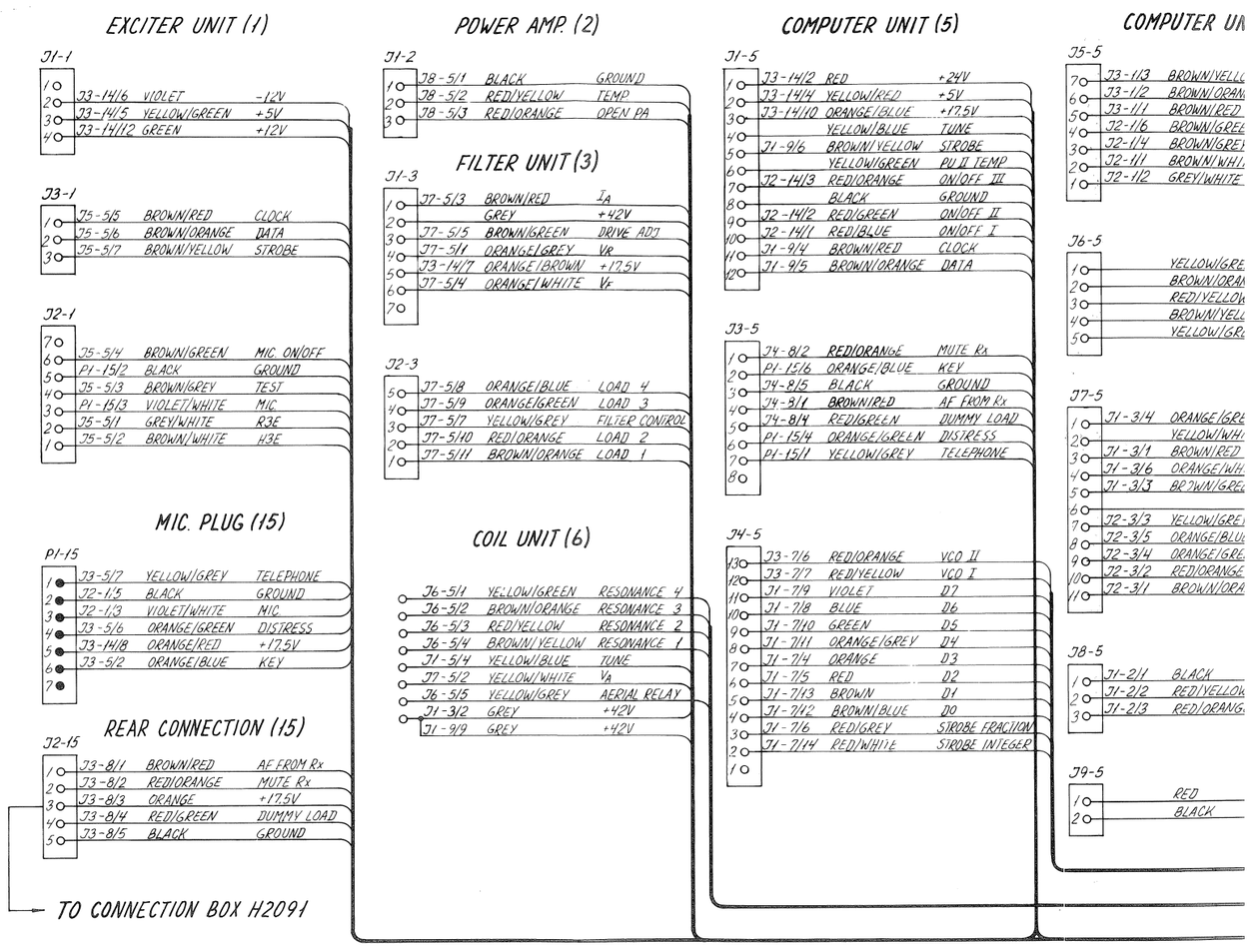
TEST CONDITIONS:

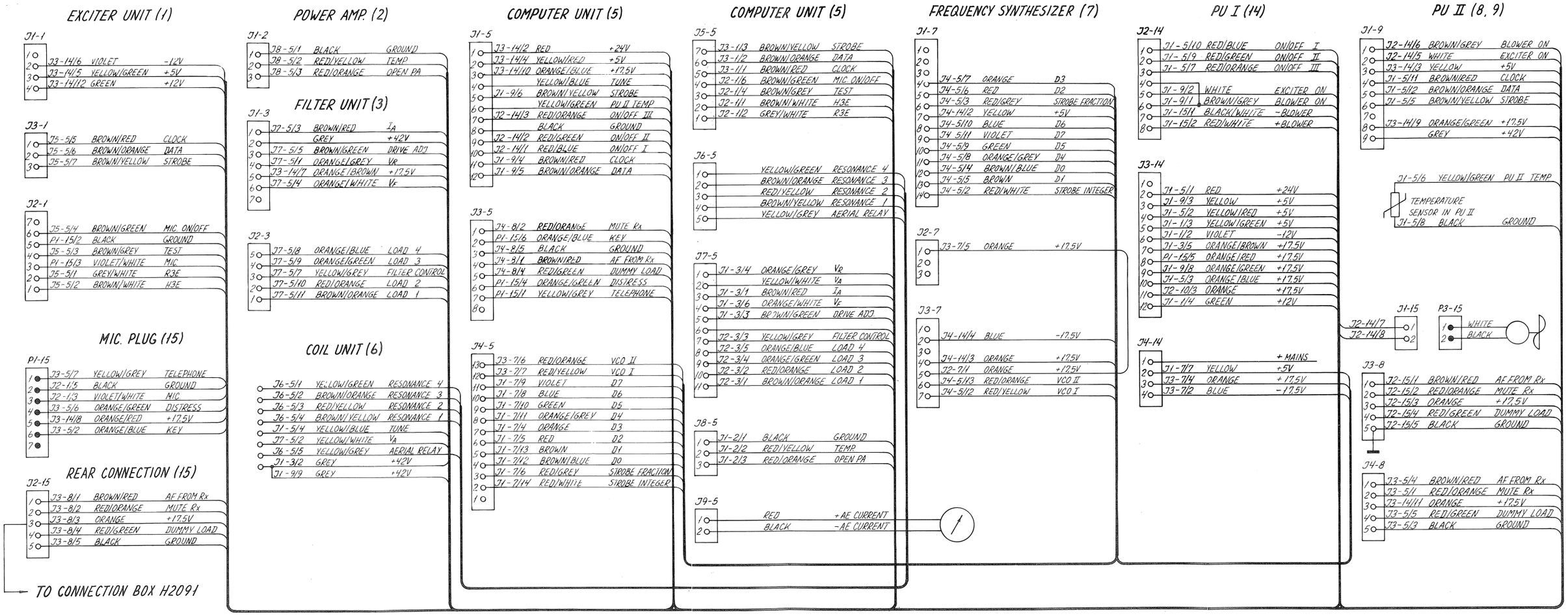
Frequency:	2076 kHz
Mode:	TUNE (transmitter turned to max. output power) or transmitter placed in test group No. 0, test 4 (tx in dummy load).
▲(xxx V_{pp}):	Measured with oscilloscope and passive probe 10 Mohm// 11 pF. (measured value V_{pp}).
⦿xxx V:	Measured with diode probe.
DC Voltmeter:	Voltage without brackets in diagram meter input impedance 10 Mohm.

Test conditions changed to measure the carrier levels.

Frequency:	2076 kHz
Mode:	Transmitter placed in test group No. 0 test 3 (tx step 31 fixed) and modulation mode is H3E.
▲(H xxx V_{pp}):	Measured with oscilloscope.
⦿H xxx V:	Measured with diode probe.

5.10. WIRING DIAGRAM





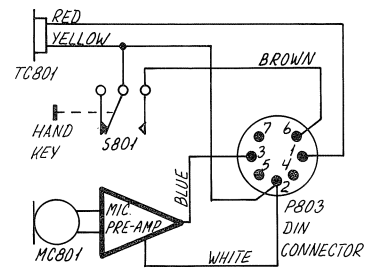
INTERCONNECTION CABLE DIAGRAM
FOR T2031 (F)

CONTENTS

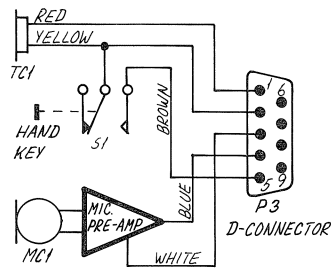
6. MICROTELEPHONE INSTALLATION

RT2047; RT2048, RE2100,
T2031, CRY2001 4-6-24025B
4-0-24293D 4-0-24025D

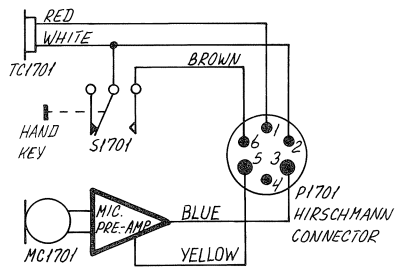
VHF RT2047 and T2031

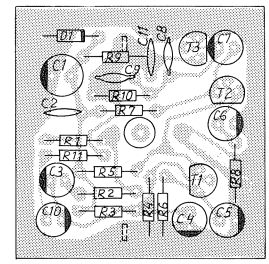


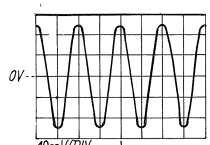
SCRAMBLER CRY2001, RT2048 and RE2100

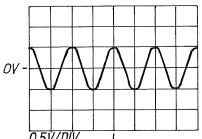


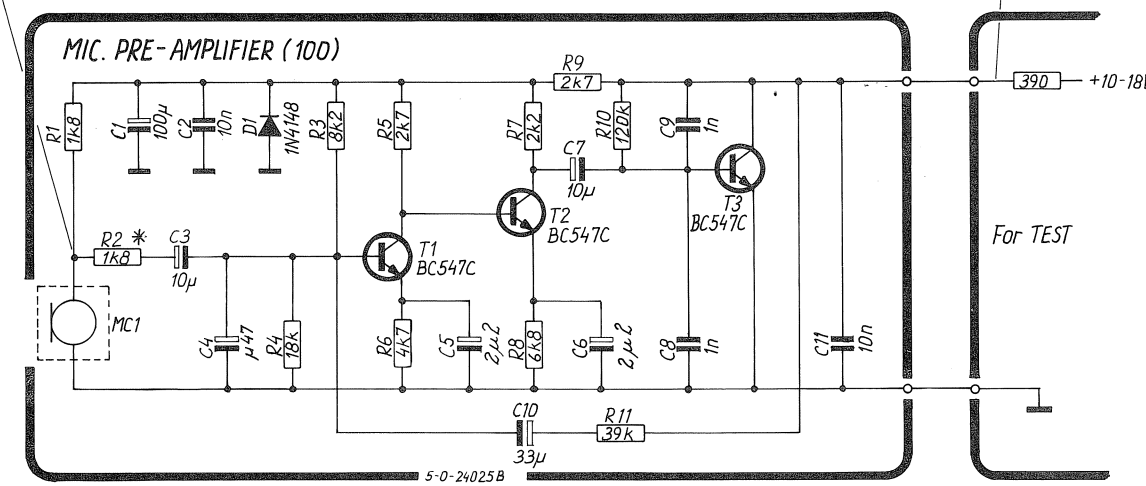
SHORTWAVE S130X











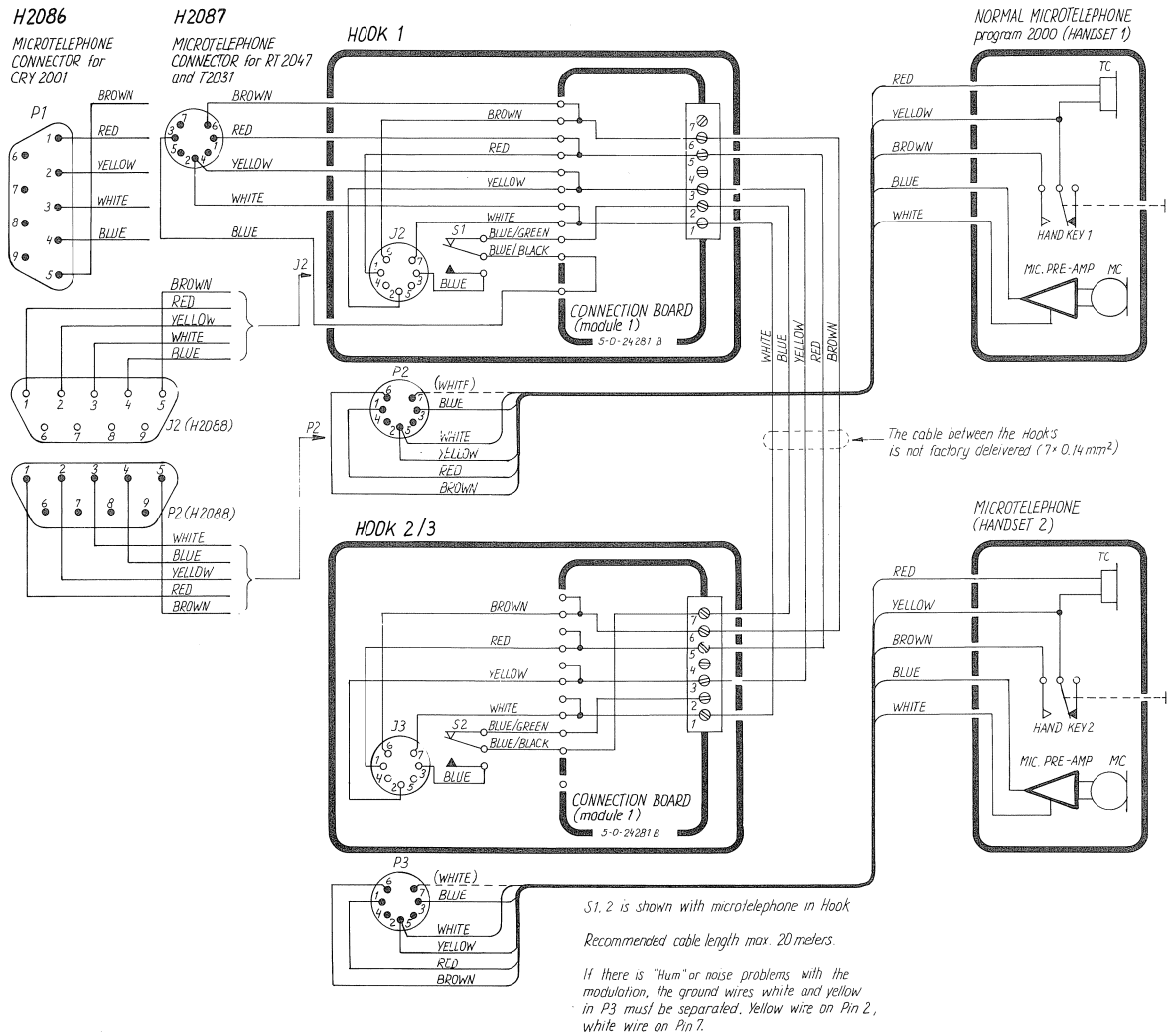
* In orange marked microtelephone cartridge R2 is changed from 1k8 to 5k6 ohm.

(D)

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMB
	MICROTELEPHONE	WITH ELECTRET MIC. AMP.	ESPERA	PRINT NR.5-0-24025B	600875
C1	CAPACITOR ELECTROLYTIC	100uF 20% 10V	*ERO	EKI 00 BB 310 C	14.607
C2	CAPACITOR CERAMIC	10nF -20/+80% 50V	#KCK	HE70SJYF103Z	15.170
C3	CAPACITOR ELECTROLYTIC	10uF 20% 35V	* ERO	EKI 00 AA 210 F	14.512
C4	CAPACITOR ELECTROLYTIC	0.47uF 20% 50V	ERO	EKI 00 AA 047 H	14.504
C5	CAPACITOR ELECTROLYTIC	10uF 20% 35V	* ERO	EKI 00 AA 210 F	14.512
C6	CAPACITOR ELECTROLYTIC	10uF 20% 35V	* ERO	EKI 00 AA 210 F	14.512
C7	CAPACITOR ELECTROLYTIC	10uF 20% 35V	* ERO	EKI 00 AA 210 F	14.512
C8	CAPACITOR CERAMIC	1nF 10% 100V	*PHILIPS	2222 630 03102	16.149
C9	CAPACITOR CERAMIC	1nF 10% 100V	*PHILIPS	2222 630 03102	16.149
C10	CAPACITOR ELECTROLYTIC	33uF 20% 16V	* ERO	EKI 00 AA 233 D	14.518
C11	CAPACITOR CERAMIC	10nF -20/+80% 50V	#KCK	HE70SJYF103Z	15.170
D1	DIODE	1N4148	* ITT	1N4148	25.131
MC1	MICROPHONE ELECTRET	WM-034BY	MATSUSHITA	WM-034BY	46.012
R1	RESISTOR	1.8 KOHM 5% 0.33W	BEYSCHLAG	MBA 0204-00-BX-5%	01.707
R2	RESISTOR	1.8 KOHM 5% 0.33W	BEYSCHLAG	MBA 0204-00-BX-5%	01.707
R3	RESISTOR	8.2 KOHM 5% 0.33W	BEYSCHLAG	MBA 0204-00-BX-5%	01.723
R4	RESISTOR	18 KOHM 5% 0.33W	BEYSCHLAG	MBA 0204-00-BX-5%	01.732
R5	RESISTOR	2.7 KOHM 5% 0.33W	BEYSCHLAG	MBA 0204-00-BX-5%	01.711
R6	RESISTOR	4.7 KOHM 5% 0.33W	BEYSCHLAG	MBA 0204-00-BX-5%	01.717
R7	RESISTOR	2.2 kOHM 5% 0.33W	BEYSCHLAG	MBA 0204-00-BX-5%	01.709
R8	RESISTOR	6.8 kOHM 5% 0.33W	BEYSCHLAG	MBA 0204-00-BX-5%	01.721
R9	RESISTOR	2.7 KOHM 5% 0.33W	BEYSCHLAG	MBA 0204-00-BX-5%	01.711
R10	RESISTOR	120 kOHM 5% 0.33W	BEYSCHLAG	MBA 0204-00-BX-5%	01.753
R11	RESISTOR	39 KOHM 5% 0.33W	BEYSCHLAG	MBA 0204-00-BX-5%	01.740
S1	MICROSWITCH	E62-10H PDT	CHERRY	E62-10H PDT	44.025
T1	TRANSISTOR	BC547C	SGS	BC547C	28.068
T2	TRANSISTOR	BC547C	SGS	BC547C	28.068
T3	TRANSISTOR	BC547C	SGS	BC547C	28.068
TC1	TELEPHONE CARTRIDGE	200 OHM	S.E.K. (KIRK)	0113.2518 (0113.2510)	46.010

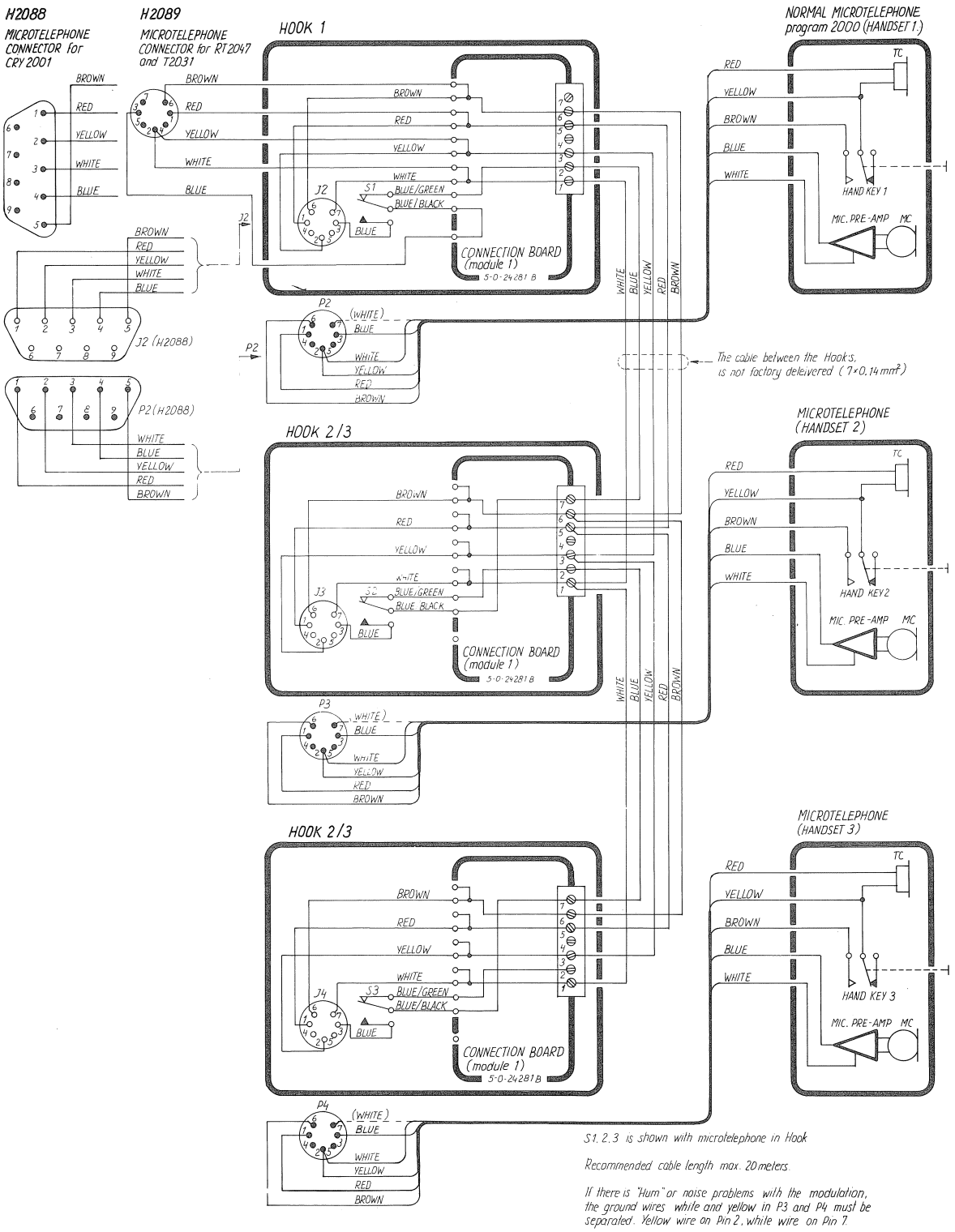
6.1. SPECIAL INSTALLATION WITH 2 MICROTELEPHONES: H2086 FOR SCRAMBLER CRY2001, RT2048 AND RE2100 H2087 FOR VHF RT2047 AND SSB T2031

MICROTELEPHONE ONE WITH PREFERENCE



6.2. SPECIAL INSTALLATION WITH 3 MICROTELEPHONES: H2088 FOR SCRAMBLER CRY2001, RT2048 AND RE2100 H2089 FOR VHF RT2047 AND SSB T2031

MICROTELEPHONE ONE WITH PREFERENCE



CONTENTS

T2031

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	MAIN CHASSIS T2031	MODULE 15	ESPERA	CT TRANSMITTER	802031
VARIOUS	KNOB	Ø35mm	ESPERA	2-0-24376A *	200265
VARIOUS	1/1 BOX KABINET FOR T2031	GREEN NYLON COATING	ESPERA	3-0-24560D / 142.205	200501
VARIOUS	COVER FOR FRQ.TABLE		ACRYCITE	TG.1-3-24462B	50.088
VARIOUS	FREQUENCY TABLE	WITHOUT FRQ PRINT	HESTBECH	TRYK TG.9-3-24722A	50.506
VARIOUS	WIRING HARNESS 1 T2031		ESPERA	500529 KABEL 1 T2031	500529
VARIOUS	WIRING HARNESS 2 T2031		ESPERA	500603 KABEL 2	500603
VARIOUS	INTERCONNECTION CABLE TO	CONNECTION BOX H2091	ESPERA	500605 KABEL 4	500605
VARIOUS	COVER FOR KNOB Ø35mm	040-6025/200265	ELMA	040-6025	83.154
-1	EXCITER	T2031 MODUL 1	ESPERA	5-0-24364F	600218
-2	POWER AMPLIFIER UNIT	T2031 MODUL 2	ESPERA	5-0-24031H	600220
-3	FILTER UNIT	T2031 MODUL 3	ESPERA	5-0-24297E	600222
-4	AERIAL CURRENT DETECTOR	T2031 MODUL 4	ESPERA	5-0-24310C	600224
-5	POWER CONTROL COMPUTER	T2031 MODUL 5	ESPERA	5-0-24440G	600226
-6	COIL UNIT	T2031 MODUL 6	ESPERA	700228 COIL UNIT T2031	700228
-7	FREQUENCY SYNTHESIZER	T2031 MODULE 7	ESPERA	5-0-24057K	600230
-8	FILTER UNIT MODULE 8	POWER UNIT II T2031	ESPERA	5-0-24587F	600392
-9	PS CONTROL UNIT MODULE 9	POWER UNIT II T2031	ESPERA	5-0-24529E	600398
-10	TRANSFORMER UNIT MODULE10	POWER UNIT II T2031	ESPERA	5-0-24534C	600394
-11	SNUPPER UNIT MODULE 11	POWER UNIT II T2031	ESPERA	5-0-24567A	600396
-12	CONVERTER UNIT MODULE 12	PUI T2031	ESPERA	5-0-24695D	600590
-13	FILTER BOARD MODULE 13	PUI T2031	ESPERA	5-0-24712D	600592
-14	REGULATOR UNIT MODULE 14	PUI T2031	ESPERA	5-0-24696F	600594
-15	THERMAL PROTECT.MODULE 15	POWER UNIT II T2031	ESPERA	5-0-24645	600400
MIC	MICROTELEPHONE FOR	T2031	ESPERA	700233 MICROTLF.T2031	700233
J2-5	MEMBRANESWITCH 5+6	11 POLE CONNECTOR	MEKOPRINT *	LEVERES EFTER GODKENDT PRØVE	44.500
MO1-15	BLOWER MOTOR	CK35-H12CH-22V	CANON	CK35-H12CH-22V	60.015
ME1-15	METER AE-CURRENT	9-3-24322	NKW	KL-243E-18B/9-3-24322A	23.106
P1-15	SOCKET CHASSIS MOUNT	7 POLES	R.P.*	351517	78.385
P3-15	PLUG (male)	2 POLE	MOLEX	03-06-2022	78.229
R1-15	RESISTOR WIRE WOUND	100 OHM 5% 25W NON INDUCT	ARCOL	NHS-25-100-5% & Lmax=17nH/25MHz	06.375
R2-15	RESISTOR WIRE WOUND	100 OHM 5% 25W NON INDUCT	ARCOL	NHS-25-100-5% & Lmax=17nH/25MHz	06.375
TS2-15	TEMP.SENSOR W.TIE ROD	KTY11-2D	ESPERA	700550 TEMP.SENSOR T2031	700550

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	POWER UNIT I & II	T2031 MODULE 8-15	ESPERA	24V POWER PACK T2031	700234
-8	FILTER UNIT MODULE 8	POWER UNIT II T2031	ESPERA	5-0-24587F	600392
-9	PS CONTROL UNIT MODULE 9	POWER UNIT II T2031	ESPERA	5-0-24529E	600398
-10	TRANSFORMER UNIT MODULE10	POWER UNIT II T2031	ESPERA	5-0-24534C	600394
-11	SNUPPER UNIT MODULE 11	POWER UNIT II T2031	ESPERA	5-0-24567A	600396
-12	CONVERTER UNIT MODULE 12	PUI T2031	ESPERA	5-0-24695D	600590
-13	FILTER BOARD MODULE 13	PUI T2031	ESPERA	5-0-24712D	600592
-14	REGULATOR UNIT MODULE 14	PUI T2031	ESPERA	5-0-24696F	600594
-15	THERMAL PROTECT.MODULE 15	POWER UNIT II T2031	ESPERA	5-0-24645	600400
C1-15	CAPACITOR POLYSTYRENE	1n00F 1% 250VDC	PHILIPS	2222 430 81002	10.350
C2-15	CAPACITOR POLYSTYRENE	1n00F 1% 250VDC	PHILIPS	2222 430 81002	10.350
D1-15	DIODE F.REC	7A/150V	THOMSON-CSF	BYW80-150	27.625
D2-15	DIODE F.REC	7A/150V	THOMSON-CSF	BYW80-150	27.625
D3-15	DIODE DUAL	2x10A/300VDC TO-220	PHILIPS	BYV34-300 (-400;-500)	27.158
D4-15	DIODE DUAL	2x10A/300VDC TO-220	PHILIPS	BYV34-300 (-400;-500)	27.158
L1-15	CHOKE	0.5mH/20ADC	* TRADANIA	TD5016.0	22.181
R1-15	COIL	TL451	ESPERA	6-0-24870A	400451
R2-15	COIL	TL452	ESPERA	6-0-24871A	400452
R3-15	COIL	TL451	ESPERA	6-0-24870A	400451
R4-15	COIL	TL452	ESPERA	6-0-24871A	400452
R5-15	RESISTOR MF	150 OHM 5% 0.4W	PHILIPS	2322 181 53151	01.179
R6-15	RESISTOR MF	150 OHM 5% 0.4W	PHILIPS	2322 181 53151	01.179
T1-15	TRANSISTOR POWER	HIGH CURRENT SWITCHING	THOMSON-CSF	BUV 19	29.210
T2-15	TRANSISTOR POWER	HIGH CURRENT SWITCHING	THOMSON-CSF	BUV 19	29.210
T3-15	TRANSISTOR POWER	HIGH CURRENT SWITCHING	THOMSON-CSF	BUV 19	29.210
T4-15	TRANSISTOR POWER	HIGH CURRENT SWITCHING	THOMSON-CSF	BUV 19	29.210
TR1-15	TRANSFORMER POWER	800VA	* TRADANIA	TD5017.1	22.182

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	EXCITER	T2031 MODUL 1	ESPERA	5-0-24364F	600218
C1-1	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C2-1	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C3-1	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C4-1	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C5-1	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C6-1	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32510-D1224-K000	11.225
C7-1	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32510-D1224-K000	11.225
C8-1	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32510-D1224-K000	11.225
C9-1	CAPACITOR ELECTROLYTIC	47uF 20% 25VDC	ELNA	RJ2-25-V-470-M-T12	14.524
C10-1	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C11-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C12-1	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C13-1	CAPACITOR ELECTROLYTIC	220uF -20/+50% 25VDC	ERO	EKM 05 DD 322 E 05	14.647
C14-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C15-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C16-1	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C17-1	CAPACITOR ELECTROLYTIC	4.7uF 20% 50VDC	ELNA	RJ2-50-V-4R7-M-T12	14.510
C18-1	CAPACITOR ELECTROLYTIC	4.7uF 20% 50VDC	ELNA	RJ2-50-V-4R7-M-T12	14.510
C19-1	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C20-1	CAPACITOR POLYSTERENE	120pF 1% 630V	*PHILIPS	2222 431 81201	10.403
C21-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C22-1	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C23-1	CAPACITOR CERAMIC	3.9pF +-.25pF 50V	KCK*	HE40SJPJ3R9D	15.004
C24-1	CAPACITOR CERAMIC	1nF 10% 50VDC CL2	NKE	DT 340 758L B 102 K 50V FLAT PACK	16.160
C25-1	CAPACITOR ELECTROLYTIC	22uF 20% 25VDC	ELNA	RJ2-25-V-220-M-T12	14.514
C26-1	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C27-1	CAPACITOR POLYSTYRENE	200pF 1% 630VDC	PHILIPS	2222 431 82001	10.408
C28-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C29-1	CAPACITOR CERAMIC	15pF 5% N150 50VDC	KCK	RT-HE40-SK PH 150 J AMMO PACK	15.055
C30-1	CAPACITOR POLYSTYRENE	100pF 1% 630VDC	PHILIPS	2222 431 81001	10.400
C31-1	CAPACITOR CERAMIC	1nF 10% 50VDC CL2	NKE	DT 340 758L B 102 K 50V FLAT PACK	16.160
C32-1	CAPACITOR ELECTROLYTIC	3.3uF 20% 50VDC	ELNA	RJ2-50-V-3R3-M-T12	14.508
C33-1	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
C34-1	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C35-1	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C36-1	CAPACITOR ELECTROLYTIC	4.7uF 20% 50VDC	ELNA	RJ2-50-V-4R7-M-T12	14.510
C37-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C38-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C39-1	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C40-1	CAPACITOR MKT	10nF 5% 250V	ERO*	MKT1818-310/01	11.380
C41-1	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C42-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C43-1	CAPACITOR MKT	10nF 5% 250V	ERO*	MKT1818-310/01	11.380
C44-1	CAPACITOR ELECTROLYTIC	3.3uF 20% 50VDC	ELNA	RJ2-50-V-3R3-M-T12	14.508
C45-1	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C46-1	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C47-1	CAPACITOR MKT	10nF 5% 250V	ERO*	MKT1818-310/01	11.380
C49-1	CAPACITOR MKT	10nF 5% 250V	ERO*	MKT1818-310/01	11.380
C50-1	CAPACITOR POLYSTYRENE	110pF 1% 630V	*PHILIPS	2222 431 81101	10.402
C51-1	CAPACITOR ELECTROLYTIC	4.7uF 20% 50VDC	ELNA	RJ2-50-V-4R7-M-T12	14.510
C52-1	CAPACITOR ELECTROLYTIC	1uF 20% 50VDC	ELNA	RJ2-50-V-010-M-T12	14.506
C53-1	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C54-1	CAPACITOR CERAMIC	1.8nF -20/+80% 400V	FERROPERM	9/0141,9	15.735
C55-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C56-1	CAPACITOR POLYSTERENE	680pF 1% 250V	*PHILIPS	2222 430 86801	10.346
C57-1	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C58-1	CAPACITOR POLYSTERENE	560pF 1% 250V	*PHILIPS	2222 430 85601	10.344
C59-1	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C60-1	CAPACITOR CERAMIC	1.8nF -20/+80% 400V	FERROPERM	9/0141,9	15.735
C61-1	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C62-1	CAPACITOR ELECTROLYTIC	3.3uF 20% 50VDC	ELNA	RJ2-50-V-3R3-M-T12	14.508
C63-1	CAPACITOR ELECTROLYTIC	3.3uF 20% 50VDC	ELNA	RJ2-50-V-3R3-M-T12	14.508
C64-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C65-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C66-1	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C67-1	CAPACITOR CERAMIC	470pF 10% 500VDC	NKE	DT35-0465 758L 471BK 500V FLAT PACK	16.095
C68-1	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C69-1	CAPACITOR CERAMIC	470pF 10% 500VDC	NKE	DT35-0465 758L 471BK 500V FLAT PACK	16.095
C70-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V	15.170

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
				FLAT PACK	
C71-1	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C72-1	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C73-1	CAPACITOR POLYSTYRENE	75pOF 1% 630VDC	PHILIPS	2222 431 87509	10.397
C74-1	CAPACITOR CERAMIC	470pF 10% 500VDC	NKE	DT35-0465 758L 471BK 500V FLAT PACK	16.095
C75-1	CAPACITOR POLYSTYRENE	75pOF 1% 630VDC	PHILIPS	2222 431 87509	10.397
C76-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C77-1	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C78-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C79-1	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C80-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C81-1	CAPACITOR MKT	10nF 10% 250V	SIEMENS	B32510-D3103-K000	11.290
C82-1	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C83-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C84-1	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C85-1	CAPACITOR MKT	10nF 10% 250V	SIEMENS	B32510-D3103-K000	11.290
C86-1	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C87-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C88-1	CAPACITOR MKT	10nF 10% 250V	SIEMENS	B32510-D3103-K000	11.290
C89-1	CAPACITOR MKT	2,2nF 10% 400V	SIEMENS	B32510-D6222-K000	11.165
C90-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C91-1	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C92-1	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C93-1	CAPACITOR ELECTROLYTIC	47uF 20% 25VDC	ELNA	RJ2-25-V-470-M-T12	14.524
C94-1	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C95-1	CAPACITOR MKT	2,2nF 10% 400V	SIEMENS	B32510-D6222-K000	11.165
C96-1	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C97-1	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C98-1	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C99-1	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C100-1	CAPACITOR POLYSTYRENE	330pF 1% 630VDC	PHILIPS	2222 431 83301	10.416
C101-1	CAPACITOR MKT	4.7nF 10% 400V	SIEMENS	B32510-D6472-K000	11.373
C102-1	CAPACITOR POLYSTYRENE	430pF 1% 630VDC	PHILIPS	2222 431 84301	10.428
C103-1	CAPACITOR MKT	10nF 10% 250V	SIEMENS	B32510-D3103-K000	11.290
C104-1	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C105-1	CAPACITOR POLYSTYRENE	470pF 1% 630VDC	PHILIPS	2222 431 84701	10.429
C106-1	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32510-D1224-K000	11.225

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
C107-1	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C108-1	CAPACITOR MKT	4.7nF 10% 400V	SIEMENS	B32510-D6472-K000	11.373
C109-1	CAPACITOR POLYSTYRENE	220pF 1% 630VDC	PHILIPS	2222 431 82201	10.409
C110-1	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32510-D1224-K000	11.225
C112-1	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C113-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C114-1	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E G5	14.610
C115-1	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C116-1	CAPACITOR ELECTROLYTIC	4.7uF 20% 50VDC	ELNA	RJ2-50-V-4R7-M-T12	14.510
C117-1	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C118-1	CAPACITOR ELECTROLYTIC	4.7uF 20% 50VDC	ELNA	RJ2-50-V-4R7-M-T12	14.510
C120-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C121-1	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E G5	14.610
C122-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C123-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C124-1	CAPACITOR ELECTROLYTIC	1uF 20% 50VDC	ELNA	RJ2-50-V-010-M-T12	14.506
C125-1	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C126-1	CAPACITOR MKT	3.3nF 10% 400V	SIEMENS	B32510-D6332-K000	11.372
C127-1	CAPACITOR MKT	3.3nF 10% 400V	SIEMENS	B32510-D6332-K000	11.372
C128-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C129-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C130-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C131-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C132-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C133-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C134-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C135-1	CAPACITOR MKT	10nF 10% 250V	SIEMENS	B32510-D3103-K000	11.290
C136-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C137-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C138-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
C139-1	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32510-D1224-K000	11.225
C140-1	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
D1-1	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D2-1	DIODE SWITCH	BA243	TFK	BA243	25.386
D3-1	DIODE SWITCH	BA243	TFK	BA243	25.386
D4-1	DIODE	2805	HP	HP 2805 15082 MATCHED 4 pieces	27.501
D5-1	DIODE	2805	HP	HP 2805 15082 MATCHED 4 pieces	27.501
D6-1	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D7-1	DIODE	2805	HP	HP 2805 15082 MATCHED 4 pieces	27.501
D8-1	DIODE	2805	HP	HP 2805 15082 MATCHED 4 pieces	27.501
D9-1	DIODE SWITCH	BA243	TFK	BA243	25.386
D10-1	DIODE SWITCH	BA243	TFK	BA243	25.386
D11-1	DIODE SWITCH	BA243	TFK	BA243	25.386
D12-1	DIODE SWITCH	BA243	TFK	BA243	25.386
D13-1	DIODE SWITCH	BA243	TFK	BA243	25.386
D14-1	DIODE SWITCH	BA243	TFK	BA243	25.386
D15-1	DIODE	BAW62 HIGH SPEED	PHILIPS	BAW62-143	25.350
D16-1	DIODE	BAW62 HIGH SPEED	PHILIPS	BAW62-143	25.350
D17-1	DIODE ZENER	7.5V 5% 0.4W	PHILIPS	BZX79C7V5	26.539
D18-1	DIODE ZENER	4.7V 5% 0.4W	PHILIPS	BZX79C4V7	26.524
D19-1	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D21-1	DIODE ZENER	5V6 5% 0.4W	PHILIPS	BZX79C5V6	26.530
FL1-1	CRYSTAL FILTER	C1032	NDK	YF 10.598S SP SPEC. C1032A	40.036
FP1-1	FERRITE BEAD	Ø3.7xØ1.2x3.5mm GRADE 4B1	PHILIPS	4322 020 34420	35.181
IC4-1	INTEGRATED CIRCUIT	DUAL OPERATIONAL AMP.	TEXAS	MC1458P	31.215
IC5-1	TRANSISTOR ARRAY	3046	RCA	CA3046E	31.025
IC6-1	INTEGRATED CIRCUIT	QUADRUPLE LINE DRIVER	TEXAS	SN75188N	34.304
IC7-1	INTEGRATED CIRCUIT	MC14094BCP	RCA*	CD4094	33.305
L1-1	CHOKE FIXED	100uH 5%	NEOSID	00 6122 12 AMMO PACK	20.169
L2-1	COIL	TL426	ESPERA	6-0-24375	400426
L3-1	COIL	TL426	ESPERA	6-0-24375	400426
L4-1	COIL	TL422	ESPERA	6-0-24371A	400422
L5-1	COIL	TL421	ESPERA	6-0-24370A	400421
L6-1	COIL	TL420	ESPERA	6-0-24369A	400420
L7-1	CHOKE FIXED	10uH 5%	NEOSID	00 6122 00 AMMO PACK	20.118
L8-1	COIL	TL423	ESPERA	6-0-24372A	400423
L9-1	COIL	TL425	ESPERA	6-0-24374A	400425

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
L10-1	COIL	TL424	ESPERA	6-0-24373A	400424
L11-1	CHOKE FIXED	82uH 5%	NEOSID	00 6122 11 AMMO PACK	20.168
L12-1	CHOKE FIXED	82uH 5%	NEOSID	00 6122 11 AMMO PACK	20.168
L13-1	CHOKE FIXED	82uH 5%	NEOSID	00 6122 11 AMMO PACK	20.168
P1-1	PLUG (MALE)	4 POLE	AMP	0-826375-4	78.104
P2-1	PLUG (MALE)	7 POLE	AMP	0-826375-7	78.107
P3-1	PLUG (MALE)	3 POLE	AMP	0-826375-3	78.103
R1-1	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222	01.208
R2-1	RESISTOR MF	1k8 OHM 5% 0.4W	PHILIPS	2322 181 53182	01.206
R3-1	RESISTOR MF	470 OHM 5% 0.4W	PHILIPS	2322 181 53471	01.191
R4-1	RESISTOR MF	43 OHM 5% 0.4W	PHILIPS	2322 181 53439	01.165
R5-1	RESISTOR	22 OHM 5% 0.5W	PHILIPS	2322 156 12209	03.159
R6-1	RESISTOR MF	2k7 OHM 5% 0.33W	PHILIPS	2322 180 73272	02.482
R7-1	RESISTOR MF	43 OHM 5% 0.4W	PHILIPS	2322 181 53439	01.165
R8-1	RESISTOR MF	330 OHM 5% 0.4W	PHILIPS	2322 181 53331	01.187
R9-1	RESISTOR MF	470 OHM 5% 0.4W	PHILIPS	2322 181 53471	01.191
R10-1	RESISTOR MF	270 OHM 5% 0.4W S	BEYSCHLAG	MUB 0207-50-5%-270R	01.685
R12-1	RESISTOR MF	1k8 OHM 5% 0.4W	PHILIPS	2322 181 53182	01.206
R13-1	RESISTOR MF	270 OHM 5% 0.4W	PHILIPS	2322 181 53271	01.185
R14-1	RESISTOR MF	68 OHM 5% 0.4W	PHILIPS	2322 181 53689	01.170
R15-1	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R17-1	RESISTOR MF	270 OHM 5% 0.4W	PHILIPS	2322 181 53271	01.185
R18-1	RESISTOR MF	27 OHM 5% 0.4W	PHILIPS	2322 181 53279	01.160
R19-1	POTENTIOMETER TRIMMING	100 OHM 10% 0.5W	PHILIPS*	2322 482 22101	07.644
R20-1	RESISTOR MF	180 OHM 5% 0.4W	PHILIPS	2322 181 53181	01.181
R21-1	RESISTOR MF	680 OHM 5% 0.4W	PHILIPS	2322 181 53681	01.195
R22-1	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R23-1	RESISTOR MF	5k6 OHM 5% 0.33W	PHILIPS	2322 180 73562	02.490
R24-1	RESISTOR MF	2k7 OHM 5% 0.4W	PHILIPS	2322 181 53272	01.210
R25-1	POTENTIOMETER TRIMMING	1 KOHM 20% 0.3W	NOBLE	TM8-KV2-1S	07.784
R26-1	RESISTOR MF	22 OHM 5% 0.4W	PHILIPS	2322 181 53229	01.158
R27-1	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222	01.208
R28-1	RESISTOR	22 OHM 5% 0.5W	PHILIPS	2322 156 12209	03.159
R29-1	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R30-1	RESISTOR MF	220 OHM 5% 0.4W	PHILIPS	2322 181 53221	01.183
R31-1	RESISTOR MF	5k6 OHM 5% 0.4W	PHILIPS	2322 181 53562	01.218
R32-1	RESISTOR MF	15k OHM 5% 0.4W	PHILIPS	2322 181 53153	01.229
R33-1	RESISTOR MF	1k5 OHM 5% 0.4W	PHILIPS	2322 181 53152	01.204
R34-1	RESISTOR MF	7k5 OHM 5% 0.33W	PHILIPS	2322 180 73752	02.493
R35-1	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R36-1	RESISTOR	82 OHM 5% 0.6W	BEYSCHLAG	MBB 0207-00-BX-82R 5%	03.174

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R37-1	RESISTOR MF	12k OHM 5% 0.4W	PHILIPS	2322 181 53123	01.227
R38-1	RESISTOR MF	27 OHM 5% 0.4W	PHILIPS	2322 181 53279	01.160
R39-1	RESISTOR MF	12 OHM 5% 0.4W	PHILIPS	2322 181 53129	01.152
R40-1	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R41-1	RESISTOR MF	330 OHM 5% 0.4W	PHILIPS	2322 181 53331	01.187
R42-1	RESISTOR MF	560k OHM 5% 0.4W	PHILIPS	2322 181 53564	01.268
R43-1	RESISTOR MF	120k OHM 5% 0.4W	PHILIPS	2322 181 53124	01.252
R44-1	RESISTOR MF	6k8 OHM 5% 0.4W	PHILIPS	2322 181 53682	01.220
R45-1	RESISTOR MF	120 OHM 5% 0.4W	PHILIPS	2322 181 53121	01.177
R46-1	RESISTOR MF	39 OHM 5% 0.4W	PHILIPS	2322 181 53399	01.164
R47-1	RESISTOR MF	470 OHM 5% 0.4W	PHILIPS	2322 181 53471	01.191
R48-1	RESISTOR MF	3k9 OHM 5% 0.4W	PHILIPS	2322 181 53392	01.214
R49-1	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R50-1	RESISTOR MF	47k OHM 5% 0.4W	PHILIPS	2322 181 53473	01.241
R51-1	RESISTOR MF	220 OHM 5% 0.4W	PHILIPS	2322 181 53221	01.183
R52-1	RESISTOR MF	1k2 OHM 5% 0.4W	PHILIPS	2322 181 53122	01.202
R53-1	RESISTOR MF	470 OHM 5% 0.4W	PHILIPS	2322 181 53471	01.191
R54-1	RESISTOR MF	10 OHM 5% 0.4W	PHILIPS	2322 181 53109	01.150
R55-1	RESISTOR MF	100 OHM 5% 0.33W	PHILIPS	2322 180 73101	02.448
R56-1	RESISTOR MF	33k OHM 5% 0.4W	PHILIPS	2322 181 53333	01.237
R57-1	RESISTOR MF	100 OHM 5% 0.33W	PHILIPS	2322 180 73101	02.448
R58-1	RESISTOR MF	330 OHM 5% 0.4W	PHILIPS	2322 181 53331	01.187
R59-1	RESISTOR MF	22 OHM 5% 0.4W	PHILIPS	2322 181 53229	01.158
R60-1	RESISTOR MF	47 OHM 5% 0.4W	PHILIPS	2322 181 53479	01.166
R61-1	RESISTOR MF	100 OHM 5% 0.33W	PHILIPS	2322 180 73101	02.448
R62-1	RESISTOR MF	100 OHM 5% 0.33W	PHILIPS	2322 180 73101	02.448
R63-1	RESISTOR MF	120 OHM 5% 0.4W	PHILIPS	2322 181 53121	01.177
R64-1	RESISTOR MF	22k OHM 5% 0.4W	PHILIPS	2322 181 53223	01.233
R65-1	RESISTOR MF	560k OHM 5% 0.4W	PHILIPS	2322 181 53564	01.268
R66-1	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R67-1	RESISTOR MF	47 OHM 5% 0.4W	PHILIPS	2322 181 53479	01.166
R68-1	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R69-1	RESISTOR MF	18 OHM 5% 0.4W	PHILIPS	2322 181 53189	01.156
R70-1	POTENTIOMETER TRIMMING	100 OHM 10% 0.5W	PHILIPS*	2322 482 22101	07.644
R71-1	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R72-1	RESISTOR MF	5k6 OHM 5% 0.4W	PHILIPS	2322 181 53562	01.218
R73-1	RESISTOR MF	82 OHM 5% 0.4W	PHILIPS	2322 181 53829	01.172
R74-1	RESISTOR MF	270 OHM 5% 0.4W	PHILIPS	2322 181 53271	01.185
R75-1	RESISTOR MF	560 OHM 5% 0.4W	PHILIPS	2322 181 53561	01.193
R76-1	RESISTOR MF	560 OHM 5% 0.4W	PHILIPS	2322 181 53561	01.193
R77-1	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222	01.208
R78-1	POTENTIOMETER TRIMMNING	2.2 KOHM 10% 0.5W	PHILIPS	2322 482 22222	07.665
R79-1	RESISTOR MF	1k8 OHM 5% 0.4W	PHILIPS	2322 181 53182	01.206
R80-1	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R81-1	POTENTIOMETER TRIMMING	220 OHM 10% 0.5W	PHILIPS*	2322 482 22221	07.647
R82-1	RESISTOR MF	2k7 OHM 5% 0.4W	PHILIPS	2322 181 53272	01.210
R83-1	RESISTOR MF	220 OHM 5% 0.4W	PHILIPS	2322 181 53221	01.183
R84-1	RESISTOR MF	3k9 OHM 5% 0.4W	PHILIPS	2322 181 53392	01.214
R85-1	RESISTOR MF	270 OHM 5% 0.4W	PHILIPS	2322 181 53271	01.185
R86-1	RESISTOR MF	215 OHM 1% 0.25W	PHILIPS	2322 150 52151	02.202
				BRUG 02.212 890808/KLM	
R87-1	RESISTOR MF	3k9 OHM 5% 0.4W	PHILIPS	2322 181 53392	01.214
R88-1	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R89-1	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R90-1	RESISTOR MF	180 OHM 5% 0.4W	PHILIPS	2322 181 53181	01.181
R91-1	RESISTOR MF	8k2 OHM 5% 0.4W	PHILIPS	2322 181 53822	01.222
R92-1	RESISTOR MF	8k2 OHM 5% 0.4W	PHILIPS	2322 181 53822	01.222
R93-1	RESISTOR MF	75 OHM 5% 0.4W	PHILIPS	2322 181 53759	01.171
R94-1	RESISTOR MF	22 OHM 5% 0.4W	PHILIPS	2322 181 53229	01.158
R95-1	RESISTOR MF	560 OHM 5% 0.4W	PHILIPS	2322 181 53561	01.193
R96-1	RESISTOR MF	357 OHM 1% 0.6W	* PHILIPS	2322 156 13571	02.204
R97-1	RESISTOR MF	220 OHM 5% 0.4W	PHILIPS	2322 181 53221	01.183
R98-1	RESISTOR MF	3k9 OHM 5% 0.4W	PHILIPS	2322 181 53392	01.214
R99-1	RESISTOR MF	2k0 OHM 5% 0.4W	PHILIPS	2322 181 53202	01.207
R100-1	RESISTOR MF	680 OHM 5% 0.4W	PHILIPS	2322 181 53681	01.195
R101-1	RESISTOR MF	6k8 OHM 5% 0.4W	PHILIPS	2322 181 53682	01.220
R102-1	RESISTOR MF	8k2 OHM 5% 0.4W	PHILIPS	2322 181 53822	01.222
R103-1	POTENTIOMETER TRIMMING	100 OHM 10% 0.5W	PHILIPS*	2322 482 22101	07.644
R104-1	RESISTOR MF	330 OHM 5% 0.4W	PHILIPS	2322 181 53331	01.187
R105-1	RESISTOR MF	240 OHM 5% 0.4W	PHILIPS	2322 181 53241	01.184
R106-1	RESISTOR MF	1k8 OHM 5% 0.4W	PHILIPS	2322 181 53182	01.206
R107-1	RESISTOR MF	10 OHM 5% 0.4W	PHILIPS	2322 181 53109	01.150
R108-1	RESISTOR MF	220 OHM 5% 0.4W	PHILIPS	2322 181 53221	01.183
R109-1	RESISTOR MF	5k6 OHM 5% 0.4W	PHILIPS	2322 181 53562	01.218
R110-1	RESISTOR	576 OHM 1% 0.4W	*PHILIPS	2322 156 15761	02.207
R111-1	RESISTOR NTC	470 OHM 10% .5W	PHILIPS	2322 642 62471	07.267
R112-1	RESISTOR MF	22 OHM 5% 0.4W	PHILIPS	2322 181 53229	01.158
R113-1	RESISTOR MF	5k6 OHM 5% 0.4W	PHILIPS	2322 181 53562	01.218
R114-1	RESISTOR MF	8k2 OHM 5% 0.4W	PHILIPS	2322 181 53822	01.222
R115-1	RESISTOR MF	1k5 OHM 5% 0.4W	PHILIPS	2322 181 53152	01.204
R116-1	POTENTIOMETER TRIMMING	470 OHM 10% 0.5W	PHILIPS*	2322 482 22471	07.651
R117-1	RESISTOR MF	27 OHM 5% 0.4W	PHILIPS	2322 181 53279	01.160
R118-1	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
R119-1	RESISTOR MF	3k9 OHM 5% 0.4W	PHILIPS	2322 181 53392	01.214
R120-1	RESISTOR MF	180 OHM 5% 0.4W	PHILIPS	2322 181 53181	01.181
R121-1	RESISTOR MF	47 OHM 5% 0.4W	PHILIPS	2322 181 53479	01.166
R122-1	RESISTOR MF	220 OHM 5% 0.4W	PHILIPS	2322 181 53221	01.183
R123-1	POTENTIOMETER TRIMMING	220 OHM 10% 0.5W	PHILIPS*	2322 482 22221	07.647

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R124-1	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222	01.208
R125-1	RESISTOR MF	5k6 OHM 5% 0.4W	PHILIPS	2322 181 53562	01.218
R126-1	RESISTOR MF	1k5 OHM 5% 0.4W	PHILIPS	2322 181 53152	01.204
R127-1	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R128-1	RESISTOR MF	5k6 OHM 5% 0.4W	PHILIPS	2322 181 53562	01.218
R129-1	RESISTOR MF	270 OHM 5% 0.4W	PHILIPS	2322 181 53271	01.185
R130-1	RESISTOR MF	3k9 OHM 5% 0.4W	PHILIPS	2322 181 53392	01.214
R131-1	RESISTOR MF	33 OHM 5% 0.4W	PHILIPS	2322 181 53339	01.162
R132-1	RESISTOR MF	3k9 OHM 5% 0.4W	PHILIPS	2322 181 53392	01.214
R133-1	RESISTOR MF	226 OHM 1% 0.4W	PHILIPS	2322 157 12261	02.203
				BRUG 02.213 890808/KLM	
R134-1	RESISTOR MF	120 OHM 5% 0.4W	PHILIPS	2322 181 53121	01.177
R135-1	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222	01.208
R136-1	RESISTOR MF	120 OHM 5% 0.4W	PHILIPS	2322 181 53121	01.177
R137-1	RESISTOR MF	8k2 OHM 5% 0.4W	PHILIPS	2322 181 53822	01.222
R138-1	RESISTOR MF	3k9 OHM 5% 0.4W	PHILIPS	2322 181 53392	01.214
R139-1	RESISTOR	464 OHM 1% 0.4W	*PHILIPS	2322 156 14641	03.392
R140-1	RESISTOR MF	180 OHM 5% 0.4W	PHILIPS	2322 181 53181	01.181
R141-1	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R142-1	RESISTOR MF	180 OHM 5% 0.4W	PHILIPS	2322 181 53181	01.181
R143-1	RESISTOR MF	3k9 OHM 5% 0.4W	PHILIPS	2322 181 53392	01.214
R144-1	RESISTOR MF	120 OHM 5% 0.4W	PHILIPS	2322 181 53121	01.177
R145-1	RESISTOR MF	8k2 OHM 5% 0.4W	PHILIPS	2322 181 53822	01.222
R146-1	RESISTOR MF	1k8 OHM 5% 0.4W	PHILIPS	2322 181 53182	01.206
R147-1	RESISTOR MF	2k0 OHM 5% 0.4W	PHILIPS	2322 181 53202	01.207
R148-1	RESISTOR MF	120 OHM 5% 0.4W	PHILIPS	2322 181 53121	01.177
R149-1	RESISTOR MF	120 OHM 5% 0.4W	PHILIPS	2322 181 53121	01.177
R150-1	RESISTOR MF	39 OHM 5% 0.4W	PHILIPS	2322 181 53399	01.164
R151-1	POTENTIOMETER TRIMMING	220 OHM 10% 0.5W	PHILIPS*	2322 482 22221	07.647
R152-1	RESISTOR MF	120 OHM 5% 0.4W	PHILIPS	2322 181 53121	01.177
R153-1	RESISTOR MF	47 OHM 5% 0.4W	PHILIPS	2322 181 53479	01.166
R154-1	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
R155-1	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
R156-1	RESISTOR	910 OHM 2% 0.25W	PHILIPS	2322 150 49101	02.208
R157-1	RESISTOR MF	1k5 OHM 5% 0.4W	PHILIPS	2322 181 53152	01.204
R158-1	RESISTOR MF	47 OHM 5% 0.4W	PHILIPS	2322 181 53479	01.166
R159-1	RESISTOR MF	6k8 OHM 5% 0.4W	PHILIPS	2322 181 53682	01.220
R160-1	RESISTOR MF	120 OHM 5% 0.4W	PHILIPS	2322 181 53121	01.177
R161-1	RESISTOR MF	8k2 OHM 5% 0.4W	PHILIPS	2322 181 53822	01.222
R162-1	RESISTOR MF	1k78 OHM 1% 0.25W	PHILIPS	2322 157 11782	02.205
R163-1	RESISTOR MF	18k OHM 5% 0.4W	PHILIPS	2322 181 53183	01.231
R164-1	RESISTOR MF	18k OHM 5% 0.4W	PHILIPS	2322 181 53183	01.231
R165-1	RESISTOR MF	15k OHM 5% 0.4W	PHILIPS	2322 181 53153	01.229
R166-1	RESISTOR MF	120 OHM 5% 0.4W	PHILIPS	2322 181 53121	01.177

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R167-1	RESISTOR MF	8k2 OHM 5% 0.4W	PHILIPS	2322 181 53822	01.222
R168-1	RESISTOR MF	110 OHM 1% 0.4W	PHILIPS	2322 157 11101	02.201
				BRUG 02.211 890808/KLM	
R169-1	RESISTOR MF	47 OHM 5% 0.4W	PHILIPS	2322 181 53479	01.166
R170-1	RESISTOR MF	180 OHM 5% 0.4W	PHILIPS	2322 181 53181	01.181
R171-1	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222	01.208
R172-1	RESISTOR MF	470 OHM 5% 0.4W	PHILIPS	2322 181 53471	01.191
R173-1	RESISTOR MF	1k2 OHM 5% 0.4W	PHILIPS	2322 181 53122	01.202
R174-1	RESISTOR MF	910 OHM 5% 0.4W	PHILIPS	2322 181 53911	01.199
R175-1	RESISTOR MF	1k2 OHM 5% 0.4W	PHILIPS	2322 181 53122	01.202
R176-1	RESISTOR MF	220 OHM 5% 0.4W	PHILIPS	2322 181 53221	01.183
R177-1	RESISTOR MF	120 OHM 5% 0.4W	PHILIPS	2322 181 53121	01.177
R178-1	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R179-1	RESISTOR MF	22 OHM 5% 0.4W	PHILIPS	2322 181 53229	01.158
R180-1	RESISTOR MF	5k6 OHM 5% 0.33W	PHILIPS	2322 180 73562	02.490
R181-1	RESISTOR MF	100k OHM 5% 0.4W	PHILIPS	2322 181 53104	01.250
R182-1	RESISTOR MF	470 OHM 5% 0.33W	PHILIPS	2322 180 73471	02.464
R183-1	RESISTOR MF	470 OHM 5% 0.33W	PHILIPS	2322 180 73471	02.464
R184-1	RESISTOR MF	470 OHM 5% 0.33W	PHILIPS	2322 180 73471	02.464
RE1-1	RELAY	12VDC 1SH. 2A.	MILTRONIC AB	OUC-S-112D	21.300
T1-1	TRANSISTOR	BFY50	PHILIPS	BFY50	29.179
T2-1	TRANSISTOR	BFY50	PHILIPS	BFY50	29.179
T4-1	TRANSISTOR RF	BFW17A PNP TO-39	SGS	BFW17A	29.151
T5-1	TRANSISTOR AF	BC558 PNP TO-92	PHILIPS	BC558 (-A/-B/-C)	28.095
T6-1	TRANSISTOR RF	BF494 PNP TO-92	PHILIPS	BF494	28.201
T7-1	TRANSISTOR JFET	TIS88A3 TO-92	MOTORPLA	TM 00 044-3	29.737
T8-1	TRANSISTOR RF	BFW17A PNP TO-39	SGS	BFW17A	29.151
T9-1	TRANSISTOR RF	BF494 PNP TO-92	PHILIPS	BF494	28.201
T10-1	TRANSISTOR RF	BF494 PNP TO-92	PHILIPS	BF494	28.201
T11-1	TRANSISTOR AF	BC548B NPN TO-92	PHILIPS	BC548B	28.076
T12-1	TRANSISTOR AF	BC548B NPN TO-92	PHILIPS	BC548B	28.076
T13-1	TRANSISTOR AF	BC548B NPN TO-92	PHILIPS	BC548B	28.076
T14-1	TRANSISTOR RF	BF494 PNP TO-92	PHILIPS	BF494	28.201
T15-1	TRANSISTOR RF	BF494 PNP TO-92	PHILIPS	BF494	28.201
T16-1	TRANSISTOR RF	BF494 PNP TO-92	PHILIPS	BF494	28.201
T17-1	TRANSISTOR AF	BC548B NPN TO-92	PHILIPS	BC548B	28.076
T18-1	TRANSISTOR AF	BC548B NPN TO-92	PHILIPS	BC548B	28.076
T19-1	TRANSISTOR RF	BF494 PNP TO-92	PHILIPS	BF494	28.201
T20-1	TRANSISTOR RF	BF494 PNP TO-92	PHILIPS	BF494	28.201
T21-1	TRANSISTOR AF	BC548B NPN TO-92	PHILIPS	BC548B	28.076
T22-1	TRANSISTOR AF	BC548B NPN TO-92	PHILIPS	BC548B	28.076
T23-1	TRANSISTOR RF	BFW17A PNP TO-39	SGS	BFW17A	29.151
TR1-1	TRANSFORMER	TL419	ESPERA	6-0-24368	400419
TR2-1	TRANSFORMER	TL418	ESPERA	6-0-24367	400418

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
TR3-1	TRANSFORMER	TL417	ESPERA	6-0-24366	400417
TR4-1	TRANSFORMER	TL417	ESPERA	6-0-24366	400417
TR5-1	TRANSFORMER	TL249	S.P.RADIO	6-0-21572	400249

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	POWER AMPLIFIER UNIT	T2031 MODUL 2	ESPERA	5-0-24031H	600220
C1-2	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E G5	14.610
C2-2	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E G5	14.610
C3-2	CAPACITOR POLYESTER	0.1uF 10% 100V	ERO*	MKT1822	11.073
C4-2	CAPACITOR POLYSTYRENE	910pF 1% 250V	*PHILIPS	2222 430 89101	10.349
C5-2	CAPACITOR POLYSTYRENE	910pF 1% 250V	*PHILIPS	2222 430 89101	10.349
C6-2	CAPACITOR ELECTROLYTIC	470uF -10/+50% 40VDC	ERO*	EKM 05 FG 347 G 05	14.650
C7-2	CAPACITOR POLYESTER	0.1uF 10% 100V	ERO*	MKT1822	11.073
C8-2	CAPACITOR POLYESTER	0.1uF 10% 100V	ERO*	MKT1822	11.073
C9-2	CAPACITOR POLYESTER	0.1uF 10% 100V	ERO*	MKT1822	11.073
C10-2	CAPACITOR POLYESTER	0.1uF 10% 100V	ERO*	MKT1822	11.073
C11-2	CAPACITOR ELECTROLYTIC	470uF -10/+50% 16V	ERO	EB 00 GC 347 D	14.572
C12-2	CAPACITOR MKT	10nF 10% 400V	PHILIPS*	2222 344 51103	12.213
C13-2	CAPACITOR MKT	10nF 10% 400V	PHILIPS*	2222 344 51103	12.213
C14-2	CAPACITOR POLYESTER	0.1uF 10% 100V	ERO*	MKT1822	11.073
C15-2	CAPACITOR POLYESTER	0.1uF 10% 100V	ERO*	MKT1822	11.073
C16-2	CAPACITOR POLYESTER	0.1uF 10% 100V	ERO*	MKT1822	11.073
C17-2	CAPACITOR ELECTROLYTIC	10uF -10/+50% 63VDC	ERO	EB 00 CA 210 J B5	14.546
C18-2	CAPACITOR POLYESTER	0.1uF 10% 100V	ERO*	MKT1822	11.073
C19-2	CAPACITOR POLYESTER	0.1uF 10% 100V	ERO*	MKT1822	11.073
C20-2	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C21-2	CAPACITOR CERAMIC	2.2nF 20% 50V	KCK	HE60SJYD222M	15.163
C22-2	CAPACITOR CERAMIC	2.2nF 20% 50V	KCK	HE60SJYD222M	15.163
C23-2	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C24-2	CAPACITOR MKT	470nF 10% 63V	ERO*	MKT1822-447/065	11.048
D1-2	DIODE ZENER	5.1V 5% 0.4W	PHILIPS	BZX79C5V1	26.527
IC1-2	DUAL OP AMP	LM358N	TEXAS	LM358P	31.100
L1-2	CHOKE FIXED	1u5H 5%	NEOSID	00 6126 10 AMMO PACK	20.126
L2-2	CHOKE FIXED	1u5H 5%	NEOSID	00 6126 10 AMMO PACK	20.126
L3-2	COIL	TL067	S.P.RADIO	6-0-20854A 400067=20.053	400067
L4-2	COIL	TL067	S.P.RADIO	6-0-20854A 400067=20.053	400067
L5-2	COIL	TL067	S.P.RADIO	6-0-20854A 400067=20.053	400067
L6-2	COIL	TL067	S.P.RADIO	6-0-20854A 400067=20.053	400067
L7-2	CHOKE	460uH	TRADANIA	TD 6209.0	20.253

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R1-2	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R2-2	RESISTOR MF	2k7 OHM 5% 0.4W	PHILIPS	2322 181 53272	01.210
R3-2	POTENTIOMETER TRIMMING	220 OHM 10% 0.5W	PHILIPS*	2322 482 22221	07.647
R4-2	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R5-2	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R6-2	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R7-2	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R8-2	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R9-2	RESISTOR MF	220 OHM 5% 0.4W	PHILIPS	2322 181 53221	01.183
R10-2	RESISTOR MF	3k3 OHM 5% 0.4W	PHILIPS	2322 181 53332	01.212
R11-2	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R12-2	RESISTOR PMF	56 OHM 5% 2W	PHILIPS	2322 191 35609	04.149
R13-2	RESISTOR MF	68 OHM 5% 0.4W	PHILIPS	2322 181 53689	01.170
R14-2	RESISTOR MF	68 OHM 5% 0.4W	PHILIPS	2322 181 53689	01.170
R15-2	RESISTOR MF	27 OHM 5% 0.4W	PHILIPS	2322 181 53279	01.160
R16-2	RESISTOR MF	27 OHM 5% 0.4W	PHILIPS	2322 181 53279	01.160
R17-2	RESISTOR MF	100 OHM 5% 0.5W	PHILIPS	2322 156 11001	01.376
R18-2	RESISTOR MF	100 OHM 5% 0.5W	PHILIPS	2322 156 11001	01.376
R19-2	RESISTOR PMF	8R2 OHM 5% 2W	PHILIPS	2322 191 38208	04.130
R20-2	RESISTOR PMF	8R2 OHM 5% 2W	PHILIPS	2322 191 38208	04.130
R21-2	RESISTOR PMF	3R3 OHM 5% 2W	PHILIPS	2322 191 33308	04.124
R22-2	RESISTOR PMF	3R3 OHM 5% 2W	PHILIPS	2322 191 33308	04.124
R23-2	RESISTOR PMF	10 OHM 5% 3W	PHILIPS	2322 192 31009	04.650
R24-2	RESISTOR PMF	10 OHM 5% 3W	PHILIPS	2322 192 31009	04.650
R25-2	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R26-2	RESISTOR MF	3k3 OHM 5% 0.4W	PHILIPS	2322 181 53332	01.212
R27-2	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R28-2	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R29-2	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R30-2	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R31-2	RESISTOR MF	3k9 OHM 5% 0.4W	PHILIPS	2322 181 53392	01.214
R32-2	POTENTIOMETER TRIMMING	220 OHM 10% 0.5W	PHILIPS*	2322 482 22221	07.647
R33-2	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R34-2	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R35-2	RESISTOR MF	22 OHM 5% 0.4W	PHILIPS	2322 181 53229	01.158
R36-2	RESISTOR MF	22 OHM 5% 0.4W	PHILIPS	2322 181 53229	01.158
T1-2	TRANSISTOR	2N5190	MOTOROLA*	2N5190	29.318
T2-2	TRANSISTOR AF	BC548 NPN TO-92	PHILIPS	BC548 (-A/-B/-C)	28.070
T3-2	TRANSISTOR AF	BC338-25 NPN TO-92	PHILIPS	BC338-25	28.058
T4-2	TRANSISTOR	SRFE 1033	MOTOROLA	SRFE 008P 1SET=2PCS	29.265
T5-2	TRANSISTOR	SRFE 1033	MOTOROLA	SRFE 008P 1SET=2PCS	29.265
T6-2	TRANSISTOR AF POWER	NPN DARLINGTON TO220	PHILIPS	BD645	29.122

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
T7-2	TRANSISTOR RF POWER	TH430 HFE SORTED	THOMSON-CSF	TH430 GRUPPE C,D,E,F,G	29.268
T8-2	TRANSISTOR RF POWER	TH430 HFE SORTED	THOMSON-CSF	TH430 GRUPPE C,D,E,F,G	29.268
T9-2	TRANSISTOR AF	BC548 NPN TO-92	PHILIPS	BC548 (-A/-B/-C)	28.070
T10-2	TRANSISTOR	2N5190	MOTOROLA*	2N5190	29.318
TR1-2	TRANSFORMER	TL389	ESPERA	6-0-24022	400389
TR2-2	TRANSFORMER	TL390	ESPERA	6-0-24029	400390
TR3-2	TRANSFORMER	TL300	S.P.RADIO	6-0-23122B	400300
TR4-2	TRANSFORMER	TL391	ESPERA	6-0-24030	400391

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	FILTER UNIT	T2031 MODUL 3	ESPERA	5-0-24297E	600222
C1-3	CAPACITOR CERAMIC	10pF NPO .5	KCK*	HE40SJCH100D	15.036
C2-3	CAPACITOR TRIMMING	8-80pF POLYKA	DAU	109.4601.080	17.200
C3-3	CAPACITOR CERAMIC	110pF 10% NPO 500VDC	KCK	RT-HM11-SK CH 111 K AMMO PACK	15.140
C4-3	CAPACITOR CERAMIC	110pF 10% NPO 500VDC	KCK	RT-HM11-SK CH 111 K AMMO PACK	15.140
C5-3	CAPACITOR MICA	160pF 5% 500VDC	SAHA	DM20 C 161 J 500V	16.600
C6-3	CAPACITOR MICA	270pF 5% 500VDC	SAHA	DM20 C 271 J 500V	16.603
C7-3	CAPACITOR MICA	220pF 5% 500VDC	SAHA	DM20 C 221 J 500V	16.602
C8-3	CAPACITOR MICA	360pF 5% 500VDC	SAHA	DM20 C 361 J 500V	16.605
C9-3	CAPACITOR CERAMIC	1.8nF 400V 20%	FERROPERM	9/0129,9	16.100
C10-3	CAPACITOR MICA	390pF 5% 500VDC	SAHA	DM20 C 391 J 500V	16.606
C11-3	CAPACITOR MICA	560pF 5% 500VDC	SAHA	DM20 C 561 J 500V	16.612
C13-3	CAPACITOR MICA	430pF 5% 500VDC	SAHA	DM20 C 431 J 500V	16.609
C14-3	CAPACITOR MICA	680pF 5% 500VDC	SAHA	DM20 C 681 J 500V	16.615
C15-3	CAPACITOR MKT	680nF 10% 63V	ERO*	MKT 1818-468/065	11.186
C17-3	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C18-3	CAPACITOR CERAMIC	1.8nF 400V 20%	FERROPERM	9/0129,9	16.100
C21-3	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C22-3	CAPACITOR MKT	680nF 10% 63V	ERO*	MKT 1818-468/065	11.186
C25-3	CAPACITOR MKT	470nF 10% 63V	ERO*	MKT 1818-447/065	11.185
D1-3	DIODE SCHOTTKY BARRIER	70V/15mA DO-35	HP	5082-2800 TAPED	27.500
D2-3	DIODE SCHOTTKY BARRIER	70V/15mA DO-35	HP	5082-2800 TAPED	27.500
D3-3	DIODE	BAW62 HIGH SPEED	PHILIPS	BAW62-143	25.350
D4-3	DIODE	BAW62 HIGH SPEED	PHILIPS	BAW62-143	25.350
D5-3	DIODE	BAW62 HIGH SPEED	PHILIPS	BAW62-143	25.350
D6-3	DIODE	BAW62 HIGH SPEED	PHILIPS	BAW62-143	25.350
D7-3	DIODE	BAW62 HIGH SPEED	PHILIPS	BAW62-143	25.350
D8-3	DIODE	BAW62 HIGH SPEED	PHILIPS	BAW62-143	25.350
D9-3	DIODE	BAW62 HIGH SPEED	PHILIPS	BAW62-143	25.350
D10-3	DIODE	BAW62 HIGH SPEED	PHILIPS	BAW62-143	25.350
D11-3	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
IC1-3	QUAD OP.AMP.	324	TEXAS	LM324N	31.065
L1-3	COIL	TL398	ESPERA	6-0-24047	400398
L2-3	COIL	TL397	ESPERA	6-0-24046	400397
L3-3	COIL	TL397	ESPERA	6-0-24046	400397
L4-3	COIL	TL397	ESPERA	6-0-24046	400397
L5-3	COIL	TL397	ESPERA	6-0-24046	400397
L6-3	COIL	TL397	ESPERA	6-0-24046	400397
L7-6	COIL	TL399	ESPERA	6-0-24048	400399
L8-3	COIL	TL397	ESPERA	6-0-24046	400397

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
L9-3	COIL	TL400	ESPERA	6-0-24049	400400
L10-3	COIL	TL397	ESPERA	6-0-24046	400397
L11-3	COIL	TL397	ESPERA	6-0-24046	400397
L12-3	COIL	TL401	ESPERA	6-0-24050	400401
L13-3	COIL	TL400	ESPERA	6-0-24049	400400
L14-3	COIL	TL397	ESPERA	6-0-24046	400397
L15-3	COIL	TL401	ESPERA	6-0-24050	400401
L16-3	COIL	TL397	ESPERA	6-0-24046	400397
L17-3	COIL	TL397	ESPERA	6-0-24046	400397
L18-3	COIL	TL393	ESPERA	6-0-24042	400393
L19-3	COIL	TL396	ESPERA	6-0-24045	400396
L20-3	COIL	TL393	ESPERA	6-0-24042	400393
L21-3	COIL	TL395	ESPERA	6-0-24044	400395
L22-3	COIL	TL393	ESPERA	6-0-24042	400393
L23-3	COIL	TL394	ESPERA	6-0-24043	400394
L24-3	COIL	TL393	ESPERA	6-0-24042	400393
P1-3	PLUG (MALE)	5 POLE	AMP	0-826375-5	78.105
P2-3	PLUG (MALE)	7 POLE	AMP	0-826375-7	78.107
R1-3	RESISTOR MF	330 OHM 5% 0.4W	PHILIPS	2322 181 53331	01.187
R2-3	RESISTOR MF	330 OHM 5% 0.4W	PHILIPS	2322 181 53331	01.187
R3-3	RESISTOR MF	330 OHM 5% 0.4W	PHILIPS	2322 181 53331	01.187
R4-3	RESISTOR MF	330 OHM 5% 0.4W	PHILIPS	2322 181 53331	01.187
R5-3	RESISTOR MF	8k2 OHM 5% 0.4W	PHILIPS	2322 181 53822	01.222
R6-3	RESISTOR MF	3k9 OHM 5% 0.4W	PHILIPS	2322 181 53392	01.214
R7-3	RESISTOR MF	8k2 OHM 5% 0.4W	PHILIPS	2322 181 53822	01.222
R8-3	RESISTOR MF	33k OHM 5% 0.4W	PHILIPS	2322 181 53333	01.237
R9-3	RESISTOR MF	150k OHM 5% 0.4W	PHILIPS	2322 181 53154	01.254
R10-3	RESISTOR MF	220k OHM 5% 0.4W	PHILIPS	2322 181 53224	01.258
R11-3	RESISTOR MF	220k OHM 5% 0.4W	PHILIPS	2322 181 53224	01.258
R12-3	RESISTOR MF	33k OHM 5% 0.4W	PHILIPS	2322 181 53333	01.237
R13-3	RESISTOR MF	150k OHM 5% 0.4W	PHILIPS	2322 181 53154	01.254
R14-3	RESISTOR MF	220k OHM 5% 0.4W	PHILIPS	2322 181 53224	01.258
R15-3	RESISTOR MF	220k OHM 5% 0.4W	PHILIPS	2322 181 53224	01.258
R16-3	RESISTOR PMF	470 OHM 5% 2W	PHILIPS	2322 191 34701	04.191
R17-3	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R18-3	RESISTOR MF	3k3 OHM 5% 0.4W	PHILIPS	2322 181 53332	01.212
R19-3	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
R20-3	RESISTOR PMF	270 OHM 5% 2W	PHILIPS	2322 191 32701	04.185
R21-3	RESISTOR PMF	270 OHM 5% 2W	PHILIPS	2322 191 32701	04.185
R22-3	RESISTOR MF	560 OHM 5% 0.5W	PHILIPS	2322 156 15601	01.394
R23-3	RESISTOR MF	560 OHM 5% 0.5W	PHILIPS	2322 156 15601	01.394
R24-3	RESISTOR MF	560 OHM 5% 0.5W	PHILIPS	2322 156 15601	01.394
R25-3	RESISTOR MF	560 OHM 5% 0.5W	PHILIPS	2322 156 15601	01.394
RE1-3	RELAY	24V DC 10A 2 SK.	PASI	KS/U-3-H BV997	21.016

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
RE2-3	RELAY	24VDC 1SH. 18A.	PASI	KH/U-3-C	21.013
RE3-3	RELAY	24VDC 1SH. 18A.	PASI	KH/U-3-C	21.013
RE4-3	RELAY	24VDC 1SH. 18A.	PASI	KH/U-3-C	21.013
RE5-3	RELAY	24V DC 18A 1 SL.	PASI	KH/A-3 BV936	21.009
RE6-3	RELAY	24V DC 18A 1 SL.	PASI	KH/A-3 BV936	21.009
RE7-3	RELAY	24V DC 18A 1 SL.	PASI	KH/A-3 BV936	21.009
RE8-3	RELAY	24V DC 18A 1 SL.	PASI	KH/A-3 BV936	21.009
TR1-3	TRANSFORMER	TL274	TERMA	6-0-22270A	400274
TR2-3	TRANSFORMER	TL274	TERMA	6-0-22270A	400274

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	AERIAL CURRENT DETECTOR	T2031 MODUL 4	ESPERA	5-0-24310C	600224
C1-4	CAPACITOR CERAMIC	1.8nF 400V 20%	FERROPERM	9/0129,9	16.100
C2-4	CAPACITOR MKT	470nF 10% 63V	ERO*	MKT 1818-447/065	11.185
D1-4	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
R1-4	RESISTOR MF	1kO OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	POWER CONTROL COMPUTER	T2031 MODUL 5	ESPERA	5-0-24440G	600226
C1-5	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C2-5	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C3-5	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C4-5	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C5-5	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C6-5	CAPACITOR MKT	470nF 10% 100V	SIEMENS	B32510-D1474-K000	11.231
C7-5	CAPACITOR ELECTROLYTIC	1uF 20% 50VDC	ELNA	RJ2-50-V-010-M-T12	14.506
C8-5	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C9-5	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C10-5	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C11-5	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C12-5	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C13-5	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C14-5	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C15-5	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E G5	14.610
C16-5	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C17-5	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C18-5	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C19-5	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C20-5	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C21-5	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C22-5	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C23-5	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C24-5	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C25-5	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C26-5	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C28-5	CAPACITOR MKT	10nF 10% 250V	SIEMENS	B32510-D3103-K000	11.290
C29-5	CAPACITOR MKT	330nF 10% 100V	SIEMENS	B32511-D1334-K000	11.229
C30-5	CAPACITOR MKT	10nF 10% 250V	SIEMENS	B32510-D3103-K000	11.290
C31-5	CAPACITOR MKT	10nF 10% 250V	SIEMENS	B32510-D3103-K000	11.290
C32-5	CAPACITOR MKT	10nF 10% 250V	SIEMENS	B32510-D3103-K000	11.290
C33-5	CAPACITOR ELECTROLYTIC	1uF 20% 50VDC	ELNA	RJ2-50-V-010-M-T12	14.506
C34-5	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32511-D1224-K000	11.227
C35-5	CAPACITOR CERAMIC	47pF 10% N33 25V	FERROPERM	9/0213,8	15.770
C36-5	CAPACITOR CERAMIC	47pF 10% N33 25V	FERROPERM	9/0213,8	15.770
C37-5	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32511-D1224-K000	11.227
C38-5	CAPACITOR ELECTROLYTIC	1uF 20% 50VDC	ELNA	RJ2-50-V-010-M-T12	14.506
C39-5	CAPACITOR POLYSTYRENE	62pF 1% 630V	#PHILIPS	2222 431 86209	10.395
C40-5	CAPACITOR POLYSTYRENE	62pF 1% 630V	#PHILIPS	2222 431 86209	10.395
C41-5	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32511-D1224-K000	11.227
C56-5	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
C58-5	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C59-5	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C60-5	CAPACITOR MKT	10nF 10% 250V	SIEMENS	B32510-D3103-K000	11.290
C61-5	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C62-5	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C63-5	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C64-5	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C70-5	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32511-D1224-K000	11.227
C71-5	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C72-5	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C73-5	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C75-5	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C76-5	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C77-5	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C78-5	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C79-5	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C80-5	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C81-5	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C82-5	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
D1-5	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D2-5	DIODE LIGHT EMITTING	ORANGE 5mm	SANKEN	SEL 1913K	25.631
D3-5	DIODE LIGHT EMITTING	ORANGE 5mm	SANKEN	SEL 1913K	25.631
D4-5	DIODE LIGHT EMITTING	ORANGE 5mm	SANKEN	SEL 1913K	25.631
D5-5	DIODE LIGHT EMITTING	ORANGE 5mm	SANKEN	SEL 1913K	25.631
D6-5	DIODE LIGHT EMITTING	YELLOW 5mm	SANKEN	SEL1910D	25.630
D7-5	DIODE LIGHT EMITTING	YELLOW 5mm	SANKEN	SEL1910D	25.630
D8-5	DIODE LIGHT EMITTING	YELLOW 3mm	GI	MV5374C-25,4MM BEN	25.540
D9-5	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D10-5	DIODE ZENER	4,3V 2% 0.4W BZX79B4V3	PHILIPS*	BZX79B4V3	26.495
D13-5	DIODE ZENER	15V 5% 0.4W	PHILIPS	BZX79C15	26.561
IC1-5	KEYBOARD PROCESSOR	IC1 T2031	ESPERA	SP C1058 G	700573
IC2-5	DUAL OP AMP	LM358N	TEXAS	LM358P	31.100
IC3-5	INTEGRATED CIRCUIT	MC14094BCP	RCA*	CD4094	33.305
IC4-5	INTEGRATED CIRCUIT	MCM2802P	MOTOROLA	MCM2802P	33.495
IC5-5	INTEGRATED CIRCUIT	74LS165AN	TEXAS	SN74LS165AN	33.961
IC6-5	INTEGRATED CIRCUIT	MC14094BCP	RCA*	CD4094	33.305
IC7-5	INTEGRATED CIRCUIT	MCM2802P	MOTOROLA	MCM2802P	33.495
IC8-5	INTEGRATED CIRCUIT	MC14094BCP	RCA*	CD4094	33.305
IC9-5	INTEGRATED CIRCUIT	MCM2802P	MOTOROLA	MCM2802P	33.495
IC11-5	INTEGRATED CIRCUIT	MC14094BCP	RCA*	CD4094	33.305
IC12-5	INTEGRATED CIRCUIT	MC14094BCP	RCA*	CD4094	33.305
IC13-5	INTEGRATED CIRCUIT	ADC 0838 CCN	NATIONAL	ADC 0838 CCN	32.800

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
IC14-5	INTEGRATED CIRCUIT	MC14094BCP	RCA*	CD4094	33.305
IC15-5	INTEGRATED CIRCUIT	MC14094BCP	RCA*	CD4094	33.305
IC16-5	CONTROL PROCESSOR	IC16 T2031	ESPERA	SP C1057 E	700574
IC17-5	INTEGRATED CIRCUIT	MC14050BCP	MOTOROLA	MC14050BCP	33.191
IC18-5	INTEGRATED CIRCUIT	MC14094BCP	RCA*	CD4094	33.305
IC19-5	INTEGRATED CIRCUIT	MC14094BCP	RCA*	CD4094	33.305
IC20-5	INTEGRATED CIRCUIT	MC14584BCP	MOTOROLA	MC14584BCP	31.210
IC21-5	VOLTAGE REGULATOR	12V 5% 0.1A	MOTOROLA	MC78L12ACP	31.139
IC22-5	DUAL OP AMP	LM358N	TEXAS	LM358P	31.100
IC23-5	INTEGRATED CIRCUIT	QUAD ANALOG SWITCH	RCA	CD4066BE	33.232
LCD1-5	LIQUID CRYSTAL DISPLAY	LCD-3424-365-923/T2031	HAMLIN	SP TG.0-3-23964 HAMLIN TG.3424-365-923	25.708
OC1-5	OPTO COUPLER	CNY17-3	MOTOROLA	CNY17-3	32.533
OC2-5	OPTO COUPLER	CNY17-3	MOTOROLA	CNY17-3	32.533
P1-5	PLUG (MALE)	12 POLE	AMP	1-826375-2	78.112
P2-5	PLUG RIGHT ANGEL	1/10" SIL SQ.PINS 11POLES	AMP	1-826950-1	78.352
P3-5	PLUG (MALE)	8 POLE	AMP	0-826375-8	78.108
P4-5	PLUG (MALE)	13 POLE	AMP	1-826375-3	78.113
P5-5	PLUG (MALE)	7 POLE	AMP	0-826375-7	78.107
P6-5	PLUG (MALE)	5 POLE	AMP	0-826375-5	78.105
P7-5	PLUG (MALE)	11 POLE	AMP	1-826375-1	78.111
P8-5	PLUG (MALE)	3 POLE	AMP	0-826375-3	78.103
P9-5	PLUG	2 POLES	AMP	0-826375-2	78.102
R1-5	RESISTOR MF	100k OHM 5% 0.4W	PHILIPS	2322 181 53104	01.250
R3-5	RESISTOR MF	56k OHM 5% 0.4W	PHILIPS	2322 181 53563	01.243
R4-5	RESISTOR MF	56k OHM 5% 0.4W	PHILIPS	2322 181 53563	01.243
R5-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R6-5	RESISTOR MF	330 OHM 5% 0.4W	PHILIPS	2322 181 53331	01.187
R7-5	RESISTOR MF	56 OHM 5% 0.4W	PHILIPS	2322 181 53569	01.168
R8-5	RESISTOR MF	1k2 OHM 5% 0.4W	PHILIPS	2322 181 53122	01.202
R13-5	RESISTOR MF	560 OHM 5% 0.4W	PHILIPS	2322 181 53561	01.193
R14-5	RESISTOR MF	18k OHM 5% 0.4W	PHILIPS	2322 181 53183	01.231
R17-5	RESISTOR MF	18k OHM 5% 0.4W	PHILIPS	2322 181 53183	01.231
R18-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R19-5	RESISTOR MF	15k OHM 5% 0.4W	PHILIPS	2322 181 53153	01.229
R22-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R23-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R25-5	RESISTOR MF	22k OHM 5% 0.4W	PHILIPS	2322 181 53223	01.233
R26-5	POTENTIOMETER TRIMMING	47 KOHM 20% 0.05W	PHILIPS	2322 410 03359	07.635
R27-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R28-5	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
R29-5			*BEYSCHLAG	MBB0207-00-BX-120R 5%	03.177
R30-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R31-5	RESISTOR MF	5k6 OHM 5% 0.4W	PHILIPS	2322 181 53562	01.218

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R32-5	RESISTOR MF	1k2 OHM 5% 0.4W	PHILIPS	2322 181 53122	01.202
R33-5	RESISTOR MF	1k2 OHM 5% 0.4W	PHILIPS	2322 181 53122	01.202
R34-5	RESISTOR MF	1k2 OHM 5% 0.4W	PHILIPS	2322 181 53122	01.202
R35-5	RESISTOR MF	1k2 OHM 5% 0.4W	PHILIPS	2322 181 53122	01.202
R36-5	RESISTOR MF	1k2 OHM 5% 0.4W	PHILIPS	2322 181 53122	01.202
R37-5	RESISTOR MF	1k2 OHM 5% 0.4W	PHILIPS	2322 181 53122	01.202
R38-5	RESISTOR MF	1k2 OHM 5% 0.4W	PHILIPS	2322 181 53122	01.202
R39-5	RESISTOR MF	1k2 OHM 5% 0.4W	PHILIPS	2322 181 53122	01.202
R40-5	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222	01.208
R41-5	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R42-5	RESISTOR MF	1k2 OHM 5% 0.4W	PHILIPS	2322 181 53122	01.202
R43-5	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R44-5	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R45-5	RESISTOR MF	15k OHM 5% 0.4W	PHILIPS	2322 181 53153	01.229
R46-5	RESISTOR MF	39k OHM 5% 0.4W	PHILIPS	2322 181 53393	01.239
R47-5	RESISTOR MF	8k2 OHM 5% 0.4W	PHILIPS	2322 181 53822	01.222
R48-5	POTENTIOMETER TRIMMING	4.7 KOHM 20% 0.05W	PHILIPS	2322 410 03356	07.575
R49-5	RESISTOR	787 OHM 1% 0.4W	*PHILIPS	2322 156 17871	03.394
R50-5	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R51-5	RESISTOR MF	6k8 OHM 5% 0.4W	PHILIPS	2322 181 53682	01.220
R52-5	RESISTOR MF	8k2 OHM 5% 0.4W	PHILIPS	2322 181 53822	01.222
R53-5	RESISTOR MF	8k2 OHM 5% 0.4W	PHILIPS	2322 181 53822	01.222
R54-5	POTENTIOMETER TRIMMING	4.7 KOHM 20% 0.05W	PHILIPS	2322 410 03356	07.575
R60-5	RESISTOR	255 KOHM 1% 0.4W	*PHILIPS	2322 156 12554	03.486
R61-5	RESISTOR	130 KOHM 1% 0.4W	*PHILIPS	2322 156 11304	03.481
R62-5	RESISTOR	64.9 KOHM 1% 0.4W	*PHILIPS	2322 156 16493	03.475
R63-5	RESISTOR	32.4 KOHM 1% 0.4W	*PHILIPS	2322 156 13243	03.467
R64-5	RESISTOR	16.2 KOHM 1% 0.4W	*PHILIPS	2322 156 11623	03.463
R65-5	RESISTOR	8.06 KOHM 1% 0.4W	*PHILIPS	2322 156 18062	03.422
R66-5	POTENTIOMETER TRIMMING	10 KOHM 20% 0.05W	PHILIPS	2322 410 03357	07.578
R67-5	RESISTOR	64.9 KOHM 1% 0.4W	*PHILIPS	2322 156 16493	03.475
R68-5	RESISTOR MF	5k6 OHM 5% 0.4W	PHILIPS	2322 181 53562	01.218
R69-5	RESISTOR MF	5k6 OHM 5% 0.4W	PHILIPS	2322 181 53562	01.218
R70-5	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
R71-5	RESISTOR MF	6.04 kOHM 1% 0.6W	* PHILIPS	2322 156 16042	03.223
R74-5	RESISTOR MF	680 OHM 5% 0.4W	PHILIPS	2322 181 53681	01.195
R75-5	RESISTOR	4.87 KOHM 1% 0.4W	*PHILIPS	2322 156 14872	03.225
R76-5	RESISTOR	32.4 KOHM 1% 0.4W	*PHILIPS	2322 156 13243	03.467
R77-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R78-5	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R79-5	RESISTOR MF	100k OHM 5% 0.4W	PHILIPS	2322 181 53104	01.250
R80-5	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R81-5	RESISTOR MF	3k9 OHM 5% 0.4W	PHILIPS	2322 181 53392	01.214
R82-5	RESISTOR MF	10 OHM 5% 0.4W	PHILIPS	2322 181 53109	01.150

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R85-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R86-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R87-5	RESISTOR	130 KOHM 1% 0.4W	*PHILIPS	2322 156 11304	03.481
R88-5	RESISTOR MF	1k2 OHM 5% 0.4W	PHILIPS	2322 181 53122	01.202
R89-5	RESISTOR MF	1k2 OHM 5% 0.4W	PHILIPS	2322 181 53122	01.202
R90-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R91-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R92-5	RESISTOR MF	1k2 OHM 5% 0.4W	PHILIPS	2322 181 53122	01.202
R93-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R94-5	RESISTOR MF	8k2 OHM 5% 0.4W	PHILIPS	2322 181 53822	01.222
R95-5	RESISTOR MF	22 OHM 5% 0.4W	PHILIPS	2322 181 53229	01.158
R96-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R97-5	RESISTOR MF	100k OHM 5% 0.4W	PHILIPS	2322 181 53104	01.250
R98-5	RESISTOR MF	100k OHM 5% 0.4W	PHILIPS	2322 181 53104	01.250
R99-5	POTENTIOMETER TRIMMING	220 OHM 20% 0.05W	PHILIPS	2322 410 03352	07.562
R100-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R101-5	RESISTOR MF	22k OHM 5% 0.4W	PHILIPS	2322 181 53223	01.233
R102-5	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R104-5	RESISTOR MF	47k OHM 5% 0.4W	PHILIPS	2322 181 53473	01.241
R105-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R111-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R112-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R113-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R114-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R117-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R118-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R120-5	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R121-5	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R122-5	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R123-5	RESISTOR MF	22k OHM 5% 0.4W	PHILIPS	2322 181 53223	01.233
R124-5	RESISTOR MF	22k OHM 5% 0.4W	PHILIPS	2322 181 53223	01.233
R125-5	RESISTOR MF	22k OHM 5% 0.4W	PHILIPS	2322 181 53223	01.233
R126-5	RESISTOR MF	22 OHM 5% 0.4W	PHILIPS	2322 181 53229	01.158
R127-5	RESISTOR MF	22 OHM 5% 0.4W	PHILIPS	2322 181 53229	01.158
R128-5	RESISTOR MF	22 OHM 5% 0.4W	PHILIPS	2322 181 53229	01.158
R129-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R131-5	RESISTOR MF	1k5 OHM 5% 0.4W	PHILIPS	2322 181 53152	01.204
R132-5	RESISTOR MF	1k5 OHM 5% 0.4W	PHILIPS	2322 181 53152	01.204
R133-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R134-5	RESISTOR MF	6k8 OHM 5% 0.4W	PHILIPS	2322 181 53682	01.220
R135-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R136-5	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R137-5	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R138-5	RESISTOR MF	18k OHM 5% 0.4W	PHILIPS	2322 181 53183	01.231

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
RA1-5	RESISTOR ARRAY	4x10k OHM 5% 1/8W	MURATA	RG LD 4 Y 103 J	08.615
RA2-5	RESISTOR ARRAY	4x1kO OHM 5% 1/8W	MURATA	RG LD 4 Y 102 J	08.603
RA3-5	RESISTOR ARRAY	4x10k OHM 5% 1/8W	MURATA	RG LD 4 Y 103 J	08.615
RA4-5	RESISTOR ARRAY	4x10k OHM 5% 1/8W	MURATA	RG LD 4 Y 103 J	08.615
RA5-5	RESISTOR ARRAY	4x10k OHM 5% 1/8W	MURATA	RG LD 4 Y 103 J	08.615
RA6-5	RESISTOR ARRAY	4x100 OHM 5% 1/8W	MURATA	RG LD 4 Y 101 J	08.602
S1-5	SWITCH SLIDE	0.1A/12VDC	ALPS	SSSS 212 B	43.092
T1-5	TRANSISTOR AF	BC548B NPN TO-92	PHILIPS	BC548B	28.076
T2-5	TRANSISTOR AF	BC548B NPN TO-92	PHILIPS	BC548B	28.076
T3-5	TRANSISTOR AF	BC548B NPN TO-92	PHILIPS	BC548B	28.076
T4-5	TRANSISTOR AF	BC548B NPN TO-92	PHILIPS	BC548B	28.076
T5-5	TRANSISTOR	BC635	PHILIPS	BC635	28.108
T6-5	TRANSISTOR	BC337-16	PHILIPS*	BC337-16	28.053
T7-5	TRANSISTOR	BC337-16	PHILIPS*	BC337-16	28.053
T8-5	TRANSISTOR	BC337-16	PHILIPS*	BC337-16	28.053
T9-5	TRANSISTOR	BC337-16	PHILIPS*	BC337-16	28.053
T10-5	TRANSISTOR	BC337-16	PHILIPS*	BC337-16	28.053
T11-5	TRANSISTOR	BC337-16	PHILIPS*	BC337-16	28.053
T12-5	TRANSISTOR	BC337-16	PHILIPS*	BC337-16	28.053
T13-5	TRANSISTOR	BC337-16	PHILIPS*	BC337-16	28.053
T15-5	TRANSISTOR AF	BC557B NPN TO-92	MOT./ITT	BC557B	28.091
T16-5	TRANSISTOR	BC337-16	PHILIPS*	BC337-16	28.053
T17-5	TRANSISTOR DARLINGTON	NPN BC618	MOTOROLA	BC618	28.107
T18-5	TRANSISTOR DARLINGTON	NPN BC618	MOTOROLA	BC618	28.107
T19-5	TRANSISTOR DARLINGTON	NPN BC618	MOTOROLA	BC618	28.107
T21-5	TRANSISTOR AF	BC548B NPN TO-92	PHILIPS	BC548B	28.076
T22-5	TRANSISTOR AF	BC548B NPN TO-92	PHILIPS	BC548B	28.076
T24-5	TRANSISTOR	BC337-16	PHILIPS*	BC337-16	28.053
T25-5	TRANSISTOR	BC337-16	PHILIPS*	BC337-16	28.053
T26-5	TRANSISTOR	BC337-16	PHILIPS*	BC337-16	28.053
T27-5	TRANSISTOR AF	BC558B	PHILIPS	BC558B	28.100
W2-5	JUMPER	2 POLE	AMP*	142270-1	78.325
W3-5	JUMPER	2 POLE	AMP*	142270-1	78.325
W4-5	JUMPER	2 POLE	AMP*	142270-1	78.325
W5-5	JUMPER	2 POLE	AMP*	142270-1	78.325
X1-5	RESONATOR CERAMIC	4MHz	TDK	FCR-4	41.510
X2-5	CRYSTAL	4MHz	*INTERNATIONAL	KRYSTAL 4MHZ SP SPEC.C1060	39.850

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	COIL UNIT	T2031 MODUL 6	ESPERA	700228 COIL UNIT T2031	700228
C1-6	CAPACITOR CERAMIC	300pF 3KV	DRALORIC	RA164042M300	18.130
C2-6	CAPACITOR CERAMIC	300pF 3KV	DRALORIC	RA164042M300	18.130
(C3-6)	CAPACITOR		ESPERA	1-0-24305 *	200244
(C3-6)	ANTENNA DEC.PCB 2 T2031			5-0-24311	51.849
L1-6	VARIOMETER 1&2	T2031	ESPERA	VARIOMETER 1&2 T2031	700241
L2-6	VARIOMETER 1&2	T2031	ESPERA	VARIOMETER 1&2 T2031	700241
R1-6	RESISTOR PMF	100 OHM 5% 3W	PHILIPS	2322 195 13101	04.675
R2-6	RESISTOR PMF	100 OHM 5% 3W	PHILIPS	2322 195 13101	04.675
R3-6	RESISTOR PMF	100 OHM 5% 3W	PHILIPS	2322 195 13101	04.675
R4-6	RESISTOR PMF	100 OHM 5% 3W	PHILIPS	2322 195 13101	04.675
R5-6	RESISTOR PMF	82 OHM 5% 3W	PHILIPS	2322 195 13829	04.672
R6-6	RESISTOR HIGH VOLTAGE	10M OHM 10% 10kVDC	PHILIPS	2322 244 13106	06.050
RE1-6	RELAY	ORF1501	ESPERA	ORF1501 SLUTTERELÆ	705051
RE2-6	RELAY	ORF1501	ESPERA	ORF1501 SLUTTERELÆ	705051
RE3-6	RELAY	ORF1501	ESPERA	ORF1501 SLUTTERELÆ	705051
RE4-6	RELAY	ORF1501	ESPERA	ORF1501 SLUTTERELÆ	705051
RE5-6	RELAY	ORF1502	ESPERA	ORF1502 SKIFTERELÆ	705061

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	FREQUENCY SYNTHESIZER	T2031 MODULE 7	ESPERA	5-0-24057L	600230
C1-7	CAPACITOR MKT	470nF 10% 100V	SIEMENS	B32510-D1474-K000	11.231
C2-7	CAPACITOR POLYSTERENE	680pF 1% 250V	#PHILIPS	2222 430 86801	10.346
C3-7	CAPACITOR POLYSTYRENE	62pF 1% 630V	#PHILIPS	2222 431 86209	10.395
C4-7	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-F12	14.512
C6-7	CAPACITOR TRIMMING	2-18pF PTFE	DAU	107.2901.018	17.100
C8-7	CAPACITOR POLYSTYRENE	470pF 1% 630VDC	PHILIPS	2222 431 84701	10.429
C9-7	CAPACITOR CERAMIC	39pF 5% NPO 50VDC	NKE	DT 350 758L CH 390 J 50V FLAT PACK	15.085
C10-7	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C11-7	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C12-7	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C13-7	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C14-7	CAPACITOR POLYSTYRENE	240pF 1% 630VDC	PHILIPS	2222 431 82401	10.410
C15-7	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C16-7	CAPACITOR POLYSTYRENE	91pF 1% 630V	#PHILIPS	2222 431 89109	10.399
C19-7	CAPACITOR POLYSTYRENE	1.2nF 1% 160V	#PHILIPS	2222 429 81202	10.278
C22-7	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C24-7	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C26-7	CAPACITOR MKT	10nF 10% 400V	SIEMENS	B32510-D6103-K000	11.381
C27-7	CAPACITOR MKT	10nF 10% 400V	SIEMENS	B32510-D6103-K000	11.381
C30-7	CAPACITOR TANTALUM	10uF 25V 20%	ERO	ETP-3F	14.130
C31-7	CAPACITOR MKT	22nF 10% 250V	SIEMENS	B32510-D3223-K000	11.297
C32-7	CAPACITOR POLYSTYRENE	100pF 1% 630VDC	PHILIPS	2222 431 81001	10.400
C33-7	CAPACITOR CERAMIC	120pF 10% 400V	FERROPERM	9/0126/9	15.755
C34-7	CAPACITOR MKT	470nF 10% 100V	SIEMENS	B32510-D1474-K000	11.231
C35-7	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C36-7	CAPACITOR POLYSTERENE	120pF 1% 630V	#PHILIPS	2222 431 81201	10.403
C37-7	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C38-7	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C39-7	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C40-7	CAPACITOR MKT	470nF 10% 100V	SIEMENS	B32510-D1474-K000	11.231
C41-7	CAPACITOR MKT	470nF 10% 100V	SIEMENS	B32510-D1474-K000	11.231
C42-7	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C43-7	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C44-7	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C45-7	CAPACITOR POLYSTYRENE	1n00F 1% 250VDC	PHILIPS	2222 430 81002	10.350
C46-7	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C47-7	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C48-7	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-F12	14.512
C49-7	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C50-7	CAPACITOR MKT	10nF 10% 400V	SIEMENS	B32510-D6103-K000	11.381

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
C51-7	CAPACITOR ELECTROLYTIC	4.7uF 20% 50VDC	ELNA	RJ2-50-V-4R7-M-F12	14.510
C52-7	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E G5	14.610
C53-7	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C54-7	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E G5	14.610
C55-7	CAPACITOR CERAMIC	7p5F +/-0.25pF NPO 50VDC	NKE	DT 330 758S CH 7R5 C 50V FLAT PACK	15.557
C56-7	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C57-7	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E G5	14.610
C58-7	CAPACITOR POLYPROPYLENE	100pF 1% 630V	SIEMENS	B33063-B6101-F7	11.701
C59-7	CAPACITOR POLYSTYRENE	56pF 1% 630V	#PHILIPS	2222 431 85609	10.394
C60-7	CAPACITOR	33pF 1% 630V	SIEMENS	B33063-B6330-F7	11.700
C61-7	CAPACITOR POLYSTYRENE	180pF 1% 630VDC	PHILIPS	2222 431 81801	10.407
C62-7	CAPACITOR POLYSTYRENE	3.3nF 1% 160V	#PHILIPS	2222 429 83302	10.288
C63-7	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C64-7	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C65-7	CAPACITOR MKT	22nF 5% 250VDC	PHILIPS	2222 371 49223	11.174
C66-7	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C67-7	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C69-7	CAPACITOR MKT	1uF 10% 63V	ERO*	MKT1818	11.138
C70-7	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-F12	14.512
C71-7	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-F12	14.512
C72-7	CAPACITOR POLYSTYRENE	3nF 1% 160V	#PHILIPS	2222 429 83002	10.287
C73-7	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C74-7	CAPACITOR MKT	1nF 10% 400VDC	SIEMENS	B32510-D6102-K000	11.360
C75-7	CAPACITOR MKT	1uF 10% 63V	ERO*	MKT1818	11.138
C76-7	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-F12	14.512
C77-7	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-F12	14.512
C78-7	CAPACITOR MKT	150nF 10% 100V	SIEMENS	B32510-D1154-K000	11.222
C79-7	CAPACITOR MKT	150nF 10% 100V	SIEMENS	B32510-D1154-K000	11.222
C80-7	CAPACITOR MKT	150nF 10% 100V	SIEMENS	B32510-D1154-K000	11.222
C81-7	CAPACITOR MKT	150nF 10% 100V	SIEMENS	B32510-D1154-K000	11.222
C82-7	CAPACITOR MKT	150nF 10% 100V	SIEMENS	B32510-D1154-K000	11.222
C83-7	CAPACITOR MKT	150nF 10% 100V	SIEMENS	B32510-D1154-K000	11.222
C84-7	CAPACITOR MKT	150nF 10% 100V	SIEMENS	B32510-D1154-K000	11.222
C85-7	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-F12	14.512
C86-7	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E G5	14.610
C87-7	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C88-7	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C89-7	CAPACITOR MKT	68nF 5% 100V	ERO	MKT1818-368/014	11.177
C90-7	CAPACITOR MKT	10nF 5% 250VDC	PHILIPS	2222 371 49103	11.167
C91-7	CAPACITOR MKT	15nF 5% 250V	ERO	MKT1818	11.170
C92-7	CAPACITOR POLYSTYRENE	240pF 1% 630VDC	PHILIPS	2222 431 82401	10.410
C93-7	CAPACITOR CERAMIC	4n7F 20% CL2 50VDC	NKE	DT 380 758S D 472 M 50V FLAT PACK	15.165

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POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
C94-7	CAPACITOR CERAMIC	4n7F 20% CL2 50VDC	NKE	DT 380 758S D 472 M 50V FLAT PACK	15.165
C97-3	CAPACITOR MKT	150nF 10% 100V	SIEMENS	B32510-D1154-K000	11.222
C98-7	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32510-D1224-K000	11.225
C99-7	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32510-D1224-K000	11.225
C100-7	CAPACITOR CERAMIC	4n7F 20% CL2 50VDC	NKE	DT 380 758S D 472 M 50V FLAT PACK	15.165
C101-7	CAPACITOR CERAMIC	4n7F 20% CL2 50VDC	NKE	DT 380 758S D 472 M 50V FLAT PACK	15.165
D1-7	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D2-7	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D3-7	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D4-7	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D5-7	DIODE ZENER	2V4 5% 0.4W	PHILIPS	BZX79C2V4	26.505
D6-7	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D7-7	DIODE ZENER	5.6V 2% 0.4W	PHILIPS	BZX79B5V6	26.500
D8-7	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D9-7	DIODE	BB139	ITT	BB139	26.130
D10-7	DIODE	BB139	ITT	BB139	26.130
D11-7	DIODE	BB139	ITT	BB139	26.130
D12-7	DIODE	BB139	ITT	BB139	26.130
D13-7	DIODE	BB139	ITT	BB139	26.130
D14-7	DIODE	BB139	ITT	BB139	26.130
D15-7	DIODE	BB139	ITT	BB139	26.130
D16-7	DIODE	BB139	ITT	BB139	26.130
D17-7	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D18-7	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D19-7	DIODE SWITCH	MPN3700	MOTOROLA	MPN3700	26.115
D20-7	DIODE SWITCH	MPN3700	MOTOROLA	MPN3700	26.115
D21-7	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D22-7	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
FP1-7	FERRITE BEAD	Ø3.7xØ1.2x3.5mm GRADE 4B1	PHILIPS	4322 020 34420	35.181
IC1-7	INTEGRATED CIRCUIT	SN74LS113AN	TEXAS*	SN74LS113AN	33.841
IC2-7	INTEGRATED CIRCUIT	7406N	TEXAS	7406N	33.521
IC3-7	INTEGRATED CIRCUIT	MC3393P	MOTOROLA	MC3393P	31.237
IC4-7	INTEGRATED CIRCUIT	DAC08H	MOTOROLA*	DAC08HP	31.000
IC5-7	INTEGRATED CIRCUIT	74LS377N	TEXAS	74LS377N	34.267
IC6-7	INTEGRATED CIRCUIT	74LS221N	TEXAS*	SN74LS221N	34.180
IC7-7	INTEGRATED CIRCUIT	74LS109N	TEXAS*	SN74LS109AN	33.831
IC8-7	INTEGRATED CIRCUIT	74LS08N	TEXAS*	SN74LS08N	33.527
IC9-7	INTEGRATED CIRCUIT	74LS283N	TEXAS*	74LS283N	34.245
IC10-7	INTEGRATED CIRCUIT	74LS283N	TEXAS*	74LS283N	34.245
IC11-7	INTEGRATED CIRCUIT	74LS221N	TEXAS*	SN74LS221N	34.180
IC13-7	INTEGRATED CIRCUIT	SYNCHR.UP/DOWN BIN.COUNT.	TEXAS	SN74LS669N	34.310

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
IC14-7	INTEGRATED CIRCUIT	SYNCHR.UP/DOWN BIN.COUNT.	TEXAS	SN74LS669N	34.310
IC15-7	INTEGRATED CIRCUIT	74LS377N	TEXAS	74LS377N	34.267
IC16-7	INTEGRATED CIRCUIT	4BIT SER.INP.PLL SYNTHES	MOTOROLA	MC145146P1	33.490
IC17-7	INTEGRATED CIRCUIT	74F74	FAIRCHILD	IC DIG.TTL 74F74	33.724
IC18-7	VOLTAGE REGULATOR	12V 5% 0.1A	MOTOROLA	MC78L12ACP	31.139
IC19-7	TRANSISTOR ARRAY	3046	NATIONAL	LM3046N	31.025
IC20-7	OPERATIONAL AMPLIFIER	JFET INPUT LF356	NATIONAL	LF356N	31.076
IC21-7	VOLTAGE REGULATOR	ADJUSTABLE Io=100mA	TEXAS	TL317CLP	31.145
IC22-7	VOLTAGE REGULATOR	LM337LZ	#NATIONAL	LM337LZ	31.147
IC23-7	OPERATIONAL AMPLIFIER	JFET INPUT LF356	NATIONAL	LF356N	31.076
IC24-7	VOLTAGE REGULATOR	15V 5% 0.1A	MOTOROLA	MC78L15ACP	31.140
IC25-7	VOLTAGE REGULATOR	5V 5% 0.1A	MOTOROLA*	MC78L05ACP	31.135
L1-7	CHOKE FIXED	330nH 10%	FASTRON	MICC-R33K-02	20.107
L2-7	CHOKE FIXED	2u7H 10%	FASTRON	MICC-2R7K-02	20.132
L3-7	CHOKE FIXED	220nH 10%	FASTRON	MICC-R22K-02	20.105
L4-7	CHOKE FIXED	33uH 5%	NEOSID	00 6122 06 AMMO PACK	20.162
L6-7	CHOKE FIXED	6u8H 5%	NEOSID	00 6126 14 AMMO PACK	20.141
L7-7	CHOKE FIXED	2u2H 10%	FRONTIER	1303-17K TAPED	20.128
L8-7	CHOKE FIXED	2u2H 10%	FRONTIER	1303-17K TAPED	20.128
L9-7	COIL	0.2uH ADJUSTABLE	MITSUMI	R12.3266K	38.412
L10-7	COIL	0.425uH ADJUSTABLE	MITSUMI	R12.3255K	38.415
L11-7	COIL	0.125uH ADJUSTABLE	MITSUMI	R12.3267K	38.410
L12-7	CHOKE FIXED	10uH 5%	NEOSID	00 6122 00 AMMO PACK	20.118
L13-7	CHOKE FIXED	220uH 5%	NEOSID	00 6122 16 AMMO PACK	20.184
L14-7	CHOKE FIXED	220uH 5%	NEOSID	00 6122 16 AMMO PACK	20.184
L15-7	CHOKE FIXED	220uH 5%	NEOSID	00 6122 16 AMMO PACK	20.184
P1-7	PLUG (MALE)	14 POLE	AMP	1-826375-4	78.114
P2-7	PLUG (MALE)	3 POLE	AMP	0-826375-3	78.103
P3-7	PLUG (MALE)	7 POLE	AMP	0-826375-7	78.107
R1-7	RESISTOR MF	3k6 OHM 5% 0.4W	PHILIPS	2322 181 53362	01.213
R2-7	RESISTOR MF	5R6 OHM 5% 0.4W	PHILIPS	2322 181 53568	01.143
R3-7	RESISTOR MF	91 OHM 5% 0.4W	PHILIPS	2322 181 53919	01.174
R4-7	RESISTOR MF	27k OHM 5% 0.4W	PHILIPS	2322 181 53273	01.235
R5-7	RESISTOR MF	33k OHM 5% 0.4W	PHILIPS	2322 181 53333	01.237
R6-7	RESISTOR MF	750 OHM 5% 0.4W	PHILIPS	2322 181 53751	01.196
R7-7	RESISTOR MF	750 OHM 5% 0.4W	PHILIPS	2322 181 53751	01.196

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R8-7	RESISTOR MF	120 OHM 5% 0.4W	PHILIPS	2322 181 53121	01.177
R9-7	RESISTOR MF	270 OHM 5% 0.4W	PHILIPS	2322 181 53271	01.185
R10-7	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R11-7	RESISTOR MF	5k6 OHM 5% 0.4W	PHILIPS	2322 181 53562	01.218
R18-7	RESISTOR MF	5k6 OHM 5% 0.4W	PHILIPS	2322 181 53562	01.218
R21-7	RESISTOR MF	10k0 OHM 1% 0.6W	* PHILIPS	2322 156 11003	03.427
R22-7	RESISTOR MF	470 OHM 5% 0.4W	PHILIPS	2322 181 53471	01.191
R23-7	RESISTOR MF	360 OHM 5% 0.4W	PHILIPS	2322 181 53361	01.188
R24-7	RESISTOR MF	3k3 OHM 5% 0.4W	PHILIPS	2322 181 53332	01.212
R25-7	RESISTOR MF	680 OHM 5% 0.4W	PHILIPS	2322 181 53681	01.195
R26-7	RESISTOR MF	910 OHM 5% 0.4W	PHILIPS	2322 181 53911	01.199
R27-7	RESISTOR	12 KOHM 1% 0.4W	*PHILIPS	2322 156 11203	03.461
R28-7	RESISTOR MF	5k11 OHM 1% 0.6W	* PHILIPS	2322 156 15112	03.414
R29-7	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R30-7	RESISTOR MF	2k7 OHM 5% 0.4W	PHILIPS	2322 181 53272	01.210
R31-7	RESISTOR MF	5k6 OHM 5% 0.4W	PHILIPS	2322 181 53562	01.218
R32-7	RESISTOR MF	2k7 OHM 5% 0.4W	PHILIPS	2322 181 53272	01.210
R33-7	RESISTOR MF	5k11 OHM 1% 0.6W	* PHILIPS	2322 156 15112	03.414
R34-7	RESISTOR	33 KOHM 1% 0.4W	*PHILIPS	2322 156 13303	03.443
R35-7	RESISTOR MF	750 OHM 5% 0.4W	PHILIPS	2322 181 53751	01.196
R36-7	RESISTOR MF	270 OHM 5% 0.4W	PHILIPS	2322 181 53271	01.185
R37-7	RESISTOR MF	470 OHM 5% 0.4W	PHILIPS	2322 181 53471	01.191
R38-7	RESISTOR MF	82 OHM 5% 0.4W	PHILIPS	2322 181 53829	01.172
R39-7	RESISTOR MF	360 OHM 5% 0.4W	PHILIPS	2322 181 53361	01.188
R40-7	RESISTOR MF	560 OHM 5% 0.4W	PHILIPS	2322 181 53561	01.193
R41-7	RESISTOR MF	160 OHM 5% 0.4W	PHILIPS	2322 181 53161	01.180
R42-7	RESISTOR	22 KOHM 1% 0.4W	*#PHILIPS	2322 156 12213	03.441
R43-7	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R44-7	POTENTIOMETER TRIMMING	1 KOHM 10% 0,5W	* PHILIPS	2322 482 42102	07.660
R45-7	RESISTOR MF	2k7 OHM 5% 0.4W	PHILIPS	2322 181 53272	01.210
R46-7	RESISTOR MF	6k8 OHM 5% 0.4W	PHILIPS	2322 181 53682	01.220
R47-7	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R48-7	RESISTOR MF	5k6 OHM 5% 0.4W	PHILIPS	2322 181 53562	01.218
R49-7	RESISTOR	2.55 KOHM 1% 0.4W	*PHILIPS	2322 156 12552	03.407
R50-7	RESISTOR MF	390 OHM 5% 0.4W	PHILIPS	2322 181 53391	01.189
R51-7	RESISTOR MF	5k11 OHM 1% 0.6W	* PHILIPS	2322 156 15112	03.414
R52-7	RESISTOR MF	1k2 OHM 5% 0.4W	PHILIPS	2322 181 53122	01.202
R53-7	RESISTOR MF	160 OHM 5% 0.4W	PHILIPS	2322 181 53161	01.180
R54-7	RESISTOR MF	220 OHM 5% 0.4W	PHILIPS	2322 181 53221	01.183
R55-7	RESISTOR MF	68 OHM 5% 0.4W	PHILIPS	2322 181 53689	01.170
R56-7	RESISTOR MF	560 OHM 5% 0.4W	PHILIPS	2322 181 53561	01.193
R57-7	POTENTIOMETER TRIMMING	1 KOHM 10% 0,5W	* PHILIPS	2322 482 42102	07.660
R58-7	RESISTOR MF	8k2 OHM 5% 0.4W	PHILIPS	2322 181 53822	01.222
R59-7	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R60-7	RESISTOR MF	1kO OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R61-7	RESISTOR MF	220 OHM 5% 0.4W	PHILIPS	2322 181 53221	01.183
R62-7	RESISTOR MF	5R6 OHM 5% 0.4W	PHILIPS	2322 181 53568	01.143
R63-7	RESISTOR MF	560 OHM 5% 0.4W	PHILIPS	2322 181 53561	01.193
R64-7	RESISTOR	8.66 KOHM 1% 0.4W	*PHILIPS	2322 156 18662	03.425
R65-7	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R66-7	RESISTOR MF	15k OHM 5% 0.4W	PHILIPS	2322 181 53153	01.229
R67-7	RESISTOR MF	220k OHM 5% 0.4W	PHILIPS	2322 181 53224	01.258
R68-7	RESISTOR MF	39k OHM 5% 0.4W	PHILIPS	2322 181 53393	01.239
R69-7	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R70-7	RESISTOR MF	1kO OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R71-7	RESISTOR MF	82 OHM 5% 0.4W	PHILIPS	2322 181 53829	01.172
R72-7	RESISTOR MF	330k OHM 5% 0.4W	PHILIPS	2322 181 53334	01.262
R73-7	RESISTOR	5.6 OHM 1% 0.4W	*PHILIPS	2322 156 15608	03.350
R74-7	RESISTOR MF	560 OHM 5% 0.4W	PHILIPS	2322 181 53561	01.193
R75-7	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222	01.208
R76-7	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222	01.208
R77-7	RESISTOR MF	18k OHM 5% 0.4W	PHILIPS	2322 181 53183	01.231
R78-7	RESISTOR MF	680 OHM 5% 0.4W	PHILIPS	2322 181 53681	01.195
R79-7	RESISTOR MF	15k OHM 5% 0.4W	PHILIPS	2322 181 53153	01.229
R80-7	RESISTOR MF	180 OHM 5% 0.4W	PHILIPS	2322 181 53181	01.181
R81-7	RESISTOR MF	270 OHM 5% 0.4W	PHILIPS	2322 181 53271	01.185
R82-7	RESISTOR MF	1k3 OHM 5% 0.4W	PHILIPS	2322 181 53132	01.203
R85-7	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222	01.208
R86-7	RESISTOR MF	8k2 OHM 5% 0.4W	PHILIPS	2322 181 53822	01.222
R87-7	RESISTOR MF	16k OHM 5% 0.4W	PHILIPS	2322 181 53163	01.230
R88-7	RESISTOR MF	1kO OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R89-7	RESISTOR	18 KOHM 1% 0.4W	*PHILIPS	2322 156 11803	03.440
R90-7	RESISTOR	18 KOHM 1% 0.4W	*PHILIPS	2322 156 11803	03.440
R91-7	RESISTOR MF	1k6 OHM 5% 0.4W	PHILIPS	2322 181 53162	01.205
R92-7	RESISTOR	9.09 KOHM 1% 0.4W	**PHILIPS	2322 156 19092	03.426
R93-7	RESISTOR	9.09 KOHM 1% 0.4W	**PHILIPS	2322 156 19092	03.426
R94-7	RESISTOR MF	43k OHM 5% 0.4W	PHILIPS	2322 181 53433	01.240
R95-7	RESISTOR MF	5k11 OHM 1% 0.6W	* PHILIPS	2322 156 15112	03.414
R96-7	RESISTOR MF	5k11 OHM 1% 0.6W	* PHILIPS	2322 156 15112	03.414
R97-7	RESISTOR MF	680 OHM 5% 0.4W	PHILIPS	2322 181 53681	01.195
R98-7	RESISTOR MF	15k OHM 5% 0.4W	PHILIPS	2322 181 53153	01.229
R99-7	RESISTOR	261 OHM 1% 0.4W	*PHILIPS	2322 156 12611	03.386
R100-7	RESISTOR	2.7 KOHM 1% 0.4W	*PHILIPS	2322 156 12702	03.405
R101-7	RESISTOR	261 OHM 1% 0.4W	*PHILIPS	2322 156 12611	03.386
R102-7	RESISTOR	2.7 KOHM 1% 0.4W	*PHILIPS	2322 156 12702	03.405
R103-7	RESISTOR MF	1k3 OHM 5% 0.4W	PHILIPS	2322 181 53132	01.203
R104-7	RESISTOR MF	16k OHM 5% 0.4W	PHILIPS	2322 181 53163	01.230
R105-7	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225

T2031 12/90.

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R106-7	RESISTOR MF	91k OHM 5% 0.4W	PHILIPS	2322 181 53913	01.248
R107-7	RESISTOR MF	1k6 OHM 5% 0.4W	PHILIPS	2322 181 53162	01.205
R108-7	RESISTOR MF	43k OHM 5% 0.4W	PHILIPS	2322 181 53433	01.240
R109-7	RESISTOR MF	56 OHM 5% 0.4W	PHILIPS	2322 181 53569	01.168
R114-7	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
R115-7	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
T1-7	TRANSISTOR RF	BFW17A PNP TO-39	PHILIPS	BFW17A	29.151
T2-7	TRANSISTOR	BF199	PHILIPS	BF199	28.179
T5-7	TRANSISTOR RF SWITCH	2N2369A	MOTOROLA	2N2369A	28.315
T6-7	TRANSISTOR	BF 506	SIEMENS	BF506	28.202
T7-7	TRANSISTOR RF	BF199	PHILIPS	BF199	28.178
T8-7	TRANSISTOR RF	BF199	PHILIPS	BF199	28.178
T9-7	TRANSISTOR	BF 506	SIEMENS	BF506	28.202
T10-7	TRANSISTOR RF SWITCH	MPS3640	MOTOROLA	MPS-3640	28.405
T11-7	TRANSISTOR RF	BFW92A	TFK	BFW92A	29.160
T12-7	TRANSISTOR JFET	TIS88A3 TO-92	MOTORPLA	TM 00 044-3	29.737
T13-7	TRANSISTOR RF SWITCH	2N2369A	MOTOROLA	2N2369A	28.315
T14-7	TRANSISTOR N-CHAN. JFET	TIS88A1	MOTOROLA	TM 00 044 -1	29.735
T15-7	TRANSISTOR N-CHAN. JFET	TIS88A1	MOTOROLA	TM 00 044 -1	29.735
T16-7	TRANSISTOR MOSFET	N-CHANNEL ENHANCEMENT	SILICONIX	SD210DE	29.719
T17-7	TRANSISTOR MOSFET	N-CHANNEL ENHANCEMENT	SILICONIX	SD210DE	29.719
T18-7	TRANSISTOR	BF 506	SIEMENS	BF506	28.202
T19-7	TRANSISTOR	BC559B	PHILIPS*	BC559B	28.105
T20-7	TRANSISTOR AF	BC548 NPN TO-92	PHILIPS	BC548 (-A/-B/-C)	28.070
T21-7	TRANSISTOR	BC559B	PHILIPS*	BC559B	28.105
T22-7	TRANSISTOR AF	BC548 NPN TO-92	PHILIPS	BC548 (-A/-B/-C)	28.070
X1-7	CRYSTAL	10.5984 MHz	DANTRONIC	C1031	39.847

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	FILTER UNIT MODULE 8	POWER UNIT II T2031	ESPERA	5-0-24587F	600392
C1-8	CAPACITOR MKT	6u8F 10% 100VDC	PHILIPS	2222 344 25685	11.084
C2-8	CAPACITOR ELECTROLYTIC	2200uF-10/+50% 40V	ERO*	EG 00 MG 422 G	14.720
C3-8	CAPACITOR ELECTROLYTIC	2200uF-10/+50% 40V	ERO*	EG 00 MG 422 G	14.720
C4-8	CAPACITOR ELECTROLYTIC	2200uF-10/+50% 40V	ERO*	EG 00 MG 422 G	14.720
C5-8	CAPACITOR ELECTROLYTIC	2200uF-10/+50% 40V	ERO*	EG 00 MG 422 G	14.720
D1-8	DIODE	MR750	MOTOROLA	MR750	25.219
F1-8	FUSE	35A M Ø6.3x32mm	WICKMANN	311035	45.636
FP2-8	FERRITE BEAD	HZ 4.2/2.1/7 G K1201	KASCHKE	HZ 4,2/2,1/7 G K1201 405 442 075 021	35.011
FP3-8	FERRITE BEAD	HZ 4.2/2.1/7 G K1201	KASCHKE	HZ 4,2/2,1/7 G K1201 405 442 075 021	35.011
FP4-8	FERRITE BEAD	HZ 4.2/2.1/7 G K1201	KASCHKE	HZ 4,2/2,1/7 G K1201 405 442 075 021	35.011
L1-8	CHOKE	TL434	B.B.ELEKTRONIK	6-0-24569D	400434
L2-8	CHOKE	TL439	S.P.RADIO	6-0-24609	400439
L3-8	CHOKE	TL439	S.P.RADIO	6-0-24609	400439
L4-8	CHOKE	TL441	S.P.RADIO	6-0-24715	400441
P3-8	PLUG (MALE)	5 POLE	AMP	0-826375-5	78.105
P4-8	PLUG (MALE)	5 POLE	AMP	0-826375-5	78.105
R1-8	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	PS CONTROL UNIT MODULE 9	POWER UNIT II T2031	ESPERA	5-0-24529E	600398
C1-9	CAPACITOR ELECTROLYTIC	4.7uF 20% 50VDC	ELNA	RJ2-50-V-4R7-M-T12	14.510
C2-9	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C3-9	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C4-9	CAPACITOR ELECTROLYTIC	4.7uF 20% 50VDC	ELNA	RJ2-50-V-4R7-M-T12	14.510
C5-9	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C6-9	CAPACITOR MKT	1uF 10% 63VDC	ERO	MKT 1826-510/06 5-G	11.137
C7-9	CAPACITOR MKT	0.68uF 10% 100V	ERO*	MKT1822	11.078
C8-9	CAPACITOR ELECTROLYTIC	22uF 20% 35VDC	ELNA	RJ2-35-V-220-M-T12	14.516
C9-9	CAPACITOR MKT	0.68uF 10% 100V	ERO*	MKT1822	11.078
C10-9	CAPACITOR POLYSTYRENE	1n00F 1% 250VDC	PHILIPS	2222 430 81002	10.350
C11-9	CAPACITOR POLYSTYRENE	1n00F 1% 250VDC	PHILIPS	2222 430 81002	10.350
C12-9	CAPACITOR MKT	330nF 10% 100V	SIEMENS	B32511-D1334-K000	11.229
C13-9	CAPACITOR ELECTROLYTIC	1uF 20% 50VDC	ELNA	RJ2-50-V-010-M-T12	14.506
C14-9	CAPACITOR MKT	4.7nF 10% 400V	SIEMENS	B32510-D6472-K000	11.373
C15-9	CAPACITOR MKT	4.7nF 10% 400V	SIEMENS	B32510-D6472-K000	11.373
C16-9	CAPACITOR CERAMIC	1n0F 10% CL2 500VDC	NKE	DT 360 758L B 102 K 500V FLAT PACK	15.160
C17-9	CAPACITOR ELECTROLYTIC	22uF 20% 35VDC	ELNA	RJ2-35-V-220-M-T12	14.516
C18-9	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C19-9	CAPACITOR MKT	1000nF 10% 100V	SIEMENS*	B32512-D1105-K000	11.234
C20-9	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C21-9	CAPACITOR POLYSTERENE	680pF 1% 250V	#PHILIPS	2222 430 86801	10.346
C22-9	CAPACITOR MKT	1000nF 10% 100V	SIEMENS*	B32512-D1105-K000	11.234
C23-9	CAPACITOR MKT	47nF 10% 250V	PHILLIPS*	2222 344 41473	11.101
C24-9	CAPACITOR ELECTROLYTIC	100uF 20% 10VDC	ELNA	RJ3-10-V-101-M-T12	14.607
C25-9	CAPACITOR POLYSTYRENE	4n70F 1% 160VDC	PHILIPS	2222 429 84702	10.292
C26-9	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C27-9	CAPACITOR POLYSTYRENE	8.2nF 1% 63V	#PHILIPS	2222 428 88202	10.224
C28-9	CAPACITOR POLYSTYRENE	4n70F 1% 160VDC	PHILIPS	2222 429 84702	10.292
C29-9	CAPACITOR POLYSTYRENE	8.2nF 1% 63V	#PHILIPS	2222 428 88202	10.224
C30-9	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
D1-9	DIODE ZENER	27V	THOMSON-CSF	BZV47C27	26.779
D2-9	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D3-9	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D4-9	DIODE RECTIFIER	1N4002 100V/1A	ITT	1N4002 (03/04/05/06/07)	25.100
D5-9	DIODE ZENER	2V7 5% 0.4W	PHILIPS	BZX79C2V7	26.506
D6-9	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D7-9	DIODE V.F.R.	100VDC 2A(AV)	PHILIPS*	BYV27-100	27.114
D8-9	DIODE V.F.R.	100VDC 2A(AV)	PHILIPS*	BYV27-100	27.114
D9-9	DIODE V.F.R.	100VDC 2A(AV)	PHILIPS*	BYV27-100	27.114
D10-9	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
D11-9	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D12-9	DIODE ZENER	2V7 5% 0.4W	PHILIPS	BZX79C2V7	26.506
D13-9	DIODE V.F.R.	100VDC 2A(AV)	PHILIPS*	BYV27-100	27.114
D14-9	DIODE V.F.R.	100VDC 2A(AV)	PHILIPS*	BYV27-100	27.114
D15-9	DIODE ZENER	2V7 5% 0.4W	PHILIPS	BZX79C2V7	26.506
D16-9	DIODE V.F.R.	100VDC 2A(AV)	PHILIPS*	BYV27-100	27.114
D17-9	DIODE V.F.R.	100VDC 2A(AV)	PHILIPS*	BYV27-100	27.114
D18-9	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D19-9	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D20-9	DIODE V.F.R.	100VDC 2A(AV)	PHILIPS*	BYV27-100	27.114
D21-9	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D22-9	DIODE V.F.R.	100VDC 2A(AV)	PHILIPS*	BYV27-100	27.114
D23-9	DIODE V.F.R.	100VDC 2A(AV)	PHILIPS*	BYV27-100	27.114
D24-9	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D25-9	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D26-9	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D27-9	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D28-9	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D29-9	DIODE ZENER	15V 5% 0.4W	PHILIPS	BZX79C15	26.561
D30-9	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D31-9	DIODE ZENER	51V 5% 0.4W	PHILIPS	BZX79C51	26.584
D32-9	DIODE ZENER	5.1V 5% 0.4W	PHILIPS	BZX79C5V1	26.527
D33-9	DIODE RECTIFIER	1N4002 100V/1A	ITT	1N4002 (03/04/05/06/07)	25.100
D34-9	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
IC1-9	VOLTAGE REGULATOR	FIXED 15V/1A	MOTOROLA	MC7815CT	31.090
IC2-9	DUAL OP AMP	LM358N	TEXAS	LM358P	31.100
IC3-9	INTEGRATED CIRCUIT	MC14007UBCP	MOTOROLA	MC14007UBCP	33.030
IC4-9	INTEGRATED CIRCUIT	TDA4718A	SIEMENS	TDA4718A	31.490
IC5-9	INTEGRATED CIRCUIT	MC14094BCP	RCA*	CD4094	33.305
IC6-9	DUAL OP AMP	LM358N	TEXAS	LM358P	31.100
IC7-9	DUAL OP AMP	LM358N	TEXAS	LM358P	31.100
IC8-9	VOLTAGE REGULATOR	15V 5% 0.1A	MOTOROLA	MC78L15ACP	31.140
OC1-9	OPTO COUPLER	CNY17-2	TOSHIBA	CNY 17-2	32.530
OC2-9	OPTO COUPLER	CNY17-2	TOSHIBA	CNY 17-2	32.530
P1-9	PLUG (MALE)	9 POLE	AMP	0-826375-9	78.109
R1-9	RESISTOR	63.4 KOHM 1% 0.4W	*PHILIPS	2322 156 16343	03.444
R2-9	RESISTOR	63.4 KOHM 1% 0.4W	*PHILIPS	2322 156 16343	03.444
R3-9	RESISTOR	11 KOHM 1% 0.4W	*PHILIPS	2322 156 11103	03.458
R4-9	RESISTOR MF	22 OHM 5% 0.4W	PHILIPS	2322 181 53229	01.158
R5-9	RESISTOR	11 KOHM 1% 0.4W	*PHILIPS	2322 156 11103	03.458
R6-9	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R7-9	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R8-9	RESISTOR MF	220 OHM 5% 0.4W	PHILIPS	2322 181 53221	01.183
R9-9	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R10-9	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222	01.208
R11-9	RESISTOR MF	100k OHM 5% 0.4W	PHILIPS	2322 181 53104	01.250
R12-9	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R13-9	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222	01.208
R14-9	RESISTOR MF	470 OHM 5% 0.4W	PHILIPS	2322 181 53471	01.191
R15-9	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R16-9	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R17-9	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R18-9	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222	01.208
R19-9	RESISTOR MF	470 OHM 5% 0.4W	PHILIPS	2322 181 53471	01.191
R20-9	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R21-9	RESISTOR MF	1kO OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R22-9	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R23-9	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222	01.208
R24-9	RESISTOR	4.7 OHM 5% 4W	PHILIPS	2322 330 22478	05.741
R25-9	RESISTOR MF	15 OHM 5% 0.4W	PHILIPS	2322 181 53159	01.154
R26-9	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R27-9	RESISTOR	5.9 KOHM 1% 0.4W	*PHILIPS	2322 156 15902	03.410
R28-9	RESISTOR	4.75 KOHM 1% 0.4W	*PHILIPS	2322 156 14752	03.468
R29-9	RESISTOR	1.5 KOHM 1% 0.4W	*PHILIPS	2322 156 11502	03.404
R30-9	RESISTOR MF	39k OHM 5% 0.4W	PHILIPS	2322 181 53393	01.239
R31-9	RESISTOR	1.5 KOHM 1% 0.4W	*PHILIPS	2322 156 11502	03.404
R32-9	RESISTOR	26.7 KOHM 1% 0.4W	*PHILIPS	2322 156 12673	03.435
R33-9	RESISTOR MF	15 OHM 5% 0.4W	PHILIPS	2322 181 53159	01.154
R34-9	RESISTOR	17.4 KOHM 1% 0.4W	*PHILIPS	2322 156 11743	03.450
R35-9	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R36-9	RESISTOR	1 KOHM 1% 0.4W	*PHILIPS	2322 156 11002	03.395
R37-9	PRESET CERMET	2k2 OHM 10% 0.5W	AB	HC10 200 150 2k2 10%	07.712
R38-9	RESISTOR MF	910 OHM 5% 0.4W	PHILIPS	2322 181 53911	01.199
R39-9	RESISTOR MF	470 OHM 5% 0.4W	PHILIPS	2322 181 53471	01.191
R40-9	RESISTOR MF	470 OHM 5% 0.4W	PHILIPS	2322 181 53471	01.191
R41-9	RESISTOR MF	100 OHM 5% 0.33W	PHILIPS	2322 180 73101	02.448
R42-9	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R43-9	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R44-9	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R45-9	RESISTOR MF	1kO OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R46-9	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R47-9	RESISTOR	64.9 KOHM 1% 0.4W	*PHILIPS	2322 156 16493	03.475
R48-9	RESISTOR	32.4 KOHM 1% 0.4W	*PHILIPS	2322 156 13243	03.467
R49-9	RESISTOR	16.2 KOHM 1% 0.4W	*PHILIPS	2322 156 11623	03.463
R50-9	RESISTOR	8.06 KOHM 1% 0.4W	*PHILIPS	2322 156 18062	03.422
R59-9	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R52-9	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R53-9	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R54-9	RESISTOR MF	82k OHM 5% 0.4W	PHILIPS	2322 181 53823	01.247
R55-9	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R56-9	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R57-9	RESISTOR MF	4k32 OHM 1% 0.6W	* PHILIPS	2322 156 14322	03.415
R58-9	RESISTOR MF	6k8 OHM 5% 0.4W	PHILIPS	2322 181 53682	01.220
R59-9	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R60-9	RESISTOR MF	82k OHM 5% 0.4W	PHILIPS	2322 181 53823	01.247
R61-9	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R62-9	RESISTOR MF	1k2 OHM 5% 0.4W	PHILIPS	2322 181 53122	01.202
R63-9	POTENTIOMETER TRIMMNING	2.2 KOHM 10% 0.5W	PHILIPS	2322 482 22222	07.665
R64-9	RESISTOR MF	4k32 OHM 1% 0.6W	* PHILIPS	2322 156 14322	03.415
R65-9	POTENTIOMETER TRIMMING	220 OHM 10% 0.5W	PHILIPS*	2322 482 22221	07.647
R66-9	RESISTOR MF	3k3 OHM 5% 0.4W	PHILIPS	2322 181 53332	01.212
R67-9	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R68-9	RESISTOR MF	470 OHM 5% 0.4W	PHILIPS	2322 181 53471	01.191
R69-9	RESISTOR MF	3k3 OHM 5% 0.4W	PHILIPS	2322 181 53332	01.212
R70-9	RESISTOR	1.37 KOHM 1% 0.4W	*PHILIPS	2322 156 11372	03.469
R71-9	RESISTOR MF	4k32 OHM 1% 0.6W	* PHILIPS	2322 156 14322	03.415
R72-9	RESISTOR MF	330 OHM 5% 0.4W	PHILIPS	2322 181 53331	01.187
R73-9	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R74-9	RESISTOR MF	2k7 OHM 5% 0.4W	PHILIPS	2322 181 53272	01.210
R75-9	RESISTOR	10.5 KOHM 1% 0.4W	*PHILIPS	2322 156 11053	03.459
R76-9	RESISTOR MF	97k6 OHM 1% 0.6W	* PHILIPS	2322 156 19763	03.471
R77-9	RESISTOR MF	1k2 OHM 5% 0.4W	PHILIPS	2322 181 53122	01.202
R78-9	RESISTOR	2.21 KOHM 1% 0.4W	*PHILIPS	2322 156 12212	03.472
R79-9	RESISTOR MF	97k6 OHM 1% 0.6W	* PHILIPS	2322 156 19763	03.471
R80-9	RESISTOR	10.5 KOHM 1% 0.4W	*PHILIPS	2322 156 11053	03.459
R81-9	PRESET CERMET	100 OHMS 10% 0.75W	PHILIPS*	2322 482 42101	07.708
R82-9	RESISTOR	2.21 KOHM 1% 0.4W	*PHILIPS	2322 156 12212	03.472
R83-9	RESISTOR MF	10 OHM 5% 0.4W	PHILIPS	2322 181 53109	01.150
R84-9	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R86-9	RESISTOR MF	39k OHM 5% 0.33W	PHILIPS	2322 180 73393	02.510
R87-9	RESISTOR MF	39k OHM 5% 0.33W	PHILIPS	2322 180 73393	02.510
T1-9	TRANSISTOR	BD140-10	AEG*	BD140-10	29.066
T2-9	TRANSISTOR AF	BC557B NPN TO-92	MOT./ITT	BC557B	28.091
T3-9	TRANSISTOR AF	BC557B NPN TO-92	MOT./ITT	BC557B	28.091
T4-9	TRANSISTOR AF	BC547B NPN TO-92	PHILIPS	BC547B	28.067
T5-9	TRANSISTOR AF	BC557B NPN TO-92	MOT./ITT	BC557B	28.091
T6-9	TRANSISTOR AF	BC557B NPN TO-92	MOT./ITT	BC557B	28.091
T7-9	TRANSISTOR	BUV26	THOMSON-CSF	BUV26	29.213
T8-9	TRANSISTOR	BUV26	THOMSON-CSF	BUV26	29.213
T9-9	TRANSISTOR AF	BC557B NPN TO-92	MOT./ITT	BC557B	28.091
T10-9	TRANSISTOR AF	BC547B NPN TO-92	PHILIPS	BC547B	28.067
T11-9	TRANSISTOR AF	BC547B NPN TO-92	PHILIPS	BC547B	28.067

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
T12-9	TRANSISTOR AF	BC547B NPN TO-92	PHILIPS	BC547B	28.067
TR1-9	TRANSFORMER DRIVER		* TRADANIA	TD5012.0	22.177
TR2-9	TRANSFORMER DRIVER		* TRADANIA	TD5012.0	22.177

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	TRANSFORMER UNIT MODULE10	POWER UNIT II T2031	ESPERA	5-0-24534C	600394
C1-10	CAPACITOR ELECTROLYTIC	2200uF -10/+50% 40V	ERO*	EGD EG 03 MG 422 G	14.730
C2-10	CAPACITOR ELECTROLYTIC	2200uF -10/+50% 40V	ERO*	EGD EG 03 MG 422 G	14.730
C3-10	CAPACITOR ELECTROLYTIC	2200uF -10/+50% 40V	ERO*	EGD EG 03 MG 422 G	14.730
C4-10	CAPACITOR ELECTROLYTIC	2200uF -10/+50% 40V	ERO*	EGD EG 03 MG 422 G	14.730
C5-10	CAPACITOR ELECTROLYTIC	2200uF -10/+50% 40V	ERO*	EGD EG 03 MG 422 G	14.730
C6-10	CAPACITOR ELECTROLYTIC	2200uF -10/+50% 40V	ERO*	EGD EG 03 MG 422 G	14.730
C7-10	CAPACITOR ELECTROLYTIC	1000uF -10/+50% 25VDC	ERO	EKM 05 JG 410 E 05	14.600
C8-10	CAPACITOR ELECTROLYTIC	2200uF -20/+50% 50VDC	FRAKO	EF 1	14.727
C9-10	CAPACITOR MKT	1uF 10% 63V	ERO*	MKT1818	11.138
C10-10	CAPACITOR MKT	1uF 10% 63V	ERO*	MKT1818	11.138
C11-10	CAPACITOR MKT	1uF 10% 63V	ERO*	MKT1818	11.138
D1-10	DIODE FAST RECOVERY	400V/3A Trr=200nS	THOMSON	PFR854	27.155
D2-10	DIODE FAST RECOVERY	400V/3A Trr=200nS	THOMSON	PFR854	27.155
D3-10	DIODE FAST RECOVERY	400V/3A Trr=200nS	THOMSON	PFR854	27.155
L1-10	CHOKE	0.96mH/3ADC	* TRADANIA	TD5015.0	22.180
P2-10	PLUG (MALE)	5 POLE	AMP	0-826375-5	78.105
R1-10	RESISTOR	220 OHM 5% 4W	PHILIPS	2322 329 04221	05.783
R2-10	RESISTOR	150 OHM 5% 4W	PHILIPS	2322 330 22151	05.778
R3-10	RESISTOR	0,0133 OHM	S.P.RADIO	6-0-24571A	400436
TR1-10	CHOKE FLYBACK	Ip=40AMPS	* TRADANIA	TD5014.0	22.179
TR2-10	TRANSFORMER CURRENT	40AMPS	* TRADANIA	TD5013.0	22.178

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	SNUPPER UNIT MODULE 11	POWER UNIT II T2031	ESPERA	5-0-24567A	600396
C1-11	CAPACITOR MKP	0.47uF 10% 250VDC	RIFA*	PHE 403 HD 6470 K	11.675
C2-11	CAPACITOR MKP	0.47uF 10% 250VDC	RIFA*	PHE 403 HD 6470 K	11.675
C3-11	CAPACITOR MKP	0.47uF 10% 250VDC	RIFA*	PHE 403 HD 6470 K	11.675
C4-11	CAPACITOR MKP	0.47uF 10% 250VDC	RIFA*	PHE 403 HD 6470 K	11.675
D1-11	DIODE F.REC	7A/150V	THOMSON-CSF	BYW80-150	27.625
D2-11	DIODE F.REC	7A/150V	THOMSON-CSF	BYW80-150	27.625
R1-11	RESISTOR	330 OHM 5% 7W	PHILIPS	2322 329 07331	05.870
R2-11	RESISTOR	330 OHM 5% 7W	PHILIPS	2322 329 07331	05.870
R3-11	RESISTOR	330 OHM 5% 7W	PHILIPS	2322 329 07331	05.870
R4-11	RESISTOR	330 OHM 5% 7W	PHILIPS	2322 329 07331	05.870

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	CONVERTER UNIT MODULE 12	PUI T2031	ESPERA	5-0-24695D	600590
C1-12	CAPACITOR POLYSTYRENE	2.2nF 1% 160V	*PHILIPS	2222 429 82202	10.284
C2-12	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C3-12	CAPACITOR MKT	100nF 10% 100V	SIEMENS	B32560-D1104-K000	11.366
C4-12	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32510-D1224-K000	11.225
C5-12	CAPACITOR ELECTROLYTIC	22uF 20% 35VDC	ELNA	RJ2-35-V-220-M-T12	14.516
C6-12	CAPACITOR ELECTROLYTIC	2200uF -10/+50% 40V	ERO*	EGD EG 03 MG 422 G	14.730
C7-12	CAPACITOR MKT	15nF 10% 400VDC	PHILIPS	2222 344 55153	11.732
C8-12	CAPACITOR MKT	10nF 10% 400V	PHILIPS	2222 344 55103	11.731
C9-12	CAPACITOR ELECTROLYTIC	470uF -10/+50% 40VDC	ERO*	EKM 05 FG 347 G 05	14.650
C10-12	CAPACITOR ELECTROLYTIC	470uF -10/+50% 40VDC	ERO*	EKM 05 FG 347 G 05	14.650
C11-12	CAPACITOR ELECTROLYTIC	2200uF -10/+50% 16V	ERO	EG 00 KE 422 D	14.710
C12-12	CAPACITOR ELECTROLYTIC	22uF 20% 35VDC	ELNA	RJ2-35-V-220-M-T12	14.516
C13-12	CAPACITOR CERAMIC	18 pF 10% NPO 400V	FERROPERM	9/0112,9	15.593
C14-12	CAPACITOR ELECTROLYTIC	22uF 20% 35VDC	ELNA	RJ2-35-V-220-M-T12	14.516
C15-12	CAPACITOR ELECTROLYTIC	470uF -10/+50% 40VDC	ERO*	EKM 05 FG 347 G 05	14.650
C16-12	CAPACITOR ELECTROLYTIC	220uF -20/+50% 25VDC	ERO	EKM 05 DD 322 E 05	14.647
C17-12	CAPACITOR ELECTROLYTIC	220uF -20/+50% 25VDC	ERO	EKM 05 DD 322 E 05	14.647
C18-12	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32510-D1224-K000	11.225
C19-12	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32510-D1224-K000	11.225
C20-12	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32510-D1224-K000	11.225
C21-12	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32510-D1224-K000	11.225
C22-12	CAPACITOR MKT	6.8nF 10% 400V	SIEMENS	B32510-D6682-K	11.378
C23-12	CAPACITOR MKT	10nF 10% 250V	SIEMENS	B32510-D3103-K000	11.290
C24-12	CAPACITOR MKT	100nF 10% 100V	SIEMENS	B32560-D1104-K000	11.366
D1-12	DIODE	MR750	MOTOROLA	MR750	25.219
D2-12	DIODE ZENER	9V1 5% 0.4W	PHILIPS	BZX79C9V1	26.546
D3-12	DIODE GENERAL PURPOSE	BAV21 200V/0.25A	PHILIPS	BAV21	25.340
D4-12	DIODE PROTECTION	51V 2W 600W Peak	THOMSON	BZW 06-P44	26.995
D5-12	DIODE	1N4936	MOTOROLA	1N4936	25.157
D6-12	DIODE FAST RECOVERY	400V/3A Trr=200nS	THOMSON	PFR854	27.155
D7-12	DIODE FAST RECOVERY	400V/3A Trr=200nS	THOMSON	PFR854	27.155
D8-12	DIODE FAST RECOVERY	400V/3A Trr=200nS	THOMSON	PFR854	27.155
D9-12	DIODE ZENER	5.1V 5% 0.4W	PHILIPS	BZX79C5V1	26.527
D10-12	DIODE ZENER	5.1V 5% 0.4W	PHILIPS	BZX79C5V1	26.527
IC1-12	PWM REGULATOR	TL494CN	TEXAS	TL494CN	31.487
IC2-12	INTEGRATED CIRCUIT	OP-AMP/OPEN COLLECTOR OUT	SIEMENS	Q67000-A524 (TAA765A)	31.300
L1-12	CHOKE	TL079	ESPERA	TL079	400079
L2-12	CHOKE	TL079	ESPERA	TL079	400079
L3-12	CHOKE	TL079	ESPERA	TL079	400079
L4-12	CHOKE	TL079	ESPERA	TL079	400079

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
OC1-12	OPTO COUPLER	CNY17-2	TOSHIBA	CNY 17-2	32.530
R1-12	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R2-12	RESISTOR	9.09 KOHM 1% 0.4W	**PHILIPS	2322 156 19092	03.426
R3-12	RESISTOR MF	2k7 OHM 5% 0.4W	PHILIPS	2322 181 53272	01.210
R4-12	RESISTOR	18.2 KOHM 1% 0.4W	*PHILIPS	2322 156 11823	03.431
R5-12	RESISTOR	5.9 KOHM 1% 0.4W	*PHILIPS	2322 156 15902	03.410
R6-12	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R7-12	RESISTOR MF	47 OHM 5% 0.4W	PHILIPS	2322 181 53479	01.166
R8-12	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R9-12	RESISTOR MF	18 OHM 5% 0.5W	PHILIPS	2322 156 11809	01.357
R10-12	RESISTOR MF	27 OHM 5% 0.5W	PHILIPS	2322 156 12709	01.361
R11-12	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R12-12	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R13-12	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222	01.208
R14-12	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222	01.208
R15-12	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R16-12	POTENTIOMETER TRIMMNING	2.2 KOHM 10% 0.5W	PHILIPS	2322 482 22222	07.665
R17-12	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R18-12	RESISTOR MF	5k6 OHM 5% 0.4W	PHILIPS	2322 181 53562	01.218
R19-12	RESISTOR MF	1k5 OHM 5% 0.4W	PHILIPS	2322 181 53152	01.204
R20-12	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
T1-12	TRANSISTOR AF	POWER NPN BD139 SOT-39	PHILIPS	BD139	29.060
T2-12	TRANSISTOR AF	BC338-25 NPN TO-92	PHILIPS	BC338-25	28.058
T3-12	TRANSISTOR AF	PNP TO-92 BC328	MOTOROLA	BC328	28.050
T4-12	TRANSISTOR	BUZ21	SILICONIX*	IFR540	29.400
T5-12	THYRISTOR	BT151-500R	PHILIPS	BT151-500R	29.912
TR1-12	TRANSFORMER	TD4918	TRADANIA	TD4918	22.169

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	FILTER BOARD MODULE 13	PUI T2031	ESPERA	5-0-24712D	600592
C1-13	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32510-D1224-K000	11.225
C2-13	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32510-D1224-K000	11.225
C3-13	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32510-D1224-K000	11.225
L1-13	CHOKE	700 OHM / 15 MHZ	SIEMENS*	B82114-R-A3	20.052
L2-13	CHOKE	700 OHM / 15 MHZ	SIEMENS*	B82114-R-A3	20.052
L3-13	CHOKE	700 OHM / 15 MHZ	SIEMENS*	B82114-R-A3	20.052

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	REGULATOR UNIT MODULE 14	PUI T2031	ESPERA	5-0-24696F	600594
C1-14	CAPACITOR MKT	10nF 10% 250V	SIEMENS	B32510-D3103-K000	11.290
C2-14	CAPACITOR MKT	10nF 10% 250V	SIEMENS	B32510-D3103-K000	11.290
C3-14	CAPACITOR MKT	10nF 10% 250V	SIEMENS	B32510-D3103-K000	11.290
C4-14	CAPACITOR MKT	10nF 10% 250V	SIEMENS	B32510-D3103-K000	11.290
C5-14	CAPACITOR MKT	150nF 10% 100V	SIEMENS	B32510-D1154-K000	11.222
C6-14	CAPACITOR MKT	150nF 10% 100V	SIEMENS	B32510-D1154-K000	11.222
C7-14	CAPACITOR MKT	150nF 10% 100V	SIEMENS	B32510-D1154-K000	11.222
C8-14	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T12	14.512
C9-14	CAPACITOR MKT	100nF 10% 100V	SIEMENS	B32560-D1104-K000	11.366
C10-14	CAPACITOR MKT	100nF 10% 100V	SIEMENS	B32560-D1104-K000	11.366
C11-14	CAPACITOR MKT	2.2uF 10% 100V	SIEMENS	B32512-E1225-K000	11.406
C12-14	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32510-D1224-K000	11.225
C13-14	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32510-D1224-K000	11.225
C14-14	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32510-D1224-K000	11.225
C15-14	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32510-D1224-K000	11.225
C16-14	CAPACITOR MKT	2.2uF 10% 100V	SIEMENS	B32512-E1225-K000	11.406
C17-14	CAPACITOR MKT	2.2uF 10% 100V	SIEMENS	B32512-E1225-K000	11.406
C18-14	CAPACITOR ELECTROLYTIC	100uF -10/+50% 40V	ERO	EKM 00 DD 310 G	14.561
C19-14	CAPACITOR ELECTROLYTIC	4.7uF 20% 50VDC	ELNA	RJ2-50-V-4R7-M-T12	14.510
D1-14	DIODE ZENER	9V1 5% 0.4W	PHILIPS	BZX79C9V1	26.546
D2-14	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D3-14	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D4-14	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D5-14	DIODE RECTIFIER	1N4002 100V/1A	ITT	1N4002 (03/04/05/06/07)	25.100
D6-14	DIODE RECTIFIER	1N4002 100V/1A	ITT	1N4002 (03/04/05/06/07)	25.100
D7-14	DIODE RECTIFIER	1N4002 100V/1A	ITT	1N4002 (03/04/05/06/07)	25.100
D8-14	DIODE ZENER	9V1 5% 5W 1N5346B	MOTOROLA	1N5346B	26.964
D9-14	DIODE ZENER	1N5350B 13V 5W	MOTOROLA	1N5350B	26.966
D10-14	DIODE ZENER	1N5350B 13V 5W	MOTOROLA	1N5350B	26.966
D11-14	DIODE ZENER	4.7V 5% 0.4W	PHILIPS	BZX79C4V7	26.524
F1-14	FUSE	3.15A M Ø5x20mm	WICKMANN	919201	45.552
IC1-14	VOLTAGE REGULATOR	POSITIVE ADJUSTABLE 1.5A	MOTOROLA	LM317T	31.055
IC2-14	VOLTAGE REGULATOR	NEGATIVE ADJUSTABLE 1.5A	MOTOROLA	LM337T	31.070
L1-14	CHOKE	TL412	TRANS-ELECTRO	6-0-24232B	400412
L2-14	CHOKE FIXED	82uH 5%	NEOSID	00 6122 11 AMMO PACK	20.168
L3-14	CHOKE FIXED	82uH 5%	NEOSID	00 6122 11 AMMO PACK	20.168
L4-14	CHOKE FIXED	82uH 5%	NEOSID	00 6122 11 AMMO PACK	20.168
OC1-14	OPTO COUPLER	CNY17-2	TOSHIBA	CNY 17-2	32.530

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
P1-14	PLUG (MALE)	9 POLE	AMP	0-826375-9	78.109
P2-14	PLUG (MALE)	8 POLE	AMP	0-826375-8	78.108
P3-14	PLUG (MALE)	12 POLE	AMP	1-826375-2	78.112
P4-14	PLUG (MALE)	4 POLE	AMP	0-826375-4	78.104
R1-14	RESISTOR MF	8k2 OHM 5% 0.4W	PHILIPS	2322 181 53822	01.222
R2-14	RESISTOR MF	15k OHM 5% 0.4W	PHILIPS	2322 181 53153	01.229
R3-14	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R4-14	RESISTOR MF	2k0 OHM 1% 0.6W	* PHILIPS	2322 156 12002	03.403
R5-14	RESISTOR MF	2k0 OHM 1% 0.6W	* PHILIPS	2322 156 12002	03.403
R6-14	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R7-14	RESISTOR MF	3k9 OHM 5% 0.4W	PHILIPS	2322 181 53392	01.214
R8-14	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
R9-14	RESISTOR MF	220 OHM 5% 0.4W	PHILIPS	2322 181 53221	01.183
R10-14	RESISTOR MF	220 OHM 5% 0.4W	PHILIPS	2322 181 53221	01.183
R11-14	RESISTOR MF	56k OHM 5% 0.4W	PHILIPS	2322 181 53563	01.243
R12-14	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R13-14	RESISTOR PMF	680 OHM 5% 2W	PHILIPS	2322 191 36801	04.195
R14-14	RESISTOR MF	2R7 OHM 5% 0.5W	PHILIPS	2322 156 12708	01.334
R15-14	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
R16-14	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R17-14	RESISTOR MF	2k2 OHM 5% 0.4W	PHILIPS	2322 181 53222	01.208
R18-14	RESISTOR MF	1 OHM 5% 0.4W	PHILIPS	2322 181 53108	01.125
R19-14	RESISTOR MF	1 OHM 5% 0.4W	PHILIPS	2322 181 53108	01.125
R20-14	RESISTOR MF	1 OHM 5% 0.4W	PHILIPS	2322 181 53108	01.125
R21-14	RESISTOR MF	1 OHM 5% 0.4W	PHILIPS	2322 181 53108	01.125
R22-14	RESISTOR MF	1 OHM 5% 0.4W	PHILIPS	2322 181 53108	01.125
R23-14	RESISTOR MF	1 OHM 5% 0.4W	PHILIPS	2322 181 53108	01.125
R24-14	RESISTOR MF	8R2 OHM 5% 0.4W	PHILIPS	2322 181 53828	01.147
R25-14	RESISTOR PMF	560 OHM 5% 2W	PHILIPS	2322 191 35601	04.193
R26-14	RESISTOR MF	1 OHM 5% 0.4W	PHILIPS	2322 181 53108	01.125
R27-14	RESISTOR MF	1 OHM 5% 0.4W	PHILIPS	2322 181 53108	01.125
R28-14	RESISTOR MF	1 OHM 5% 0.4W	PHILIPS	2322 181 53108	01.125
R29-14	RESISTOR MF	1 OHM 5% 0.4W	PHILIPS	2322 181 53108	01.125
R30-14	RESISTOR MF	1 OHM 5% 0.4W	PHILIPS	2322 181 53108	01.125
R31-14	RESISTOR MF	1 OHM 5% 0.4W	PHILIPS	2322 181 53108	01.125
R32-14	RESISTOR PMF	470 OHM 5% 3W	PHILIPS	2322 195 13471	04.691
R33-14	RESISTOR MF	820 OHM 5% 0.4W	PHILIPS	2322 181 53821	01.197
R34-14	RESISTOR MF	5k6 OHM 5% 0.4W	PHILIPS	2322 181 53562	01.218
T1-14	TRANSISTOR AF	BC548 NPN TO-92	PHILIPS	BC548 (-A/-B/-C)	28.070
T2-14	TRANSISTOR	BC640	PHILIPS	BC640	28.124
T3-14	TRANSISTOR AF	BC557B NPN TO-92	MOT./ITT	BC557B	28.091
T4-14	TRANSISTOR AF	BC558 PNP TO-92	PHILIPS	BC558 (-A/-B/-C)	28.095
T5-14	TRANSISTOR AF	BC548 NPN TO-92	PHILIPS	BC548 (-A/-B/-C)	28.070
T6-14	TRANSISTOR AF	POWER NPN BD139 SOT-39	PHILIPS	BD139	29.060

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
T7-14	TRANSISTOR AF	POWER NPN BD139 SOT-39	PHILIPS	BD139	29.060
T8-14	TRANSISTOR POWER	BD649	PHILIPS	BD649	29.085
T9-14	TRANSISTOR POWER	BD649	PHILIPS	BD649	29.085
T10-14	TRANSISTOR POWER	BD649	PHILIPS	BD649	29.085
T11-14	TRANSISTOR	BD140-10	AEG*	BD140-10	29.066

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	THERMAL PROTECT.MODULE 15	POWER UNIT II T2031	ESPERA	5-0-24645	600400
C3-15	KOND. SIBATIT	100NF 63V	SIEMENS	B37449-F6104-S002	11.755
TS1-15	RESISTOR TEMP.SENSOR	2kO 10% AT 25 CENTIGRADE	SIEMENS	Q63705-K56 (KTY11-2D)	07.150

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