

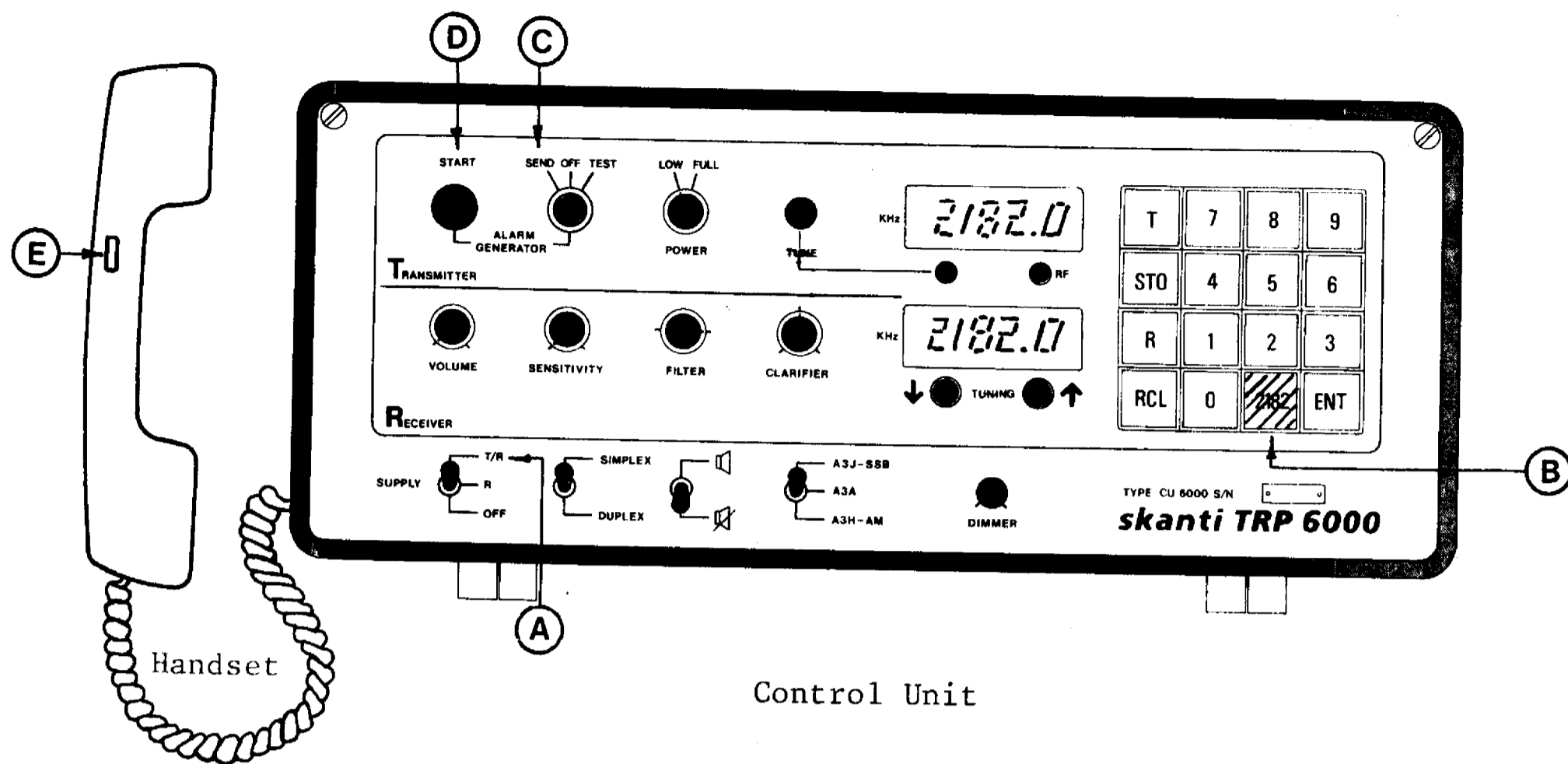
skanti

INSTRUCTION MANUAL

SSB RADIOTELEPHONE

TRP 6000

DISTRESS OPERATION ON 2182 kHz



Transmission of two-tone alarm signal

1. Switch SUPPLY (A) to "T/R"
2. Press the "2182" key (B)
3. Switch ALARM GENERATOR to "SEND" (C)
4. Press ALARM GENERATOR "START" pushbutton (D)

Transmission starts immediately after the automatically initiated tuning sequence and the alarm signal is now transmitted for about 45 seconds.

To repeat the alarm signal transmission just press the "START" pushbutton (D) again.

The alarm signal can be monitored in the handset earpiece.

An alarm signal transmission may be interrupted at any time by turning the ALARM GENERATOR switch to "OFF".

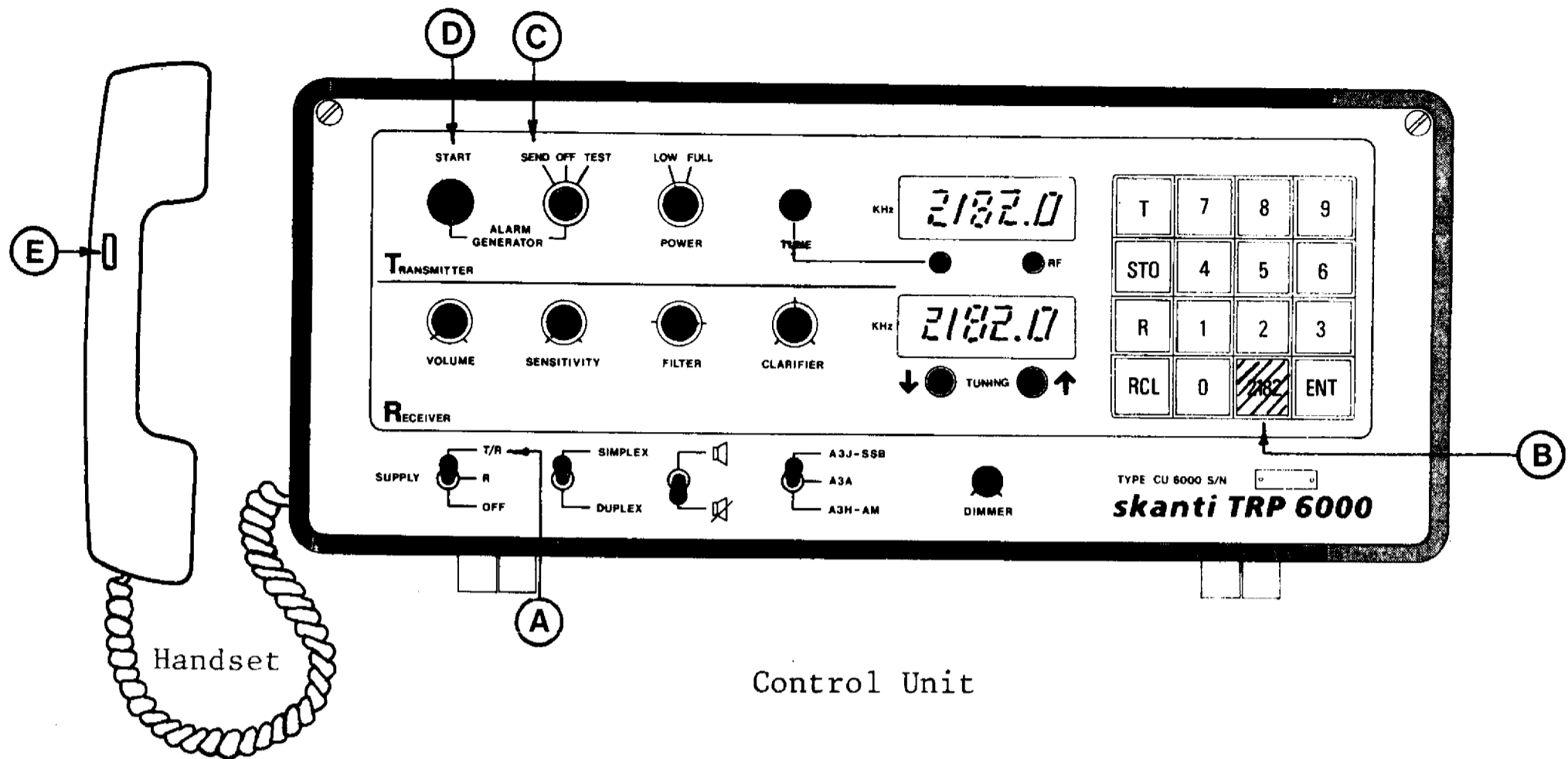
Transmission of distress message

When the alarm signal ceases press handset key (E), and transmit your distress message by speaking into the handset microphone with a clear and calm voice.

Release handset key (E) and wait for a reply.

Repeat the distress message at intervals until a reply is received.

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TRP 6000 INSTRUCTION MANUAL

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NOTICE

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Due to the constant processing of the experience gained during production and operation of our equipment, minor modifications may occur relative to the information given in this manual. Whenever practicable corrections will be listed on a correction sheet inside the front cover of this manual.

TRP 6000 INSTRUCTION MANUAL

CONTENTS

	Page
DISTRESS OPERATION ON 2182 kHz	0
1. INTRODUCTION TO TRP 6000	1-1
2. OPERATION	2-1
2.1. Operating instructions - short form	2-1
2.2. Detailed description of operating controls	2-9
3. PREVENTIVE MAINTENANCE	3-1
4. TROUBLE SHOOTING AND SERVICE	4-1
4.1. Malfunction	4-1
4.2. Battery	4-1
4.3. Replacement of fuses	4-1
4.4. How to use the built-in selfcheck function	4-2
4.5. Transmitter Unit fault finding	4-5
4.6. How to manually tune the transmitter to 2182 kHz	4-6
4.7. Spare parts list	4-7
5. TECHNICAL DATA	5-1
6. TECHNICAL DESCRIPTION	6-1
7. INSTALLATION	7-1
8. CIRCUIT DIAGRAMS AND PARTS LISTS	8-1

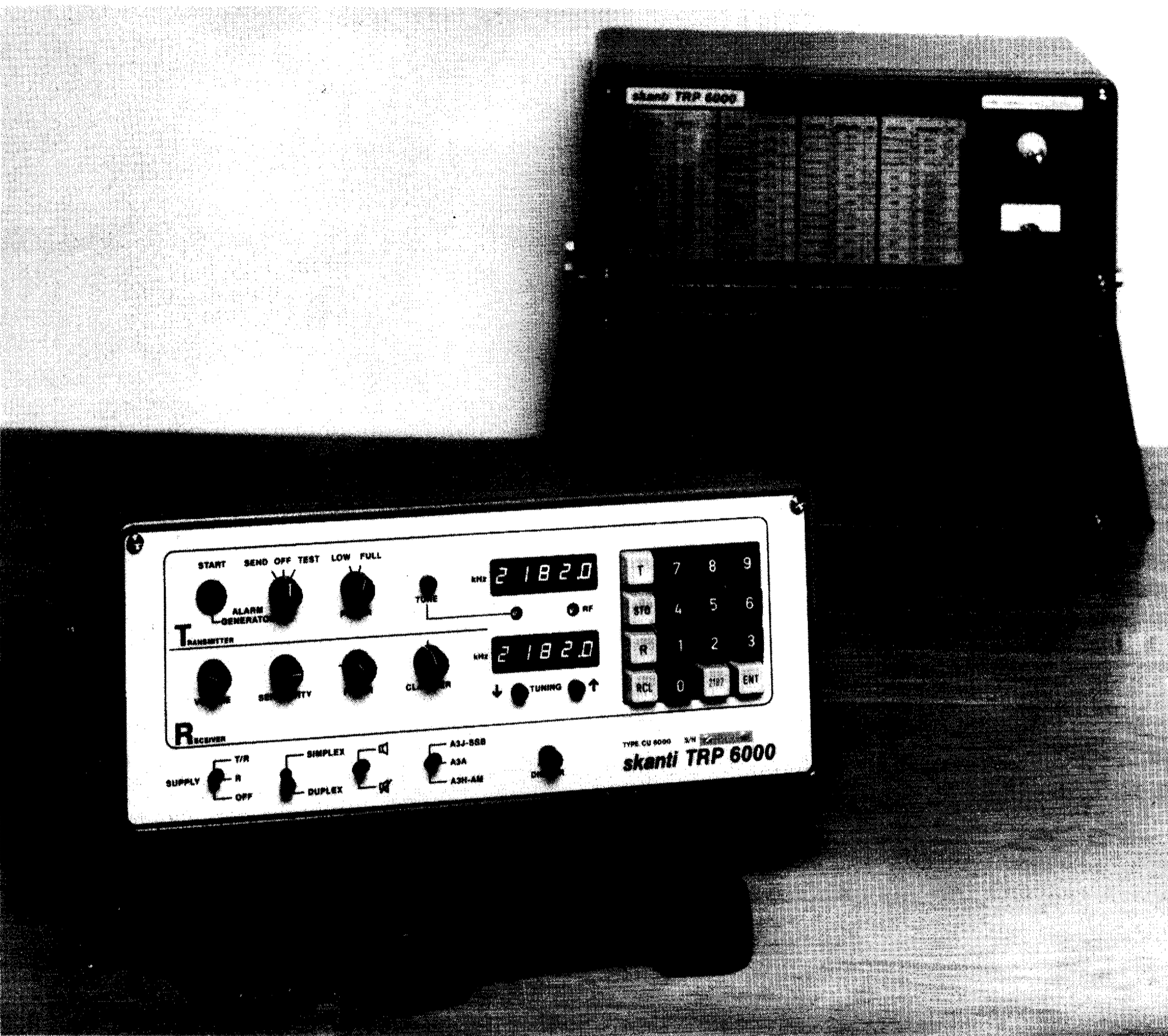


Fig. 1.1

1. INTRODUCTION TO TRP 6000

The TRP 6000 is an SSB Radiotelephone equipment for duplex, semiduplex and simplex communications in the maritime mobile bands from 1.6 to 4.5 MHz.

The novel design of the SKANTI TRP 6000 breaks with the traditional SSB radiotelephone concept. The TRP 6000 is divided into two units, a handy CONTROL UNIT and a fully remote controlled TRANSMITTER UNIT (fig. 1.1).

The Control Unit (CU 6000) contains all receiver and transmitter operating controls and is housed in a non-metallic, non-magnetic cabinet. This combined with the small dimensions of the cabinet ensures maximum installation flexibility.

The transmitter Unit (TU 6400, 400 W or TU 6200, 200 W) is fully remote controlled and may be installed up to 50 metres from the Control Unit where most convenient with respect to antenna lead-in, grounding and the battery connections, thus reducing the well-known problems of power-loss and radio frequency interference caused by long antenna- and ground-wires.

The Transmitter Unit is housed in a rugged nylon-coated steel cabinet and contains the fully solid state linear power amplifier, the power supply and the automatic tuning system. Cooling is performed by temperature controlled fans switched on only under heavy duty operation.

The microprocessor equipped Control Unit contains two separate frequency synthesizers and two frequency displays for the receiver and transmitter functions. Frequency selection is carried out via a common keyboard. A single key operation instantly selects 2182 kHz operation.

The keyboard permits the operator to program up to 20 channels with his busiest receiving and transmitting frequency pairs, and to recall each channel with a few key operations. The TRP 6000 will store the programmed channels for several years, even when switched off. Where required by the authorities, the TRP 6000 will contain a transmitter-frequency PROM with a capacity of up to 80 frequencies. Transmitter keying can only then take place exclusively on the authorized frequencies programmed into the PROM. The keyboard permits recall and display of all the frequencies contained in the PROM.

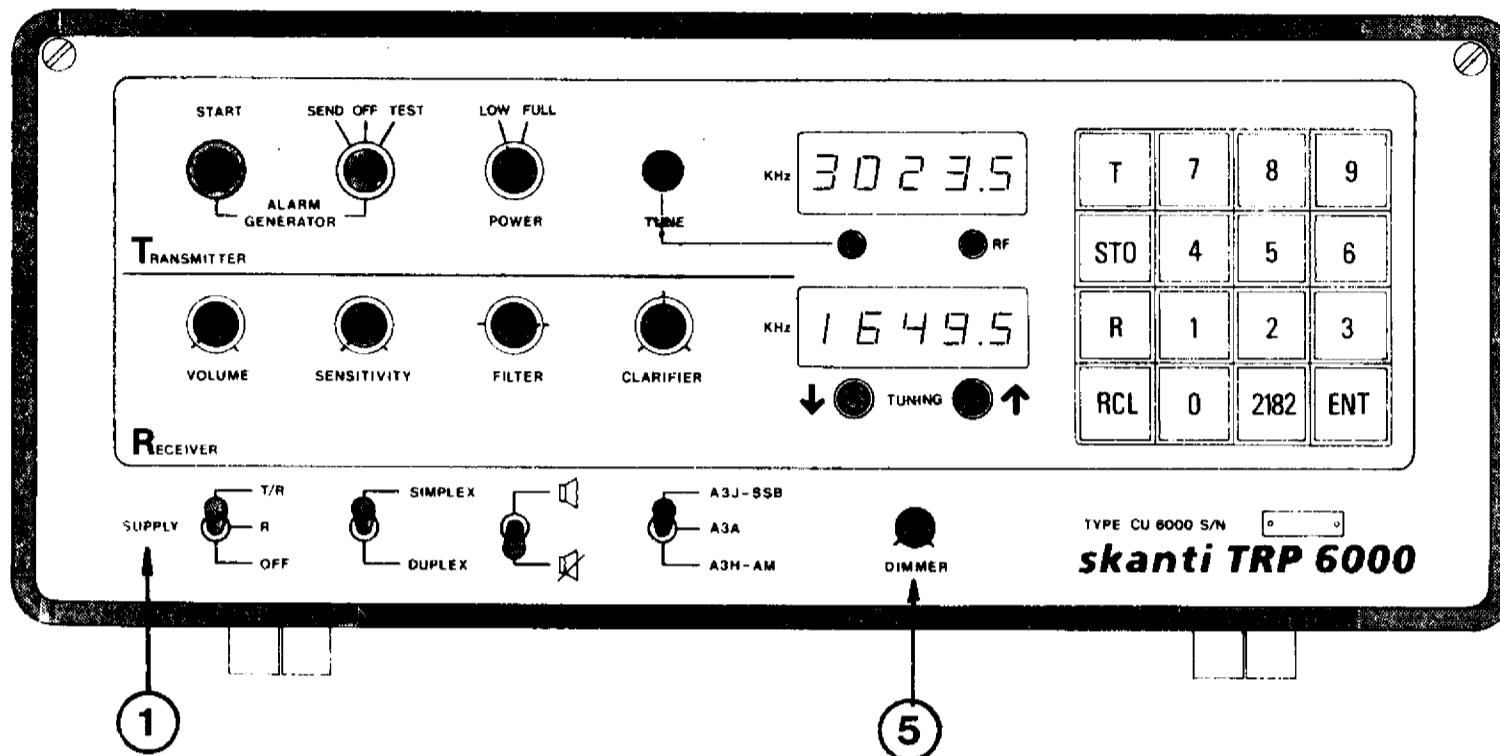
Due to the all solid state design the TRP 6000 is ready for operation within seconds after being switched on.

The automatic tuning system ensures optimum antenna matching under all conditions. This results in maximum RF output power for reliable short, medium and long range communications.

2. OPERATION

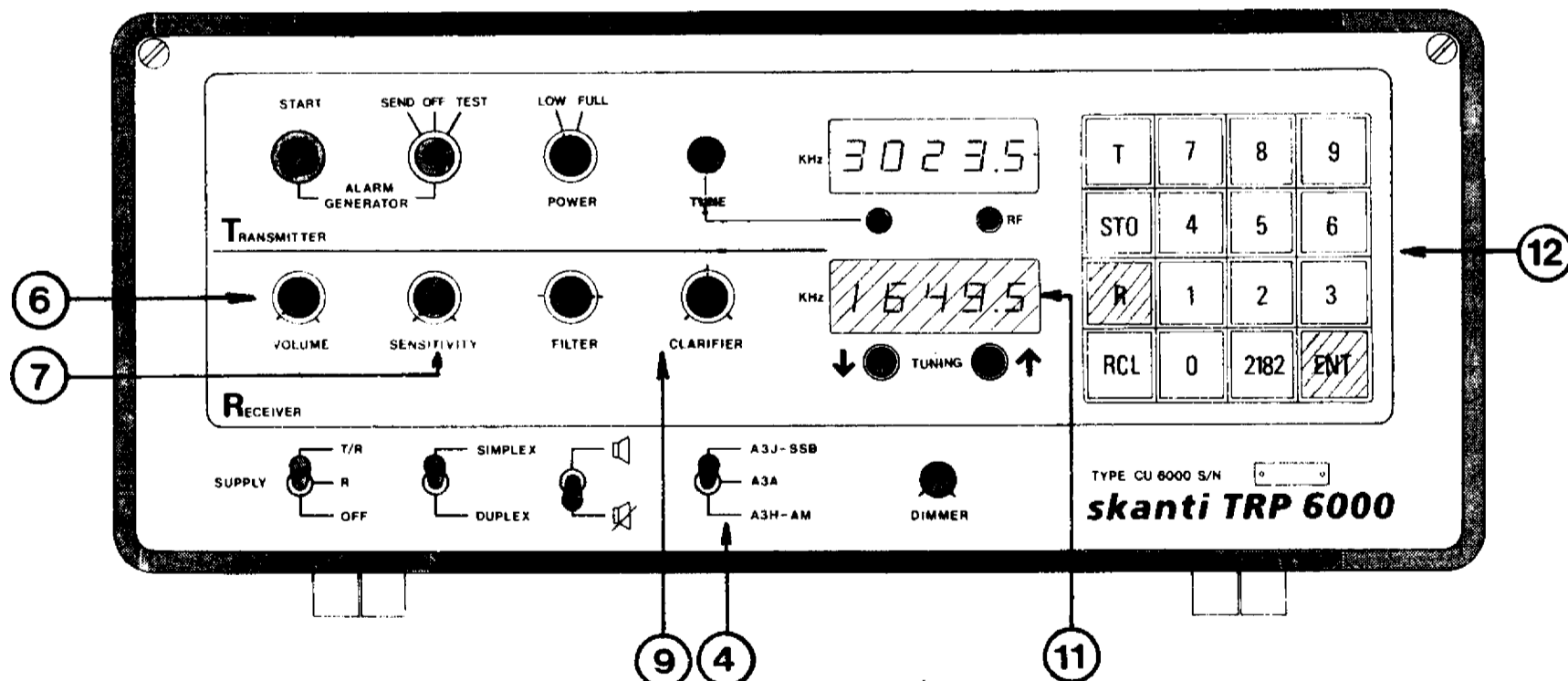
2.1. OPERATING INSTRUCTIONS - SHORT FORM

SWITCH ON



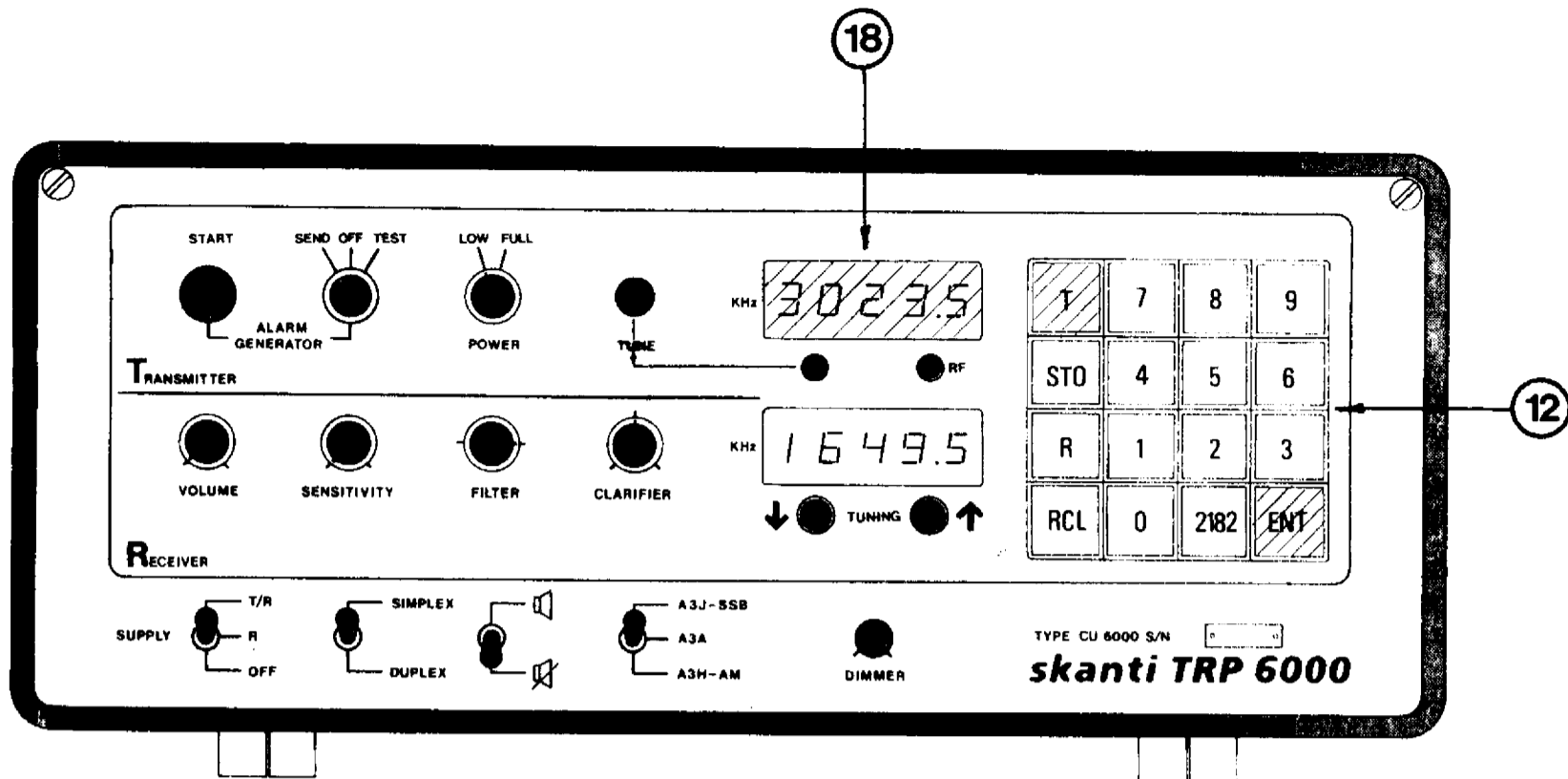
1. Switch SUPPLY (1) to "T/R".
2. Turn DIMMER (5) fully clockwise.

RECEIVE FREQUENCY SET-UP



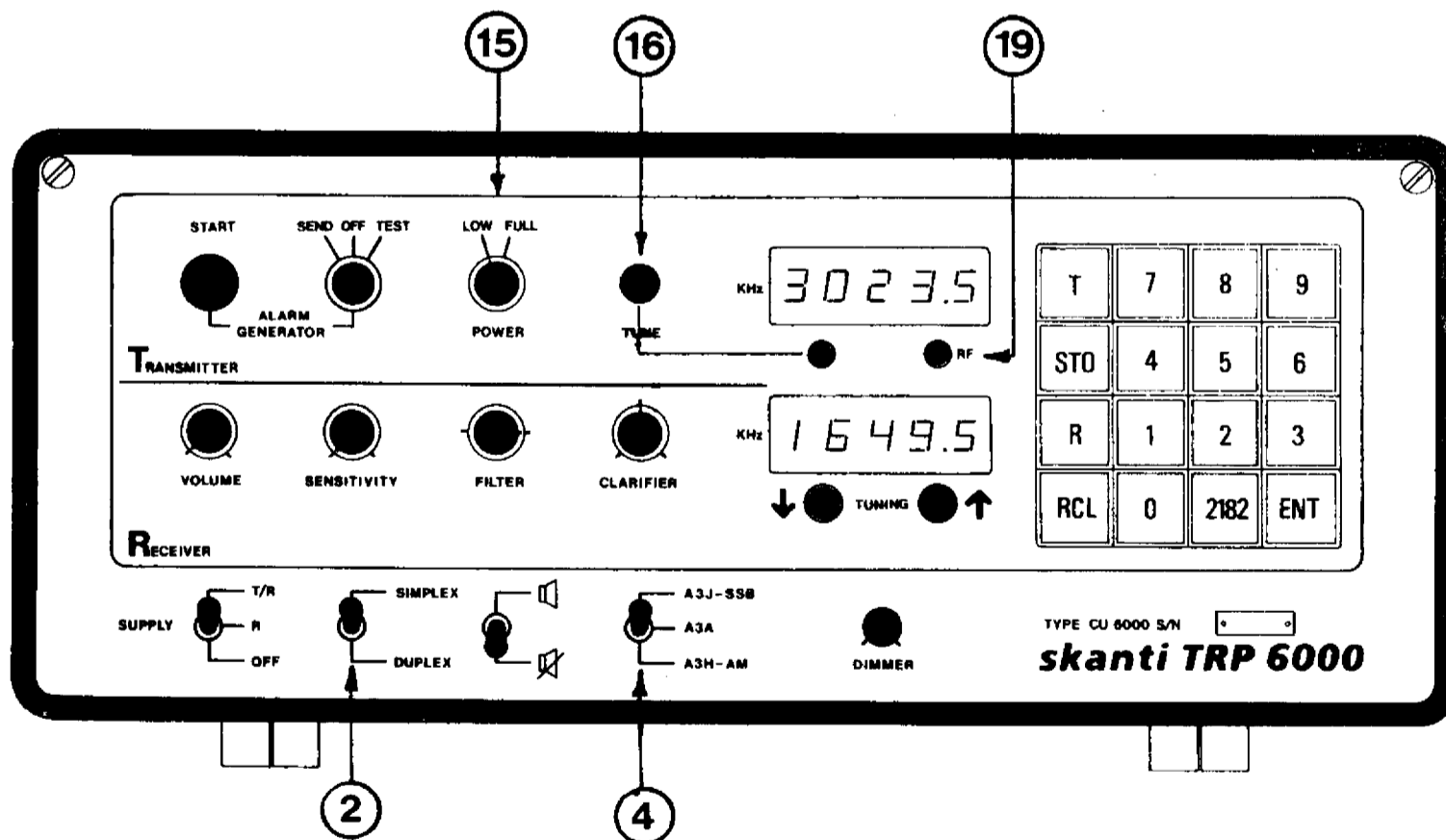
1. Press "R" key on keyboard (12).
2. Enter desired frequency in the receive frequency display (11) via keyboard (12) numeric keys.
3. Press "ENT" key on keyboard (12).
4. Turn SENSITIVITY (7) fully clockwise.
5. Adjust VOLUME (6) for a convenient sound level.
6. Set Mode-switch (4) to "SSB" or "AM" according to received signal.
7. Adjust CLARIFIER (9) for natural-sounding speech if mode is "SSB".

TRANSMIT FREQUENCY SET-UP



1. Press "T" key on keyboard (12)
2. Enter desired frequency in the transmit frequency display (18) via keyboard (12) numeric keys.
3. Press "ENT" key on keyboard (12).

TRANSMITTER TUNING

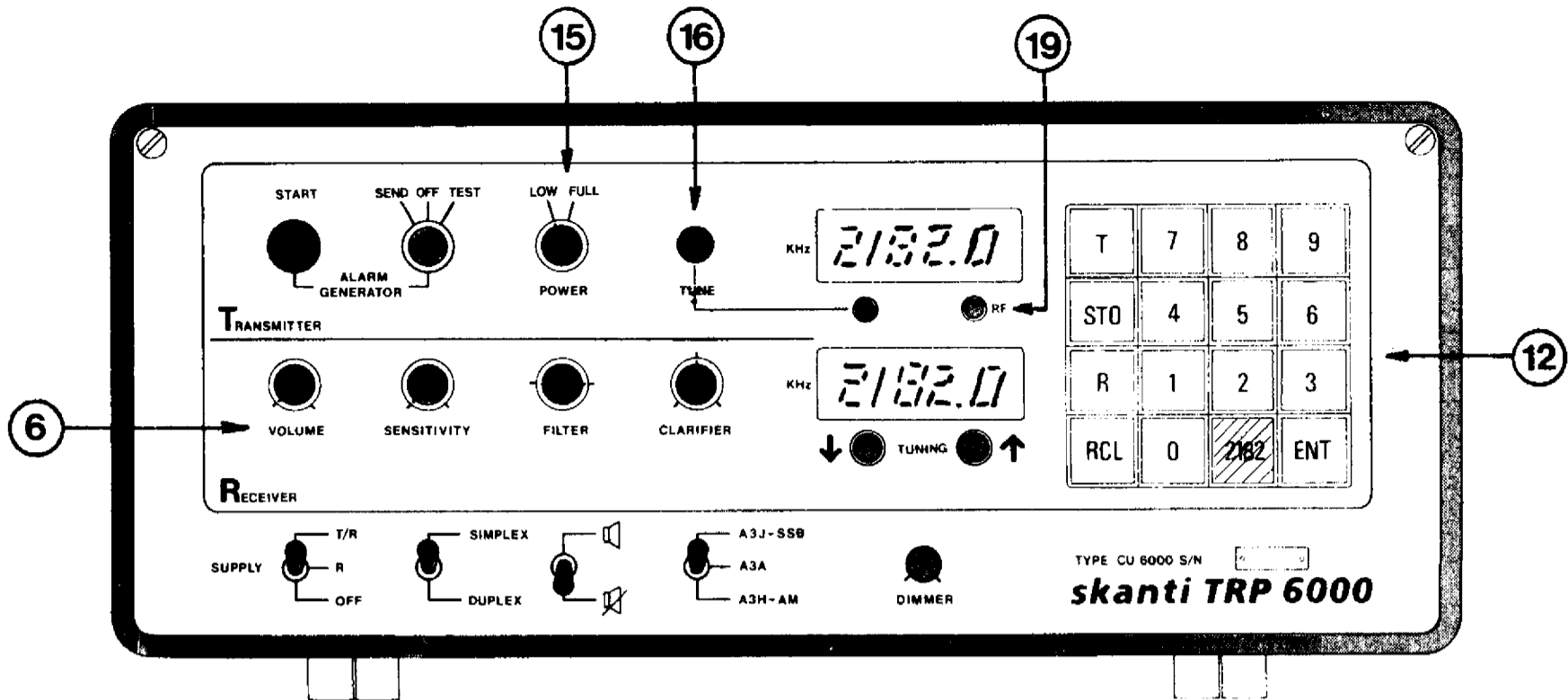


1. Press TUNE pushbutton (16).
The RF output indicator (19) lights during the automatic tuning procedure. When this light goes off, tuning is completed.

TO TRANSMIT

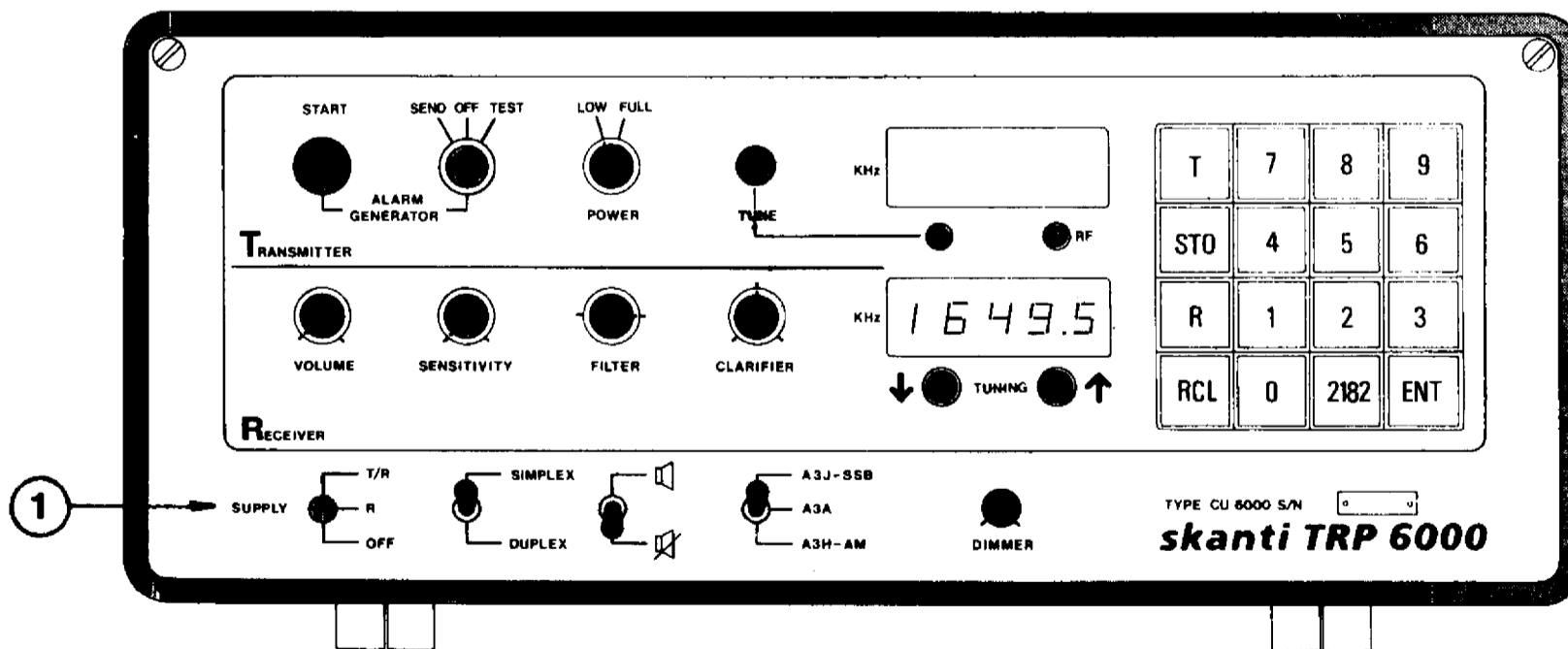
1. Set POWER-switch (15) to "LOW" or "FULL".
2. Choose SIMPLEX or DUPLEX (2) and SSB or AM (4).
3. Press the handset key - you are now on-the-air.

QUICK SET-UP FOR 2182 kHz



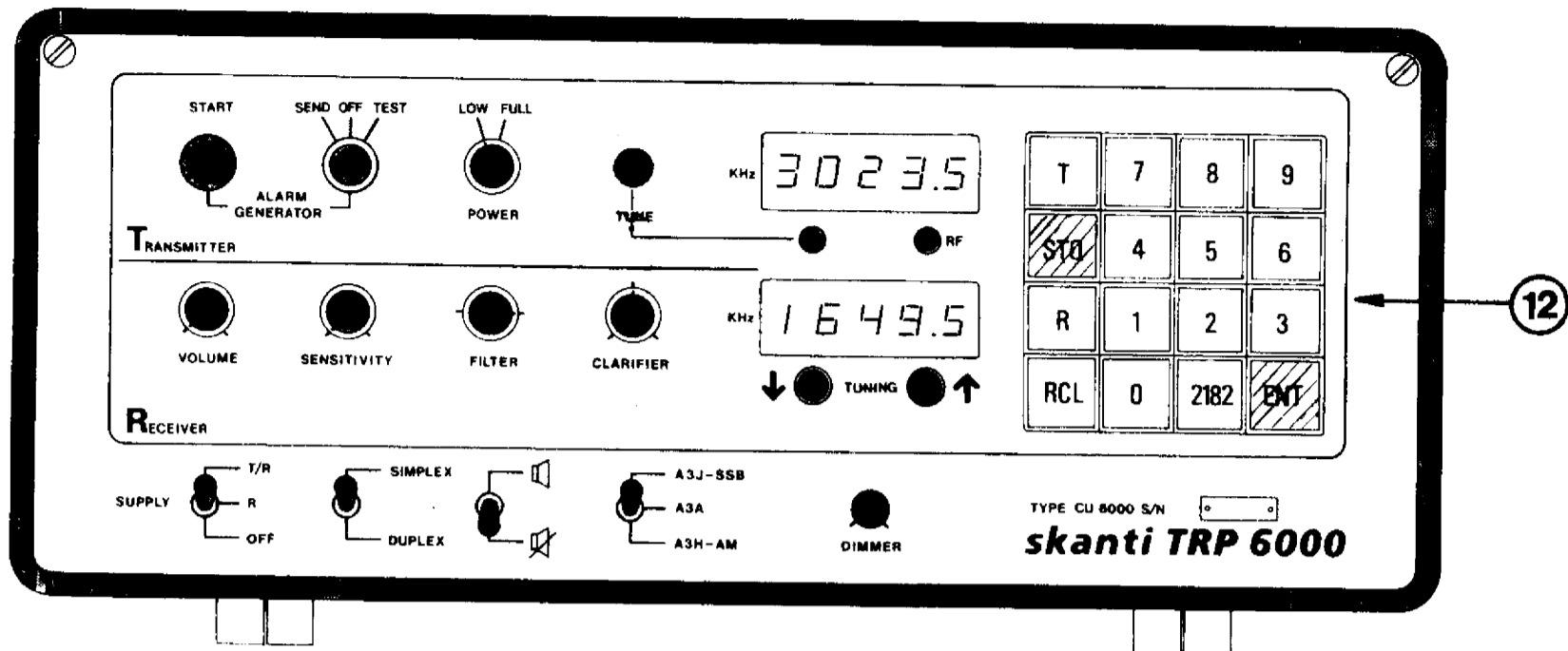
1. Press "2182" key on keyboard (12).
This instantly changes receive and transmit frequency to 2182 kHz.
Mode A3H-AM is automatically selected (mode switch is de-activated).
Receiver sensitivity is automatically switched to maximum. (The SENSITIVITY control is de-activated).
2. Adjust VOLUME (6) for a convenient sound level.
3. Press the TUNE (16) pushbutton and wait until the light in the RF (19) output indicator goes out.
4. Set POWER-switch (15) to "LOW" or "FULL".
5. Press the handset key - you are now on-the-air.

RECEIVE ONLY



1. Switch SUPPLY (1) to "R".
This will switch off all transmitter functions.

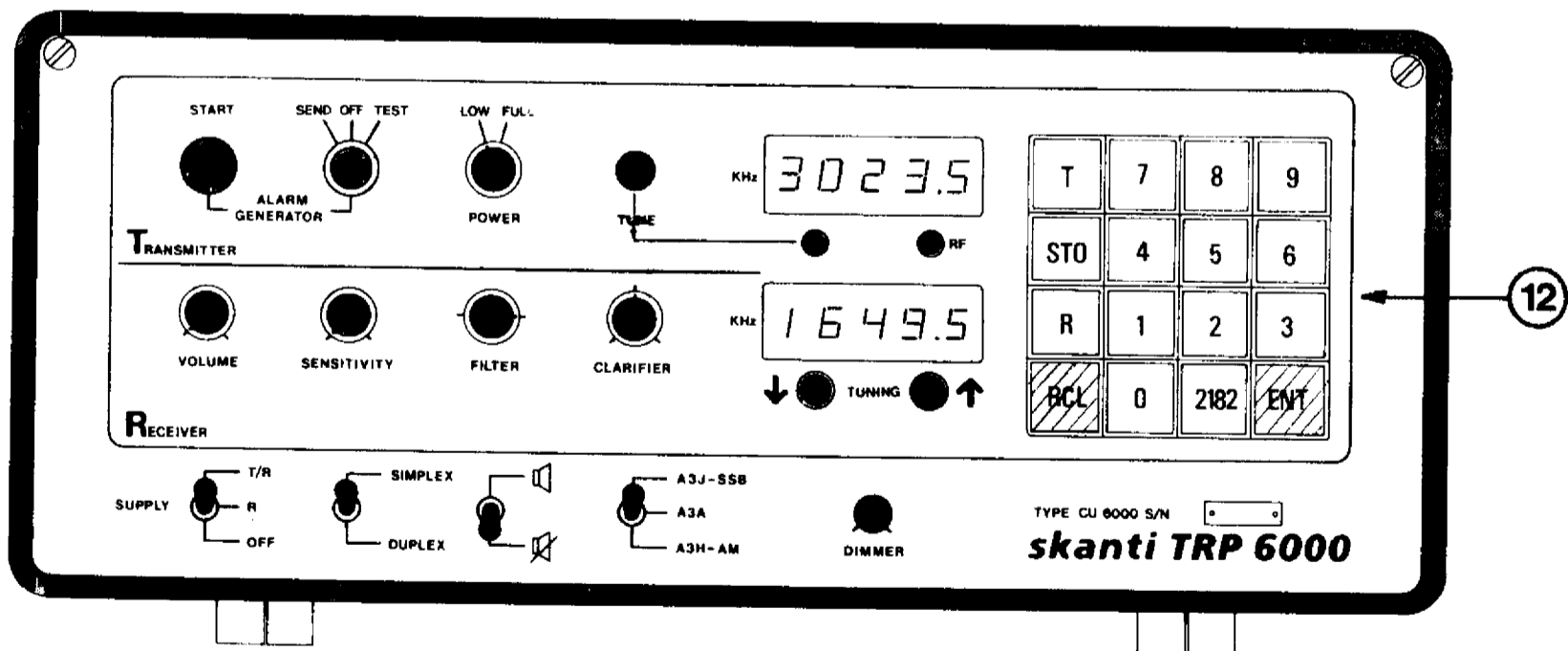
HOW TO STORE (STO) RECEIVE AND TRANSMIT FREQUENCY PAIRS



To programme a "channel" into the built-in frequency memory proceed as follows:

1. Set up the actual frequencies on the two displays.
2. Press the "STO" key on keyboard (12) and keep it pressed.
3. Enter your channel-number via the keyboard (12) numeric keys. You have 20 channels from 0-19.
4. Press and release "ENT" key, release "STO".

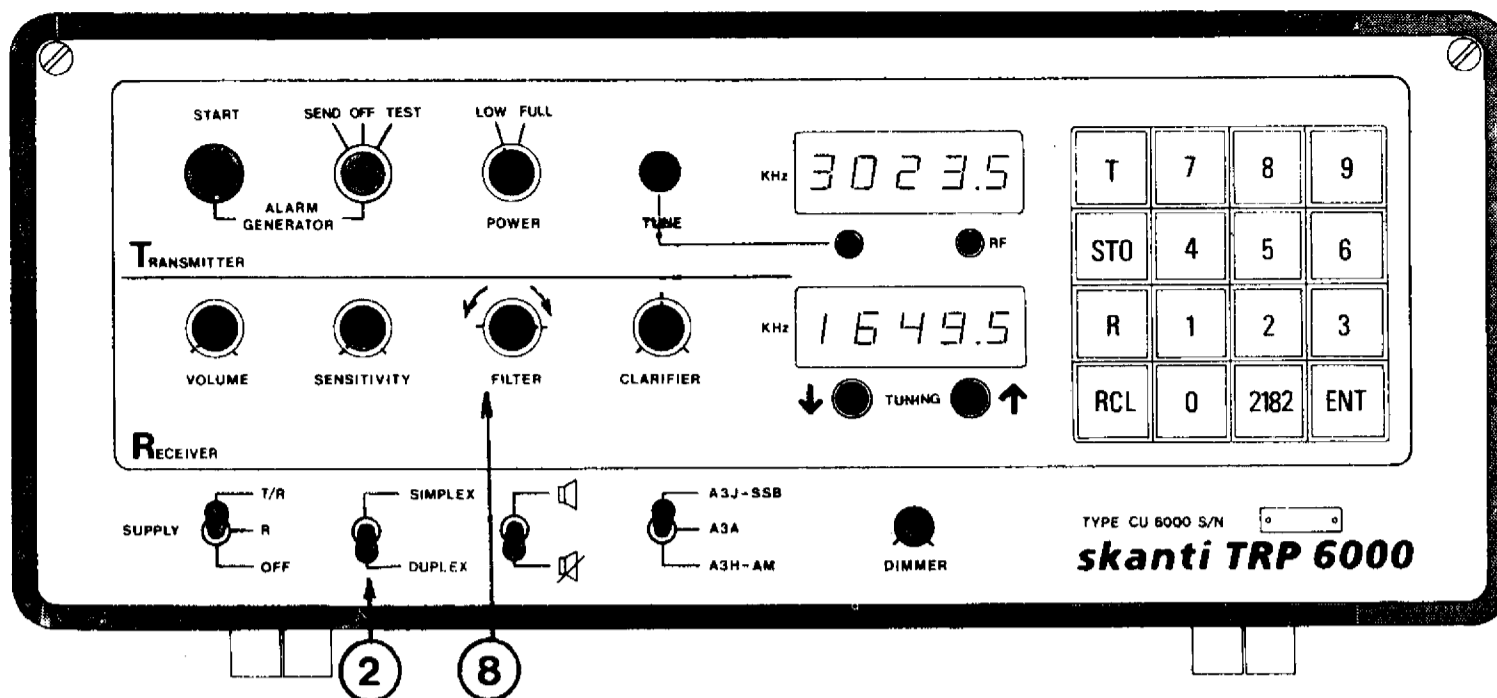
HOW TO RECALL (RCL) STORED RECEIVE AND TRANSMIT FREQUENCIES



To recall a "channel" in the frequency memory proceed as follows:

1. On keyboard (12) press
"RCL"
Channel no.
"ENT"

DUPLEX OPERATION



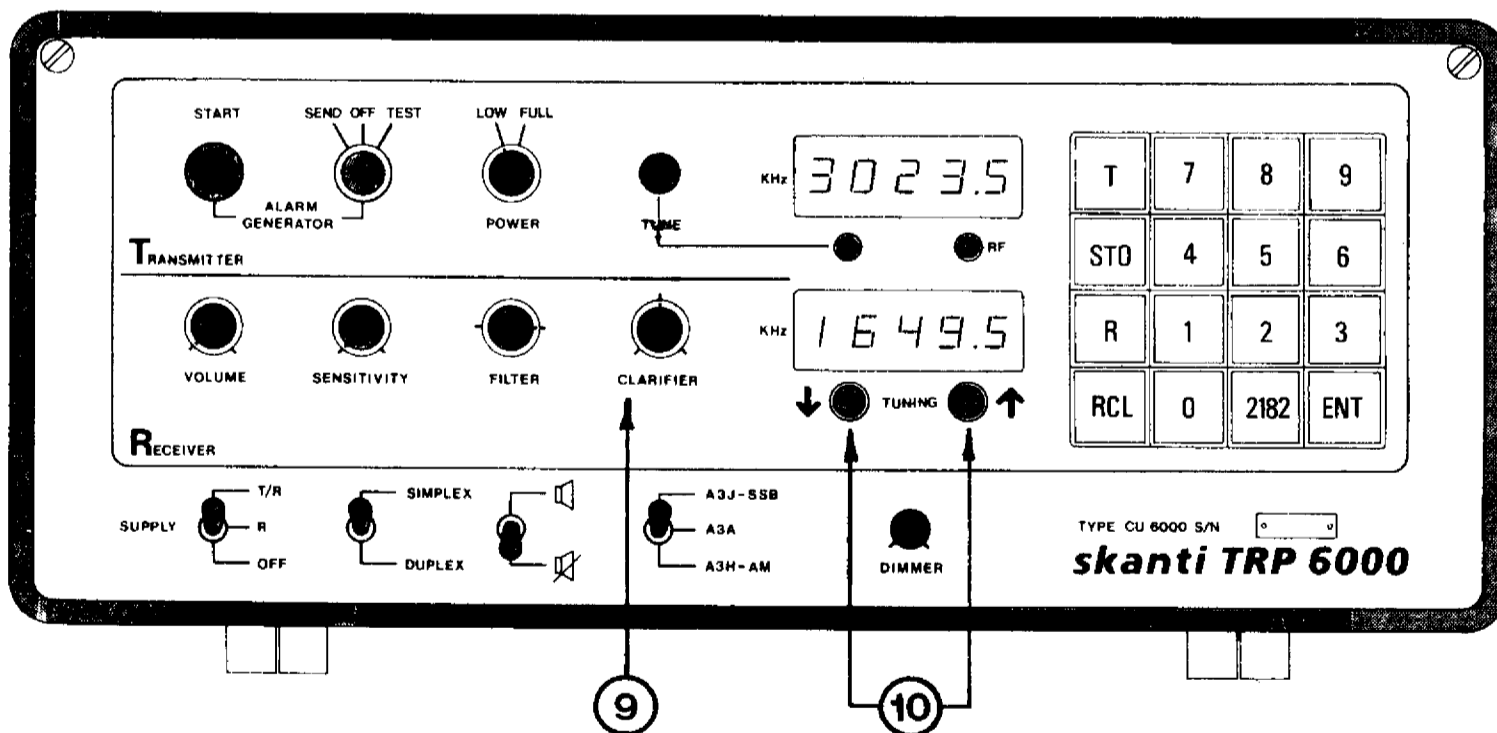
1. Set SIMPLEX/DUPLEX switch (2) to DUPLEX.

To minimize noise and interference at the receiving frequency, activate the FILTER (8) as follows:

2. Turn the FILTER (8) knob to its extreme left or right position (right or left demarcation line); this will activate the filter.
3. Adjust FILTER (8) knob for max. receiver sensitivity or minimum transmitter noise/interference.

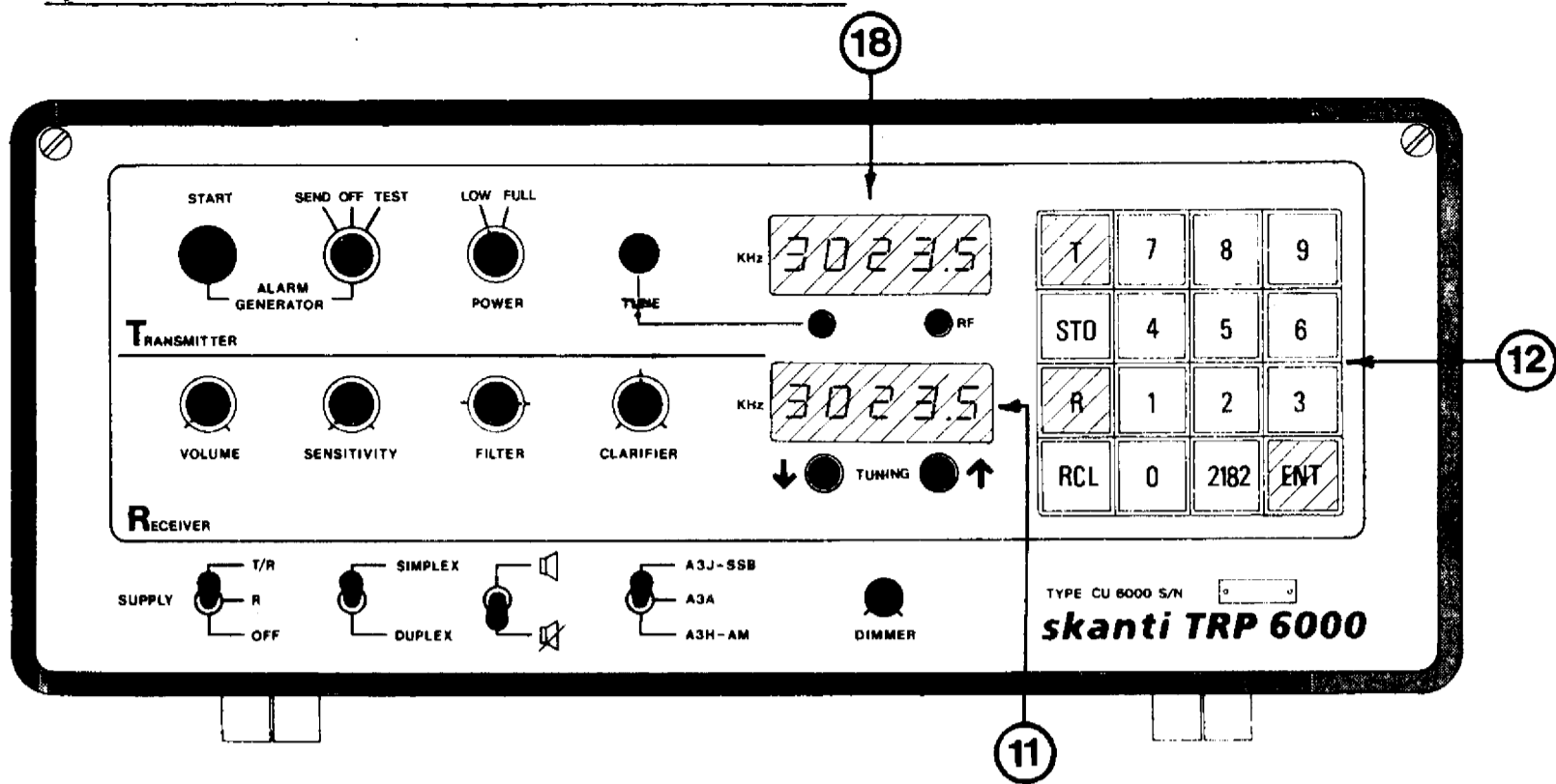
NOTE: The filter switches off automatically if the receiver frequency is changed either by TUNING or by a new key-board entry of receiver frequency.

RECEIVER TUNING



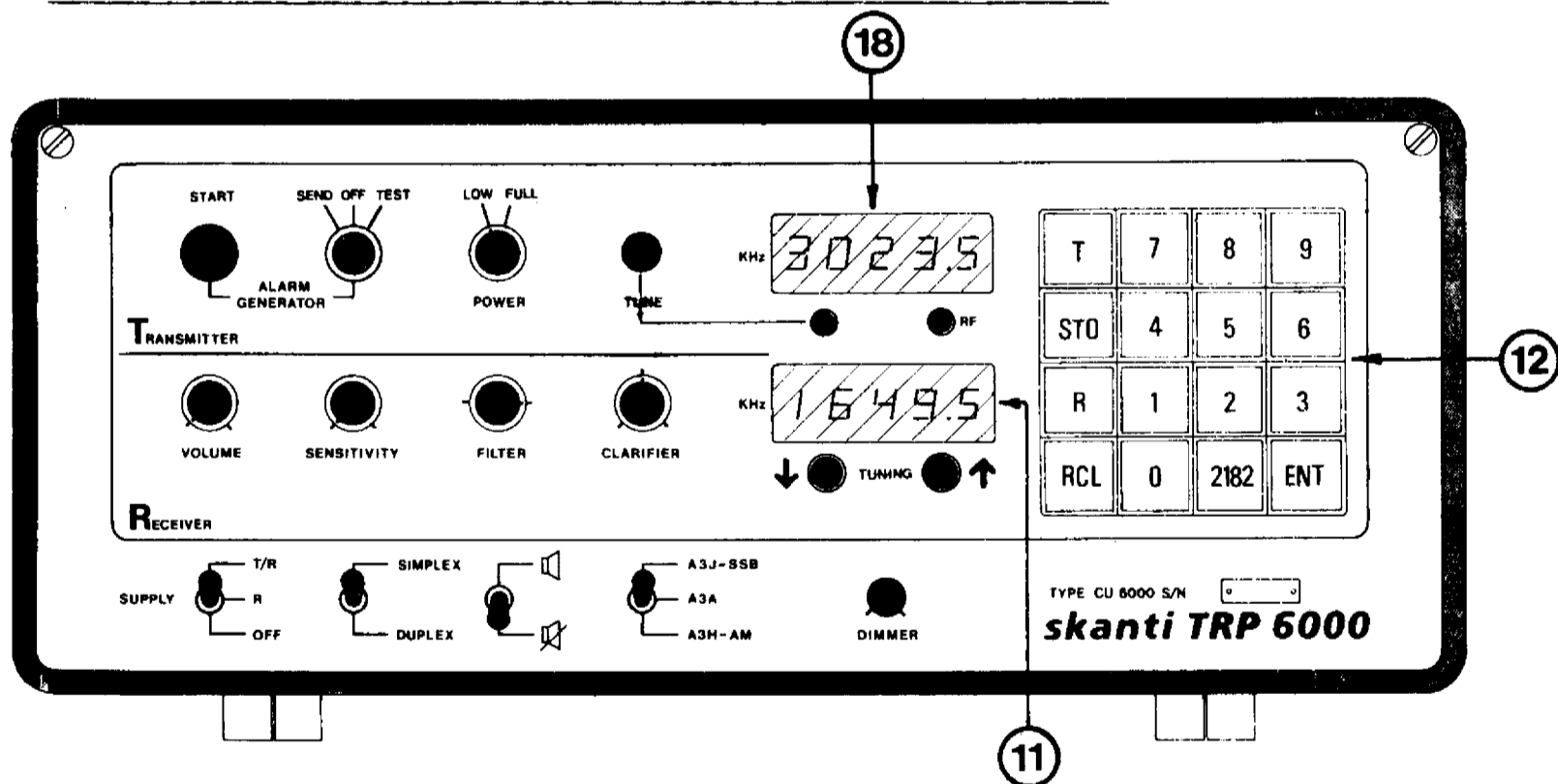
1. TUNING pushbuttons (10) are used to change the receive frequency up/down. A short operation will change the frequency 1 kHz or 100 Hz in A3/A3H and A3J/A3A mode respectively. If a TUNING pushbutton is pressed and held pressed for more than 0.5 sec. the receiving frequency will change continuously with 10 kHz/sec. or 5 kHz/sec. in A3/A3H and A3J/A3A mode respectively. After 1 second the rate of change will be doubled. See also page 2-7.
2. For fine tuning to an SSB station use the CLARIFIER control (9) and adjust for natural-sounding speech.

QUICK SET-UP FOR SIMPLEX OPERATION



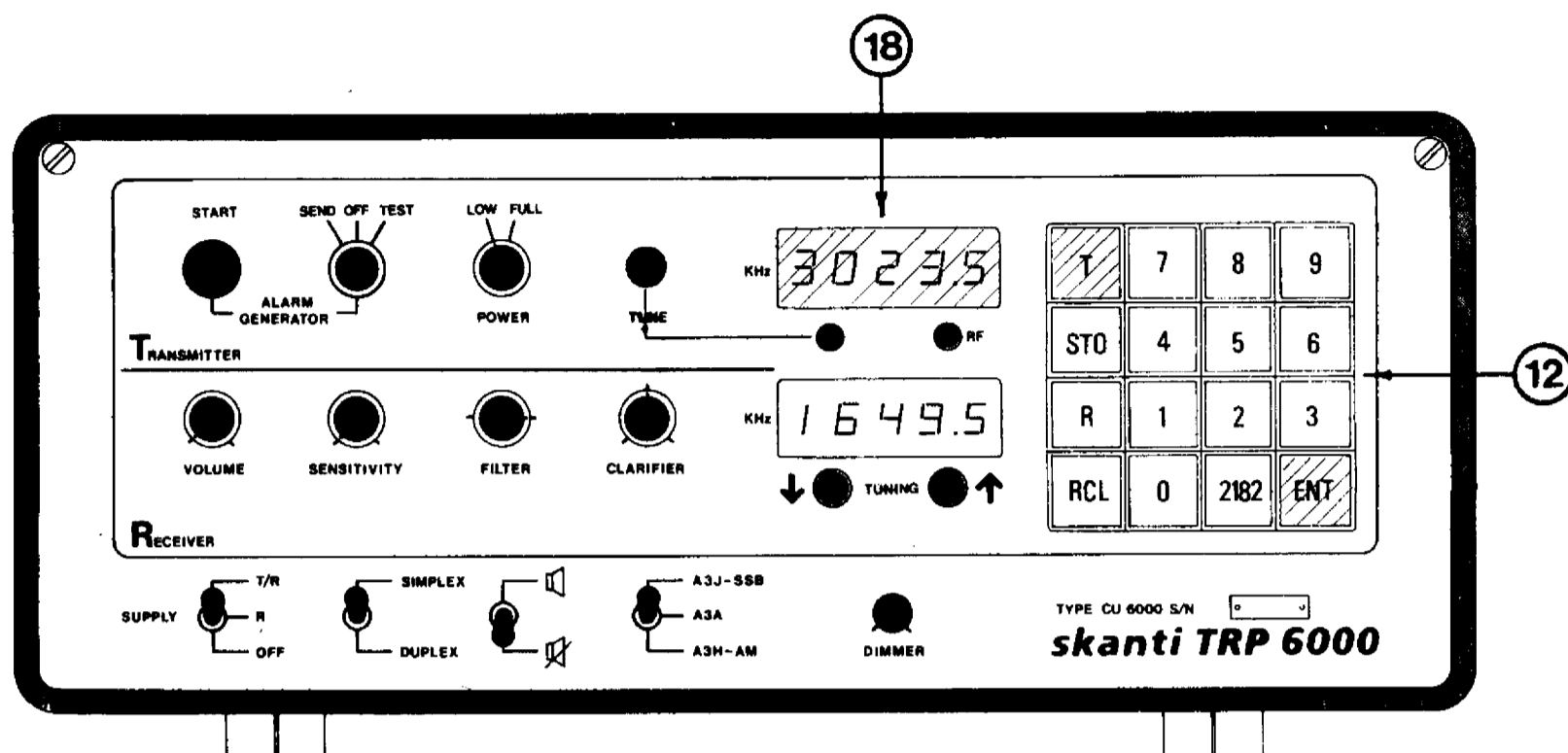
1. Press "T" key on keyboard (12)
2. Press "R" key on keyboard (12)
3. Enter desired frequency in the transmit and receive frequency displays (18) and (11) simultaneously via keyboard (12) numeric keys.
4. Press "ENT" key on keyboard (12)

QUICK WAY OF RECALLING STORED FREQUENCY PAIRS



1. Press "R" key on keyboard (12)
2. Press "ENT" key on keyboard (12)
3. The transmit and receive frequency displays (18) and (11) will now show the first stored frequency pair.
4. Repeat step 2 to see the next frequency pair.

VERIFICATION OF TRANSMITTER -FREQUENCY PROM



1. Press "T" key on keyboard (12)
2. Press "ENT" key on keyboard (12)
3. The transmit frequency display (18) will now show the first authorized frequency programmed into the PROM.
4. Repeat step 2 up to 80 times to see the next frequency.

9 kHz (10 kHz) SCANNING FACILITY IN THE BROADCAST BANDS

This facility eliminates the need for fine-tuning to broadcast stations when using the TUNING pushbuttons. The broadcast bands 155 kHz to 281 kHz and 531 kHz to 1602 kHz are scanned in steps of 9 kHz, corresponding to the channel spacing of broadcast stations in Regions 1 and 3. Alternatively the band 540 to 1600 may be scanned in steps of 10 kHz, corresponding to the channel spacing in Region 2.

To obtain 9 kHz (10 kHz) scanning proceed as follows:

Press in sequence

"R"
 "9" ("10")
 "ENT"

"9.0" ("10.0") is flashing in the R-display. Store the information in channel No. 19:

Press "STO" and keep it pressed

Press in sequence

"1"
 "9"
 "ENT"

Release

"STO"

Any other content in channel 19 than 9.0 or 10.0 causes 1 kHz scanning.

Note that when the 9 kHz (10 kHz) scanning facility is desired channel 19 cannot be used for storing a receiver frequency.

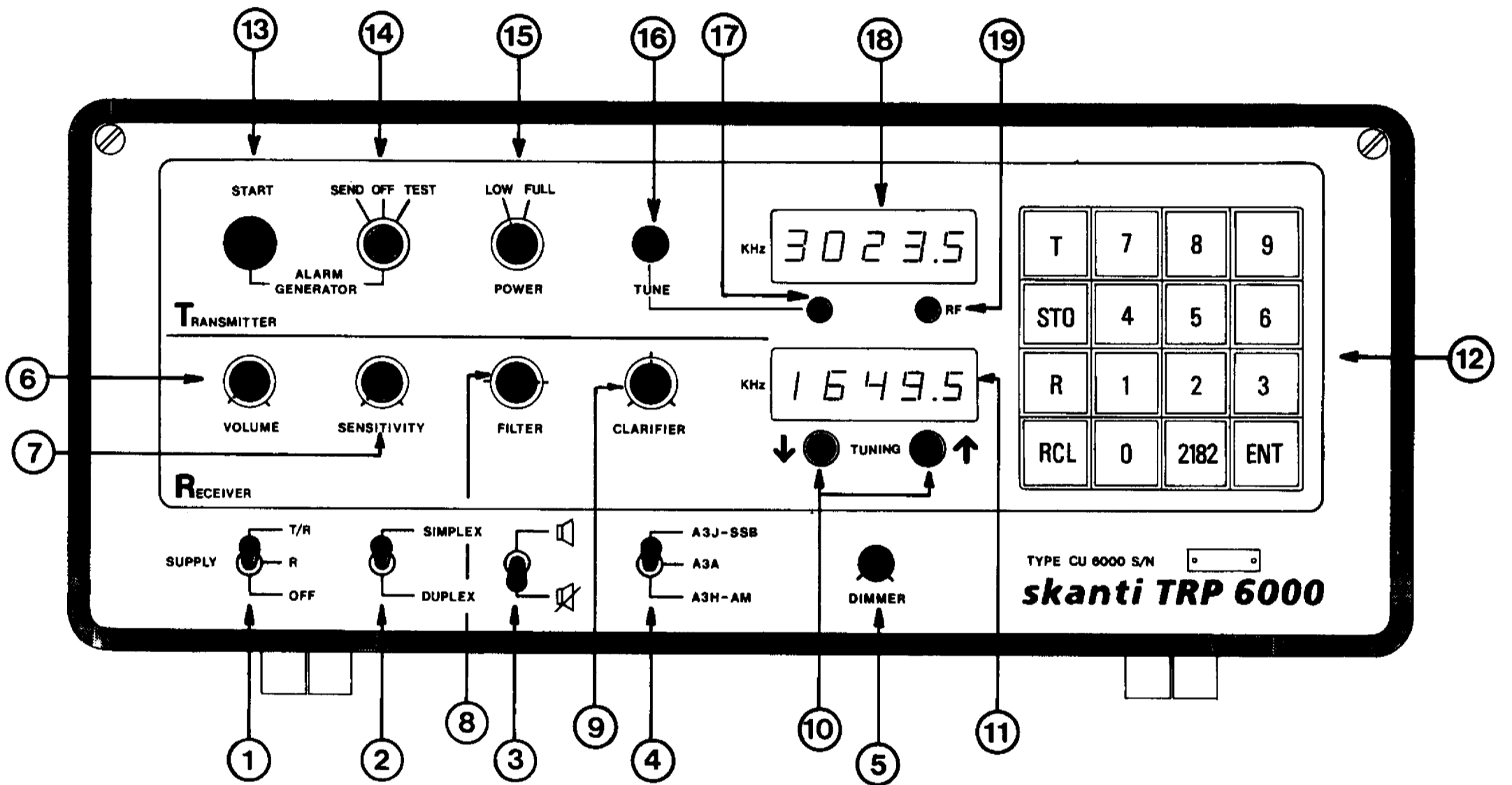


Fig. 2.2.1



2.2. DETAILED DESCRIPTION OF OPERATING CONTROLS

Refer to fig. 2.2.1.

- ① SUPPLY
 - T/R : Complete switch-on of TRP 6000
 - R : Receiver only is switched on
 - OFF : Complete switch-off of TRP 6000

- ② SIMPLEX / DUPLEX
 - DUPLEX : Transmitter is keyed from handset key.
Receiver is on, but speaker(s) is disconnected.

 - SIMPLEX : Transmitter is keyed from handset key.

- ③ Speaker on/off
 -  : Speaker(s) on
 -  : Speaker(s) off

- ④ Mode switch
 - A3J-SSB : Transmission of A3J
Reception of A3J and A3A

 - A3A : Transmission of A3A
Reception of A3A and A3J

 - A3H-AM : Transmission of A3H
Reception of A3H and A3
A3H-AM is automatically selected in the receiver
for frequencies below 1606.5 kHz.

- ⑤ DIMMER : For adjustment of the light intensity in the frequency displays.
Turn fully clockwise, for full maximum intensity.

- ⑥ VOLUME : For adjustment of receiver AF gain.

- ⑦ SENSITIVITY: Adjusts receiver IF amplifier gain. Turning the control anticlockwise gradually reduces the gain. This can be advantageous during SSB reception as it prevents noise from coming up in speech pauses.

NOTE: The AGC (Automatic Gain Control) is impeded when the gain is manually reduced by means of the SENSITIVITY control. Always turn the control fully clockwise when selecting a new frequency.

The SENSITIVITY control is disabled at frequencies below 1606.5 kHz (broadcast bands) and 2182 kHz (if selected by 2182 key) where A3H-AM, AGC ON is automatically selected.

- ⑧ FILTER : For activation and adjustment of the narrow, tunable receiver input filter. To activate the filter, turn the knob to its extreme left or right position (right or left horizontal markers).

Next, adjust the knob for maximum receiver sensitivity or minimum transmitter noise/interference.

NOTE: The filter is taken out of circuit automatically if the receiver frequency is changed, with either the TUNING pushbuttons (10) or with a new keyboard entry of receiver frequency.

- ⑨ CLARIFIER : Receiver frequency fine tuning in modes A3A and A3J.

- ⑩ TUNING



: Receiver frequency-decrease pushbutton



: Receiver frequency-increase pushbutton

NOTE: Rate of change is 10 kHz/second in A3/A3H mode and 5 kHz/second in A3A/A3J mode.

However, the rate of frequency change will double if a TUNING pushbutton is kept pressed for more than one second. See also page 2-7.

In A3J/A3A mode the frequency will step 100 Hz each time one of the pushbuttons is pressed.

- ⑪ R-display : Receive frequency display.

A flashing decimal point indicates that an enter or recall of a new receive frequency is not finalized.

Flashing digits indicate that the frequency is outside the specified receiver frequency range.

⑫ Keyboard

The keyboard consists of six control keys and ten numeric keys.

T			
STO			
R			
RCL			ENT

FUNCTION CONTROL KEYS

	7	8	9
	4	5	6
	1	2	3
	0		

NUMERIC KEYS

		2182	

2182 CONTROL KEY

All keyboard operations (except use of the "2182" key) must begin with one of the four extreme left column keys T - STO - R - RCL to define the type of function and must end with ENT to indicate that the keyboard operation is finalized.

For this reason keyboard operations generally have the following 3-step structure:

- Step 1 Press one of the four function control keys:
 - T for updating the T-display
 - STO for storing the frequencies in T- and R-display
 - R for updating the R-display
 - RCL for recalling stored frequencies (channels).
- Step 2 Use the numeric keys, either for entering new frequencies or a channel number.
- Step 3 Press ENT.

Details related to the six control keys are as follows:

- T Transmitter frequency key.
Pressing this key will clear the T-display.
The decimal point flashes to indicate that a new transmit frequency must be entered with the numeric keys.

- STO Store key.
To be used for storing the current contents of the T- and R-displays in the user-programmable memory.
Pressing STO will not change the contents of the T- and R-displays.
STO must be pressed during the complete store sequence, see section 2.1.
- R Receiver frequency key.
Pressing this key will clear the R-display.
The decimal point flashes to indicate that a new receive frequency must be entered with the numeric keys.
- RCL Recall key.
To be used for recalling a channel (a frequency pair) from the user-programmable memory.
Pressing this key will clear both T- and R-displays.
The decimal point will flash, in both displays, to indicate the channel number must be entered with the numeric keys.
The entered channel number will now show in the R-display.
Refer to section 2.2 for complete recall procedure.
- ENT Enter key.
Must be operated to terminate all keyboard operations initiated by the T-STO-R or RCL keys.
- 2182 Quick set-up key for 2182 kHz.
Pressing this key will instantly select 2182 kHz as both transmit and receive frequency.
A3H simplex operation and full receiver sensitivity is automatically selected independent of the actual positions of the mode-switch, simplex/duplex switch or sensitivity control knob.

⑬ START : Alarm generator start push-button.

Pressing this red pushbutton will initiate the 45 seconds two-tone alarm signal generation period if the ALARM GENERATOR SWITCH (14) is in position SEND or TEST. If in position SEND, the transmitter is automatically tuned when the START pushbutton is pressed.

⑭ ALARM GENERATOR SWITCH

SEND : In this position the alarm generator is ready to be started by the START pushbutton (13).

When START is pressed the transmitter is automatically tuned, then keyed and the two-tone alarm signal is transmitted for approx. 45 seconds at full output power.

The alarm signal can be monitored in the telephone handset and can be interrupted at any time, by switching (14) to OFF.

OFF : The alarm generator is switched off and cannot be activated by pressing START (13).

TEST : Transmitter cannot be keyed.

The alarm generator can be started by pressing the START pushbutton (13).

The alarm signal is generated for 45 seconds.

The alarm signal can be monitored in the telephone handset and can be interrupted at any time, by switching (14) to OFF.

⑮ POWER

LOW : Transmitter is driven to approx. 1/8 of full rated output power.

NOTE: Full power is automatically selected when the ALARM GENERATOR switch (14) is in the SEND position.

FULL : Transmitter is driven to full rated output power.

①⑥ TUNE : Pushbutton for initiating the automatic tuning procedure in the Transmitter Unit. A typical tuning takes about 7 seconds. During tuning the RF output indicator (19) will light to indicate that the transmitter is keyed and that power is delivered to the antenna during tuning. When the light in (19) is switched off, tuning is completed.
During tuning the receiver is muted.

①⑦ Tune indicator:

Light indicates that tuning is needed.
Press TUNE (16).

If the tune indicator lights even when tuning has been performed, an overload condition is present in the Transmitter Unit. Refer to page 4-5 for specific instructions.

①⑧ T-display: Transmitting frequency display.

A flashing decimal point indicates that an enter or recall of a new transmitting frequency is not finalized.

Flashing digits indicates that the frequency is unauthorized, i.e. the frequency is outside the specified transmitter frequency range and/or not contained in the transmit frequency PROM.

The transmitter cannot be keyed if the T-display is flashing.

①⑨ RF

: RF output indicator.

A low light intensity indicates the transmitter is being keyed.

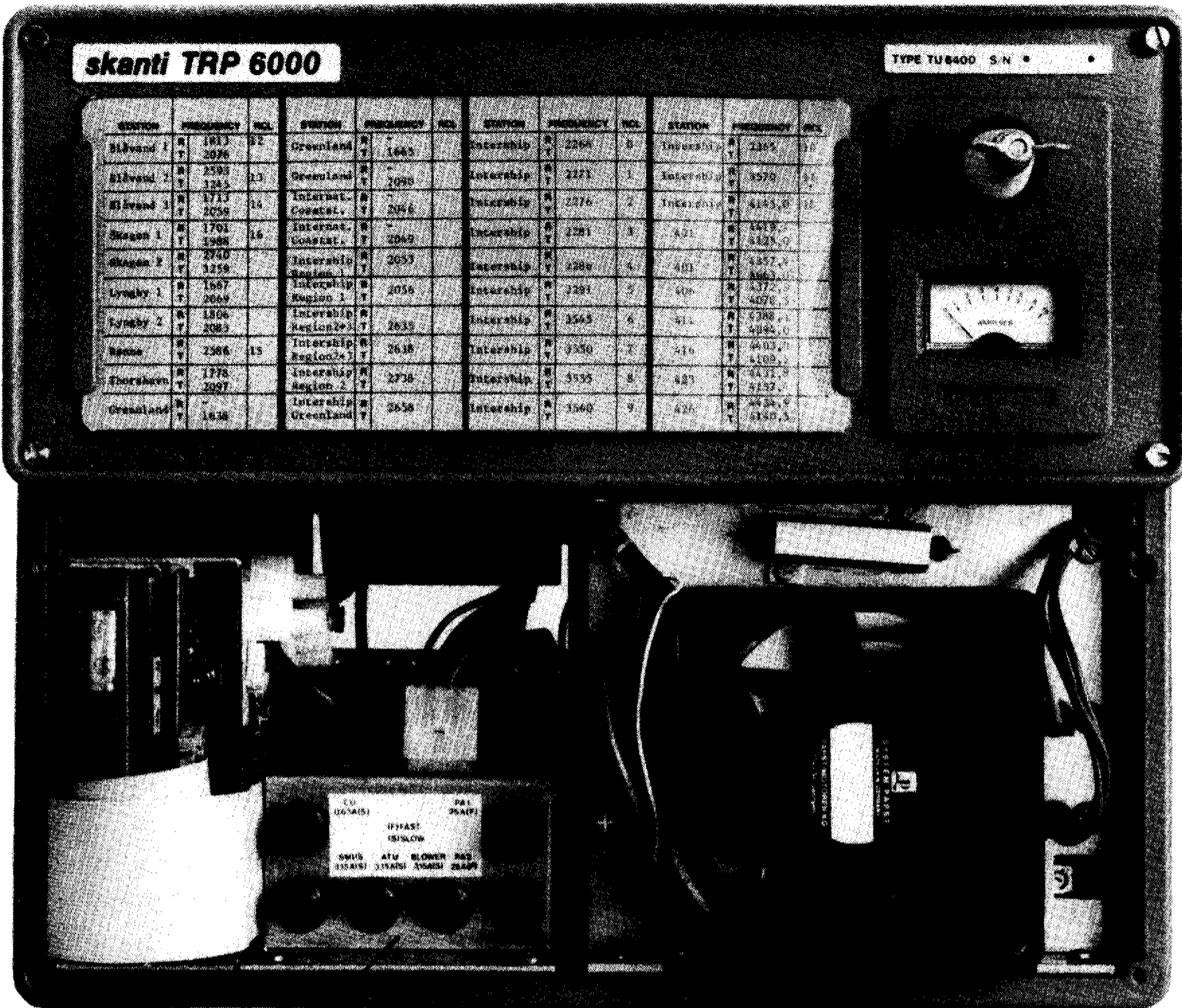
Light intensity increases in direct relation to increase in the actual antenna current.

3. PREVENTIVE MAINTENANCE

To ensure maximum performance and minimum repair trouble, we strongly recommend you to follow below stated headlines for preventive maintenance.

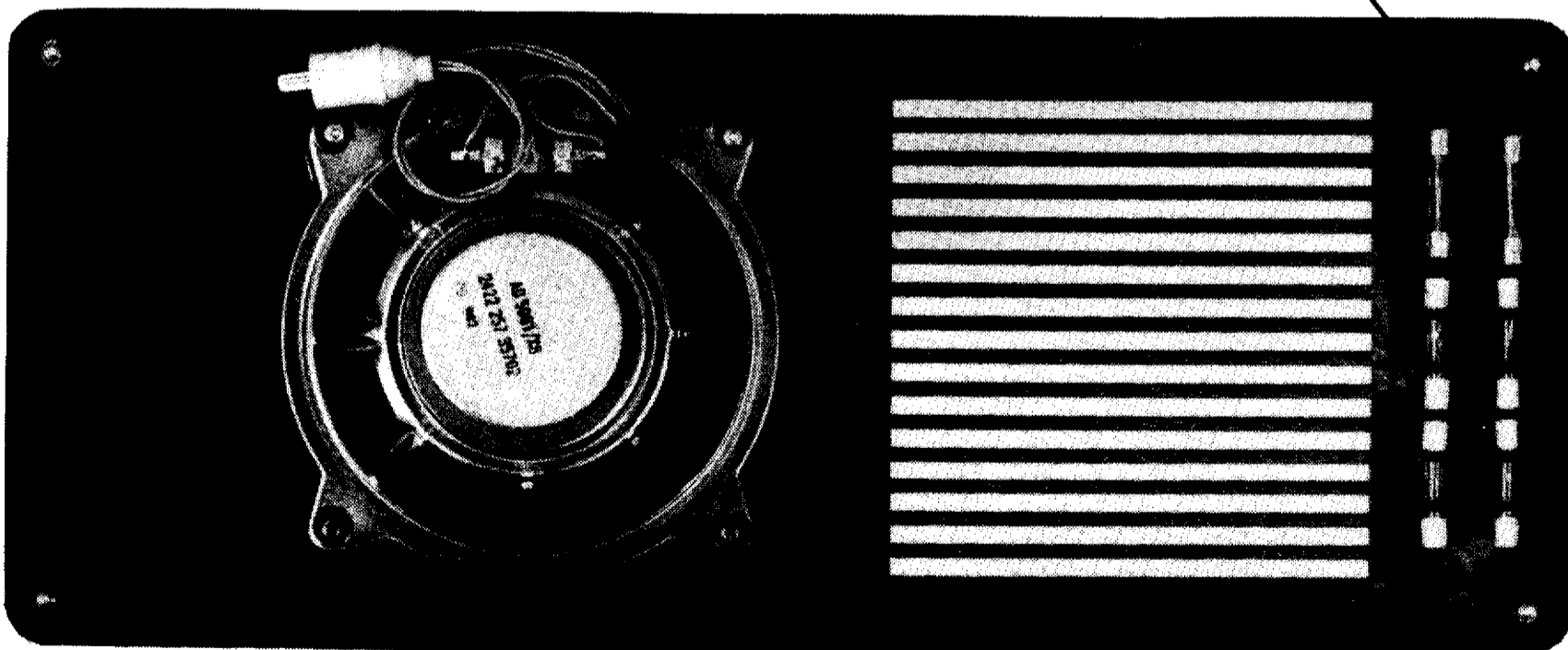
1. Always keep the battery fully charged.
2. Check antenna installation and the ground connection at regular intervals.
3. Keep antenna feed-through insulators clean and dry.
4. Keep your TRP 6000 clean and dry externally: this will ensure continued function of the front panel controls and will prevent flash-over from the antenna-horn.
5. If TRP 6000 has not been used for a long period of time combined with exposure to extreme environmental conditions, open both units and make a visual inspection. Remove salt, water or ice with a moist cloth before switching on the equipment. Check that the cooling fans and the two tuning coils are running freely.
6. For general maintenance and top performance, call an authorized service technician to give the equipment and the complete antenna / earth connection installation a general check every 12-18 months.

NOTE: Check at regular intervals that the Power Amplifier air intake located at the lower right front of the Transmitter Unit is free of dust. If dust is visible detach the front panel and remove the dust by means of a soft brush. Check intervals should be from one to six months dependent upon the environment.



FUSES

SPARE FUSES



Transmitter Unit - Lower front panel removed

Fig. 4.1

4. TROUBLE SHOOTING AND SERVICE

4.1. Malfunction

If the equipment is not functioning correctly, a check should be made that it is being operated properly; see chapter 2.

4.2. Battery

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

4.3. Replacement of Fuses

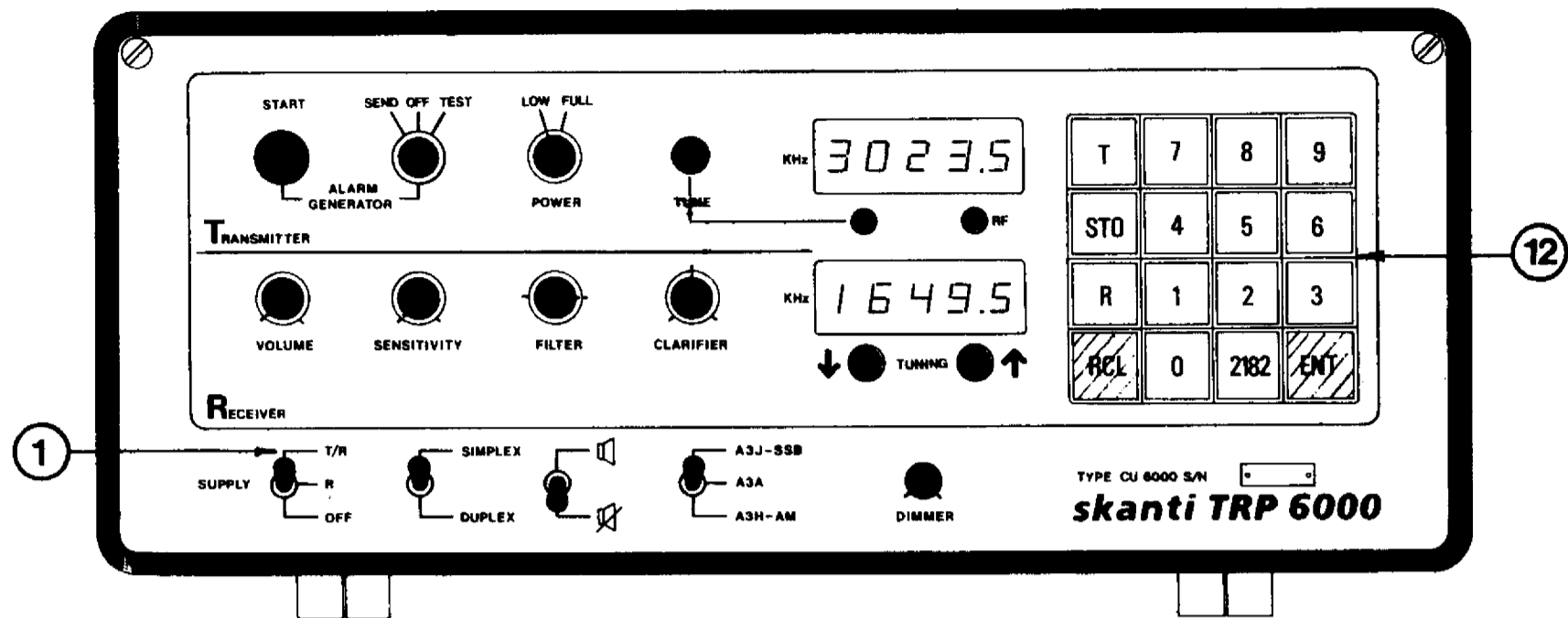
All fuses can be found behind the lower front panel of the Transmitter Unit. The fuses become accessible when the front panel is removed (4 screws). Spare fuses are placed on the inside of the lower front panel (see fig. 4.1.).

NOTE: Set SUPPLY switch to OFF and open external supply voltage switch before opening the equipment and replacing fuses.

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

Fuse Rating	Fuse Marking	Function	Symptom if fuse is blown
0.63 A slow	CU	+24V to SUPPLY switch	Equipment totally dead. Main relay in Transmitter Unit does not operate when SUPPLY switch is activated.
3.15 A slow	SMPS	Generation of 7.5V and 15V	Control Unit off. Main relay in Transmitter Unit operates when SUPPLY switch is switched from OFF to R. Cooling fans in Transmitter Unit are off.
3.15 A slow	AAC	+24V for automatic antenna coupler	TUNE pushbutton no function.
3.15 A slow	Blower	+24V for blower con- verter	PA cooling fan does not rotate when SUPPLY switch is in posi- tion T/R.
25 A slow	PA 1	+24V to left- hand power amp.	Reduced antenna current and RF output indicator light.
25 A slow	PA 2 (TU6400 only)	+24V to right- hand power amp.	No antenna current and minimum RF output indicator light in- tensity if PA 1 and PA 2 are both blown.

4.4. HOW TO USE THE BUILT-IN SELF-CHECK FUNCTION



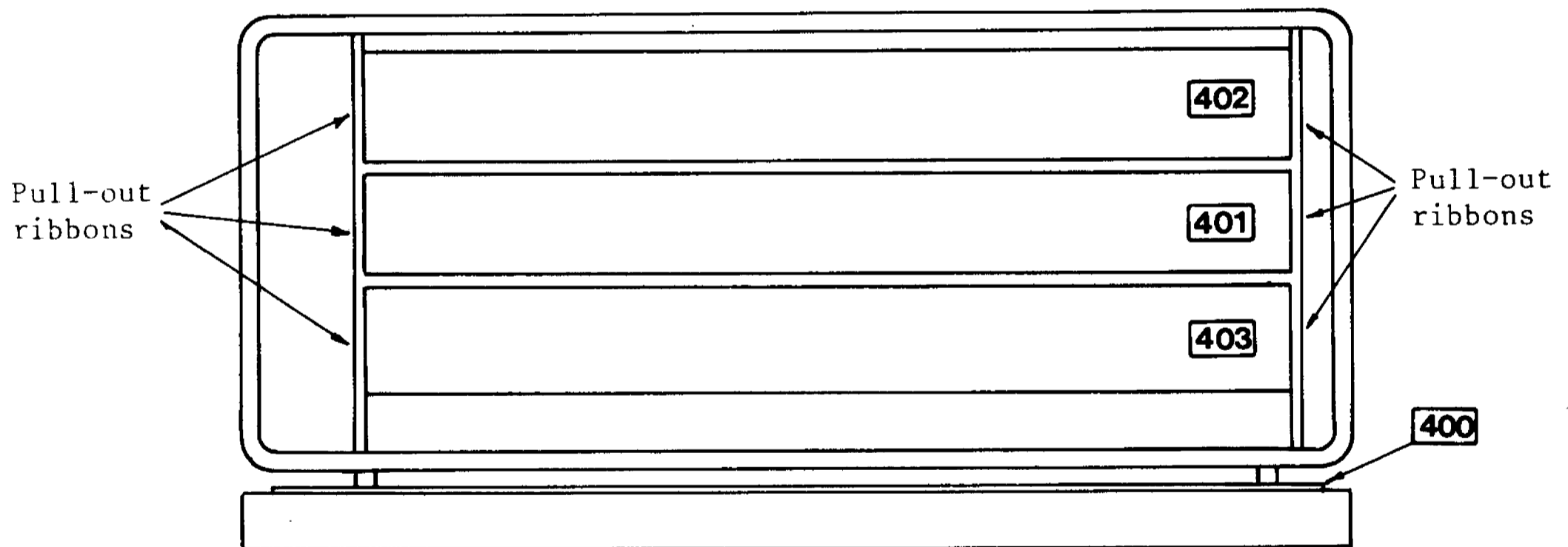
The built-in selfcheck function checks all major functions in the Control Unit.

Check procedure:

1. Set SUPPLY-switch (1) to "T/R" and switch off speaker.
2. Press "RCL" and keep it pressed, then press "ENT"
3. Release "RCL" and "ENT".

A check takes approx. 4 seconds. The result of the check is shown in the T-display.

Table 4.4.1 shows the possible error codes and the corresponding most probable faults.



Control Unit p.c.b. positions

To replace a faulty p.c.b. set SUPPLY switch to OFF, disconnect the coax- and flat-ribbon-cables and pull out the faulty p.c.b. box taking advantage of the pull-out ribbons placed on each side of the box.

NOTE: Make sure to state the exact part number (refer to the spare parts lists in section 4.7.) of the faulty p.c.b. when ordering a replacement

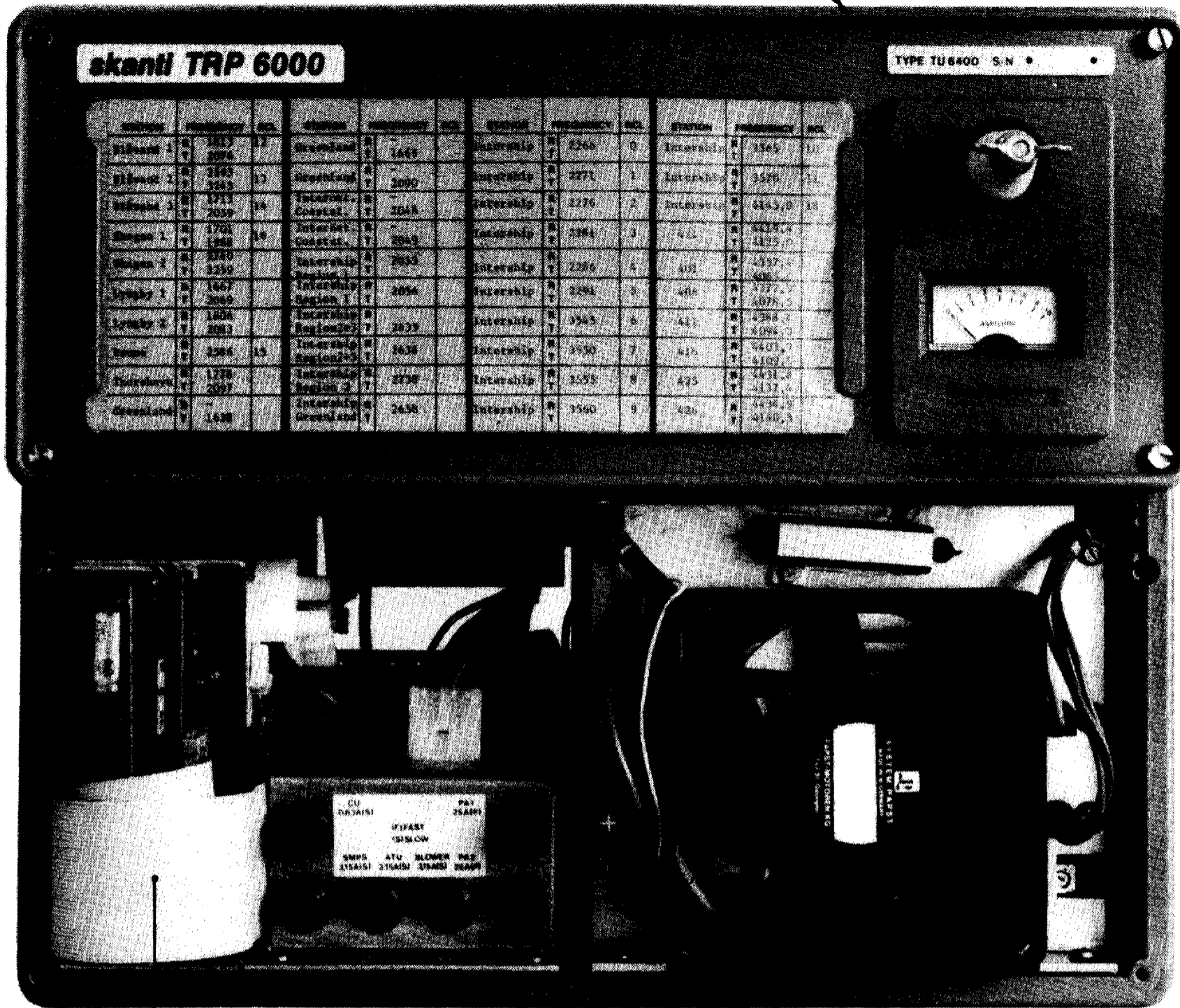
SELFCHECK ERROR MESSAGES			
ERROR CODE	PCB WITH FAILURE	TEST POINT FAILING	POSSIBLE FAILURE
C 000	no fault	-	-
101	401	6	a) AF-amplifier; BS- and LP-filters b) Mode switch circuit (SSB)
102		5	a) Signal detector; AGC detector b) 1.4 MHz BP-filter
103		4	a) RX signal path incl. 1.4 MHz x-tal LSB filter to signal detector.
104		6	a) Mode switch circuit (AM)
105		4	a) 1.4 MHz wide AM filter
201	402	3	a) 3.3 MHz VCXO; 9.3 MHz mixer b) 9.3 MHz BP-filter
202		1	a) VCO in RX-synthesizer
203		2	a) ÷ N divider; reference divider b) Phase comparator; LP-filter
301	403	9	a) 1.4 MHz level stabilizer
302		10	a) ÷ N divider; ÷ 14.000 divider b) Phase comparator; LP-filter
303		11	a) VCO in EX-synthesizer
304		12	a) EX signal path incl. 2.8 MHz LP- filter from 1.4 MHz mixer.
305		8	a) Compressor
306		12	a) 4.22 MHz LP-filter
399		-	a) SUPPLY-switch not in position "T/R"
400		7	a) 15 V power from supply missing

a) Most probable failure

b) Second most probable failure

Table 4.4.1.

AUTOMATIC ANTENNA COUPLER



POWER SUPPLY MODULE

POWER AMPLIFIER MODULE

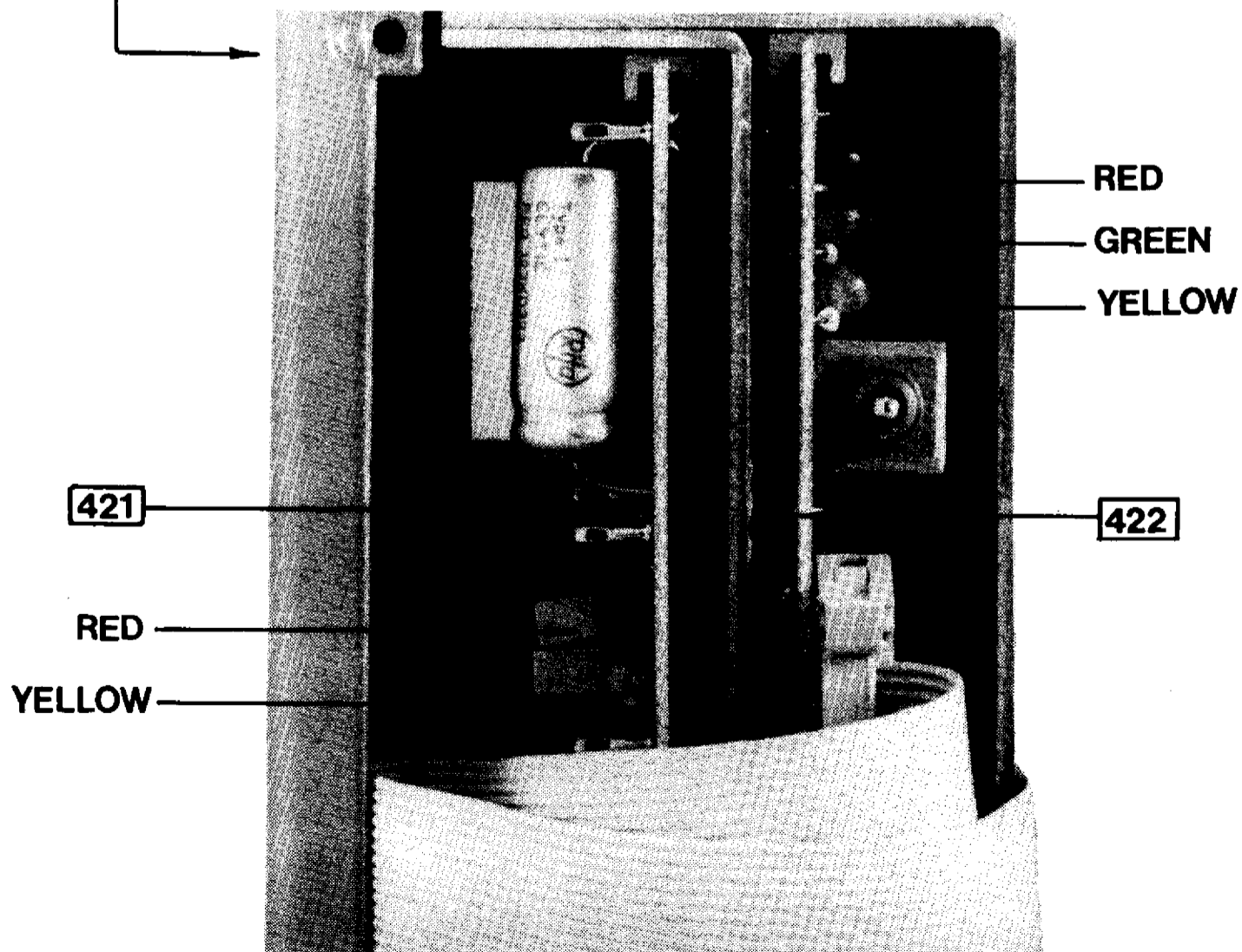


Fig. 4.5.1 Transmitter Unit

4.5. TRANSMITTER UNIT FAULT FINDING

Remove the lower front panel as illustrated on fig. 4.5.1.
Set SUPPLY switch (Control Unit front panel) to T/R.

As illustrated on fig. 4.5.1 you will find five LED status-indicators on the power supply module:

421 Red light indicates 15V stabilized supply voltage OK.
Yellow light indicates 7.5V stabilized supply voltage OK.

If either red or yellow is off replace **421**.

If both indicators are off check SMPS-fuse and CU-fuse. If both fuses OK replace **421**.

422 Red light indicates that +24V for **422** is OK.
Green light indicates that the transmitter is keyed.
Yellow light indicates that the cooling fans are switched to full speed.

If red is off check the BLOWER-fuse.

If yellow is on, but cooling fans are stopped, replace **422**.

Control Unit TUNE INDICATOR lights continuously.

Press TUNE pushbutton and wait until light in the RF output indicator is switched off. If the tune indicator is still lit when the transmitter is keyed a transmitter overload condition exists due to one or more of the following abnormal conditions:

- A - Load mismatch. Check the complete antenna installation and the earth connection carefully.
- B - The Power Amplifier Module temperature is too high. Check cooling fans and ensure that transmitter unit ambient temperature and ventilation are within specified limits.
- C - The Automatic Antenna Coupler is faulty. Remove the frequency table, change frequency, press TUNE and observe the two tuning coils through the openings behind the frequency table. If the coils do not rotate, replace **433** and/or **434**. If you do not have the necessary spares, refer to section 4.6. of this manual.

Antenna current too low, tuning normal.

If the antenna current is less than normal, but tuning is OK (no light in the tune indicator (17) when the transmitter is keyed), the output power from the Power Amplifier Module might be too low due to one of the two **441** Power Amplifiers failing. This can be checked as follows:

Remove the PA1 fuse and observe the antenna current. If antenna current is unchanged and the PA1 fuse is OK, the lefthand **441** (PA1) is faulty. If the antenna current is reduced to about zero, PA1 is OK. Reinsert the PA1 fuse. Repeat the test by removing the PA2 fuse.

4.6. HOW TO MANUALLY TUNE THE TRANSMITTER TO 2182 kHz IN CASE OF A FAILURE IN THE AUTOMATIC TUNING SYSTEM.

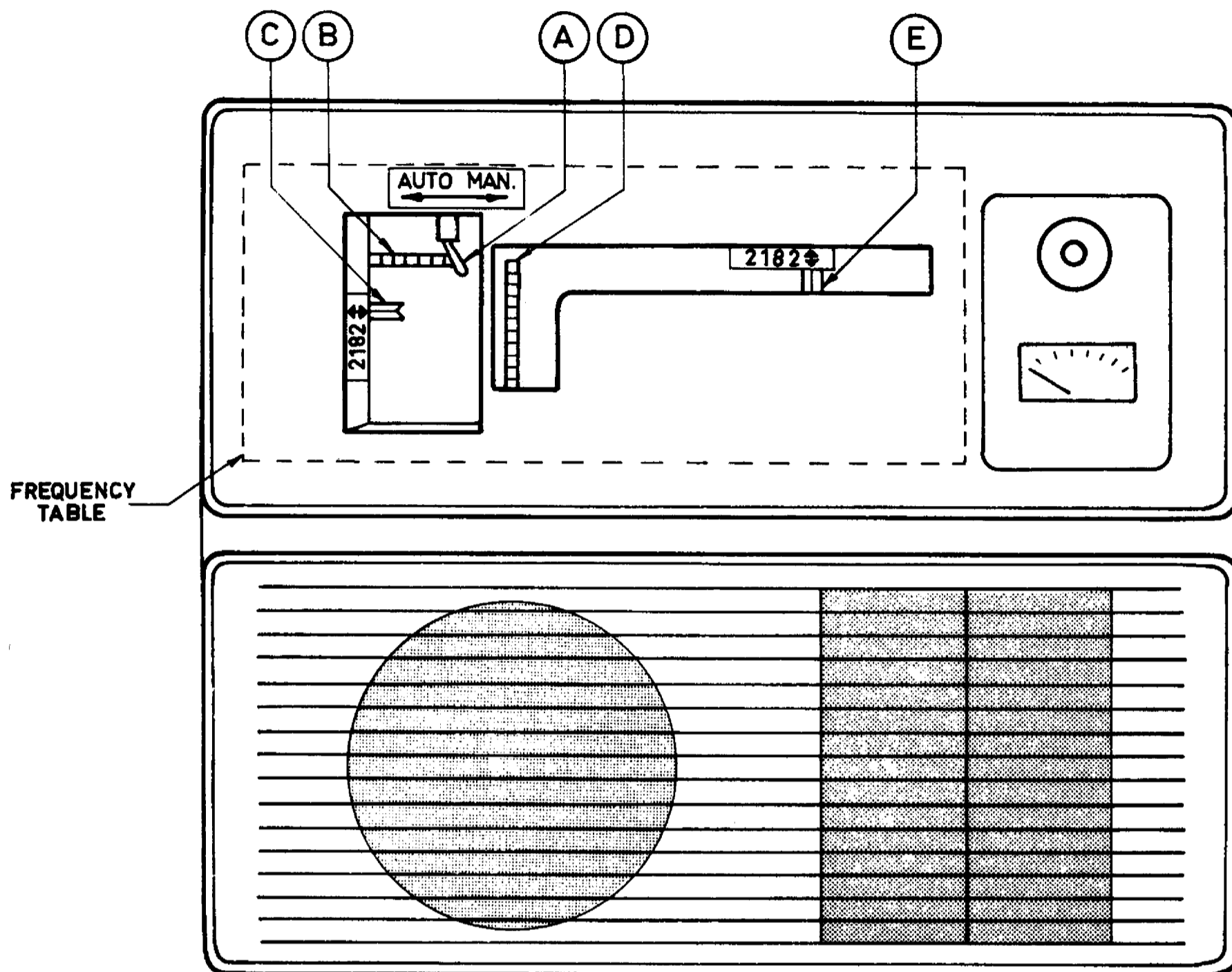


Fig. 4.6.1 Transmitter Unit

1. Switch SUPPLY to "OFF" on Control Unit
2. Remove Frequency Table from Transmitter Unit (Fig. 4.6.1)
3. Remove the self-adhesive plastic film behind the frequency table.
4. Switch AUTO/MAN switch (A) to position MAN.
5. Rotate with a finger, wheel (B) until the roller (C) is positioned exactly at the 2182-marker.
6. Rotate with a finger, wheel (D) until the roller (E) is positioned exactly at the 2182 marker.
7. Switch SUPPLY to "T/R" on Control Unit.
8. The radiotelephone is now ready for operation on 2182 kHz only.
9. Operate the radiotelephone as described in section 2.1.

NOTE: Call for immediate repair when you reach port.

4.7. SPARE PARTS LIST

Standard Shipborne Spares

					Part No.
2	fuse	0.63 A	slow	6.3 x 32 mm	720 263 00
2	fuse	3.15 A	slow	6.3 x 32 mm	720 331 50
2	fuse	25 A	slow	6.3 x 32 mm	720 425 01

Depot Spares for TRP 6000

Control Unit CU 6000

<u>400</u>	Front Panel Board	107 440 01
<u>401</u>	Receiver	107 440 11
<u>402</u>	Control and Rx Synthesizer	107 440 21
<u>403</u>	Exciter	107 440 31
	60 Lead Flat Ribbon Cable	106 400 10
	26 Lead Flat Ribbon Cable	106 400 30
	10 Lead Flat Ribbon Cable	106 400 20

Handset

<u>450</u>	Microphone Amplifier	107 445 01
	Earpiece	862 000 05
	Microphone	862 000 06

Transmitter Unit TU 6400

Power Supply Module:

<u>421</u>	Switch Mode Power Supply	107 442 11
<u>422</u>	Blower Converter	107 442 21
<u>423</u>	Interconnection Board	107 442 31
RL1	Relay, 24V	780 000 05
C1-2	4700 uF 40V	652 947 02
D1	BZY93 Zener	832 933 90

Power Amplifier Module:

<u>441</u>	Power Amplifier	107 444 11
<u>442</u>	Stabilizer and Combiner	107 444 21
B1	Blower 24V AC	872 000 06
R1	70 ohm 50 W	548 150 00

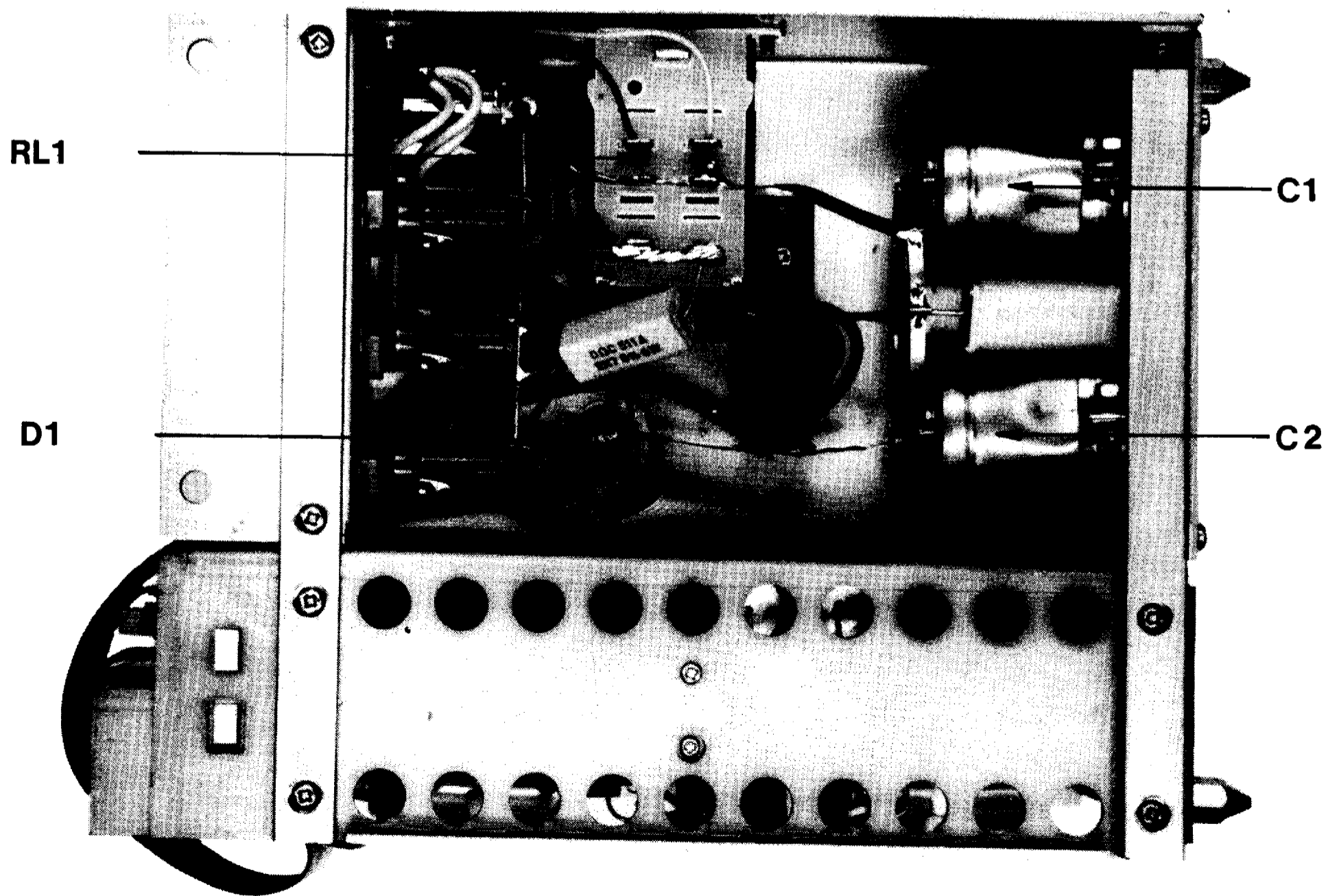
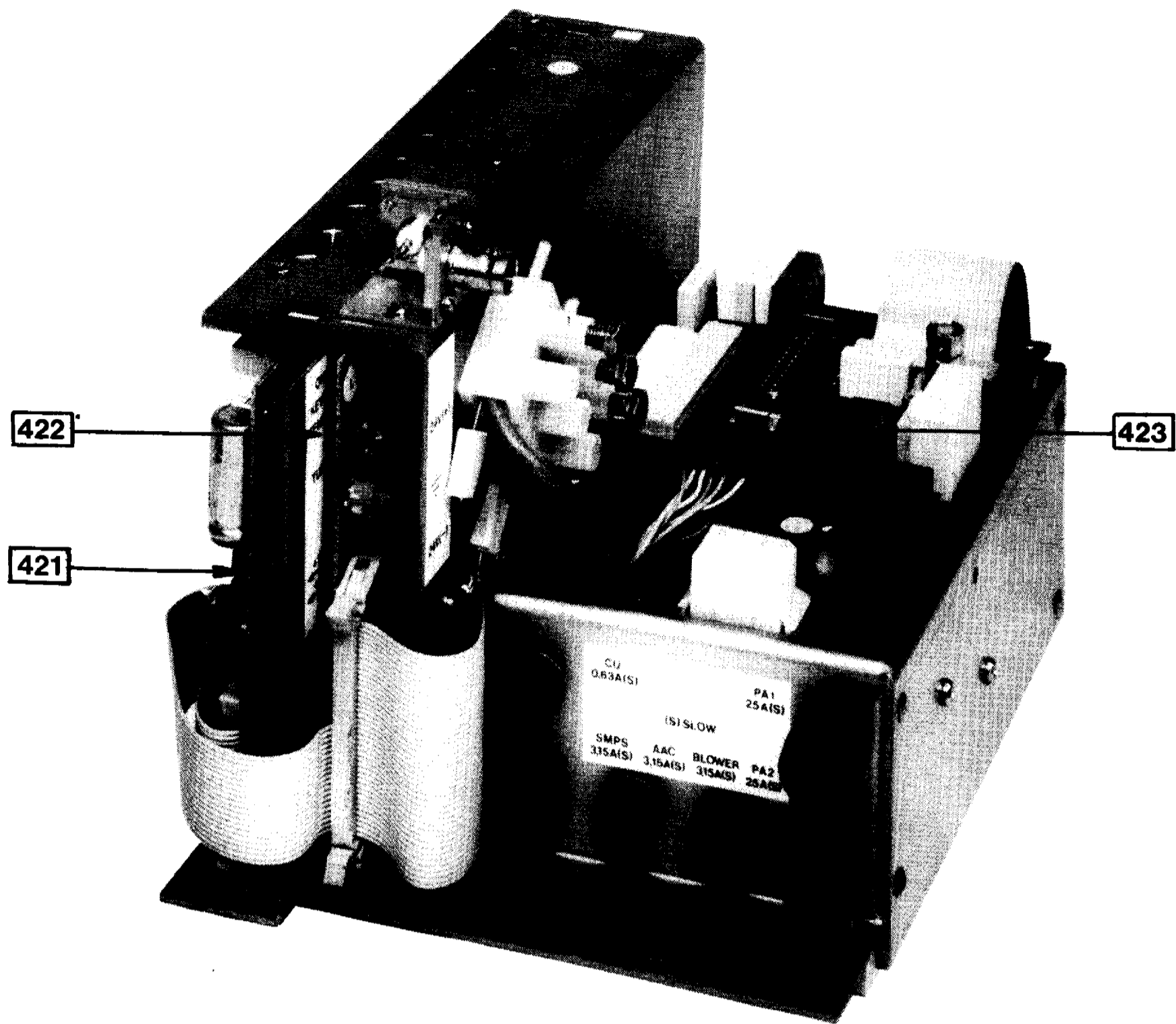


Fig. 4.7.1. Power Supply Module

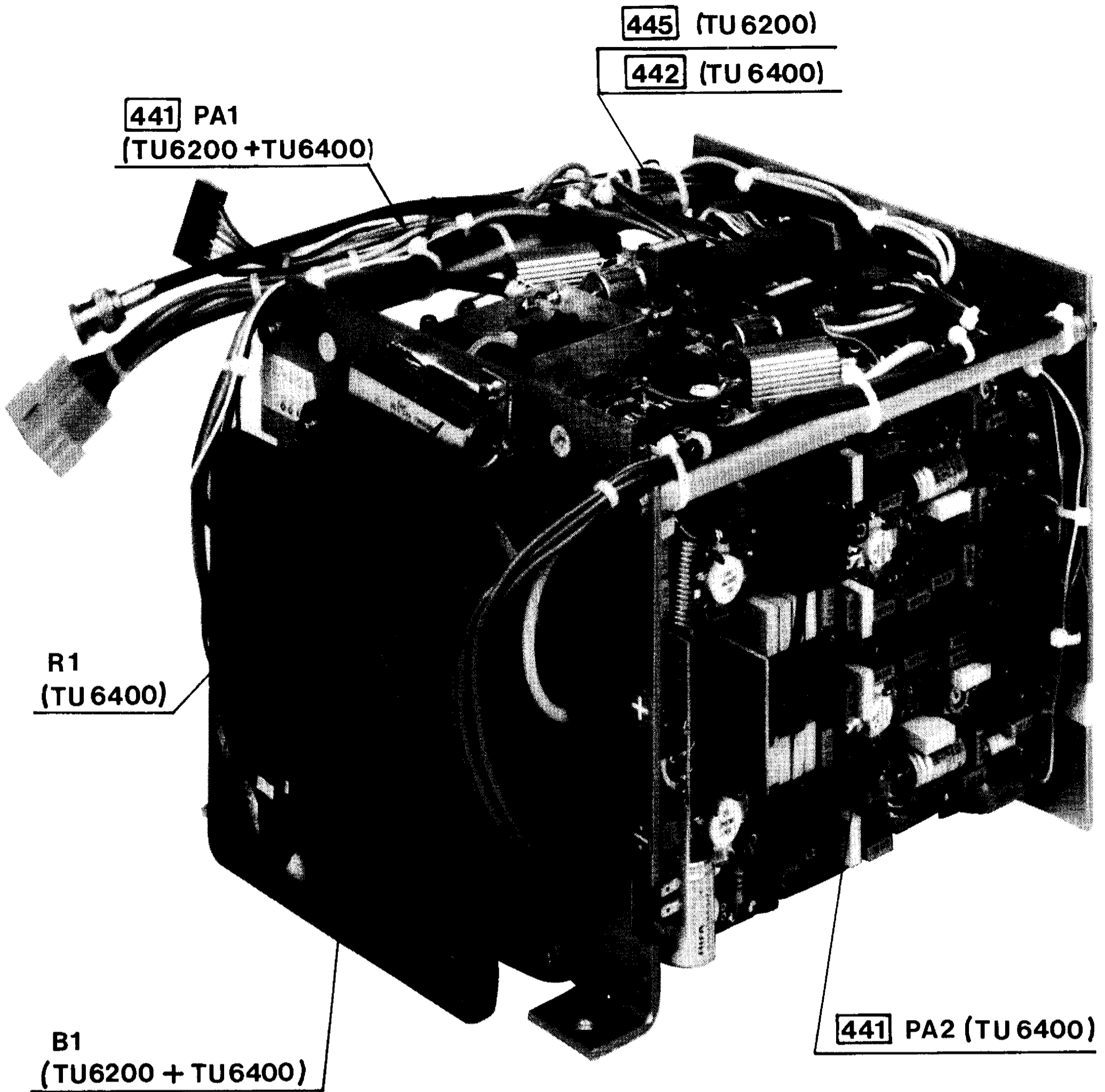


Fig. 4.7.2.

Power Amplifier Module

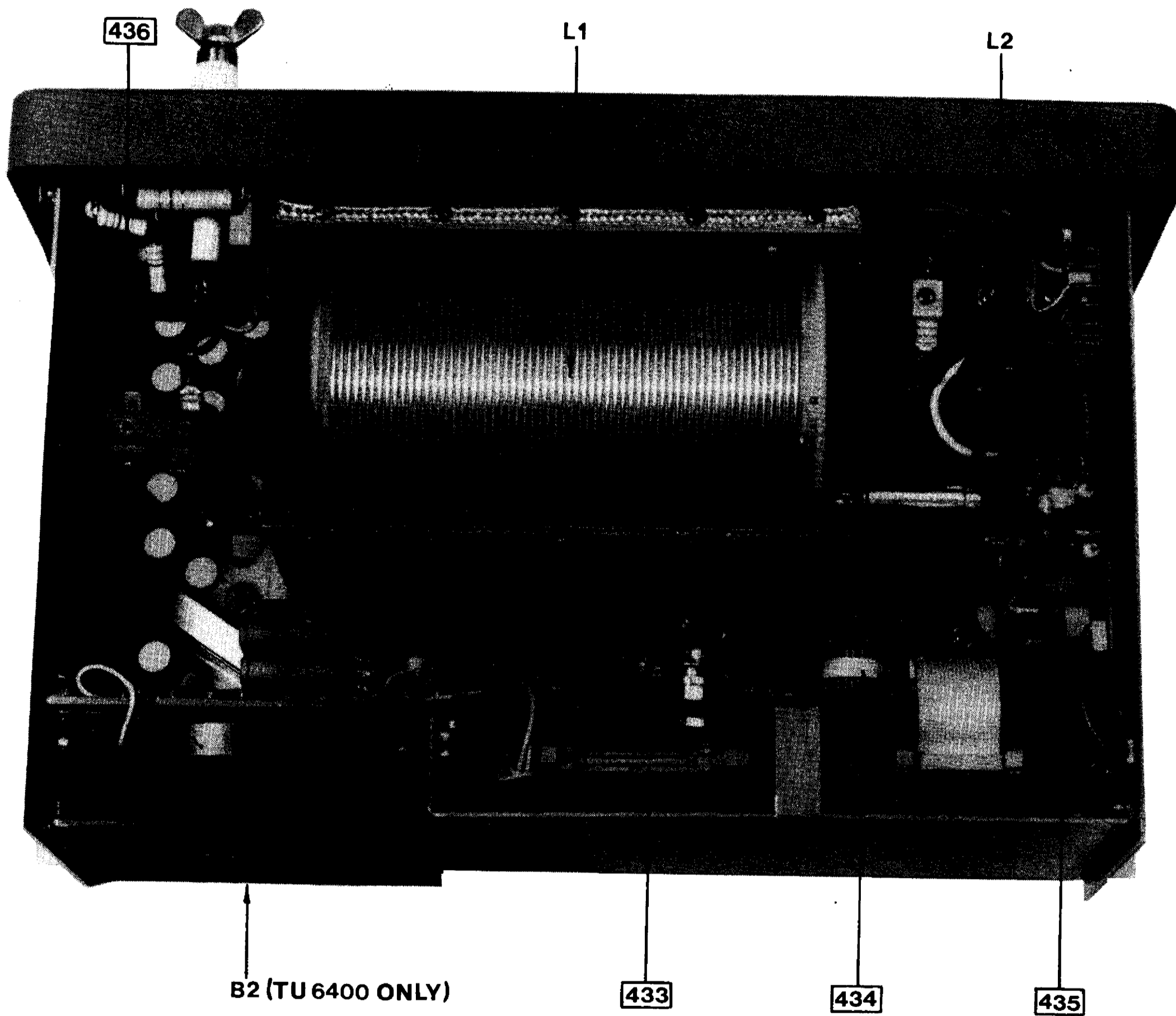


Fig. 4.7.3 Automatic Antenna Coupler

5. TECHNICAL DATA

The SKANTI TRP 6000 complies with the SOLAS 74 convention and the ITU Radio Regulations. It meets the CEPT specifications, the UK MPT specifications as well as the national requirements of most countries.

GENERAL

Frequency Generation: True digital frequency synthesis with 100 Hz resolution.

Frequency Presentation: Two 5-digit digital LED displays.

Frequency Accuracy: Better than 40 Hz.

Operating modes: Duplex, semiduplex and simplex A3A, A3H and A3J (upper side band).

Operating Temperature: -10°C to $+55^{\circ}\text{C}$.

Frequency Selection: By common keyboard.
2182 kHz is entered for both transmitter and receiver by a single key, also providing automatic selection of A3H and simplex mode.

RECEIVER

Frequency Range: Broadcast bands: 100 - 1606.5 kHz
Communication bands: 1606.5 - 4500 kHz

Frequency Selection: A search/scanning facility is provided with 1000 Hz resolution in A3/A3H mode.
A 100 Hz step function is provided in A3J/A3A mode.
A3/A3H mode is automatically selected below 1606.5. kHz.

Sensitivity: Antenna input for 10 dB SINAD:
0.15 - 1.6 MHz AM: 20 uV
1.6 - 4.5 MHz AM: 6.3 uV
SSB: 1 uV
measured with high antenna impedance.
With 50 ohms input the figures are improved by approx. 6 dB.

Clarifier Control: Variation \pm 100 Hz.

Duplex Filter: The built-in preselector is automatically disabled by any frequency change. The circuit is re-established (when required) by turning the control knob to one of its extreme positions.

Audio Output: 5 W in 4 ohms to internal and/or external loudspeaker(s)

TRANSMITTER

Output Power: 200 W p.e.p. with TU 6200
 400 W p.e.p. with TU 6400
 Reduction to less than 60 W p.e.p.

Transmitter Frequencies: Up to 80 PROM programmable channels, freely distributed in the range 1606.5 to 4220 kHz. Free frequency selection in 100 Hz steps is optionally available where permitted.

Antenna Requirements: 7-18 metres wire and/or whip.

Antenna Tuning Fully automatic to above antennas and to any load with a resistive impedance from 1 to 75 ohms (minimum series capacitor 100 pF) from 1.6 to 4.2 MHz.

Alarm Generator: A two-tone alarm generator is incorporated. Full power is automatically selected and the antenna tuning carried out when the alarm is activated.

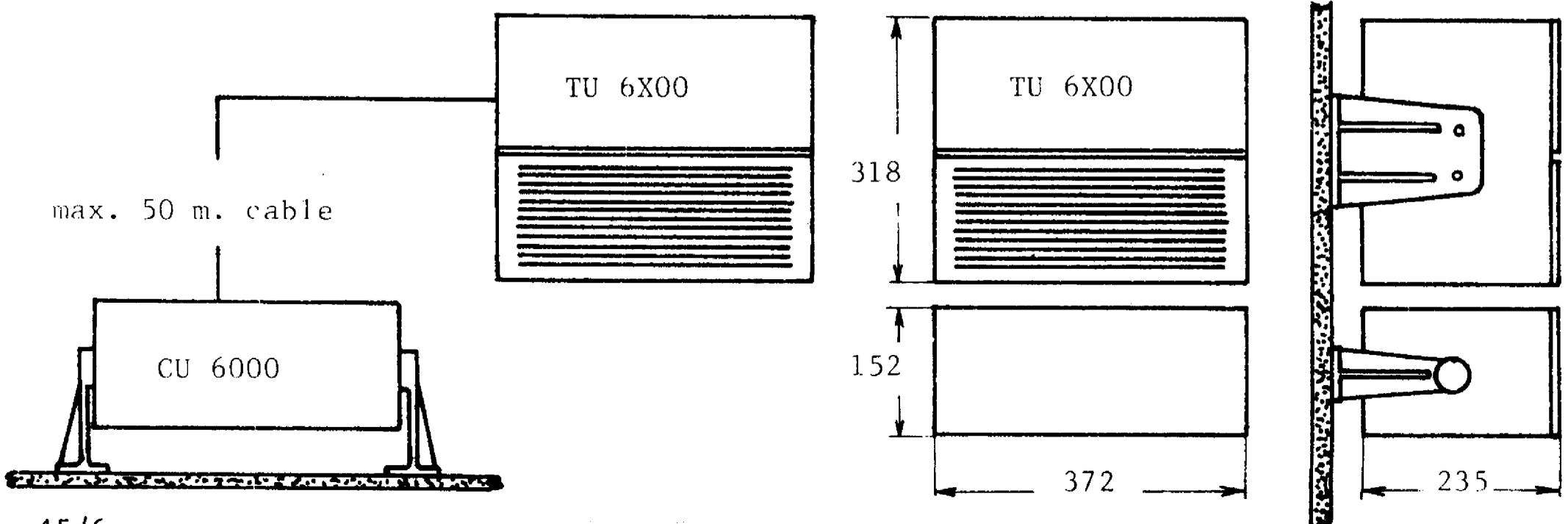
POWER REQUIREMENTS

Supply Voltage: 24V DC (+30%, -10%)
 Connection will not earth supply battery.
 AC mains by optional external unit.

Consumption:	Operation	400 W p.e.p.	200 W p.e.p.
	R	0,75A	0,75A
	T/R Unkeyed	2,30A	2,30A
	A3J Unmod.	4,00A	3,25A
	A3H Unmod.	21,5A	13,0A
	A3J Normal speech	11,0A	7,50A
	A3H Normal speech	21,0A	13,0A
	A3H Transmit alarm	27,5A	15,3A

DIMENSIONS AND WEIGHT

CU 6000: 7.3 kgs
 TU 6200: 16.0 kgs
 TU 6400: 18.0 kgs



All manual controls on the front panel, with exception of the FILTER control, are connected to this p.c.b. All control signals branch out from this board to the different Control Unit p.c.b.'s, by way of two ribbon cables.

The Keyboard is continuously scanned by the Microprocessor Circuit, located on p.c.b. 402. Activation of a particular key will load the number corresponding to that key, into the Microprocessor Circuit. This scanning process will also detect whether one of the two frequency tuning pushbuttons has been activated.

A multiplex technique is utilized to present the information, requested by the user, on the R-and-T displays.

For each display element, a BCD-code is sent from the Microprocessor Circuit to the BCD-to-7 Segment Decoder which in turn directly controls a Segment Driver. Concurrently, a display element address is sent to the Scan Decoder where one of the ten Digit Drivers is selected. The display element selected is now permitted to display the data for a length of time. Subsequently, the Microprocessor Circuit will send new data to a new display element, and so forth.

All display elements are updated every second millisecond. The maximum time-on duration for a single display is 200 microseconds. Continuously variable reduction of time-on duration - to the point where no light is visible on the displays - is available with the DIMMER control.

6.1.2. RECEIVER 401

The antenna RF signal is led through 401-SK1 to a circuit designed to protect the receiver against excessive RF voltage and static electricity discharges, appearing on the antenna.

The RF signal from the protection circuit goes to one of the four input filters. Three of these filters are fixed-tuned and have respective passbands of 100 - 400 kHz, 400 - 1606.5 kHz and 1606.5 kHz - 4499.9 kHz. The fourth filter, used in duplex operation, has a passband with a variable center frequency, controlled by the FILTER knob on the front panel. Center frequency range is 1606.5 - 4499.9 kHz.

A change in receiving frequency will be followed by automatic selection from among the three fixed-tuned filters. The automatic selection is controlled from the Microprocessor via the Gate Circuit. If the duplex filter is to be used the FILTER knob must be turned to one of its extreme positions, where a switch is activated and sets a latch in the Gate Circuit which in turn selects the duplex filter.

During SELF-CHECK the antenna input is disabled and a RF CHECK SIGNAL from the EXCITER, p.c.b. 403, is fed to the Input Filters. The VOLUME/SENSITIVITY GND Switch is also controlled via the Gate Circuit. This

switch ensures maximum volume and sensitivity during SELFCHECK, irrespective of the actual settings of the front panel controls. The RF signal from the input filters is mixed, in the 1st mixer, with a 10.8 - 15.2 MHz signal from the RX synthesizer, located on p.c.b. 402. Mixer output is filtered in a 10.7 MHz double sideband crystal filter, where overall AM selectivity is determined.

The 10.7 MHz IF signal passes a PIN diode attenuator, controlled from the AGC circuit, before being fed to the 2nd Mixer. The other input signal to this mixer is a 9.3 MHz + 100/- 500 Hz signal from the Clarifier Circuit on p.c.b. 402.

The 2nd IF filtering is selected from the Gate Circuit. In the SSB-mode, the output from the 2nd Mixer is fed to a lower sideband crystal filter which determines overall SSB selectivity. In the AM-mode the output is fed to a 1.4 MHz LC-filter.

The filters are followed by the IF Amplifier, the gain of which is controlled by the AGC voltage. A check signal (CHECK 4) is produced by a Detector connected to the output of the IF Amplifier. This facilitates a check for the presence of a 1.4 MHz IF signal during SELFCHECK, provided that the AGC is at failure.

A 1.4 MHz Band-Pass Filter connects the IF Amplifier to the Signal Detector. The integrated circuit of the Signal Detector contains a balanced mixer and a high-gain limiting amplifier. The IF signal is applied balanced to the one input part of the mixer.

In the AM mode, the IF signal is also fed to the amplifier input. This signal is amplified and clipped to constant amplitude and internally connected to the other input part of the mixer where it is mixed with the modulated signal. The difference frequency contains the wanted AF signal.

In the SSB-mode a 1.4 MHz signal, derived from the Reference Divider on p.c.b. 402, is applied to the amplifier input.

The AF signal is via the VOLUME potentiometer on p.c.b. 400 fed to the AF amplifier which contains a 3 kHz active low-pass filter. AF output excites p.c.b. 401 to enter the handset earpiece and the loudspeaker(s).

The Signal Detector output also contains the sum frequency of the two input signals. This signal is used for the Automatic Gain Control and is taken off across a 2.8 MHz tuned circuit. The signal is amplified before being brought to the AGC Detector. The AGC Detector output controls the overall IF gain of the receiver.

IF gain may also be manually controlled with the SENSITIVITY control on the front panel. However, at frequencies below 1606.5 kHz and when 2182 kHz, is selected by means of the 2182 key, the SENSITIVITY control is disabled so as to allow maximum IF gain irrespective of the actual setting of the control knob.

A check signal (CHECK 5) derived from the AGC Detector, is used to confirm correct AGC circuit operation during SELFCHECK.

6.1.3. CONTROL AND RX SYNTHESIZER 402

6.1.3.1. Microprocessor Circuit

The Microprocessing Unit (MPU) is the central unit of the Microprocessor Circuit. It responds to inputs and produces outputs in a manner determined wholly by a sequence of instructions referred to as its program. The sequential operation of the MPU is clocked by a 2.8 MHz signal derived from the Reference Divider of the RX Synthesizer.

The program is held in the Read-Only Memory (ROM). The instructions are fetched into the MPU one at a time to be decoded and actioned. The program contains instructions for reading input from the Keyboard; how to display transmitting and receiving frequencies; carrying out of SELFCHECK analysis, to mention a few of the tasks.

The TX Frequency PROM can be programmed to store up to 80 transmitting frequencies. Stored information may be recalled by the user when required. The PROM can be programmed to allow free selection of transmitting frequencies where permitted by the authorities.

The Input/Output (I/O) circuits are utilized by the MPU to communicate with the keyboard, the Displays, the two synthesizers as well as the RAM and the check Multiplexer. The I/O Circuits also delivers a two tone alarm signal to the Exciter.

The Non Volatile Random Access Memory (RAM) is the user-programmable frequency memory. Memory content will not be lost when power is switched off, because a lithium battery will then supply current to the RAM.

The Multiplexer (MUX) is connected to 12 check signal lines from various circuits in the Control Unit. Call-up of the SELFCHECK routine causes the MPU to scan these check signals. Appearance of a check signal indicating a functional error will stop MPU scanning and an error message will be displayed.

MPU start-up procedure is controlled by the Restart Generator, when power is turned on.

The Power Down Detector detects if the 7.5 V supply voltage is decreasing below a certain limit - a warning sign that power will most likely disappear very soon. At this point an order is communicated to the MPU to conclude all current tasks and to await return of power.

6.1.3.2. RX Synthesizer

The reference oscillator of the synthesizer is a 12.6 MHz crystal controlled oscillator. The amplitude stabilized output signal is fed to the Clarifier Mixer and to the Reference Divider.

In the Reference Divider a 2.8 MHz source for the MPU is produced, a 1.4 MHz source for the Exciter and the Receiver, 5 kHz and 500 Hz sources for the I/O circuits as well as a 500 Hz reference frequency for the synthesizer loop.

The 500 Hz reference frequency and the Loop Divider output frequency are compared in the Phase/Frequency Comparator circuit. To obtain lock two conditions must be met: First, the frequency of the two output signals must be the same, i.e. 500 Hz. Second, a very small, but definite, phase difference must exist between the two signals. If this minute phase difference changes, the Phase/Frequency Comparator will immediately produce

a correction voltage that will correct the VCO frequency until the original phase difference is reestablished.

A check signal (CHECK 2) used to confirm proper lock of the Synthesizer Loop, is derived from the Phase/Frequency Comparator.

The Loop Filter is designed to stop unwanted noise from modulating the VCO, and to give the loop a proper dynamic response.

The Voltage Controlled Oscillator (VCO) covers a frequency range of 10.8 - 15.2 MHz. The amplitude stabilized output signal is split between two Buffer Amplifiers, one for the injection signal to the Receiver's 1st Mixer, the other for the Loop Divider.

A check signal (CHECK 1) confirms that the VCO produces an output signal.

The division ratio of the Loop Divider is controlled by the contents of the Serial-to Parallel Shift Registers. Information to these registers is received from the Microprocessor Circuit in serial format. Loop Divider output frequency is 500 Hz, when the loop is locked.

The frequency of the 3.3 MHz Voltage Controlled Crystal Oscillator (VCXO) is determined both by the 100 Hz information, stored in the Shift Registers, and the Clarifier Control Voltage. The control voltages are added in a summing amplifier. VCXO frequency may be varied approximately ± 100 Hz with the CLARIFIER control whereas frequency may be varied 0, 100, 200, 300 or 400 Hz by the 100 Hz information-controlled voltage. The total frequency variation range is thus -100 Hz to + 500 Hz.

The 3.3 MHz signal is mixed with the 12.6 MHz XO frequency in the Clarifier Mixer. The output signal is filtered in a 9.3 MHz band-pass filter and applied to a Buffer Amplifier. The output is amplitude stabilized by means of a detector controlling the 3.3 MHz oscillator gain. A check signal (CHECK 3) used to confirm the presence of adequate output, is drawn from the same detector. The resulting 9.3 MHz +100/-500 Hz signal is led to the Receiver's 2nd Mixer.

6.1.4. EXCITER 403

6.1.4.1. Signal Path

The AF input signal from the MICROPHONE AMPLIFIER 450, located in the handset, or the two tone alarm signal generated on p.c.b. 402 is fed to the Compressor. The Compressor serves to maintain a constant AF modulation peak level. The regulating voltage, controlling the gain of the Compressor, is driven from the output of the Sideband Amplifier.

A check signal (CHECK 8) is derived from the compressor for checking correct compressor operation.

A 1.4 MHz signal, produced by the Reference Divider in the RX Synthesizer is fed, by way of a Buffer Amplifier, to the 1.4 MHz Level Stabilizer. The stabilized 1.4 MHz signal can be turned on or off by a control line from the Gate Circuit, corresponding to keyed or non-keyed state.

A check signal (CHECK 9) is derived from the Level Stabilizer to indicate if the 1.4 MHz signal is present.

The 1.4 MHz signal is fed to the 1st Mixer where the compressed AF signal is converted into a double sideband suppressed carrier signal at 1.4 MHz. The upper sideband is then removed by the lower sideband crystal filter at the mixer output. The filtered signal is now amplified in the sideband amplifier and fed to the Sideband Level Regulator. The amplification of both regulators are controlled by two control lines from the Gate Circuit in accordance with the mode selected. The amplification ratios are mutually related such that the peak to peak voltage of the combined signal appearing after the two regulators is the same independent of the operating mode.

The 2nd Mixer receives the combined 1.4 MHz A3J, A3A or A3H LSB signal and mixes it with the output signal from the Exciter Synthesizer. The output is passed through one of the two low-pass filters which pass only the difference frequency of the two input signals. Thus the 1.4 MHz LSB signal is converted to an upper sideband signal at the actual transmitting frequency.

If the transmitting frequency is below 2.8 MHz the Gate Circuit selects the 2.8 MHz low-pass filter, otherwise the 4.2 MHz low-pass filter is selected.

The RF signal from one of the two low-pass filters are then fed through an amplifier where RF signal-level control takes place. A trimming potentiometer permits adjustment of the Exciter RF signal output level to the correct value.

RF Power Control is operated from the front panel via the Gate Circuit. A DC voltage selects either low or full output power from the Exciter.

The Check Signal Switch, controlled by the Microprocessor, opens during SELFCHECK so as to deliver an RF CHECK SIGNAL to the Receiver.

6.1.4.2. Exciter Synthesizer

A 1.4 MHz signal, derived from the RX Synthesizer is fed to a Buffer Amplifier, which produces two output signals, one for the 1.4 MHz Level Stabilizer and one for the Reference Divider. In the Reference Divider the 1.4 MHz frequency is divided by 14000 and the resulting 100 Hz signal is applied to the Phase/Frequency Comparator as a reference frequency for the Exciter Synthesizer.

The Phase/Frequency Comparator compares the 100 Hz reference frequency with the output frequency of the Loop Divider. Two conditions must be met to ensure a correct VCO frequency: First, the frequency of the two input signals must be the same, i.e. 100 Hz. Second, the phase error must be within close limits. If the phase error exceeds a certain limit, the Phase/Frequency Comparator will close the Synthesizer Loop and produce a correction voltage which, via the Loop Filter, adjusts the VCO frequency until the original phase difference is reestablished. The comparator will then reopen the Synthesizer loop.

Another DC-signal is derived from the comparator to indicate if the VCO frequency is correct. This DC-signal enters the Gate Circuit, which then produces a check signal (CHECK 10).

The Loop Filter is designed to stop unwanted noise from modulating the VCO, and to give the loop a proper dynamic response.

The VCO covers a frequency range of 3-5.9 MHz. The amplitude stabilized output signal is split between two Buffer Amplifiers, one for the injection signal to the 2nd mixer in the Exciter's signal path, the other for the Loop Divider. A check signal (CHECK 11) indicates if the VCO produces an output signal.

The division ratio of the Loop Divider is controlled by the contents of the serial-to-Parallel Shift Registers. Information to these registers is received from the Microprocessor Circuit in serial format. Loop Divider output frequency is 100 Hz, when the VCO frequency is correct.

The DC-power, derived from the battery, have to pass at first a relay switch, controlled by the Overvoltage And Reverse Polarity Protection circuit, an input filter, and a transient protection circuit before it is allowed to flow on to the two converter boards **421** and **422**, via Interconnection Board **423**. Power for the AAC is also routed via **423** while power for the PA-module is fed to a 12-pole socket on the power supply module chassis.

6.2.1.1. Switch Mode Power Supply **421**

The input power is fed through an additional Noise Filter before it is supplied to the Converter Driver.

On the secondary side of the converter-transformer one of the rectified outputs is compared to a reference voltage and the result is transferred to the primary side via an optocoupler and is used to control the duty cycle of the flyback converter. This is done by regulating the duty cycles of the pulses, derived from a 20kHz Oscillator, before they are forming the driving signal for the Converter Driver.

So a regulating loop has been designed in order to keep the output voltage from the converter fairly stable independent of battery voltage variations and different loading conditions on the outputs.

By means of optocouplers in the feedback path the secondary side of the converter is galvanic isolated from the primary side and thereby from the battery.

Two Rectifiers produce 17V and 9V respectively. Of these the 9 V output is regulated while the 17V output is tracking. Each Rectifier is equipped with a Current Sensor and an Overvoltage Protector. The two Sensors, and the Overvoltage Protector, attached to the 9V line, disables the regulating loop and forces the converter into a low-power mode if an abnormal loading condition exists on the outputs.

6.2.1.2. Blower Converter **422**

By means of the Power Switch on the CU-front panel the Overvoltage and Reverse Polarity Protection circuit is connected to the input lines from the battery except when the switch is in its OFF position.

In case a reverse polarity is applied the relay RL1 will not be activated thereby protecting the whole Power Supply. Also if input voltage exceeds limits RL1 will be deactivated.

If the Overvoltage And Reverse Polarity Protection circuit accepts voltage level and polarity, the RL1 is activated and simultaneously the 20 kHz Oscillator on p.c.b. **421** is powered from p.c.b. **422**.

The blower converter produces square wave signals for driving two blowers. Blower no. 1 (on the PA module) is always operating when "T/R" is selected on the power switch. Blower no. 2 (in the AAC-unit) is only in operation when extra cooling is required. The converter has two modes of operation:

- a) Blower no. 1 only. Constant speed (slow and quiet).
- b) Both blowers. Variable speed (tracks battery voltage, maximum cooling).

In mode a) both frequency and voltage inputs to the converter driver are stabilized.

In mode b) a relay switches in blower no. 2. At the same time the VCO (Voltage Controlled Oscillator) generating the square wave is made to track battery voltage thus generating a higher frequency when battery voltage is high. Also in this mode the voltage stabilizer is bypassed in order to supply maximum power to the blowers.

Mode b) is selected when the input TEMP 1 is taken low. This happens when the temperature sensors on the PA-module reaches a temperature of approx. 60° C.

The keying relay produces a 24 V output signal when KEYLINE goes active. This can be used for external purposes (i.e. antenna relay) but is also used internally to key the PA-module. This is done by activating the stabilizers on this module via "PA PWR CTRL" derived from 24 V when keyed. A delay circuit compensates for the delay in the simplex relay if fitted. If a delay in the keying of the transmitter is unwanted the delay-circuit can be deactivated by removing a jumper.

A tune switch is located on this board to facilitate servicing the AAC.

6.2.2. POWER AMPLIFIER MODULE

6.2.2.1. STABILIZER 442

The RF signal, produced by the Exciter in the Control Unit, enters via the INTERCONNECTION BOARD 423 .

First, the signal goes through the Protection Attenuator. This attenuator, controlled by the Protection Attenuator Control, protects the succeeding P.A. boards and is activated if one or more of the following three situations occur:

1. The peak value of the output voltage from one of the two P.A.-stages exceeds a certain limit.
2. The SWR measured in the Automatic Antenna Coupler exceeds 2.5
3. The temperature measured at one of the two P.A.-stages exceeds 92°C.

Output of the Protection Attenuator is split-up by the Input Power Splitter circuit. The two-6dB outputs go to their respective P.A. boards. The two boards, POWER AMPLIFIER 441 , are identical.

The output signals from the power amplifiers are combined in the Output Power Combiner, the output of which goes to the Automatic Antenna Coupler.

Two 25.4 Volt regulators deliver supply voltage to the P.A. boards. The base currents of the 25.4 V regulators also serve to provide current to the two Bias Stabilizers. The 4.5 V Regulators supply additional current. The 5.4 V Limiters limit the Bias Supply Voltages.

6.2.2.2. POWER AMPLIFIER 441

The RF signal is brought through a Gain Adjustment Attenuator (adjustment range approx. 6 dB) before being amplified approx. 21 dB in Driver 1, a class A amplifier.

Subsequently, 18 dB gain is supplied in Driver 2 (class AB, push-pull) before the signal is given 10 dB of final amplification in the P.A. output stage (also, class AB, push-pull). Resulting output power is 225 Watts, PEP, into 35 ohms.

The Peak Detector that monitors the output voltage is connected to the Protection Attenuator Control on p.c.b. 442 .

The Bias Stabilizers supplies the bases of the class AB amplifiers with stabilized bias voltages.

A temperature sensor circuit monitors the temperature of the heat sink. If the temperature exceeds 60°C the BLOWER CONVERTER 422 is alerted and if the temperature exceeds 92°C, the monitor will alert the Protection Attenuator Control on p.c.b. 442 .

6.2.3. AUTOMATIC ANTENNA COUPLER

The RF signal from the Power Amplifier Module is connected to the LOW-PASS FILTER 434 , which removes the harmonics from the signal.

During the tuning sequence a 4.22 MHz Low-pass filter, loaded with 70 ohms at the output, is switched-in. A Directional Coupler extracts information about forward and reflected voltages on the RF signal line following the low-pass filter.

The impedance level is then changed by means of a 50 ohms to 112.5 ohms transformer.

The RF signal is now fed to the L-matching network, comprised of two variable inductors, L1 and L2. A shortening capacitor, C2, may be inserted in series with the antenna.

RF current is measured with the aid of a current transformer before the RF signal is taken from the Automatic Antenna Coupler. A detector rectifies the RF current and provides a signal to the RF lamp on the Control Unit's front panel as well as the Antenna Current Meter on the Transmitter Unit's front panel.

When a TUNE COMMAND is received from the Control Unit, a 20 sec. Timer is started, enabling the 2.5 Hz Clock Generator that makes the Sequential Network step through its tuning sequence.

The first steps are:

1. to inhibit keying
2. to reset Protection Atenuator
3. to switch-in the 4.22 Mhz low-pass tuning filter
4. to disconnect L2 from chassis

The next steps are

1. to cancel the keying inhibit
2. to send a TUNE POWER REQUEST to the Control Unit.
3. to start up Phase Comparator 1, Predriver 1 and Motor 1 Driver.

When Phase Comparator 1 detects a completed adjustment of L1, the Motor 1 Driver is cut off and the Motor 1 Stop Detector outputs a signal, which tells the Sequential Network to move to the next step sequence:

1. to inhibit keying while connecting L2 to chassis
2. to allow keying to resume
3. to start up Phase Comparator 2, Predriver 2 and Motor 2 Driver.
Phase Comparator 1 fine-adjusts L1 at the same time L2 is adjusted.

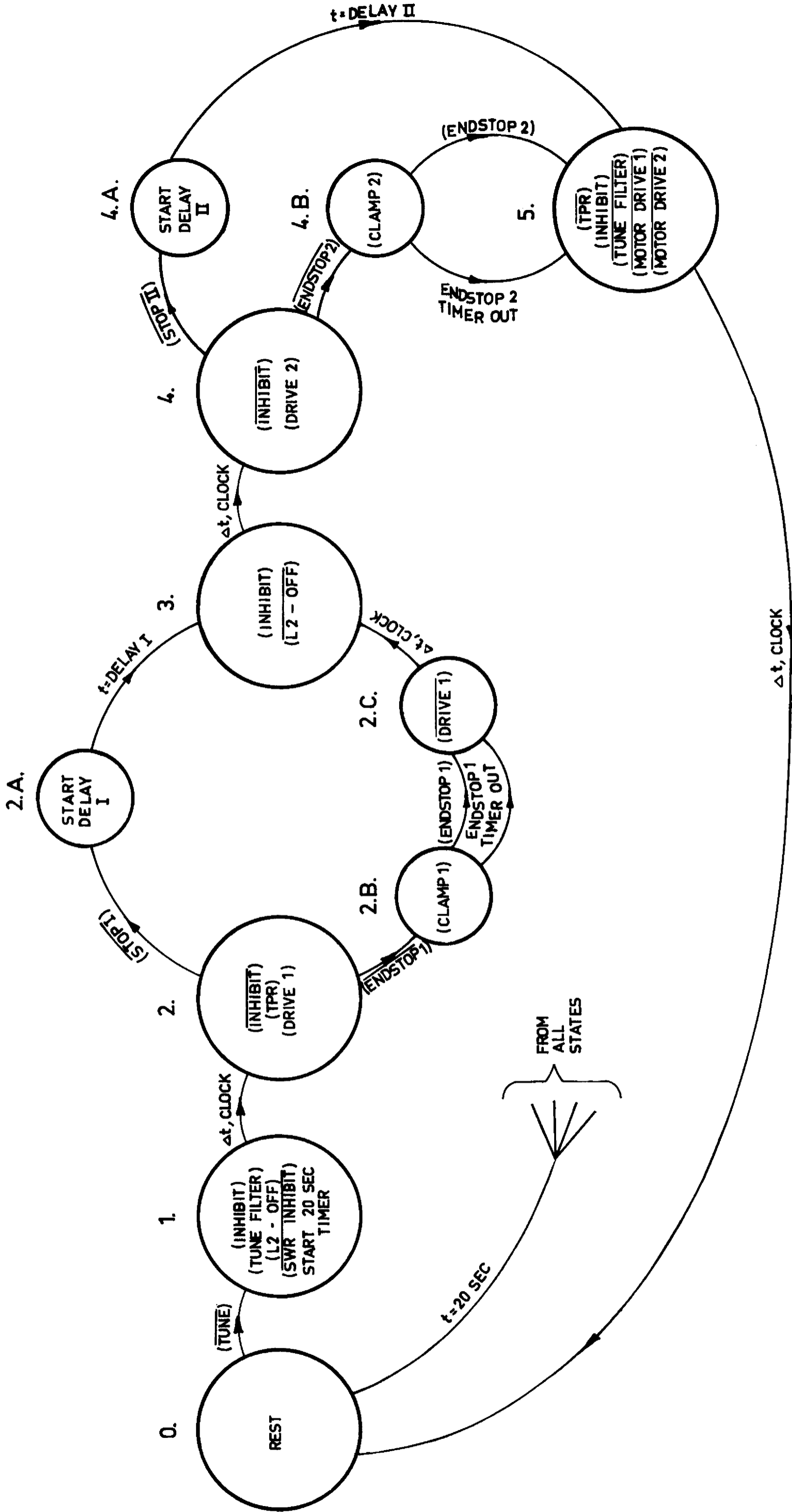
When Phase Comparator 2 detects a correct adjustment of L2, the Motor 2 Driver is cut off and the Motor 2 Stop Detector outputs a signal which causes the sequential Network to progress to the final steps, which are:

1. to cancel the TUNE POWER REQUEST
2. to inhibit keying
3. to disconnect the Tuning Filter
4. to disconnect the Phase Detectors, Predrivers and Motor Drivers
5. to permit keying

Two Endstop Detectors, one for each variable inductor, detect if one of the roller contacts reaches the end of a coil. A signal is then sent to the respective predrivers to force the motor to rotate in the correct direction, independent of the Phase Detector output.

If the tuning sequence has not been concluded within 20 seconds from the tune command the Automatic Antenna Coupler returns to its rest state and awaits the appearance of a new Tune Command, before starting up a new tuning sequence.

TUNING SEQUENCE



7. INSTALLATION

Correct installation of the equipment is important for maximum performance and reliability. Antennas and earth connections must be installed with the greatest care, especially where duplex telephony is desired.

7.1. Control Unit

The Control Unit is suspended in a pair of brackets supplied. The drawing on page 7-9 shows possible mounting positions, overall dimensions and a drilling plan for the necessary holes. The unit can be tilted in the brackets to a convenient angle and fixed in that position by tightening the bolts at the sides.

A frame for flush mounting is optionally available.

7.2. Transmitter Unit

The Transmitter Unit may be mounted up to 15 metres from the Control Unit using a RG-58C/U coaxial cable and a screened 24x0.15 sq.mm multi-wire cable for interconnection and up to 50 metres away using heavier cables and junction boxes. In installations where the cable length between the units exceeds 15 metres, use RG-213/U (RG-8A/U) coaxial cable and a screened 24x0.75 sq.mm cable. The unit should be installed in a dry place near antenna lead-in and battery connection. Consideration should be given to accessibility for servicing. The brackets supplied allow for bulkhead or bench mounting. The drawing on page 7-9 shows mounting details. Observe minimum clearances.

7.3. Connection to the Permanent Installation

The TRP 6000 is to be powered from a 24V battery or a separate AC-to-24V DC converter unit. The supply leads are connected to the Transmitter Unit through the cable entry at the rear of the cabinet. Note that fuses must be provided in the supply leads. Maximum voltage drop in the supply leads should be 0.5 Volts. Table 7.1. shows the necessary cable cross sections and external fuse ratings.

Transmitter Unit	Max. cable length to battery	Conductor area	External fuses
TU 6200	6 m	2 x 6 mm ²	25A
	10 m	2 x 10 mm ²	
	16 m	2 x 16 mm ²	
	27 m	2 x 25 mm ² *)	
TU 6400	5 m	2 x 10 mm ²	50A
	8 m	2 x 16 mm ²	
	13 m	2 x 25 mm ² *)	

*) Use pin terminal adaptor 343 428 11.

Table 7.1.

7.4. Earth Connections

As the transmitter earth connection is a part of the total antenna system, it is of the utmost importance that the earth connection is constructed to have the smallest possible RF-impedance. Losses in the earth connection will result in a decrease in radiated power which means that the range of the transmitter will be reduced. A poor earth connection will further impede or even make duplex communication impossible.

7.4.1. Transmitter Earth Terminal:

The transmitter earth terminal is located at the rear of the Transmitter Unit.

7.4.2. Steel Ships:

From the transmitter earth terminal a 100 x 0.5 mm copper strap is run uninterrupted to two $\frac{1}{2}$ " or M12 bolts welded to the hull as close to the equipment as possible.

7.4.3. Wooden Ships:

From the transmitter earth terminal a 100 x 0.5 mm copper strap is run, preferably uninterrupted, to a copper earth bolt hard soldered to an earth plate having a minimum area of 1 m² mounted under the water line. Should it, however, be necessary to break the copper strap, for example to pass through a deck, two $\frac{1}{2}$ " or M12 bolts should be used for this feed through. The copper strap should then be continued below deck, after connection to the same two bolts.

The copper strap must not be passed through iron pipes and should be kept a minimum distance of 0.5 m from iron parts of some extent. If this minimum distance cannot be kept the copper strap must be effectively connected to these parts using a strap having the same dimensions.

On wooden ships having a superstructure of metal, this superstructure should also be effectively connected to the copper strap by using stainless steel bolts and preferably pieces of stainless steel strips between the metal parts.

7.4.4. Receiver Earth Terminal:

The receiver earth terminal is located in the receiver antenna connection box. To facilitate duplex operation the instructions given below should be followed.

7.4.5. Steel Ships:

A flexible 2.5 sq.mm earth wire is run from the antenna connection box to a separate $\frac{1}{2}$ " or M12 earth bolt welded to the hull as close to the antenna connection box as possible. As an alternative the receiver earth connection may be established at the antenna-end of the coaxial cable.

7.4.6. Wooden Ships:

A flexible 2.5 sq.mm earth wire is run from the receiver antenna connection box directly to the transmitter earth bolt on the earth plate. The earth wire should be run a minimum distance of 0.5 m from the transmitter copper strap. As an alternative the receiver earth connection may be established at the antenna-end of the coaxial cable.

7.4.7. Control Unit Earth Terminal:

The Control Unit earth terminal is located at the rear of the front panel. The Control Unit should be connected to earth if it is separated from the Transmitter Unit.

7.4.8. Steel Ships:

A flexible 2.5 sq. mm earth wire is run to a separate $\frac{1}{2}$ " earth bolt welded to the hull as close to the Control Unit as possible.

7.4.9. Wooden Ships:

A flexible 2.5 sq. mm earth wire is run directly to the transmitter earth bolt on the earth plate. The wire should be run at a minimum distance of 0.5 m from the receiver earth wire.

7.4.10. Other Cables:

Other cables should be placed as far away as possible from the earth leads and under no circumstances parallel with the transmitter copper strap closer than 0.7 m and, for the receiver and Control Unit earth leads, closer than 0.2 m.

7.4.11. Earthing the Battery:

RF earth connections will cause neither battery nor mains leads to be connected to the hull. If it is desired to connect the battery to the hull, it is important to make the connection right at the battery, never in the transmitter. Max. permissible peak voltage between the battery terminals and earth is 250 V.

7.5. Antennas

In order to minimize duplex noise, the transmitting and receiving antennas should be kept as far away from each other as possible. Stays, wires, steel masts, etc. should either be earthed effectively or insulated.

Likewise in order to minimize duplex noise, every other electric installation such as cable braiding (screens) and instruments should be earthed effectively, and the instruments in question should be fitted with noise-interference suppression devices, effective in the range 0.1 MHz to 4.5 MHz.

The antennas should be suspended well in the clear, away from objects whose influence on the antennas may vary, such as derricks etc. Insulators should be of the best type having low leakage even when wet.

7.5.1. Transmitter Antenna Terminal:

The transmitter antenna terminal is located on the front of the Transmitter Unit.

7.5.2. Transmitter Antenna:

The Automatic Antenna Coupler will tune at any frequency in the range 1.6 to 4.22 MHz to wire and/or whip antennas of 7 to 18 metres total length, including earth strap length. See page 7-10.

To ensure the greatest possible radiated power the transmitter antenna should be as long as possible. The antenna should be terminated in a lead-in insulator in the roof or side wall of the radio room. The lead-in insulator should be located in such a way that the distance between the insulator and the transmitter antenna terminal is as short as possible to avoid losses and radiated RF-power inside the radio room which might disturb other equipment.

A short length of coaxial cable type RG-213/U, of which only the braid and the outer insulation is used, is inserted between the lead-in insulator and the transmitter antenna terminal. Both ends of the coaxial screen are soldered to cablesheoes of suitable dimensions for the lead-in insulator and the transmitter antenna terminal.

If, for practical reasons, it should be necessary to mount the lead-in insulator some distance from the transmitter, the connection from the insulator to the vicinity of the transmitter should be done with a length of copper tubing mounted on stand-off insulators. A length of coaxial cable, as described above, should then be inserted between the last stand-off and the transmitter antenna terminal; any play between the transmitter and the bulkhead will then be taken up by the cable.

7.5.3. Receiver Antenna Terminal:

The receiver antenna terminal is a UHF-connector (PL 259 type) located in the receiver antenna connection box.

7.5.4. Receiver Antenna:

Length: 7 - 30 m. The receiving antenna should be brought in with a length of coaxial cable, which should be as short as possible, especially in the case of a short antenna.

If a long coaxial cable is used in order to separate receiver and transmitter antennas it will often be advantageous to insert an impedance matching transformer at the antenna end of the coaxial cable.

7.6. Extension Speaker

If an extension speaker is to be installed it should be connected to terminal strip TSl in the Control Unit. The terminals are located at the rear of the front panel.

An audio power of 5 watts is available into a 4 ohms load. This power can be shared between several loudspeakers if so desired. The built-in speaker in the Transmitter Unit has an impedance of 8 ohms. When connecting the extension speaker(s) the minimum value of the total impedance should be 4 ohms including the built-in speaker. If 5 watts is required in the extension speaker(s), the built-in speaker must be disconnected.

7.7. Equipment-On and Transmitter-Keyed Indications

Indications of equipment-on and transmitter-keyed conditions can be obtained by means of two voltages (both 24 V at max. 0.4A) which are controlled by the Supply Switch and the Keying Relay respectively. The voltages can be taken off at a terminal strip located on the Power Supply Module in the

Transmitter Unit. The terminals are marked 24 V (+) WHEN ON and 24 V (+) WHEN KEYED respectively. The voltages may be used for activating an antenna relay or an earth-free relay in another apparatus, e.g. C.A.S., direction finder or an extra receiver.

7.8. Use of Shortening Capacitor

The shortening capacitor in the Automatic Antenna Coupler is normally shorted when the equipment is delivered from the factory as this gives the highest output power on short antennas. To check if the shortening capacitor is necessary in the actual installation select the highest possible transmitting frequency and activate the TUNE button. If the Automatic Antenna Coupler fails to tune (motor runs for 20 seconds and large variometer roller is positioned to the utmost right) the shortening capacitor must be inserted.

To insert the shortening capacitor pull the Automatic Antenna Coupler unit partly out of the cabinet. Move the connector behind the antenna insulator to the left hand terminal above the capacitor.

If the Automatic Antenna Coupler still fails to tune, the antenna is too long and must be shortened.

7.9. Final Installation Check

7.9.1. 2182 Labels:

Switch to 2182 kHz and press "TUNE".

Remove the frequency table on the front plate of the Automatic Antenna Coupler. Partially remove the self-adhesive plastic film covering the cut-outs on the front plate and place the two red labels marked 2182 so that the arrows point exactly at the positions of the two variometer rollers. See fig. 4.6.1. Replace the self-adhesive plastic film and the frequency table.

7.9.2. Memory Programming:

Program the frequency pairs marked with an RCL number on the frequency table into the user programmable memory as described in chapter 2 of this manual.

7.10. Transmit Frequency PROM Programming

The authorized transmit frequencies are programmed into the transmit frequency PROM normally localized on p.c.b. 402 accessible through a slot in the box, when the two screws securing the front panel have been loosened.

Up to 80 transmit frequencies may be stored as channel-numbers 20 to 99. The coding chosen is the simplest possible: write down the desired transmit frequency with 100 Hz resolution as a 5-digit number, add a leading "zero" and program the resulting 6-digit number as 3 consecutive bytes (groups of 8 bits) using BCD-code as illustrated by the following example (table 7.2). The frequencies may be programmed in an arbitrary order and cancelled by programming 0000 0000 into the 3 bytes corresponding to the particular frequency. New frequencies can be added until the capacity is exhausted; however no vacant space (locations containing 1111 1111) must be left between programmed frequencies.

PROM-types which can be installed

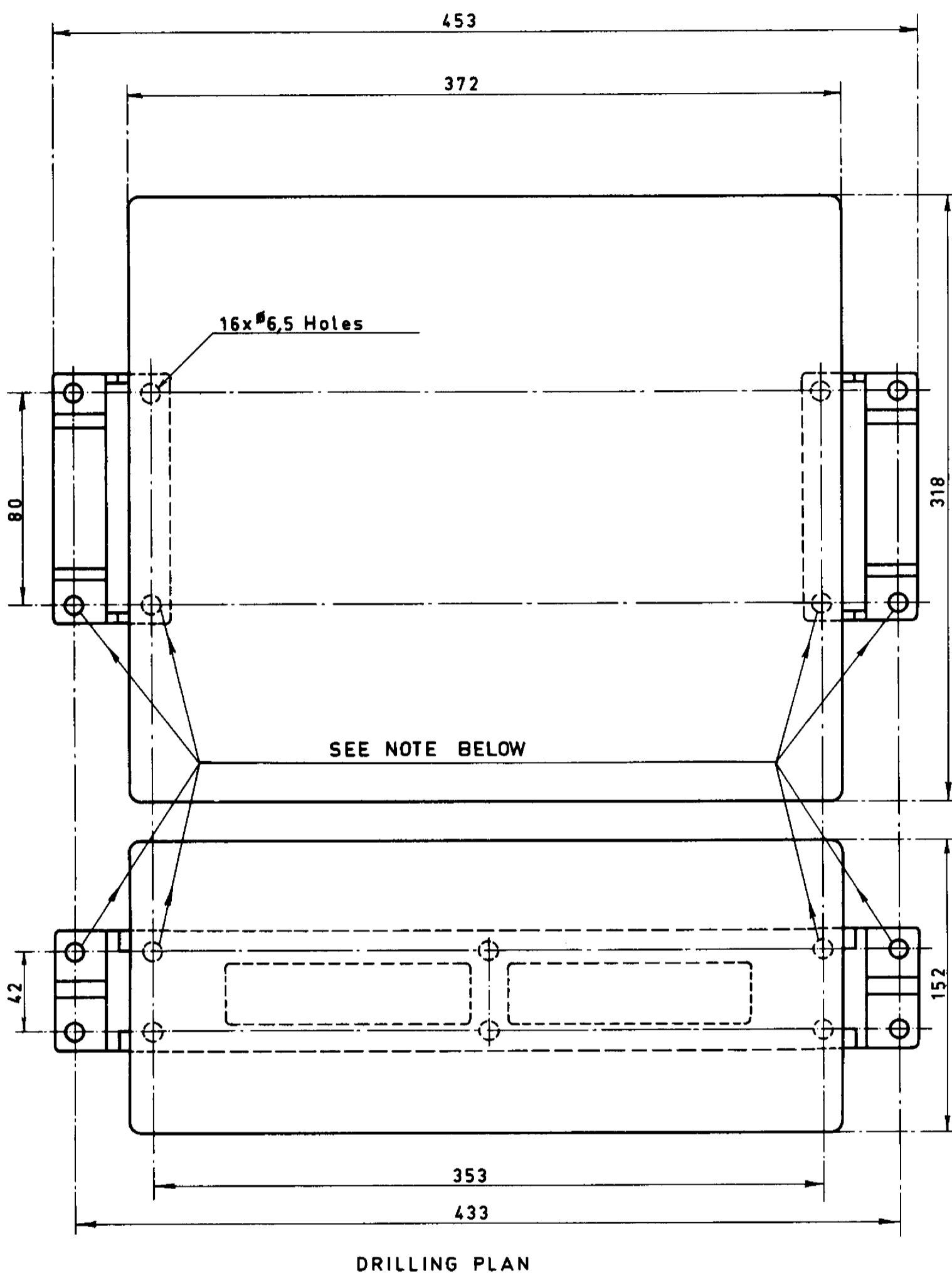
Manufacturer	Types
Monolithic Memories	6335-1 6336-1 5335-1 5336-1 6340-1 6341-1 5340-1 5341-1
Harris	HM-7640 A HM-7641 A
Motorola	MCM 7640 MCM 7641
Fairchild	93438 93448

ADDRESS		DATA								
dec.	hex.	0 ₇	0 ₆	0 ₅	0 ₄	0 ₃	0 ₂	0 ₁	0 ₀	
0	00	0	0	0	0	0	0	1	0	
		(0)				(2)				
1	01	0	0	0	0	0	1	1	0	2069 kHz (channel 20)
		(0)				(6)				
2	02	1	0	0	1	0	0	0	0	
		(9)				(0)				
3	03	0	0	0	0	0	0	1	0	
		(0)				(2)				
4	04	0	0	1	0	0	1	1	0	2263.5 kHz (channel 21)
		(2)				(6)				
5	05	0	0	1	1	0	1	0	1	
		(3)				(5)				
6	06	0	0	0	0	0	0	1	1	
		(0)				(3)				
7	07	0	1	0	1	0	1	1	0	3567.5 kHz (channel 22)
		(5)				(6)				
8	08	0	1	1	1	0	1	0	1	
		(7)				(5)				
237	ED	0	0	0	0	0	0	0	1	
		(0)				(1)				
238	EE	1	0	0	0	0	0	1	1	1834 kHz (channel 99)
		(8)				(3)				
239	EF	0	1	0	0	0	0	0	0	
		(4)				(0)				

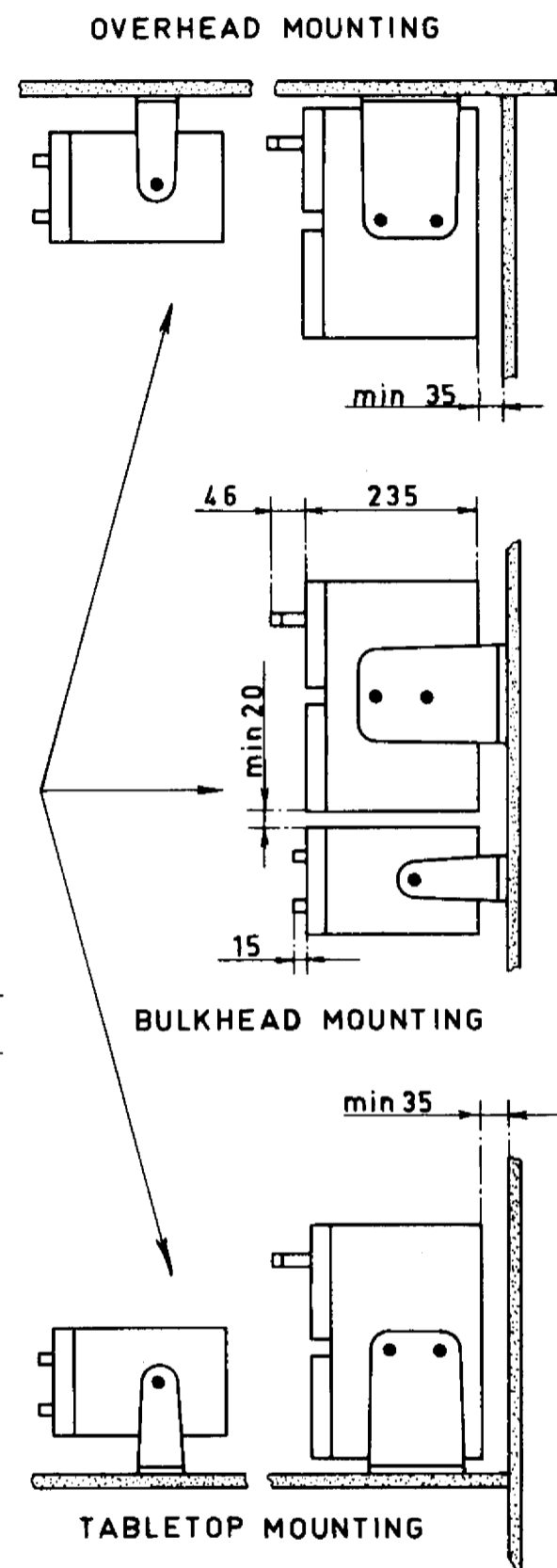
Decimal number	BCD-code
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001

Table 7.2

FREQUENCY	ADR	0 ₇	0 ₆	0 ₅	0 ₄	0 ₃	0 ₂	0 ₁	0 ₀
f= _____ kHz		0	0	0	0				
		(0)							
f= _____ kHz		0	0	0	0				
		(0)							
f= _____ kHz		0	0	0	0				
		(0)							
f= _____ kHz		0	0	0	0				
		(0)							
f= _____ kHz		0	0	0	0				
		(0)							
f= _____ kHz		0	0	0	0				
		(0)							



NOTE : CU 6000 BRACKET MAY BE USED AS A JIG FOR THE MARKING OF TU 6X00 BRACKETS HOLES AS SHOWN.



UNIT:	APPRWEIGHT:
CU 6000	7.3 kg
TU 6200	16.0 kg
TU 6400	18.0 kg

TOLERANCES: \pm 1mm

DIMENSIONS IN mm

MOUNTING OF TRP 6000

343 423 82

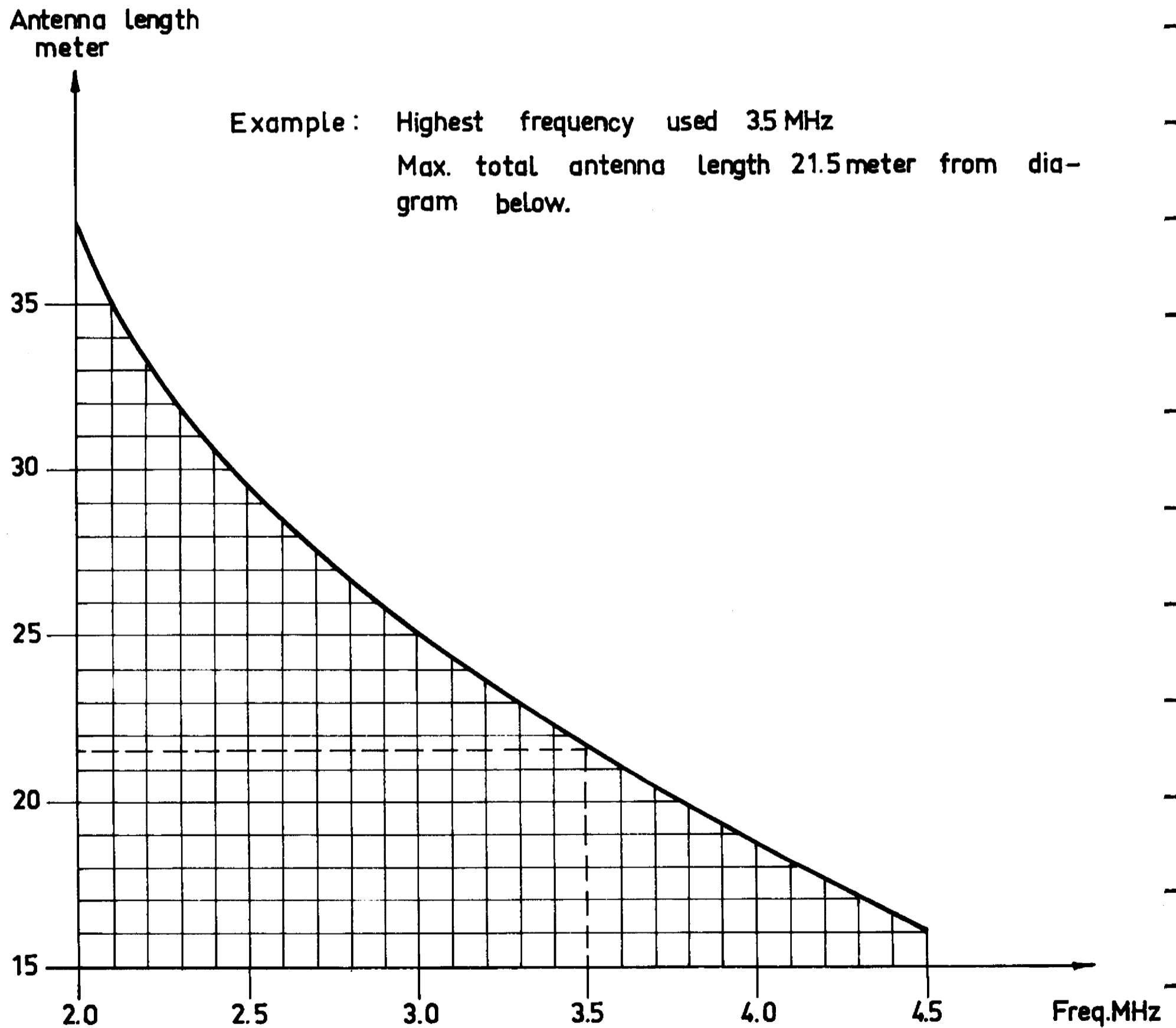
THE TRANSMITTER ANTENNA

Important :

The antenna length must always be shorter than a quarter wavelength on the highest operating frequency.

The maximum length (including down lead and earth connection) versus frequency is shown in the diagram below.

A whip antenna with built-in loading coil is not tuneable above its quarterwave resonance, and therefore is not recommended.



Max. Antenna length versus frequency
with the shortening capacitor inserted.

8. CIRCUIT DIAGRAMS

AND PARTS LISTS

8.1. Symbol Explanation

8.1.1. Arrows:

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

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

8.1.2 Logic circuits:

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

A clock input is indicated by an open triangle. A small circle at a clock input means that the outputs change on the HIGH to LOW clock transition.

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

Inputs and outputs are labelled with mnemonic letters as described in table 8.1.

8.1.3. Logic Functions:

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

8.1.4. Voltages:

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

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

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

ABBREVIATIONS

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

Table 8.1

Label	Short for	Meaning
A	Trig Input	triggers one-shot on falling edge
A _x	Address	selects a memory location (data word) or a multiplexer input
B	Trig Input	triggers one-shot on rising edge
B/D	Binary/Decimal	selects counting mode (modulus 16 or 10)
BI	Blank Input	deactivates BCD-to-7 segment decoder (blanks connected display)
C _x ^Y	Control Signal	programmable bidirectional hand-shake signal to/from peripheral
CEP, CET	Clock Enable	enables clock signal to counter
CP	Clock Pulse	edge activated input for updating synchronous circuit
CS _x	Chip Select	selects a memory or peripheral circuit (bus slave)
D _x	Data	input to D flip-flop and register or bidirectional information path for bus connected device
E	Enable Input	enables clock signal
EO	Enable Output	activates output(s) from combinatorial circuit
EQ	Enable Output	activates output(s) from sequential circuit
HLT	Halt	suspends MPU activity and releases busses
I _x ^Y	Input Data	input for combinatorial circuit
IRO _y	Interrupt Request	wired-OR flag from peripheral to MPU indicating interrupt detected

Table 8.1 (continued)

Label	Short for	Meaning
J, K	Data	input to J-K flip-flop
K_x	Mode Select	selects counting mode for programmable counter
LE	Latch Enable	updates latching register
LT	Lamp Test	activates all outputs on BCD-to-7 segment decoder
MR	Master Reset	input for initializing MPU or clearing programmable registers in peripheral circuit
MRDY	Memory Ready	hand-shake flag to MPU indicating new bus cycle may be started
NMI	Non-maskable Interrupt	flag to MPU, which cannot be masked softwarewise indicating interrupt detected
O_x	Output	output from combinatorical circuit
P_x	Data (bidirectional)	input to programmable counter or programmable bidirectional signal to/from peripheral
PE	Parallel Enable	loads P_x data into programmable counter
Q_x	Output	output from sequential circuit
R	Reset	forces flip-flop(s) to LOW state
RBI	Ripple Blank Input	deactivates BCD-to-7 segment decoder (blanks connected display) if data correspond to leading zero, when decoders are cascaded
RS_x	Register Select	addresses programmable registers in peripheral circuit
S	Set	forces flip-flop(s) to HIGH state
S_y	Select Data	selects data path through multiplexer

Table 8.1 (continued)

Label	Short for	Meaning
SYNC	Synchronize	issued from bus master (MPU) to synchronize data transfer
TC	Terminate Count	output from counter indicating new cycle started (corresponds to carry or borrow depending on counting direction)
U/D	UP/Down	selects counting direction
VMA	Valid Memory Address	issued from bus master (MPU) to indicate stable address bus
WI	Write Input	input to bus slave to make it accept data from master
WQ	Write Output	output from bus master (MPU) when it is a data source.

(1) "x" is a numerical index (zero origin indexing) corresponding to bit position

(2) "y" is an alphabetical index used for multiple ports.

PARTS LIST

FOR

400

Printed Circuit Board Complete 400						107 440 01
400C1,2,3,4,7,8,9,10 11,12,13,14,15	47 nF	10%	100V	Polyes.		623 447 00
C5	0.47 uF	10%	63V	Polyes.		622 547 00
C6	100 uF		25V	WW		652 810 00
C100	100 uF		25V	WW		652 810 00
C101	6.8 nF	1%	250V	Polyst.		614 368 00
C102	0.1 uF	10%	100V	Polyes.		623 510 01
C103	1000 uF		16V	Tan.		651 910 00
400D1,6	1S920					830 192 00
D2,3	MV5353					823 000 01
D4	10D05					831 000 51
D5	AA143					830 014 30
400L1,2	25 uH			RF Choke		740 125 00
L100	10 uH			RF Choke		740 110 00
400PL2	40 Way					756 040 00
PL3	26 Way					756 026 01
PL4	25 Way					751 000 81
PL5	1 Way					750 000 14
400Q100,101,102,103, 104,105,106,107, 108,109,111	BC327					840 032 70
Q110	BC547B					840 054 70
400R1,2	2,2 kohm	5%	1/2W	Car.		502 322 00
R3,12	10 kohm	Var.	Lin.			353 407 4X

PARTS LIST

FOR

400

400R4, 6, 9	10 kohm	5%	1/3W	Car.	501 410 00
R5	560 ohm	5%	1/3W	Car.	501 256 00
R7	1.5 kohm	5%	1/2W	Car.	502 315 00
R8	10 kohm	Var.	Log	1	353 407 3X
R10	220 ohm	5%	1/3W	Car.	501 222 00
R11	10 ohm	5%	1/3W	Car.	501 110 00
R100, 101, 104, 105, 110, 110, 119, 120, 122, 123	120 ohm	5%	1/3W	Car.	501 212 00
R102, 103, 106, 107, 114, 115, 120, 121, 125, 126, 131	1 kohm	5%	1/3W	Car.	501 310 00
R108, 109, 112, 113, 116, 117, 118, 119, 127	56 ohm	5%	1/3W	Car.	501 156 00
R124	220 ohm	5%	1/3W	Car.	501 222 00
R128	10 ohm	5%	1/3W	Car.	501 110 00
R129	100 kohm	Var.	Lin		353 407 5X
R130	5.6 kohm	5%	1/3W	Car.	501 356 00
R132	120 ohm	5%	1/2W	Car.	502 212 00
400S1	Alarm/Start				763 000 16
S2	Supply				762 000 14
S3	Alarm/Send/Off/Test				373 409 7X
S4	Duplex/Simplex				762 000 16
S5	Power				373 409 8X
S6	Loudspeaker				762 000 17
S7	Tune				763 000 15
S8	Mode/A3J-SSB/A3A/A3H-AM				762 000 15

PARTS LIST

FOR

400

400S100, 101		763 000 15
S102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117	M73-0100	
400TS1	2 Way	770 000 18
TS2	4 Way	770 000 19
400U1	SN74LS05	850 740 51
U2, 3	CNY17-II	825 000 00
U100	SN74LS145	857 414 50
U101, 102, 103, 104, 107, 108, 109, 110, 112, 113	Man 82	824 008 20
U105	ULN2803	850 280 30
U106	74LS48	850 744 81
U111	SN74LS08	850 740 80
U114	SN74LS123	857 412 30

PARTS LIST

FOR

401

Printed Circuit Board complete 401					107 440 11
401C1	470 uF		40V	W.Alum.	652 847 00
C2,4	0.1 uF	10%	100V	Polyes.	623 510 01
C3	10 nF	10%	100V	Polyes.	623 410 00
C100, 101,104	0.22uF	10%	63V	Polyes.	622 522 00
C102,103,121,142, 145	10 nF	10%	100V	Polyes.	623 410 00
C105,106,116,117 138,139,140,141 143,144,149,150 151,153	0.1 uF	10%	100V	Polyes.	623 510 00
C107,114	1 nF	1%	125V	Polyst.	613 310 00
C108, 128	820 pF	1%	500V	Polyst.	615 282 00
C109,147	270 pF	1%	500V	Polyst.	615 227 00
C110	220 pF	1%	500V	Polyst.	615 222 00
C111,134,148	15 pF	+/-0.25%	400V	Cer.	605 115 01
C112,122,130,135	1.2 nF	1%	125V	Polyst.	613 312 00
C113	560 pF	1%	560 pF	Polyst.	615 256 00
C115	2x335 pF			Var.	682 233 50
C118	33 pF	5%	400V	Cer.	605 133 00
C119,127	27 pF	5%	400V	Cer.	605 127 00
C120	2.7 pF	+/- 0.25%	400V	Cer.	605 027 00
C123,132,136,146	180 pF	1%	500V	Polyst.	615 218 00
C124	160 pF	1%	500V	Polyst.	615 216 00
C125	10 pF	5%	400V	Cer.	605 110 00
C126	22 nF	10%	100V	Polyes.	623 422 00
C129	1.8 nF	1%	125V	Polyst.	613 318 00

PARTS LIST

FOR

401

401C131,152	130 pF	1%	500V	Polyst.	615 213 00
C133	18 pF	5%	400V	Cer.	605 118 03
C137	4.7 pF	+/-0.25%	400V	Cer.	605 047 01
C200, 203, 204, 206 214, 216, 217, 218 219, 220, 224, 225 229, 231, 232, 234, 235, 236, 239, 240, 243, 245, 248, 249 250, 252, 254, 255, 267	0.1 uF	10%	100V	Polyes.	623 510 00
C201	15 pF	+/-0.25%	400V	Cer.	605 115 01
C202, 207, 212, 215, 227, 233, 238, 242, 247, 251, 257, 261	10 nF	10%	100V	Polyes.	623 410 00
C205	47 pF	5%	400V	Cer.	605 147 00
C208, 269	510 pF	1%	500V	Polyst.	615 251 00
C209	590 pF	1%	500V	Polyst.	615 259 00
C210	560 pF	1%	500V	Polyst.	615 256 00
C211	39 pF	5%	500V	Cer.	605 139 00
C213, 221, 223, 237	1 nF	1%	125V	Polyst.	613 310 00
C222	6.8 nF	1%	250V	Polyst.	614 368 00
C226, 262	22 uF		15V	Tan.	651 722 00
C228, 263, 266	100 uF		25V	W.Alum.	652 810 00
C230	4.7 pF	+/-0.25%	400V	Cer.	605 047 00
C241	120 pF	1%	500V	Polyst.	615 212 00
C244	12 pF	5%	400V	Cer.	605 112 01
C246	1.2 nF	1%	125V	Polyst.	613 312 00

PARTS LIST

FOR

401

401C253	2.2 nF		500V	Polyst.	615 322 01
C256	470 pF	1%	500V	Polyst.	615 247 00
C258, 259	0.47uF	10%	63V	Polyes.	622 547 00
C260	22 nF	10%	100V	Polyes.	623 422 00
C264	5.6 nF	1%	125V	Polyst.	613 356 00
C265	1.5 nF	1%	500V	Polyst.	615 315 00
C268	470 uF		40V	W.Alum.	652 847 00
401D100,101,102,103 108,109,110,113 114,115,116,117 118,119,120	1S920				830 192 00
D104,105,106,107 111,112	10D05				831 100 51
D200, 201	BA379				833 037 90
D202, 203, 203, 205 206, 207, 208, 209 210, 211, 212	1S920				830 192 00
401L100	5 mH			RF Choke	740 350 00
L101,116,117	100 uH			RF Choke	740 210 00
L102,107	1 mH			RF Choke	740 310 00
L103,109	47 uH			RF Choke	740 147 01
L104					103 400 8X
L105					103 400 4X
L106,112					103 400 21
L108	68 uH			RF Choke	740 168 00
L110	330 uH			RF Choke	740 233 00
L111					103 400 3X

PARTS LIST

FOR

401

401L113	220 uH			RF Choke	740 222 00
L114					103 400 91
L115	0.68uH			RF Choke	740 006 80
L200	4.7 uH			RF Choke	740 147 00
L201,203	100 uH			RF Choke	740 210 00
L202					103 400 7X
L203,205,206					103 400 5X
L207					103 400 6X
401PL1	10 Way				756 010 00
PL2	60 Way				756 060 00
401Q100	BC337-25-40				840 033 70
Q101	BC547B				840 054 70
Q102	BSX20				840 002 00
Q103,104	J310				840 031 02
Q200,203,204,205 207,209,211	BC547B				840 054 70
Q201	BSX20				840 002 00
Q202	J310				840 031 03
Q206,208,210	BF240				840 024 00
401R1	390 ohm	5%	1/3W	Car.	501 239 00
R2	4.7 kohm	5%	1/3W	Car.	501 347 00
R3	22 kohm	5%	1/3W	Car.	501 422 00
R4	100 kohm	5%	1/3W	Car.	501 510 00

PARTS LIST

FOR

401

401R100,101,102,105	4.7 kohm	5%	1/3W	Car.	501 347 00
R104,106	10 kohm	5%	1/3W	Car.	501 410 00
R107	1.2 kohm	5%	1/3W	Car.	501 312 00
R108	47 kohm	5%	1/3W	Car.	501 447 00
R109,121	2.2 kohm	5%	1/3W	Car.	501 322 00
R110	33 kohm	5%	1/3W	Car.	501 433 00
R111,112,113,114	1 kohm	5%	1/3W	Car.	501 310 00
R115,116,117,118 119,120	390 ohm	5%	1/3W	Car.	501 239 00
R122,124	560 ohm	5%	1/3W	Car.	501 156 00
R123,131,132	100 ohm	5%	1/3W	Car.	501 210 00
R125	3.3 kohm	5%	1/3W	Car.	501 333 00
R126	1.8 kohm	5%	1/3W	Car.	501 318 00
R127	82 ohm	5%	1/3W	Car.	501 182 00
R128	150 ohm	5%	1/3W	Car.	501 215 00
R129, 130	332 ohm	1%	1/3W	MF	511 233 20
R200	22 kohm	5%	1/3W	Car.	501 422 00
R201,226,232, 235,246,261	1 kohm	5%	1/3W	Car.	501 310 00
R202	1.8 kohm	5%	1/3W	Car.	501 318 00
R203	56 kohm	5%	1/3W	Car.	501 456 00
R203,218,219,227 231,267	100 ohm	5%	1/3W	Car.	501 210 00
R205,206,223	33 kohm	5%	1/3W	Car.	501 433 00
R207	1.5 kohm	5%	1/3W	Car	501 315 00
R208,244,263	1.2 kohm	5%	1/3W	Car.	501 312 00

PARTS LIST

FOR

401

401R209	120 ohm	5%	1/3W	Car.	501 212 00
R210	560 ohm	5%	1/3W	Car.	501 256 00
R211	27 kohm	5%	1/3W	Car.	501 427 00
R212, 233, 245, 248 256	330 ohm	5%	1/3W	Car.	501 233 00
R213, 216, 217	6.8 kohm	5%	1/3W	Car.	501 368 00
R214, 215, 254	820 ohm				
R220	15 kohm	5%	1/3W	Car.	501 415 00
R221, 229, 230, 238 241, 242, 262	10 kohm				
R222, 247	4.7 kohm	5%	1/3W	Car.	501 347 00
R224, 225, 228, 251 264	3.3 kohm	5%	1/3W	Car.	501 333 00
R226, 232, 235	1 kohm	5%	1/3W	Car.	501 310 00
R234	680 ohm	5%	1/3W	Car.	501 268 00
R236, 240	220 kohm	5%	1/3W	Car.	501 522 00
R237, 260	330 ohm	5%	1/3W	Car.	501 133 00
R239	27 ohm	5%	1/3W	Car.	501 127 00
R243, 250	470 ohm	5%	1/3W	Car.	501 247 00
R249, 252, 265	100 kohm	5%	1/3W	Car.	501 510 00
R253, 257	2.2 kohm	5%	1/3W	Car.	501 322 00
R255	47 kohm	5%	1/3W	Car.	501 447 00
R258	56 ohm	5%	1/3W	Car.	501 156 00
R259	2.7 kohm	5%	1/3W	Car.	501 327 00
R266	68 ohm	5%	1/3W	Car.	501 168 00
R268	1 ohm	5%	1/3W	Car.	501 010 00

PARTS LIST

FOR

401

401RL100	Reed Relay	12V	780 000 25
401RN103	15x10 kohm		530 000 03
401SK1	Socket		750 000 13
401SL1	Lamp	Neon	722 000 00
401T1			103 401 9X
T100			130 401 0X
T101			103 401 1X
T102			103 401 2X
T103			103 401 3X
T104			103 401 7X
T200			103 401 8X
T201			103 401 4X
T202			103 401 5X
T203			103 401 6X
401U1	MA7812		850 781 20
U100	ULN2803		850 280 30
U101	4081B		850 408 10
U102	4011B		850 401 10
U103	CD4049B		850 404 90
U200	TBA 120		850 012 00
U201	TBA 810S		850 081 00

PARTS LIST

FOR

402

Printed Circuit Board Complete 402					107 440 21
402B1	Battery		3.7V		890 000 01
402C1,2,5,	0.47 uF	10%	63V	Polyes.	622 547 00
C3	10 nF	10%	100V	Polyes.	623 410 00
C4	220 uF		25V	W.Alum.	652 822 00
C6,7	22 uF		15V	W.Alum.	651 722 00
C100	1 nF	1%	250V	Polyst.	614 310 00
C101,103,105	10 nF	10%	100V	Polyes.	623 410 00
C102	22 uF		15V		651 722 00
C104,106,107	0.1 uF	10%	100V	Polyes.	623 510 00
C108	0.47 uF	10%	63V	Polyes.	622 547 00
C109,110,111,112, 113	0.1 uF	10%	100V	Polyes.	623 510 00
C200	0.1 uF	10%	100V	Polyes.	623 510 00
C201	4.5-26 pF	Var.			683 126 00
C202,203,207,208	10 nF	10%	100V	Polyes.	623 410 00
C204	27 pF	+/-0.25%	400V	Cer.	605 127 01
C205	330 pF	1%	500V	Polyst.	615 233 00
C206	180 pF	1%	500V	Polyst.	615 218 00
C209,210,216,220, 221,226,228,229, 234,235,238,239, 244,247,250,252, 253,254,255,256, 257,258	0.1 uF	10%	100V	Polyes.	623 510 00
C213	220 pF	1%	500V	Polyst.	615 222 00
C214	6.8 uF	10%	63V	Polyes.	622 668 00

PARTS LIST

FOR

402

C215	33 pF	5%	400V	Cer.	605 133 00
C217	3.3 nF	1%	125V	Polyst.	613 333 00
C218,222,237,240 243,246,248,249 251	10 nF	10%	100V	Polyes.	623 410 00
C219	220 uF		25V	W.Alum	652 822 00
C223	.1 nF	1%	250V	Polyst.	614 310 00
C224	39 pF	10%		Cer.	602 139 00
C225,231	470 pF	1%	500V	Polyst.	615 247 00
C227	120 pF	10%	25V	Cer.	602 212 01
C230,232	680 pF	1%	500V	Polyst.	615 268 00
C233	0.22 uF	10%	63V	Polyes.	622 522 00
C236	0.47 uF	10%	63V	Polyes.	622 547 00
C241	47 pF	5%	400V	Cer.	605 147 00
C242,245	1 nF	-20+80%	25V	Cer.	602 310 00
402D1	AA143				830 014 30
D2	BZX79	Zener			832 796 20
D3,4	1S920				830 192 00
D100	AA143				830 014 30
D101	BZX79	Zener			832 796 20
D200,205,207	1S920				830 192 00
D201,202,203	BB109				833 010 90
D204	BB204				833 020 40
D206	BB212				833 021 20

PARTS LIST

FOR

402

402L1	25 uH			RF Choke	740 125 00
L200	10 uH			RF Choke	740 110 00
L201,203,204,205	100 uH			RF Choke	740 210 00
L202					103 402 1X
402PL1	10 Way				756 010 00
PL2	60 Way				756 060 00
PL3	26 Way				756 026 00
402Q1	BC547B				840 054 70
Q100,102,103	BC547B				840 054 70
Q101	BF240				840 024 00
Q200,201,202,203, 204,205,206,207, 208,210	BF240				840 024 00
Q209	BC547B				840 054 70
Q211,212	BSX20				840 002 00
402R1	15 kohm	5%	1/3W	Car.	501 415 00
R2	4.7 kohm	5%	1/3W	Car.	501 347 00
R3	220 ohm	5%	1/3W	Car.	501 222 00
R4	330 ohm	5%	1/3W	Car.	501 233 00
R5	470 ohm	5%	1/3W	Car.	501 247 00
R100	470 ohm	5%	1/3W	Car.	501 247 00
R101,102,105,106, 109	3.3 kohm	5%	1/3W	Car.	501 333 00
R103,108	12 kohm	5%	1/3W	Car.	501 412 00

PARTS LIST

FOR

402

402R104,113,117,120	1 kohm	5%	1/3W	Car.	501 310 00
R107	68 ohm	5%	1/3W	Car.	501 168 00
R110	4.7 kohm	5%	1/3W	Car.	501 347 00
R111	680 ohm	5%	1/3W	Car.	501 268 00
R112	270 ohm	5%	1/3W	Car.	501 227 00
R114	1.8 kohm	5%	1/3W	Car.	501 318 00
R115	330 ohm	5%	1/3W	Car.	501 233 00
R116	10 kohm	5%	1/3W	Car.	501 410 00
R118	68 kohm	5%	1/3W	Car.	501 468 00
R119	15 kohm	5%	1/3W	Car.	501 415 00
R121	47 kohm	5%	1/3W	Car.	501 447 00
R200,201	10 kohm	5%	1/3W	Car.	501 410 00
R202,212,214,215, 219,232,249,251, 262,267,273	1 kohm	5%	1/3W	Car.	501 310 01
402R203,245,255,243	2.2 kohm	5%	1/3W	Car.	501 322 00
R204,207,210,226, 227,247,248,250, 264,266,268	10 kohm	5%	1/3W	Car.	501 410 00
R205,211,230,234, 246,252,257,265, 272	3.9 kohm	5%	1/3W	Car.	501 339 00
R206,208,253,258	470 ohm	5%	1/3W	Car.	501 247 00
R209,259	150 ohm	5%	1/3W	Car.	501 215 00
R213	1.5 kohm	5%	1/3W	Car.	501 315 00
R216	330 kohm	5%	1/3W	Car.	501 533 00
R217,220,222,228	15 kohm	5%	1/3W	Car.	501 415 00

PARTS LIST

FOR

402

402R218,221,223,229	47 kohm	Horizontal			582 447 00
R224	27 kohm	5%	1/3W	Car.	501 427 00
R225	120 ohm	5%	1/3W	Car.	501 212 00
R231	3.3 Mohm	5%	1/3W	Car.	501 633 00
R233,240	22 kohm	5%	1/3W	Car.	501 422 00
R235,237	33 kohm	5%	1/3W	Car.	501 433 00
R236	6.8 kohm	5%	1/3W	Car.	501 368 00
R238,239,241	100 kohm	5%	1/3W	Car.	501 510 00
R242,261,276,279, 280	220 ohm	5%	1/3W	Car.	501 222 00
R244	220 kohm	5%	1/3W	Car.	501 222 00
R254,269,274	100 ohm	5%	1/3W	Car.	501 210 00
R256	12 kohm	5%	1/3W	Car.	501 412 00
R260,270,271	4.7 kohm	5%	1/3W	Car.	501 347 00
R263	330 ohm	5%	1/3W	Car.	501 233 00
R275	47 ohm	5%	1/3W	Car.	501 147 00
R277	56 ohm	5%	1/3W	Car.	501 156 00
R278	82 ohm	5%	1/3W	Car.	501 182 00
R281	33 ohm	5%	1/3W	Car.	501 133 00
402RN100	15x10 kohm				530 000 03
RN101	14x47 kohm				530 000 04
402T200					103 402 3X
T201					103 402 4X
T202					103 402 2X

PARTS LIST

FOR

402

402U1	MA7812	850 781 20
U2,3	MA7805	850 780 50
U100	SN7406	850 740 60
U101	SN74LS08	850 740 80
U102	4093BC	850 409 30
U103	74LS04	850 740 41
U104	6802	850 680 20
U106	2532	850 253 20
U107	SN74LS10	850 741 01
U108	6335-1	850 633 50
U109	MC6821P	850 682 10
U110	6522	850 652 20
U111	74C160	857 416 01
U112,113	4019BC	850 401 90
U114	74C164	857 416 31
U115	510L-1	850 510 10
U116	74LS30	850 743 01
U117	74C150	857 415 00
U200,213,216	SN74LS163	857 416 31
U201,210	SN74LS00	850 740 02
U202	4013B	850 401 30
U203,214,218	CD4029B	850 420 90
U204	4001	850 400 10
U205	CD4046B	850 404 60
U206	CD4059A	850 405 90
U208,209,215	74C164	850 416 40

PARTS LIST

FOR

402

402U211	LF356	850 035 60
U212	LM301AN	850 030 10
U219	LM1496CN	850 035 60
402X200		383 418 92
X201		383 419 02

PARTS LIST

FOR

403

Printed Circuit Board Complete 403					107 440 31
403C1,6	0.47 uF	10%	63V	Polyes.	622 547 00
C2,8,9,10,11, 12,13,14,15	0.1 uF	10%	100V	Polyes.	623 510 01
C3	1.0 uF	10%	63V	Polyes.	622 610 00
C4,5	10 nF	10%	100V	Polyes.	624 410 00
C6	0.47 uF	10%	63V	Polyes.	622 547 00
C7	220 uF		25V	W.Alum.	652 822 00
C100,104,105,112, 114,120,121,125,130 131,135,136	0.1 uF	10%	100V	Polyes.	623 510 01
C101	0.47 uF	10%	63V	Polyes.	622 547 00
C102,109,111,117	22 uF		15V	Tan.	651 722 00
C103	0.33 uF	10%	63V	Polyes.	622 533 00
C106	0.15 uF	10%	100V	Polyes.	623 515 00
C107,115,119,122 124,126,127,129 132,133,134	10 nF	10%	100V	Polyes.	623 410 00
C108,128	1 nF	1%	250V	Polyst.	614 310 00
C110,113,118	2.2 uF	10%	63V	Polyes.	622 622 00
C116	100 uF		16V		651 810 00
C123	2.7 nF	1%	125V	Polyst.	613 327 00
C200,201,203,204, 205,206,207,208, 209,210,213	0.1 uF	10%	100V	Polyes	623 510 01
C202	2.2 nF	1%	125V	Polyst.	613 312 00
C211					
C212,224	39 pF	5%	400V	Cer.	605 139 00

PARTS LIST

FOR

403

403C214	10 pF	5%	400V	Cer.	605 082 00
C215	8.2 pF	+/-0.25%	400V	Cer.	605 110 00
C216					
C217	91 pF	1%	500V	Polyst.	615 191 00
C218	62 pf	1%	500V	Polyst.	615 162 00
C219	51 pF	1%	500V	Polyst.	615 151 00
C221	82 pF	1%	500V	Polyst.	615 182 00
C222	27 pF	5%	400V	Cer.	605 127 00
C226	47 pF	5%	400V	Cer.	605 147 00
C227, 228, 229 231, 232, 233, 236, 237, 238	0.1 uF	10%	100V	Polyes.	623 510 01
C230, 235	5.6 nF	1%	125V	Polyst.	613 356 00
C234	10 nF	10%	100V	Polyes.	623 410 00
C239	130 pF	1%	500V	Polyst.	615 213 00
C240	120 pF	1%	500V	Polyst.	615 212 00
C241	43 pF	5%	400V	Cer.	605 143 00
C300, 308, 314, 315	0.47 uF	10%	63V	Polyes	622 547 00
C301, 303, 318, 319 320, 323, 324	10 nF	10%	100V	Polyes.	623 410 00
C304, 311, 322	1 nF	1%	250V	Polyst.	614 310 00
C305, 309, 316, 317 321	0.1 uF	10%	100V	Polyes.	623 510 01
C306	220 uF		25V	W.Alum.	652 822 00

PARTS LIST

FOR

403

403C307	6.8 uF	10%	63V	Polyes.	622 668 00
C310	1 nF	-20/+80%	25V	Cer.	602 310 00
C312	12 pF	5%	400V	Cer.	605 112 01
C313	750 pF	1%	500V	Polyst.	615 275 00
403D1	1S920				830 192 00
D100,101	1S920				830 192 00
D200,202,203,204 206,207,208,209 210,211,212	1S920				830 192 00
D201	AA143				830 014 30
D300	AA143				830 014 30
D301	BB212				833 021 20
D302	1S920				830 192 00
403L1	100 uH			RF Choke	740 210 00
L100	10 uH			RF Choke	740 110 00
L101,102	100 uH			RF Choke	740 210 00
L103	220 uH			RF Choke	
L201,211				RF Choke	740 222 00
L202					103 402 5X
L203					103 402 8X
L204					103 402 6X
L205					103 402 9X
L206					103 402 7X
L207					103 403 0X
L209	47 uH			RF Choke	740 147 00
L210	10 uH			RF Choke	740 110 00

PARTS LIST

FOR

403

403L212	680 uH			RF Choke	740 268 01
L301	680 uH			RF Choke	740 268 01
403PL1					756 010 00
PL2					756 060 00
403Q1	BD234-10				842 023 40
Q100,103	BC547B				840 054 70
Q101	T112				843 011 20
Q102	BC557B				840 055 70
Q200	BSX20				840 002 00
Q201	BC547B				840 054 70
Q202, 203	BF240				840 024 00
Q204	BFW17A				840 001 70
Q300, ,302, 303,304,305	BF240				840 024 00
403R1, 2, 16	10 kohm	5%	1/3W	Car.	501 410 00
R3	47 kohm	5%	1/3W	Car.	501 447 00
R4	22 kohm	5%	1/3W	Car.	501 422 00
R5	1.2 mohm	5%		Car	501 612 00
R6	680 ohm	5%	1/3W	Car.	501 268 00
R8	3.9 kohm	5%	1/3W	Car.	501 339 00
R9	560 ohm	5%	1/3W	Car.	501 256 00
R7,10	2.2 kohm	5%	1/3W	Car.	501 322 00

PARTS LIST

FOR

403

403R11	12 kohm	5%	1/3W	Car.	501 412 00
R12	8.2 ohm		6 W	WW.	527 082 01
R13	5.6 kohm	5%	1/3W	Car.	501 356 00
R14	8.2 kohm	5%	1/3W	Car.	501 382 00
R15	68 ohm	5%	1/3W	Car.	501 168 00
R100,128,140 155,163	470 ohm	5%	1/3W	Car.	501 247 00
R101,138,164	100 ohm	5%	1/3W	Car.	501 210 00
R102,165	820 ohm	5%	1/3W	Car.	501 282 00
R103	270 ohm	5%	1/3W	Car.	501 127 00
R104,105,137	47 kohm	5%	1/3W	Car.	501 447 00
R106,110,113,116 121,139,141,147 160,170,178					
R107,108	1.2 mohm	5%	1/3W	Car.	501 612 00
R109,151	1.8 kohm	5%	1/3W	Car.	501 318 00
R111	33 kohm			Var.	582 433 00
R112	120 kohm	5%		Car.	501 512 00
R114	180 kohm	5%	1/3W	Car.	501 518 00
R115,127,174	6.8 kohm	5%	1/3W	Car.	501 368 00
R117	390 ohm	5%	1/3W	Car.	501 239 00
R118,142,145,153, 156,173	1 kohm	5%	1/3W	Car.	501 310 00
R119,122,159,161 177	22 kohm	5%	1/3W	Car.	501 422 00

PARTS LIST

FOR

403

403R120	1 mohm	5%	1/3W	Car.	501 610 00
R123	33 kohm	5%	1/3W	Car.	501 433 00
R124, 179	5.6 kohm	5%	1/3W	Car.	501 356 00
R125	390 kohm	5%	1/3W	Car.	501 539 00
R126	15 kohm	5%	1/3W	Car.	501 415 00
R129	82 kohm	5%	1/3W	Car.	501 482 00
R130,134	560 kohm	5%	1/3W	Car.	501 556 00
R131,133,148, 152	4.7 kohm	5%	1/3W	Car.	501 347 00
R132	180 ohm	5%	1/3W	Car.	501 218 00
R135	22 ohm	5%	1/3W	Car.	501 122 00
R136	560 ohm	5%	1/3W	Car.	501 256 00
R143	56 ohm	5%	1/3W	Car.	501 156 00
R144	330 ohm	5%	1/3W	Car.	501 233 00
R146,154,172	680 ohm	5%	1/3W	Car.	501 268 00
R149	47 kohm			Var.	582 447 02
R150,175	1.2 kohm	5%	1/3W	Car.	501 312 00
R157	220 ohm	5%	1/3W	Car.	501 222 00
R158	2.2 kohm	5%	1/3W	Car.	501 322 00
R162,165	1.5 kohm	5%	1/3W	Car.	501 315 00
R167	12 kohm	5%	1/3W	Car.	501 412 00
R168, 169	2.7 kohm	5%	1/3W	Car.	501 327 00
R171	1 kohm			Var.	582 310 00
R176	270 ohm	5%	1/3W	Car.	501 222 00
R166	68 ohm	5%	1/3W	Car.	501 168 00

PARTS LIST

FOR

403

403R240, 250	820 ohm	5%	1/3W	Car.	501 282 00
R201, 246	6.8 kohm	5%	1/3	Car.	501 368 00
R202	8.2 kohm	5%	1/3W	Car.	501 382 00
R203	2.2 kohm	5%	1/3W	Car.	501 322 00
R204	147 ohm	1%	0.4W	MF	511 214 70
R205, 237	1.5 kohm	5%	1/3W	Car.	501 315 00
R206, 247	3.9 kohm	5%	1/3W	Car.	501 339 00
R207, 208, 215, 221 244	100 ohm	5%	1/3W	Car.	501 210 00
R209	475 ohm	1%	0.4W	MF	511 247 50
R216	10 kohm	5%	1/3W	Car.	501 410 00
R212, 213	121 ohm	1%	1/3W	MF	511 212 10
R214	412 ohm	1%	0.4W	MF	511 241 20
R217, 219, 227, 256	1.8 kohm	5%	1/3W	Car.	501 318 00
R218, 225	1 kohm			Var.	582 310 00
R220	536 ohm	1%		MF	511 253 60
R223, 224, 226	470 ohm	5%	1/3W	Car.	501 247 00
R228	47 ohm	5%	1/3W	Car.	501 147 00
R229, 230, 243	22 kohm	5%	1/3W	Car.	501 422 00
R231, 235, 236, 251 253, 254	1 kohm	5%	1/3W	Car.	501 310 00
R232, 234	220 ohm	5%	1/3W	Car.	501 222 00
R233, 245	560 ohm	5%	1/3W	Car.	501 256 00
R238, 252, 200	680 ohm	5%	1/3W	Car.	501 268 00
R239	680 ohm			Var.	582 268 00
R241, 242	4.7 kohm	5%	1/3W		501 347 00

PARTS LIST

FOR

403

403R248	68 ohm	5%	1/3W	Car.	501 168 00
R249	270 ohm	5%	1/3W	Car.	501 227 00
R255	33 ohm	5%	1/3W	Car.	501 133 00
R257	374 ohm	1%		MF	511 237 40
R300, 301, 328, 339 342	3.9 kohm	5%	1/3W	Car.	501 339 00
R302	33 kohm	5%	1/3W	Car.	501 433 00
R304	390 ohm	5%	1/3W	Car.	501 239 00
R305, 345	560 ohm	5%	1/3W	Car.	501 256 00
R , 325, 332, 336, 340, 341	1 kohm	5%	1/3W	Car.	501 310 00
R306	100 ohm	5%	1/3W	Car.	501 210 00
R307, 318	22 kohm	5%	1/3W	Car.	501 422 00
R308, 348	47 kohm	5%	1/3W	Car.	501 447 00
R309, 344	220 ohm	5%	1/3W	Car.	501 222 00
R310	1.5 mohm	5%	0.4W	Car.	501 615 00
R311	56 kohm	5%	1/3W	Car.	501 456 00
R312, 316, 322, 333, 338, 345, 346	10 kohm	5%	1/3W	Car.	501 410 00
R313	27 kohm	5%	1/3W	Car.	501 427 00
R314, 303	3.3 kohm	5%	1/3W	Car	501 333 00
R315	5.6 kohm	5%	1/3W	Car.	501 356 00
R317	8.2 kohm	5%	1/3W	Car.	501 382 00
R319	6.8 kohm	5%	1/3W	Car.	501 368 00
R320	27 ohm	5%	1/3W	Car.	501 127 00
R323, 344	470 kohm	5%	1/3W	Car.	501 547 00
R324, 326	100 ohm	5%	1/3W	Car.	501 210 00
R327	1.5 kohm	5%	1/3W	Car.	501 315 00

PARTS LIST

FOR

403

403R329,334	470 ohm	5%	1/3W	Car.	501 247 00
R330	12 kohm	5%	1/3W	Car.	501 412 00
R331	2.2 kohm	5%	1/3W	Car.	501 322 00
R335	150 ohm	5%	1/3W	Car.	501 215 00
R337	180 ohm	5%	1/3W	Car.	501 218 00
R343	220 kohm	5%	1/3W	Car.	501 522 00
R347	47 ohm	5%	1/3W	Car.	501 147 00
R349	100 kohm	5%	1/3W	Car.	501 510 00
403RN200	15x10 kohm				530 000 03
403 SK1					751 000 84
SK2					750 000 13
403T100					103 403 5X
T200					103 403 2X
T201					102 102 3X
T202					103 403 3X
T300					103 403 1X
403U1	MA 7805				850 780 50
U2	LM723N				850 072 30
U100	LM2901				850 290 10
U101	SN7406				850 740 60
U102	SN74LS00				850 740 02
U103,105	CA3046				850 304 60
U104	LM1496CN				850 149 60
U200	SN74LS11				850 741 11
U201	CD4049B				850 404 90

403U202	SN7426	850 742 60
U203	SN74LS28	850 742 80
U300	CD4520B	850 452 00
U301	CD4518B	850 451 80
U302	CD4073B	850 407 30
U303,306,310	74C164	857 416 40
U304	CD4046B	850 404 60
U305	CD4059A	850 405 90
U307	CD4007B	850 400 70
U308	LF356	850 035 60
U309	SN74LS00	850 740 02
U311	SN74LS163	857 416 31
U312	CD4029B	850 402 90
403X100	LSB Filter	385 112 03

PARTS LIST

FOR

450

Printed Circuit Board Complete 450						107 445 01
450C1	47 nF	10%	100V	Polyes.		623 447 00
C2,3	10 nF	10%	100V	Polyes.		623 410 00
C4,6	22 uF		15V	W.Alum.		651 722 00
C5	1 nF		25V	Cer.		602 310 00
C7,8	0.22 uF	10%	63V	Polyes		622 522 00
450Q1	BC 547B					840 054 70
450R1	39 kohm	5%	1/3W	Car.		501 439 00
R2	5.6 kohm	5%	1/3W	Car.		501 356 00
R3	2.2 kohm	5%	1/3W	Car.		501 322 00
R4	82 ohm	5%	1/3W	Car.		501 182 00
R5	150 ohm	5%	1/3W	Car.		501 215 00
R6	100 ohm	5%	1/3W	Car.		501 210 00
450S1	micro switch					764 000 05

PARTS LIST
FOR
Power Supply Module

Power Supply Module						107 400 00
C200,201	0.1 uF	10%	250 V	Polyes.		624 510 01
C202	1 uF	+/-10%	63V	Polyes.		622 610 01
C203,204	1 uF	10%	250 V	Polyes.		624 610 00
C205, 206	4700 uF		40V	W.Alum.		652 947 02
D200	BZY93C39					832 933 90
FS200,201	25 A					720 425 00
FS202,203, 205	3.15 A					720 331 50
FS204	630					720 263 00
R200	2.7 kohm	5%	6W	W.W.		527 327 01
RL200						780 000 05
SK200	12 Way					106 400 60
SK201	10 Way					106 400 50
SK203,204						750 000 10
TS200	3 Way					770 000 21

PARTS LIST

FOR

421

Printed Circuit Board Complete 421					107 442 11
421C1	220 uF		40V	W. Alum	652 822 01
C2	22 uF		15V	W. Alum	651 722 00
C3,4	1 uF	10%	250V	Polyes.	624 610 01
C5,8	1 uF	10%	100V	Polyes.	623 610 00
C6	1 nF	1%	500V	Polyst.	615 310 01
C7,11,20	10 nF	10%	100V	Polyes.	623 410 00
C9,10,12,13	0.1 uF	10%	250V	Polyes.	624 510 00
C14	750 pF	1%	500V	Polyst.	615 275 00
C15,21,22	2200 uF		40V	W. Alum.	652 922 00
C16	2.2 nF	1%	125V	Polyst.	613 322 00
C17	22 nF	10%	100V	Polyes.	623 422 00
C18	47 nF	10%	100V	Polyes.	623 447 00
C19	100 uF		25V	W. Alum.	652 810 00
C23,24,25	0.47 uF	10%	63V	Polyes.	622 547 00
C26	680 pF	1%	500V	Polyes.	615 268 00
C27	22 uF		16V	Tantal	651 722 01
C28	100 pF	1%	500V	Polyes.	615 210 00
421D1	BZX79C8V2				832 798 21
D2,3	IN4148				830 414 80
D4	A114D				830 011 41
D5	IS920				830 192 00
D6	BYW72				831 007 20
D7	VSK330				831 033 00
D8,12	TIL220				823 000 02
D9,10,11	BZX79C9V1	Zener			832 799 11
D13	MV5353				823 000 01
421L1	2 x 6.8 mH		RFI-Choke		740 368 00
L2,3,4,5	25 uH				740 125 00

PARTS LIST

FOR

421

421PL1	20 Way					756 020 02
421Q1	BC557B					840 055 70
Q2, 3, 5	BC547B					840 054 70
Q4	D44E3					842 440 30
Q6	BD135					842 013 51
421R1, 2	470 ohms	5%	1/2W	Car.		502 247 00
R3	47 kohm	5%	1/3W	Car.		501 447 00
R4, 8, 32, 39, 43, 44	1 kohm	5%	1/3W	Car.		501 310 00
R5	33 kohm	5%	1/3W	Car.		501 433 00
R6, 15	5.6 kohm	5%	1/3W	Car.		501 356 00
R7	820 ohm	5%	1/3W	Car.		501 282 00
R10	4.7 kohm	5%	1/3W	Car.		501 282 00
R9	15 kohm	5%	1/3W	Car.		501 415 00
R11	6.8 kohm	5%	1/3W	Car.		501 368 00
R12, 29	10 kohm	5%	1/3W	Car.		501 410 00
R13, 25, 38, 45	1 Mohm	5%	1/3W	Car.		501 610 00
R14, 47	330 ohm	5%	1/3W	Car.		501 233 00
R16	680 ohm	5%	1W	Car.		504 268 00
R17	33 ohm	5%	1/3W	Car.		501 133 00
R18	220 ohm	5%	1/3W	Car.		501 222 00
R19, 26, 27, 31	22 kohm	5%	1/3W	Car.		501 422 00
R20	1 kohm	Var.				582 310 00
R22,	100 ohm	5%	1W	Car.		504 210 00
R23	0.082ohm	5%	1W	WW.		523 000 80
R24	47 ohm	5%	1/3W	Car.		501 147 00
R57, 58	100 ohm	5%	1/3W	Car.		501 210 00

PARTS LIST

FOR

421

421R28,33	3.3 kohm	5%	1/3W	Car.	501 333 00
R30	22 ohm	5%	1/3W	Car.	501 122 00
R34,53	0.1 ohm	5%	1W	WW	523 001 00
R35	39 kohm	5%	1/3W	Car.	501 439 00
R37	470 ohm	5%	1/3W	Car.	501 247 00
R40	100 kohm	5%	1/3W	Car.	501 510 00
R41	3.3 ohm	5%	1/2W	Car.	502 033 00
R42	1.2 kohm	5%	1/3W	Car.	501 312 00
R46	33 ohm	5%	3W	WW	526 133 00
R48,52	27 kohm	5%	1/3W	Car.	501 427 00
R49	270 ohm	5%	1/3W	Car.	501 227 00
R50	100 ohm	Var.			583 210 00
R51	390 ohm	5%	1/3W	Car.	501 239 00
R54	82 ohm	5%	1/3W	Car.	501 182 00
R56	680 ohm	5%	1/3W	Car.	501 268 00
R55	820 ohm	5%	1/3W	Car.	501 282 00
421T1	Transformer				103 403 4X
421U1	NE555				850 055 50
U2	M7555				850 755 50
U3,5	CNY17				825 000 00
U4,7	LM2903				850 290 30
U6	LM723CN				850 072 30

PARTS LIST

FOR

422

Printed Circuit Board Complete 422

422C1	0.1 uF	10%	250V	Polyes.	624 510 00
C2,3	470 uF		40V	W.Alum.	652 847 00
C4	0.47uF	10%	63V	Polyes.	622 547 00
C6,8	0.22uF	10%	63V	Polyes.	622 522 00
C7,9	0.22u	5%	63V	Polyes.	622 522 02
C10	10 nF	10%	100V	Polyes.	623 410 00
C11	0.33uF	10%	63V	Polyes.	622 533 00
422D1,8,12,16,17 19,20,21,22	IN 4148				830 414 80
D2	BZX79C8V2		Zener		832 798 21
D3	MV 5353				823 000 01
D4,5,10	10D4				831 010 40
D6,13,18	BZX79C12				832 791 21
D7	TIL 220				823 000 02
D9,14	10D2				831 102 00
D11	BZX79C24				832 792 40
D15	TIL 234				823 000 03
D23	BZX79C22		Zener		832 792 20
422L1,2	100 uH			RF Choke	740 210 03
422PL1	40 Way				756 040 03
PL2	10 Way				751 000 90
422Q1	BC557B				840 055 70
Q2,4,8,14, 17,20	BC547B				840 054 70
422Q3,5	BD158				842 015 80

PARTS LIST

FOR

422

422Q6	BD204				842 020 40
Q7	BD645				842 064 50
Q9,10	BD234-10				842 023 40
Q11,21	BC327				840 032 70
Q12,18	BD646				842 064 60
Q15,16	BC337				840 033 70
422R1	47 kohm	5%	1W	Car.	504 447 00
R2	12 kohm	5%	1/3W	Car.	501 412 00
R3,18,38,41	2.2 kohm	5%	1/3W	Car.	501 322 00
R4	33 kohm	5%	1/3W	Car.	501 433 00
R5,8,10	56 kohm	5%	1W	Car.	504 456 00
R6	680 ohm	5%	1/3W	Car.	501 268 00
R7,11,21,33 35,44	10 kohm	5%	1/3W	Car.	501 410 00
R9	1.2 kohm	5%	1/3W	Car.	501 312 00
R12,28,32,50 51,36,45	6.8 kohm	5%	1/3W	Car.	501 368 00
R13	56 ohm	5%	1/3W	Car.	501 156 00
R14,15	22 ohm	5%	6W	WW	527 122 00
R16	1 ohm	5%	3W	WW	526 010 00
R17	470 ohm	5%	1/3W	Car.	501 247 00
R19	180 ohm	5%	1W	Car.	504 218 00
R20	560 ohm	5%	1/2W	Car.	502 256 00
R22,31	1.5 kohm	5%	1/3W	Car.	501 315 00
R23,26,29	4.7 kohm	5%	1/3W	Car.	501 347 00
R24	2.7 kohm	5%	1/3W	Car.	501 327 00
R25	10 ohm	5%	1/3W	Car.	501 110 00
R27	100 ohm	5%	1/3W	Car.	501 210 00
R30	1.2 kohm	5%	1/2W	Car.	502 312 00

PARTS LIST

FOR

422

442R34,48	2.2 kohm	5%	1/2 W	Car.	502 322 00
R37,46	3.3 kohm	5%	1/3W	Car.	501 333 00
R39,47	330 ohm	5%	1/3W	Car.	501 233 00
R40,42	82 kohm	5%	1/3W	Car.	501 482 00
R43	220 kohm	5%	1/3W	Car.	501 522 00
R49	22 kohm	5%	1/3W	Car.	501 422 00
442RL1,2					780 000 02
442S1					763 000 17
442U1	LM723CN				850 072 30
U2	78M15CT				850 781 51
U3	NE 555				850 055 50

PARTS LIST

FOR

423

Printed Circuit Board Complete 423					107 442 31
423C1	2.2 uF	10%	250 V	Polyes.	624 622 01
C2,3,4,5,6, 7.8	0.1 uF	10%	250 V	Polyes	624 510 00
423CON1+SK3+ SK4	40/20 Way				106 400 40
CON2 +SK5	26 Way				106 400 80
423D1, 2, 3	10D4				831 010 40
423PL1	25 Way				751 000 81
PL2	10 Way				751 000 93
PL3	10 Way				751 000 90
423SK1	3 Way				750 000 35
SK2					750 000 10
423TS1	4 Way				770 000 22

PARTS LIST

FOR

Automatic Antenna Coupler

Automatic Antenna Coupler					107 400 10
B300	Motor		15V DC		871 000 01
B301	Motor		15V DC		871 000 00
C300	300 pF	+/-10%	4kV	Cer.	608 230 02
C301	0.1 uF	-20/80%	16V	Cer.	601 510 00
F300	Fan		24V AC		872 000 06
L300	Coupling variometer				107 400 40
L301	Antenna variometer				107 400 50
ME300	70 ohm	1mA			382 151 71
R300	70 ohm	5%	50W	Metox	548 170 00
R301	3.3 Mohm	5%	1W	WW	523 633 00
S300	Automatic/Manual				762 000 00
S301	Micro Switch				764 000 06

PARTS LIST

FOR

433

Printed Circuit Board Complete 433					107 443 31
433C1	10 nF	10%	250V	Polyes.	623 410 01
C2	0.1 uF	10%	100V	Polyes.	623 510 01
433C100, 101, 102, 104 108, 112	0.22 uF	10%	63V	Polyes.	622 522 00
C103	22 uF		15V	Tan.	651 722 00
C105	2.2 nF	1%	125V	Polyst.	613 322 00
C106	100 uF		25V	W.Alum.	652 810 00
C107	10 nF	10%	250V	Polyes.	623 410 00
C109	0.1 uF	10%	100V	Polyes.	623 510 01
C110	470 pF	1%	500V	Polyst.	615 247 00
C111	0.47 uF	10%	63V	Polyes.	622 547 00
C113	2.2 uF		35V	Tan.	652 622 01
C200	5.1 pF	+/-0.25%	400V	Cer.	605 051 00
C201, 202, 209, 210, 212, 213, 214, 215, 216, 217	10 nF	10%	250V	Polyes.	623 410 00
C203, 206	1 nF	-20/+80%	25V	Cer.	602 310 00
C204	0.68 uF	10%	63V	Polyes.	622 568 00
C205	0.47 uF	10%	63V	Polyes.	622 547 00
C207, 208, 211, 218, 219, 220, 221, 222, 223	0.1 uF	10%	100V	Polyes.	623 510 01
433D100, 101, 102, 103, 104, 105, 106	1S920				830 192 00
D107	BZX79 C5V6	Zener			832 795 61
D108, 109, 113, 114, 115	1N4148				830 414 80
D110, 111, 112	10D1				831 100 10

PARTS LIST

FOR

433

433D200,201,202,205	1N4148				830 414 80
D203,204	AA143				830 014 30
D206,215,216,217, 218	1S920				830 192 01
D207,208,209,210 211,212,213,214 D219,220	BZX79C8V2	Zener			832 798 21
433L200	BZX79	Zener			832 795 60
	1 uH			HF-Choke	740 010 00
L201,202	150 uH			RF-Choke	740 215 00
L203,204,205,206	100 uH			RF-Choke	740 210 02
433PL1	6 Way				751 000 92
PL2	20 Way				756 020 02
PL3	26 Way				756 026 03
PL4	10 Way				751 000 93
433Q1	BC547B				840 054 70
Q100,107	BC547B				840 054 70
Q102,101	BD204				842 020 40
Q103,104	BC557B				840 055 70
Q105,106	BC327				840 032 70
Q200,201	2N5485				840 548 50
Q202,203,204,205	BC547B				840 054 70
433R1	2.2 kohm	5%	1/3W	Car.	501 322 00
R2	18 kohm	5%	1/3W	Car.	501 418 00
R3	27 kohm	5%	1/3W	Car.	501 427 00
R4	470 kohm	5%	1/3W	Car.	501 547 00
R5					

PARTS LIST

FOR

433

433R100, 113, 114, 118, 145	4.7 kohm	5%	1/3W	Car.	501 347 00
R101, 102, 112	1.5 kohm	5%	1/3W	Car.	501 315 00
R103, 150	150 ohm	5%	1/3W	Car.	501 215 00
R104, 116, 121	47 kohm	5%	1/3W	Car.	501 447 00
R105, 122, 152	100 kohm	5%	1/3W	Car.	501 510 00
R106, 107, 111	150 kohm	5%	1/3W	Car.	501 515 00
R108, 119	1 kohm	5%	1/3W	Car.	501 310 00
R109, 110, 120, 135, 136, 137, 138, 151	10 kohm	5%	1/3W	Car.	501 410 00
R151	22 kohm	5%	1/3W	Car.	501 422 00
R115, 123, 141, 143, 144	27 kohm	5%	1/3W	Car.	501 427 00
R117	1 Mohm	5%	1/3W	Car.	501 610 00
R124, 125, 126, 127 128	33 kohm	5%	1/3W	Car.	501 433 00
R129	560 kohm	5%	1/3W	Car.	501 556 00
R130, 132	220 ohm	5%	1/3W	Car.	501 222 00
R131	270 ohm	5%	2.5W	MF	546 227 00
R133	560 ohm	5%	1.6W	MF	544 256 00
R134, 139	390 ohm	5%	1/3W	Car.	501 239 00
R140, 142	6.8 kohm	5%	1/3W	Car.	501 368 00
R146	330 ohm	5%	1/3W	Car.	501 233 00
R147	1 ohm	5%	1/3W	Car.	502 010 00
R148, 149	470 ohm	5%	1/3W	Car.	501 247 00
R200	22 kohm	5%	2/3W	Car.	504 422 00
R201, 202	470 ohm	5%	1/3W	Car.	501 247 00

PARTS LIST

FOR

433

433R203	1.2 kohm	5%	1/3W	Car.	501 312 00
R204,211,212,213, 214,236,237,238, 239,240,241,242, 243	1 kohm	5%	1/3W	Car.	501 310 00
R205,206	240 ohm	1%	1/2W	MF	512 224 00
R207	150 kohm	5%	1/3W	Car.	501 515 00
R208,209,226 ,252,253	1 Mohm	5%	1/3W	Car.	501 610 00
R210,215,216,218, 244,245,248,249	100 kohm	5%	1/3W	Car.	501 510 00
R217	100 ohm	5%	1/3W	Car.	501 210 00
R219,228	15 kohm	5%	1/3W	Car.	501 415 00
R220,227,230,232, 234,235	4.7 kohm	5%	1/3W	Car.	501 347 00
R235	2,2 kohm	5%	1/3W	Car.	501 322 00
R221	33 kohm	5%	1/3W	Car.	501 433 00
R222,255	6.8 kohm	5%	1/3W	Car.	501 368 00
R223,224,250,251, 254	10 kohm	5%	1/3W	Car.	501 410 00
R225,231,233	27 kohm	5%	1/3W	Car.	501 427 00
R229	8.2 kohm	5%	1/3W	Car.	501 382 00
R246,247	220 kohm	5%	1/3W	Car.	501 522 00
433T200,201					103 404 51
U100,104,106,110, 111	4027 B				850 402 270
U101,107	4017 B				850 401 70
U102	LM78L15				850 781 50
U103,105,108,109	4001 B				850 400 10

PARTS LIST

FOR

433

433U112	4075 B	850 407 50
U113	NE555	850 055 50
U200	LM2901	850 290 10
U201	741	850 074 10
U202	LM348	850 034 80

PARTS LIST

FOR

434

Printed Circuit Board Complete 434						107 443 41
434C1,2,13	360 pF	5%	500V	Mica		645 236 00
C3,5,8,9,10,14,16	200 pF	5%	500V	Glass		645 220 00
C4,15	180 pF	5%	500V	Glass		645 218 00
C6,7,11	390 pF	5%	500V	Mica		645 239 00
C12	220 pF	5%	500V	Glass		645 222 00
C17	110 pF	5%	500V	Mica		645 211 00
C18	220 pF	5%	500V	Mica		645 222 01
C19	240 pF	5%	500V	Glass		645 224 00
C20	240 pF	5%	500V	Mica		645 224 00
C21,22,23,26	47 nF	10%	250V	Polyes.		624 447 01
C24,25	0.22 uF	10%	250V	Polyes.		624 522 01
434L1,4						103 406 9X
L2						103 404 8X
L3						103 404 7X
L5						103 405 5X
L6						103 404 9X
434R1,5	150 ohm	5%	1/3W	Car.		501 215 00
R2,3,4	150 ohm	5%	5W	Metox		547 215 00
434RL1,2	1 Change over		15.6V	Coil		780 000 26
434T1,2						103 405 8X

PARTS LIST

FOR

435

Printed Circuit Board Complete	435					107 443 51
435C1,2	0.1 uF	10%	250V	Polyes.		624 510 00
C3,4,5,6,13,14,15,16, 17,18	0.1 uF	10%	100V	Polyes.		623 510 00
C7,8,11,12	10 nF	10%	250V	Polyes.		623 410 00
C9,10	0.47 uF	10%	63V	Polyes.		622 547 00
435D1	1S920					830 192 00
D2,3	TIL 220					823 000 02
435L1	25 uH	10%		RF-Choke		740 125 00
L2	22 uH	10%		RF-Choke		740 122 00
435Q1,3,5,7	BD 645					842 064 50
Q2,4,6,8	BD 646					842 064 60
435R1,2	3.3 kohm	5%	1/3W	Car.		501 333 00
R3,4,5,6,17,18,19,20	100 ohm	5%	1/3W	Car.		501 210 00
R7,8,9,10,13,14,15,16	10 kohm	5%	1/3W	Car.		501 410 00
R11,12	10 kohm	5%	1/2W	Car.		502 110 00
435RL1	1 Change over		15.6V	Coil		780 000 26
435S1	Micro Switch					765 000 06
435SK1	BNC					750 000 32
SK2	20 Way					106 400 70
435T1						103 403 6X

PARTS LIST

FOR

436

Printed Circuit Board Complete 436						107 443 61
436C1	1.0 uF	10%	63V	Polyes.		622 610 00
C2	10 nF	10%	100V	Polyes.		623 410 00
436D1	AA143					830 014 30
D2	1S920					830 192 00
436R1,2,3,4	3.3 Mohm	5%	1W	WW		623 633 00
R5	47 ohm	5%	2W	Car.		505 147 00
R6	8.2 kohm	5%	1/3W	Car.		501 382 00
R7,8	820 ohm	5%	1/3W	Car.		501 282 00
436T1						103 404 61

PARTS LIST

FOR

Power Amplifier Module 200 W

Power Amplifier Module 200 W			107 400 20
F500	24 V AC	50/60 Hz	872 000 06
PL8-445			373 407 91
PL500+SK500	12 Way		106 900 40
SK501	10 Way		106 401 51
SK503, 508	8 Way		106 400 20
SK505, 506	1 Way		106 900 10

PARTS LIST
FOR
Power Amplifier 400 W

Power Amplifier 400 W						107 400 20
F400	24 V AC	50/60 Hz				872 000 06
PL400+SK400+ SK408	12 Way					106 900 00
PS8-442						373 407 91
R400	70 ohm	10%	50 W	Metox		548 170 60
SK401,402	10 Way					106 401 51
SK403,408	8 Way					106 400 20
SK404,407	1 Way					106 900 30
SK405,406						106 900 10

PARTS LIST

FOR

441

Printed Circuit Board Complete 441

441 C1, 6, 63, 65 66, 68	47 nF	10%	250 V	Polyes.	624 447 01
C2, 3, 4, 5	22 uF	20%	16V	Tan.	651 722 01
C7, 8, 11, 12, 13, 14, 15, 16, 17, 18, 20, 21, 22, 23, 24, 28, 29, 31, 32, 43, 46,34	0.1 uF	10%	100 V	Polyes.	623 510 01
C10, 26, 27	0.22 uF	10%	63 V	Polyes.	622 522 02
C19, 33	2.2 uF	20%	35 V	Tan.	652 622 01
C25, 47	220 uF	-10/+50%	10V	W. Alum.	651 822 00
C30, 35, 36, 38 48, 49, 50, 51, 55, 56, 57, 58	0.1 uF	10%	100 V	Polyes.	623 510 00
C37, 38, 39, 40, 41, 42	2400 pF	5%	500 V	Mica	645 324 00
C44, 45	0.47 uF	10%	63 V	Polyes.	622 547 00
C52, 62	15 pF	±0.25 pF	400 V	Cer.	605 115 01
C53	470 pF	1%	300 V	Mica.	644 247 00
C54	0.22 uF	10%	100 V	Polyes.	623 522 00
C59	470 uF	-10/+50%	40 V	W.Alum.	652 847 00
C60	22 uF	20%	6.3 V	W.Alum.	650 722 00
C61, 67	47 nF	-20/+80%	16V	Cer.	601 447 00
C64	56 pF	5%	500 V	Mica	645 156 00

PARTS LIST

FOR

441

441 D1	BZX79-C13	Zener			832 791 31
D2,	BZX79-C5V6	Zener			832 795 61
D3, 5	IN4148				830 414 80
D4	BZX79-B9V1	Zener			832 799 10
D6	BZX79.B5V1	Zener			832 795 11
D7	IN 5401				831 540 10
441 L1, 3	100 uH	10%		RF Choke	740 210 00
L2	100 uH	10%		RF Choke	740 210 03
L4, 7	4.7 uH	10%		RF Choke	740 047 00
L5, 6, 8, 9	Wide-Band			RF Choke	740 000 00
L10	5 uH	20%		RF Choke	740 050 00
441 P1, 2	1 Way				750 000 33
PL3	8 Way				751 000 98
PL 4, 5, 6	2 Way				750 000 29
441 Q1	BFW 17A				840 001 70
Q2, 3, 7	BD 175				842 017 50
Q4, 8	BD 645				842 064 50
Q5, 6	SD 1220-9	(a matched pair)			842 122 00
Q9, 10	CD 4578 X	(a matched pair)			842 457 80
Q11	BC 547 B				840 054 70
441 R1, 5, 31, 32	22 ohm	5%	1/3W	Car.	501 122 00
R2, 3, 4, 7	56 ohm	5%	1/3W	Car.	501 156 00
R6	150 ohm	5%	1/3W	Car.	501 215 00
R8, 26	820 ohm	5%	1/3W	Car.	501 282 00
R9	6.8 kohm	5%	1/3W	Car.	501 368 00
R10	150 kohm	5%	1/3W	Car.	501 515 00
R12, 24	18 ohm	5%	1/3W	Car.	501 118 00

PARTS LIST

FOR

441

441 R13	47 ohm	20%	Var.		582 147 00
R14, 15	4.87 kohm	1%	1/3W	MF	511 348 70
R16	250 ohm	20%	Var.		582 225 00
R17	332 ohm	1%	1/3W	MF	511 233 20
R18	150 ohm	5%	2,5W	Metox	546 215 00
R19	2.74 kohm	1%	1/3W	MF	511 327 40
R20	12.1 kohm	1%	1/3W	MF	511 412 10
R21	24 ohm	5%	1/3W	Car.	501 124 00
R22	110 ohm	5%	1/3W	Car.	501 211 00
R23	7.15 kohm	1%	1/3W	MF	511 371 50
R 25	820 ohm	5%	1/2W	Car.	502 282 00
R27, 38	20 ohm	20%	Var.		582 120 00
R28	6.8 ohm	5%	1/3W	Car.	501 068 00
R29, 30	560 ohm	5%	1/2W	Car.	502 256 00
R33	330 ohm	5%	1/3W	Car.	501 233 00
R34,35	22 ohm	5%	2.5W	Metox.	546 122 01
R36	1.2 kohm	5%	1/3W	Car.	501 312 00
R37, 46	1 kohm	5%	1/3W	Car.	501 310 00
R39, 40, 41, 42	12 ohm	5%	2,5W	Metox.	546 112 00
	or 18 ohm	5%	2,5W	Metox.	546 118 01
	or 27 ohm	5%	2,5W	Metox.	546 127 01
R43	33 ohm	5%	1/3W	Car.	501 133 00
R44, 45	15 ohm	5%	1/2W	Car.	502 115 00
R47	470 kohm	5%	1/3W	Car.	501 547 00
R48	4.7 kohm	5%	1/3W	Car.	501 347 00
441 SK 4, 5, 6				Jumper	750 000 31
441 T1, 2				Transformer	103 406 52
T3				Transformer	103 406 62

PARTS LIST

FOR

442

Printed Circuit Board Complete 442

442C1,2	0.1 uF	10%	63V	Polyes	622 510 00
C3,4	0.47 uF	10%	63V	Polyes.	622 547 01
C5,6,7,10,13	0.22 uF	10%	63V	Polyes.	622 522 01
C8,9,16	10 nF	10%	63V	Polyes	622 410 01
C11	220 uF		10V	W.Alum.	651 822 01
C14	22 uF		15V	W.Alum.	651 722 00
C15	2.2 uF		25V	W.Alum.	652 622 00
442D1,2,5,6,8	10D05				831 100 51
D3,4	BZX79C4VF	Zener			832 794 70
D7	BZX79C15	Zener			832 791 50
442L1,2	100 uH	10%	RF Choke		740 210 03
442PL1,2	10 Way				751 000 93
PL3	8 Way				751 001 06
PL4,5	1 Way				750 000 36
PL6,7	2 Way				751 001 03
442Q1,2,3,4,5,6	TIP 36B				842 003 60
Q7,8	BC547B				840 054 70
Q9,10,11,12	BD203				842 020 30
Q13	BD175				842 017 50
Q14,15	BC557B				840 055 70
442R1,4	150 ohm	5%	1/3W	Car.	501 215 00
R2,3,6,7	5.6 kohm	5%	1/3W	Car.	501 356 00
R5,8	33 ohm	5%	3W	WW	526 133 00

PARTS LIST

FOR

442

442R9,10	12 ohm	5%	25W	WW	528 112 01
R11,14	270 ohm	5%	1/3W	Car.	501 227 00
R12,13	1 kohm	5%	1/3W	Car.	501 312 00
R15,16,37	390 ohm	5%	1/3W	Car.	501 239 00
R17,18	180 ohm	5%	1/3W	Car.	501 218 00
R19,24	0.39 ohm	5%	1W	WW	523 003 90
R20,21,22	3.3 kohm	5%	1/3W	Car.	501 333 00
R23,R40					
R25,26	680 ohm	5%	1/3W	Car.	501 268 00
R27,28	47 ohm	5%	1/3W	Car.	501 147 00
R29,34,43	10 kohm	5%	1/3W	Car.	501 410 00
R30,33	250 ohm	Var.			583 225 00
R31,32	1.5 kohm	5%	1/3W	Car.	501 315 00
R35,54,55 56,57,58	820 ohm	5%	1/3W	Car.	501 282 00
R36	68 ohm	5%	1/3W	Car.	501 168 00
R38	1.8 kohm	5%	1/3W	Car.	501 318 00
R39	6.8 kohm	5%	1/3W	Car.	501 368 00
R41,45	22 kohm	5%	1/3W	Car.	501 422 00
R42	2.7 kohm	5%	1/3W	Car.	501 327 00
R44,48	47 kohm	5%	1/3W	Car.	501 447 00
R46,47	470 ohm	5%	1/3W	Car.	501 247 00
R49	56 ohm	5%	1/3W	Car.	501 156 00
R51,52	51 ohm	5%	1/3W	Car.	501 151 00
R53	100 ohm	5%	1/3W	Car.	501 210 00

PARTS LIST

FOR

442

442T1		Transformer	103 405 6X
T2		Transformer	103 405 7X
442U1	7805		850 780 50
U2,3,4	723		850 072 30
U5	2240		850 224 00

PARTS LIST

FOR

445

Printed Circuit Board Complete 445						107 444 51
445C1	0.1 uF	10%	63V	Polyes		622 510 00
C3	0.47 uF	10%	63V	Polyes		622 547 01
C5,7,13	0.22 uF	10%	63V	Polyes		622 522 01
C8,16	10 nF	10%	63V	Polyes.		622 410 01
C11	220 uF		10V	W.Alum.		651 822 01
C14	22 uF		15V	W.Alum.		651 722 00
C15	2.2 uF		25V	W.Alum.		652 622 00
C19,20,21,22	4.7 nF	10%	250V	Polyes.		624 447 00
445 D1,5,8	10D05					831 100 51
D3	BZX79C4V7	Zener				832 794 70
D7	BZX79C15	Zener				832 791 50
445L1	100 uH		RF Choke			740 210 03
445PL5	1Way					750 000 35
PL7	2Way					751 001 03
445Q1,2,3	TIP36B					842 003 60
Q7	BC547B					840 054 70
Q9,11	BD203					842 020 30
Q13	BD175					842 017 50
Q14,15	BC557B					840 055 70
445R1	150 ohm	5%				
R2,6	5.6 kohm	5%	1/3W	Car.		501 356 00
R5	33 ohm	5%	3W	WW		526 133 00

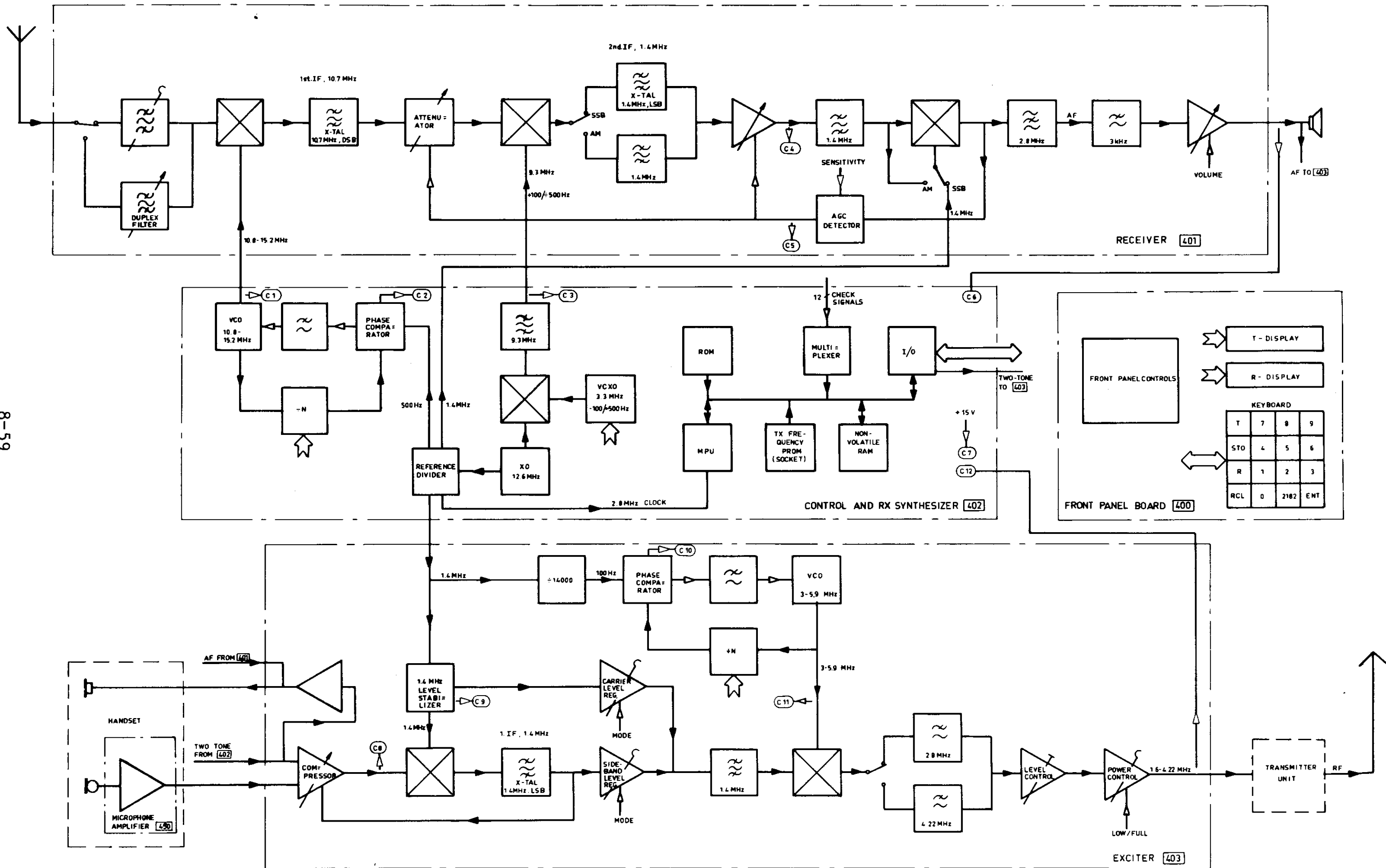
993 444 51

PARTS LIST

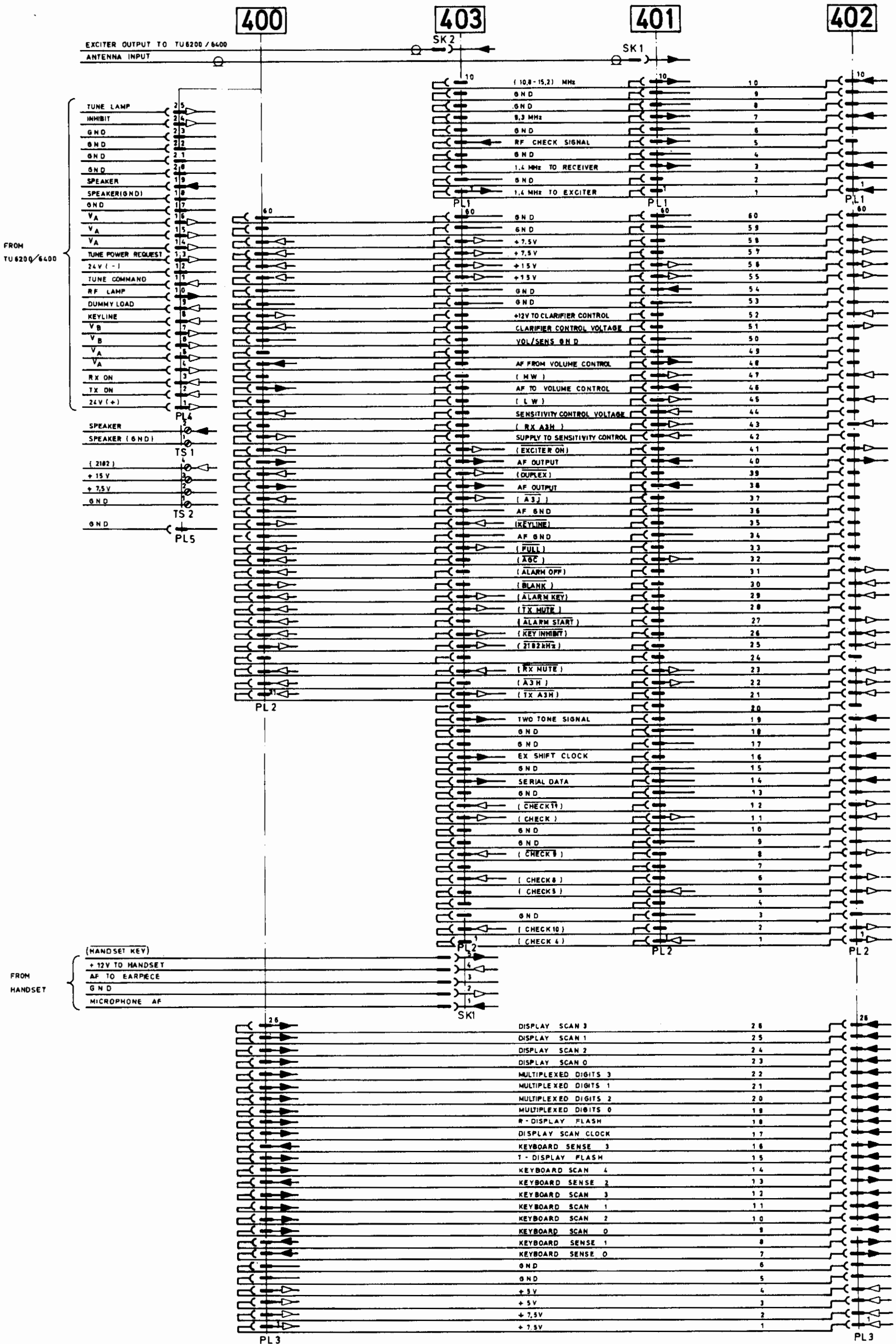
FOR

445

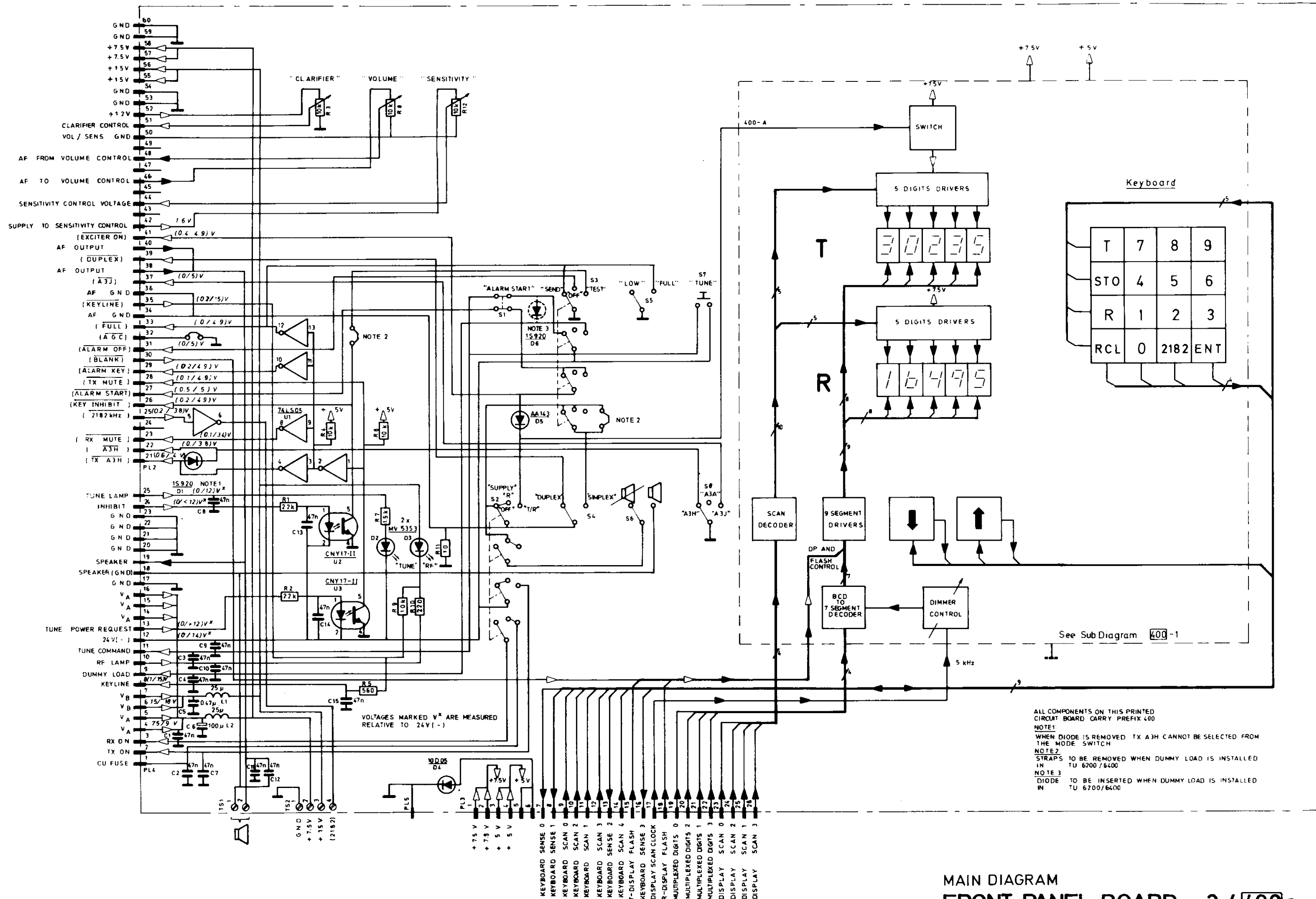
445R9	12 ohm	5%	25W	WW	528 112 01
R11	270 ohm	5%	1/3W	Car.	501 227 00
R12	1 kohm	5%	1/3W	Car.	501 312 00
R15,37	390 ohm	5%	1/3W	Car.	501 239 00
R17	180 ohm	5%	1/3W	Car.	501 218 00
R19	0.39ohm	5%	1W	WW	523 003 90
R20,21,40	3.3 kohm	5%	1/3W	Car.	501 333 00
R25	680 ohm	5%	1/3W	Car.	501 268 00
R27	47 ohm	5%	1/3W	Car.	501 147 00
R29,43	10 kohm	5%	1/3W	Car.	501 410 00
R30	250 ohm		3/4W		583 225 00
R31	1.5 kohm	5%	1/3W	Car.	501 315 00
R35,54,55,56,57 58	820 ohm	5%	1/3W	Car.	501 282 00
R36	68 ohm	5%	1/3W	Car.	501 168 00
R38	1.8 kohm	5%	1/3W	Car.	501 318 00
R39	6.8 kohm	5%	1/3W	Car.	501 368 00
R41,R45	22 kohm	5%	1/3W	Car.	501 422 00
R42	2.7 kohm	5%	1/3W	Car.	501 327 00
R44,48	47 kohm	5%	1/3W	Car.	501 447 00
R46,47	470 ohm	5%	1/3W	Car.	501 247 00
R49	56 ohm	5%	1/3W	Car.	501 155 00
R51,52	51 ohm	5%	1/3W	Car.	501 151 00
R53	100 ohm	5%	1/3W	Car.	501 210 00
445RL1			RF Choke		780 000 25
445T3			Transformer		103 406 5X



BLOCK DIAGRAM, CONTROL UNIT CU6000

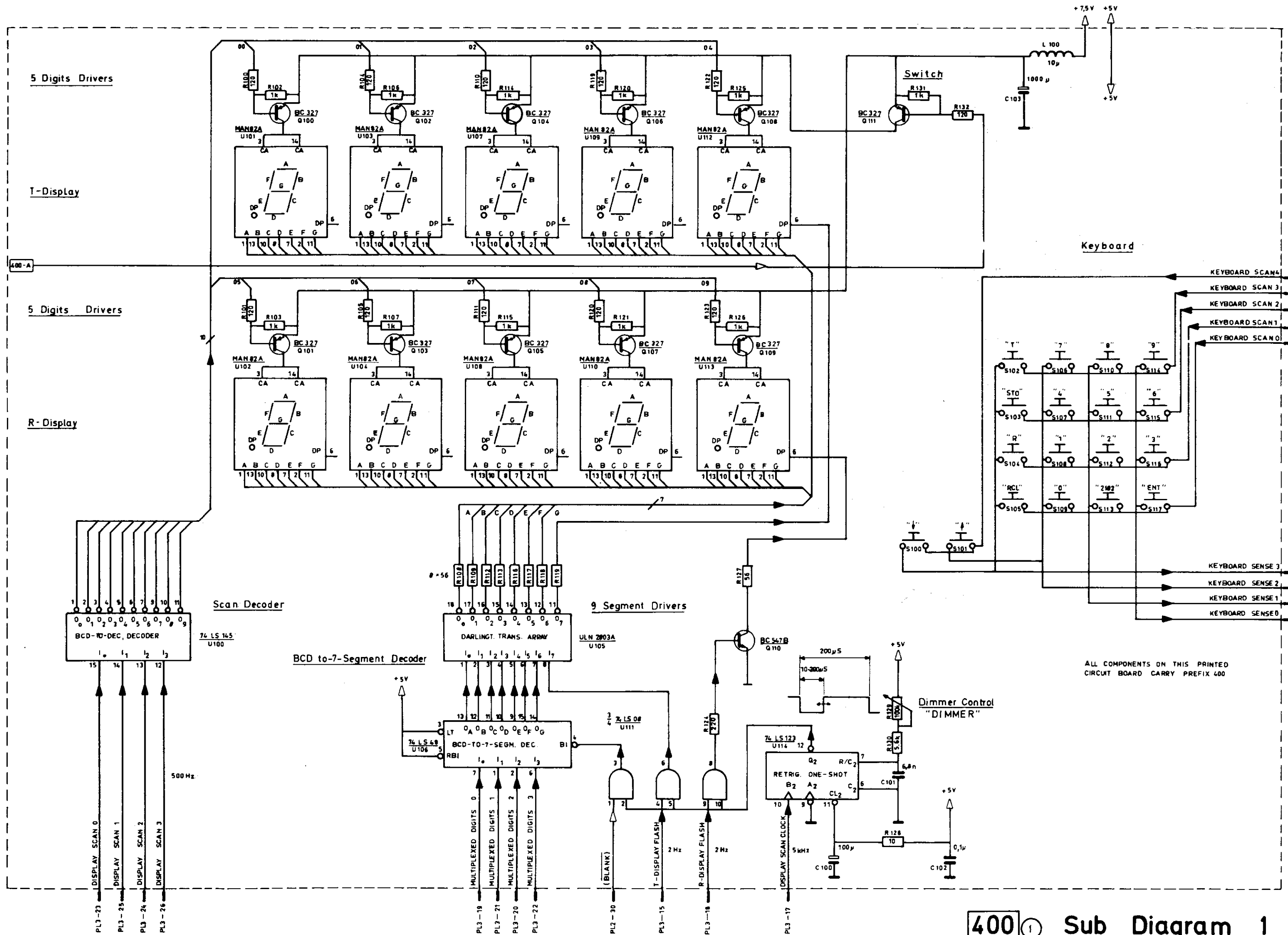


WIRING DIAGRAM, CONTROL UNIT CU 6000



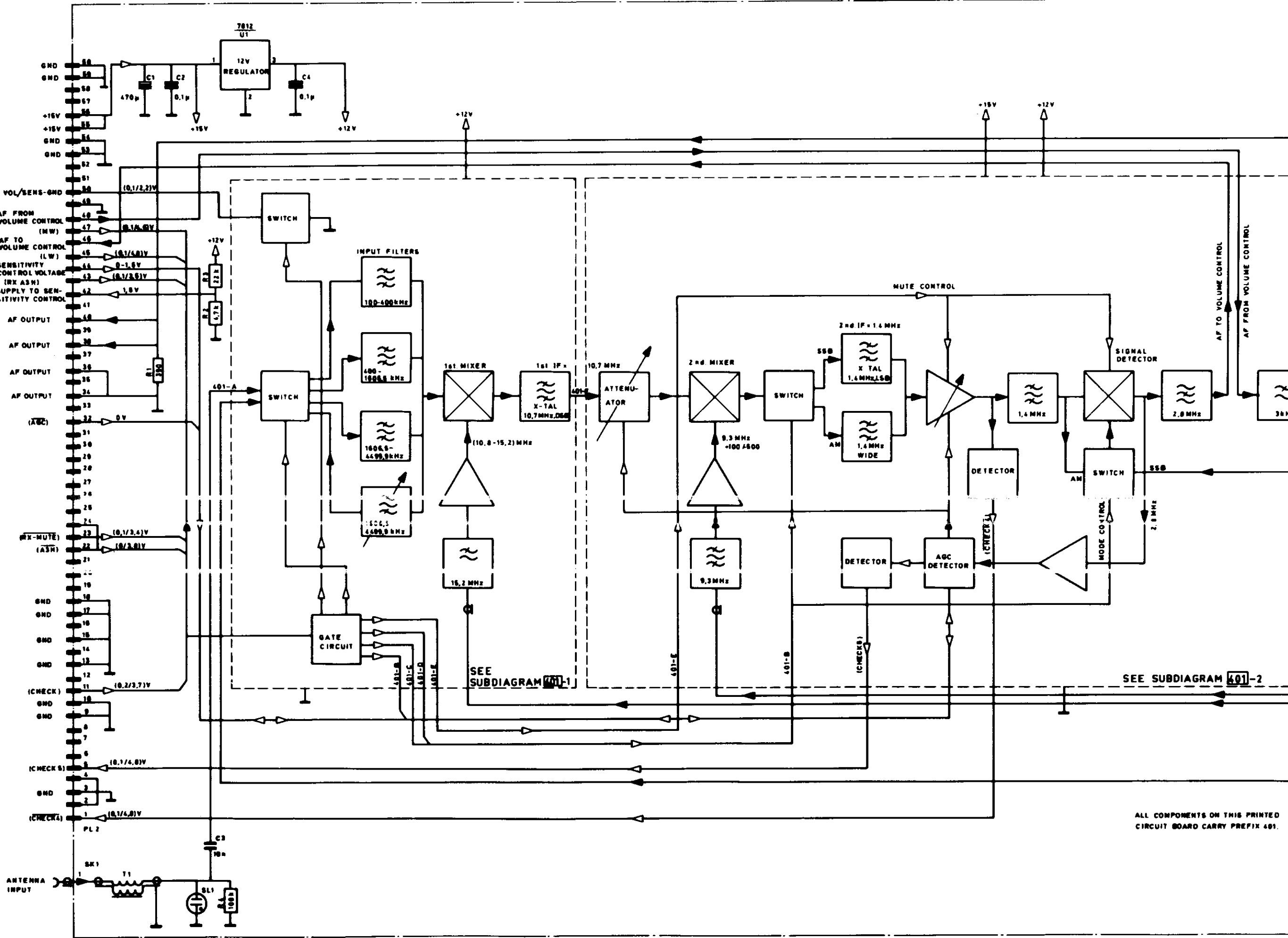
MAIN DIAGRAM
 FRONT PANEL BOARD 993 4400 1A

8-65



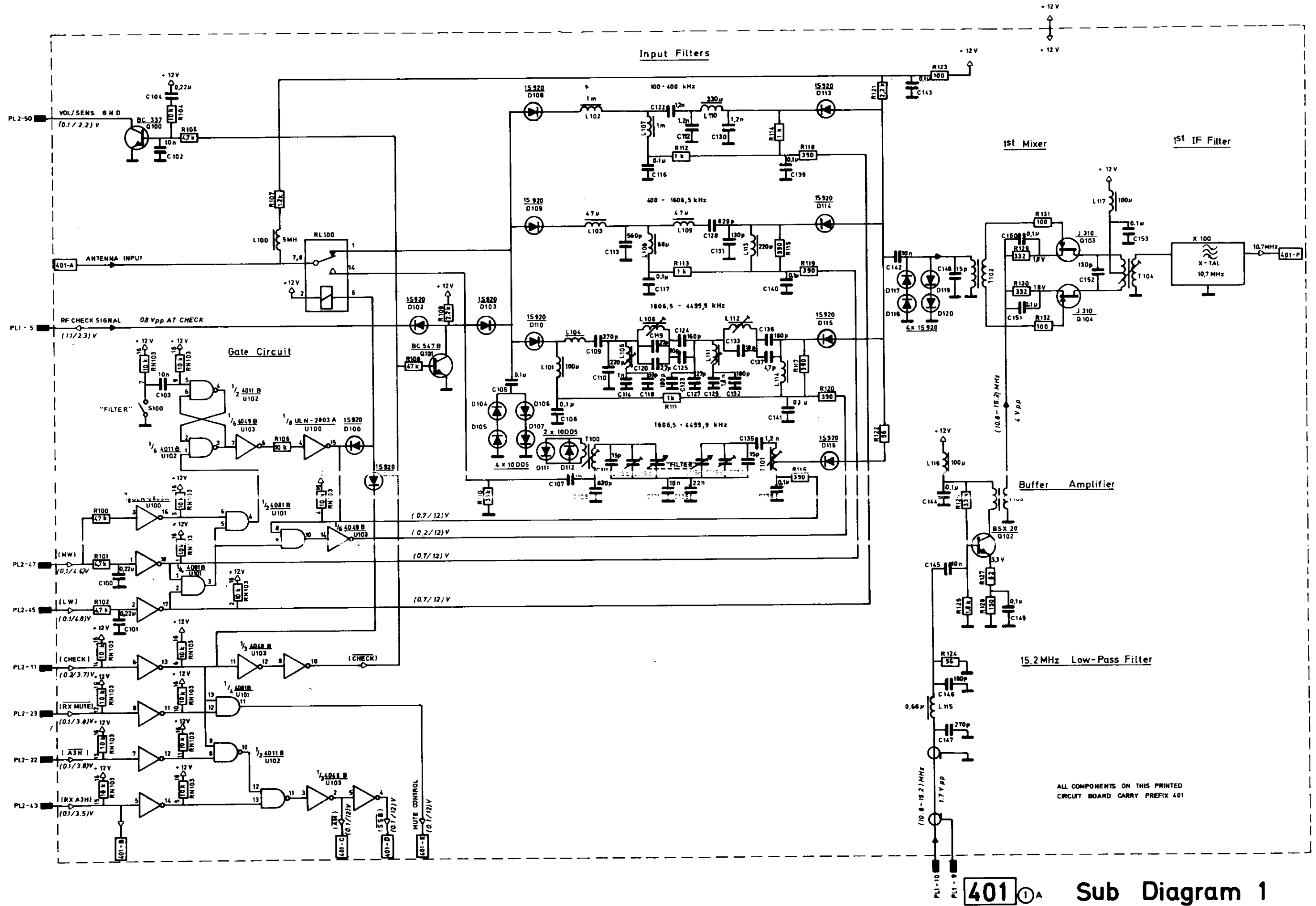
400 Sub Diagram 1

8-67



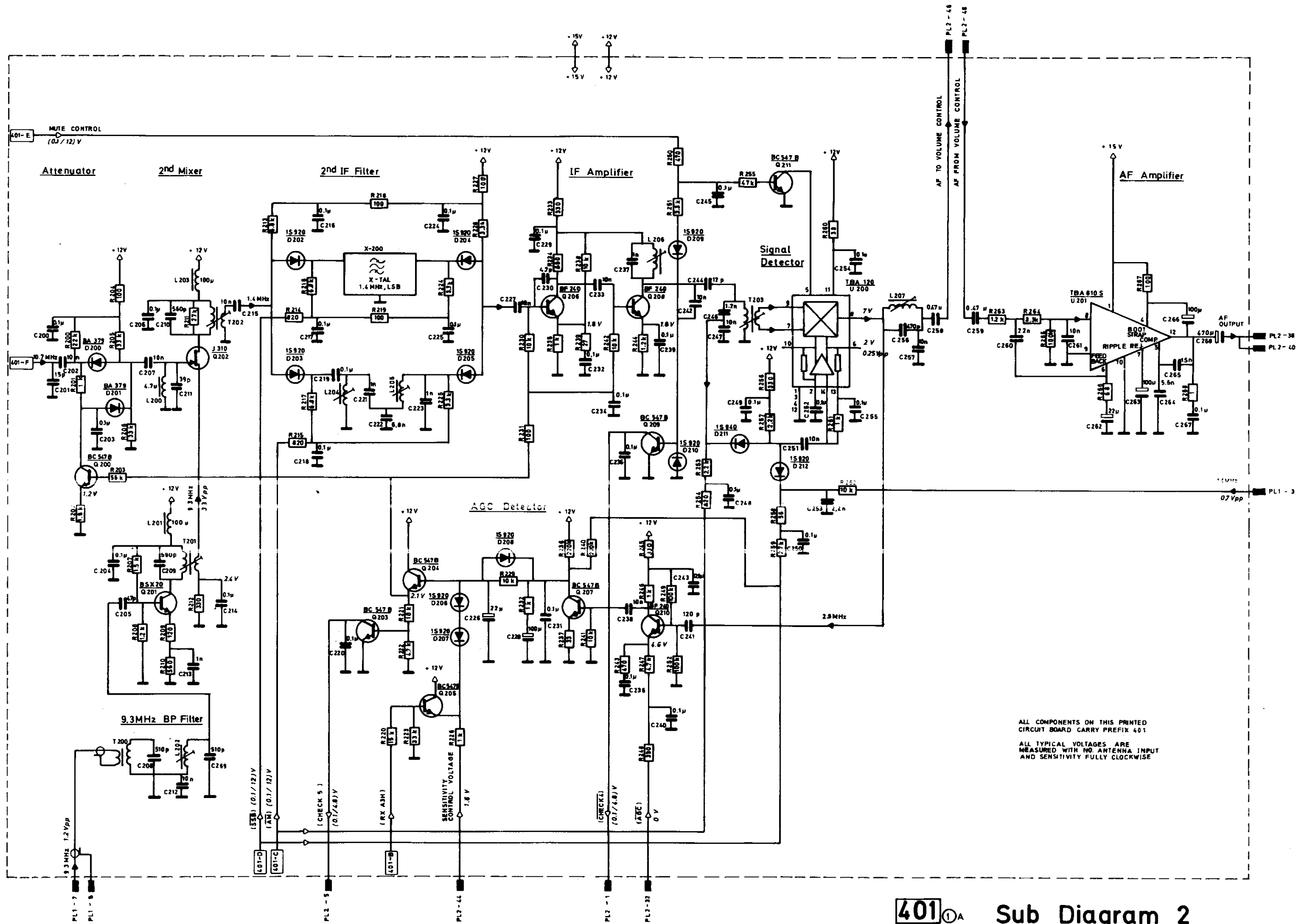
ALL COMPONENTS ON THIS PRINTED CIRCUIT BOARD CARRY PREFIX 491.

8-69



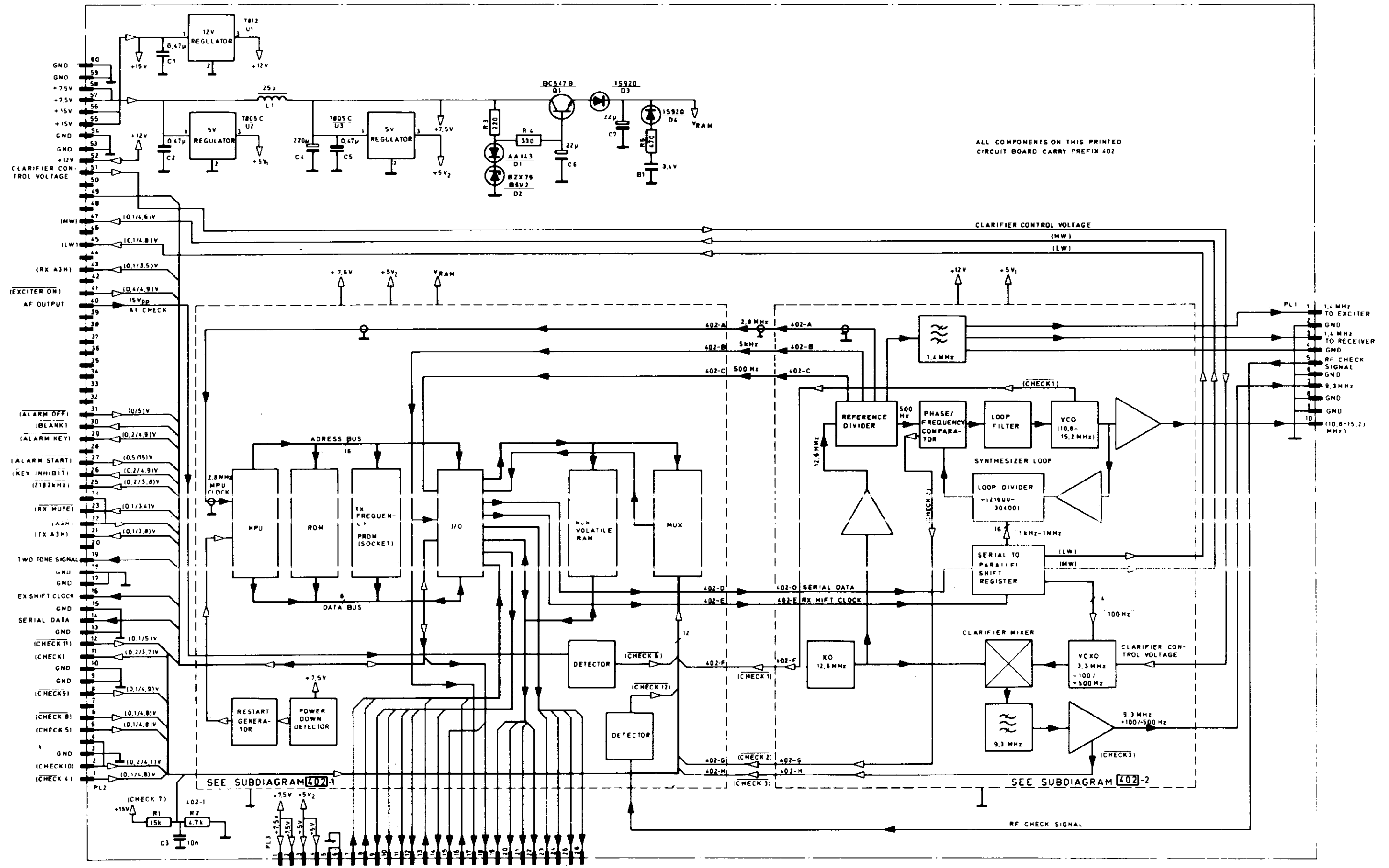
401 Sub Diagram 1

8-71



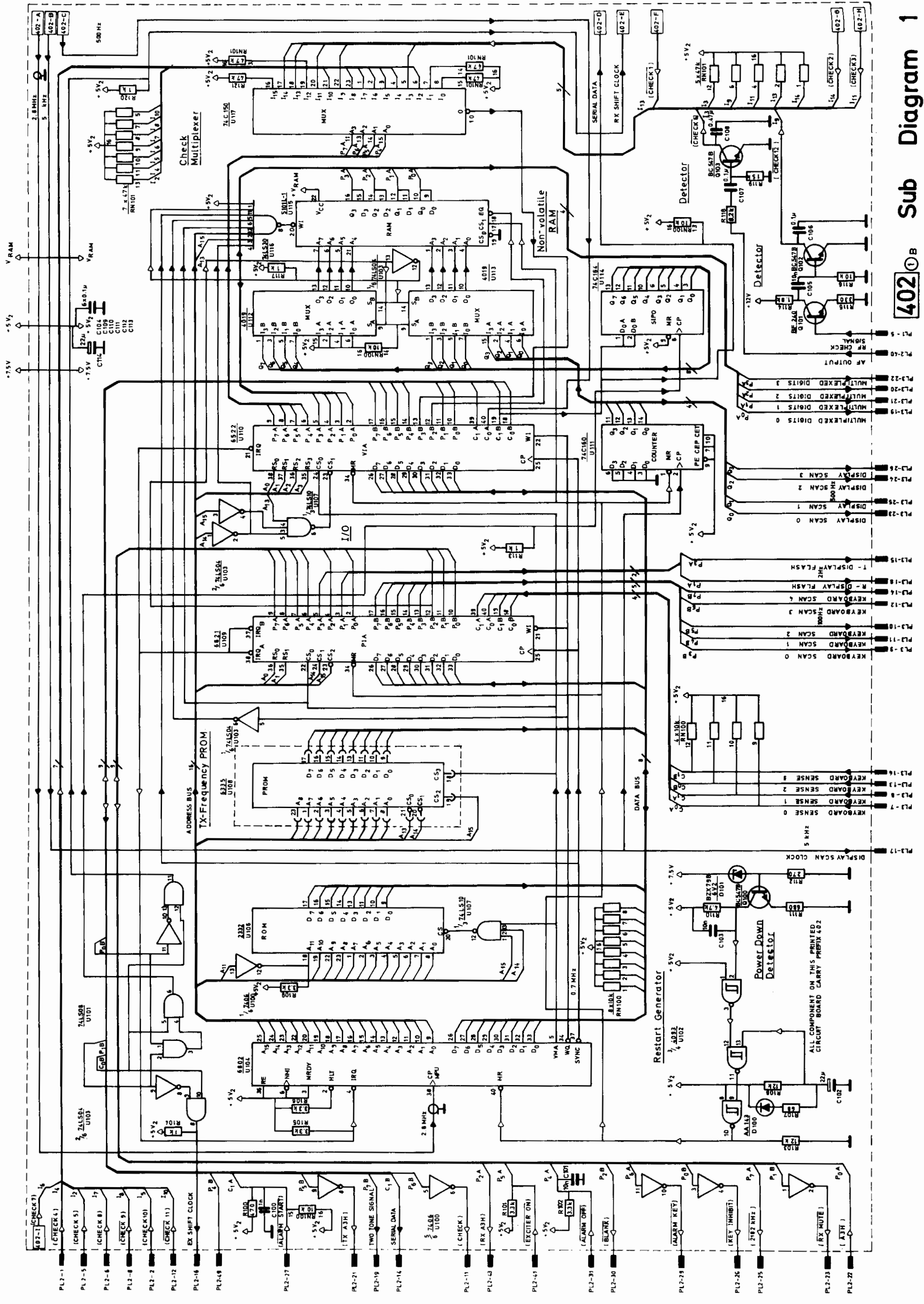
401 Sub Diagram 2

8-73



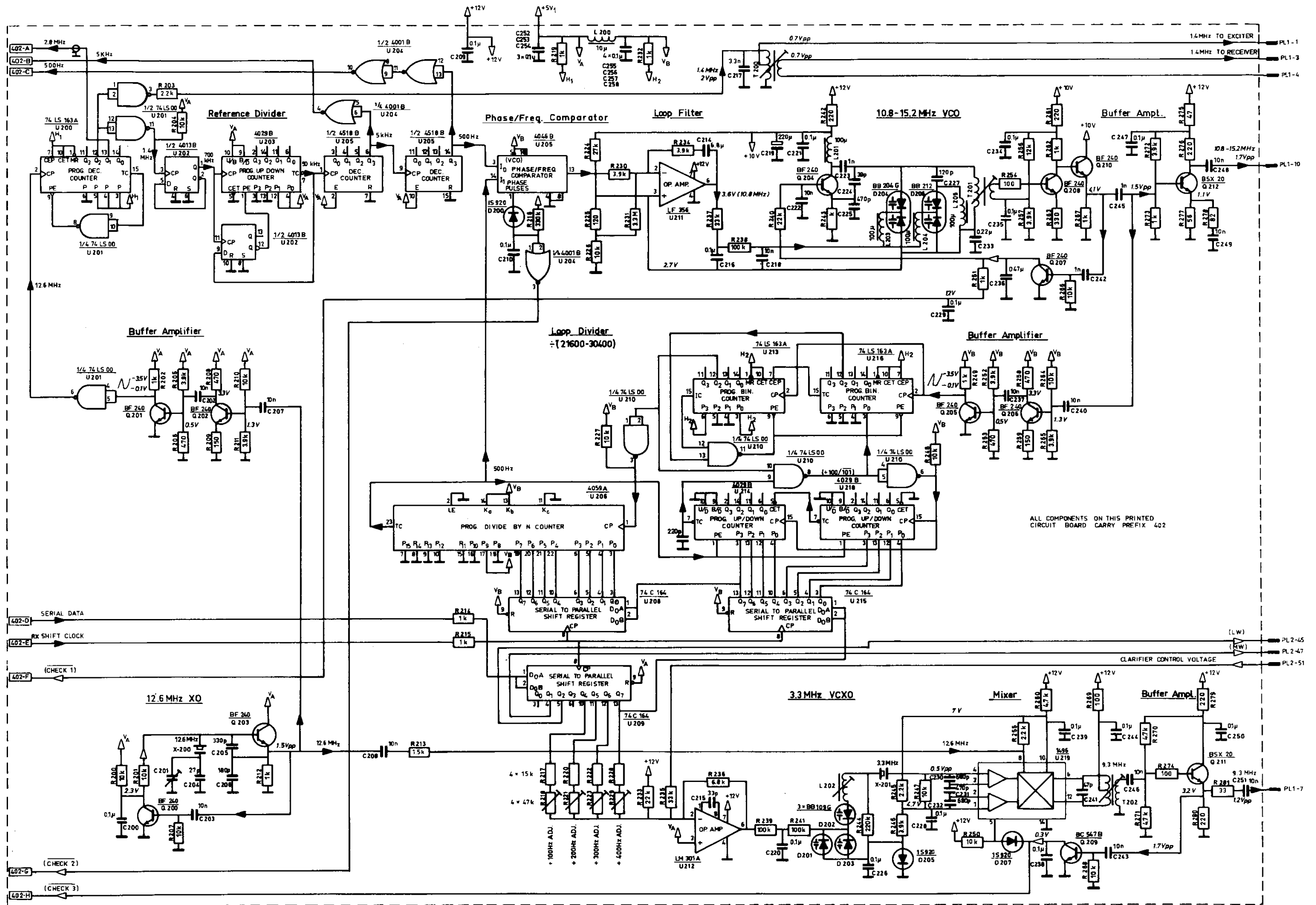
- KEYBOARD SENSE 0
- KEYBOARD SENSE 1
- KEYBOARD SCAN 0
- KEYBOARD SCAN 1
- KEYBOARD SCAN 2
- KEYBOARD SCAN 3
- KEYBOARD SENSE 2
- KEYBOARD SCAN 4
- T-DISPLAY FLASH
- KEYBOARD SENSE 3
- DISPLAY SCAN CLOCK
- R-DISPLAY FLASH
- MULTIPLYED DIGITS 0
- MULTIPLYED DIGITS 1
- MULTIPLYED DIGITS 2
- MULTIPLYED DIGITS 3
- DISPLAY SCAN 0
- DISPLAY SCAN 1
- DISPLAY SCAN 2
- DISPLAY SCAN 3

MAIN DIAGRAM
CONTROL AND RX SYNTHESIZER 993 402 ① A



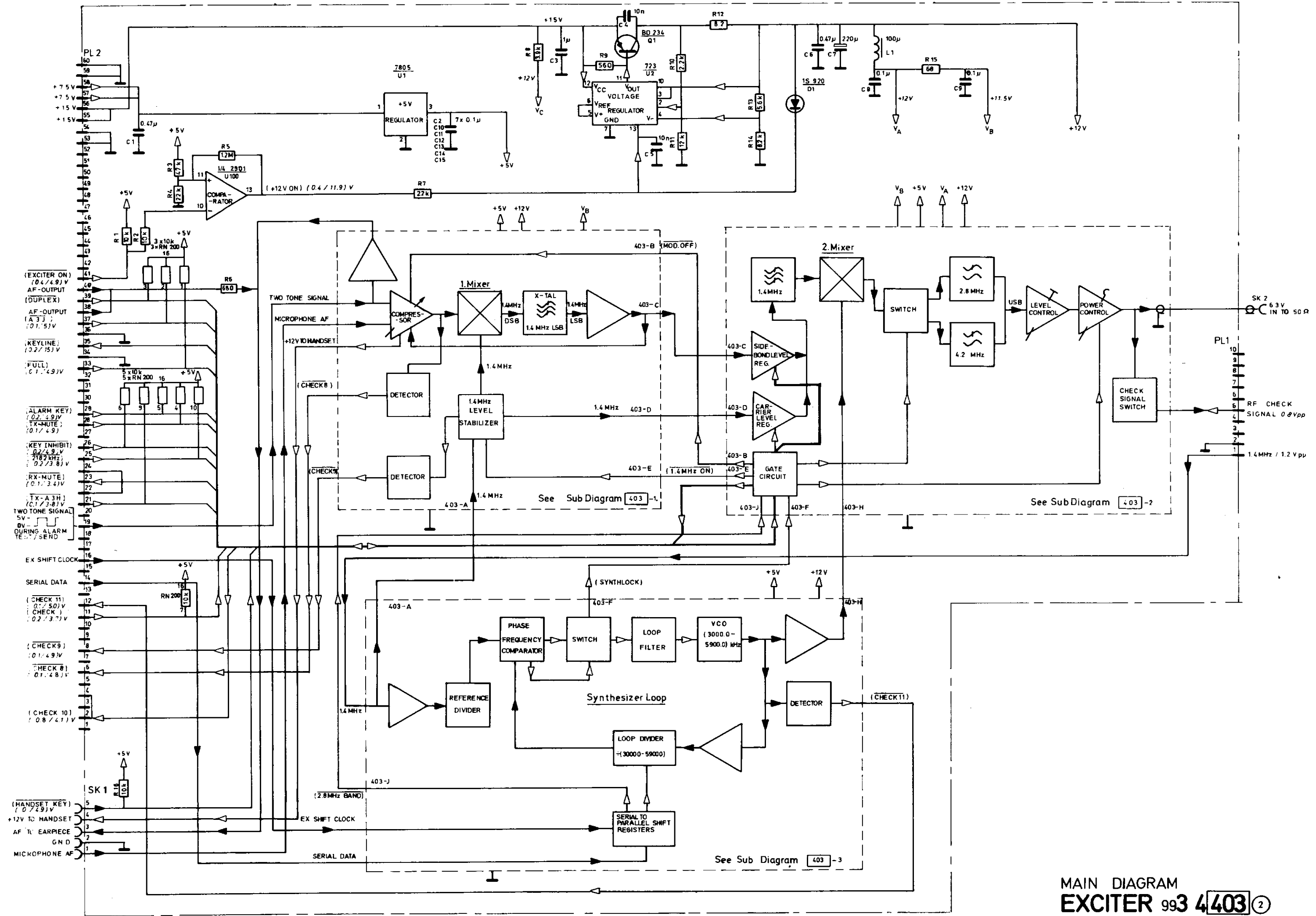
402-1B Sub Diagram 1

8-77



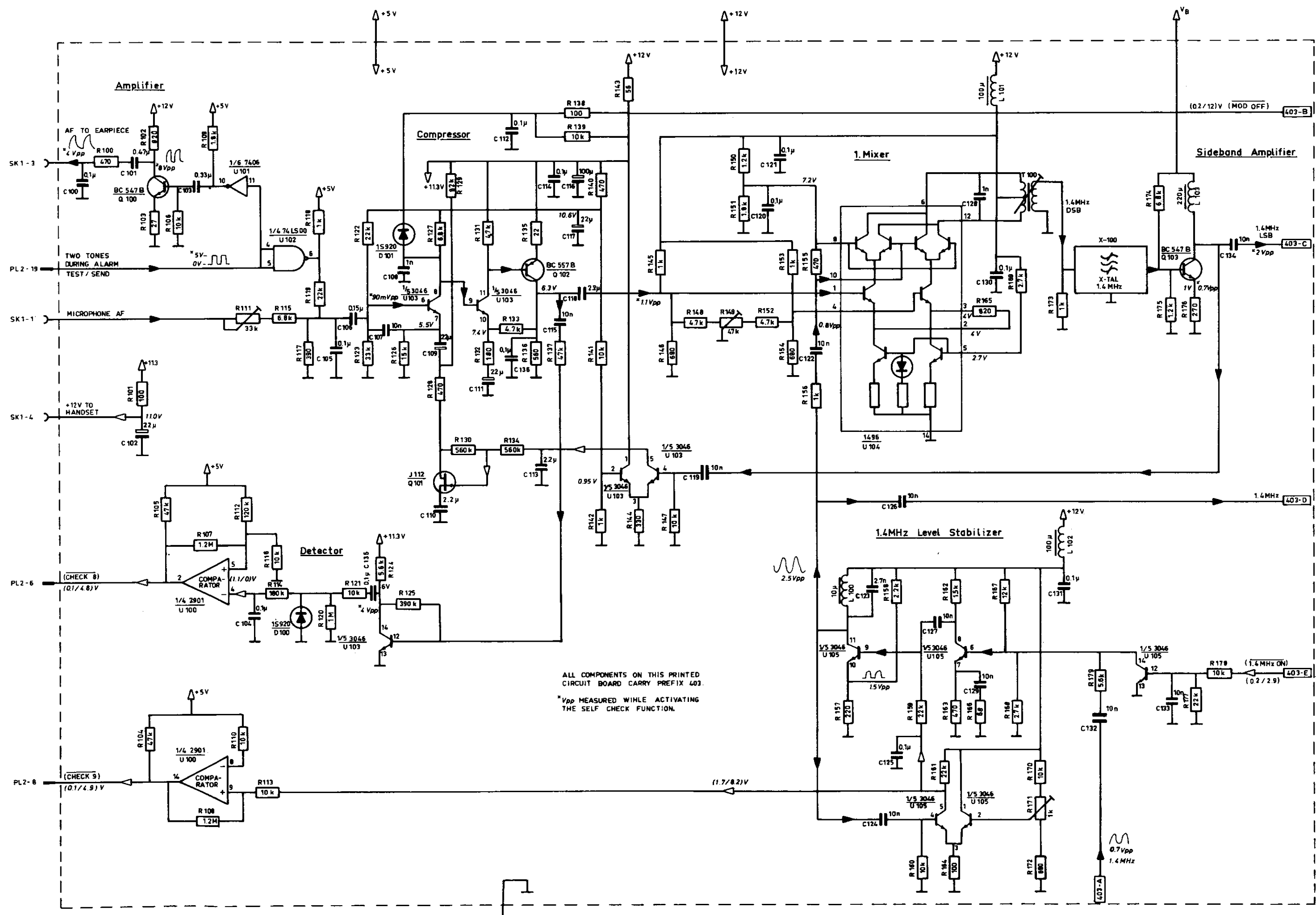
402 ① A Sub Diagram 2

8-79



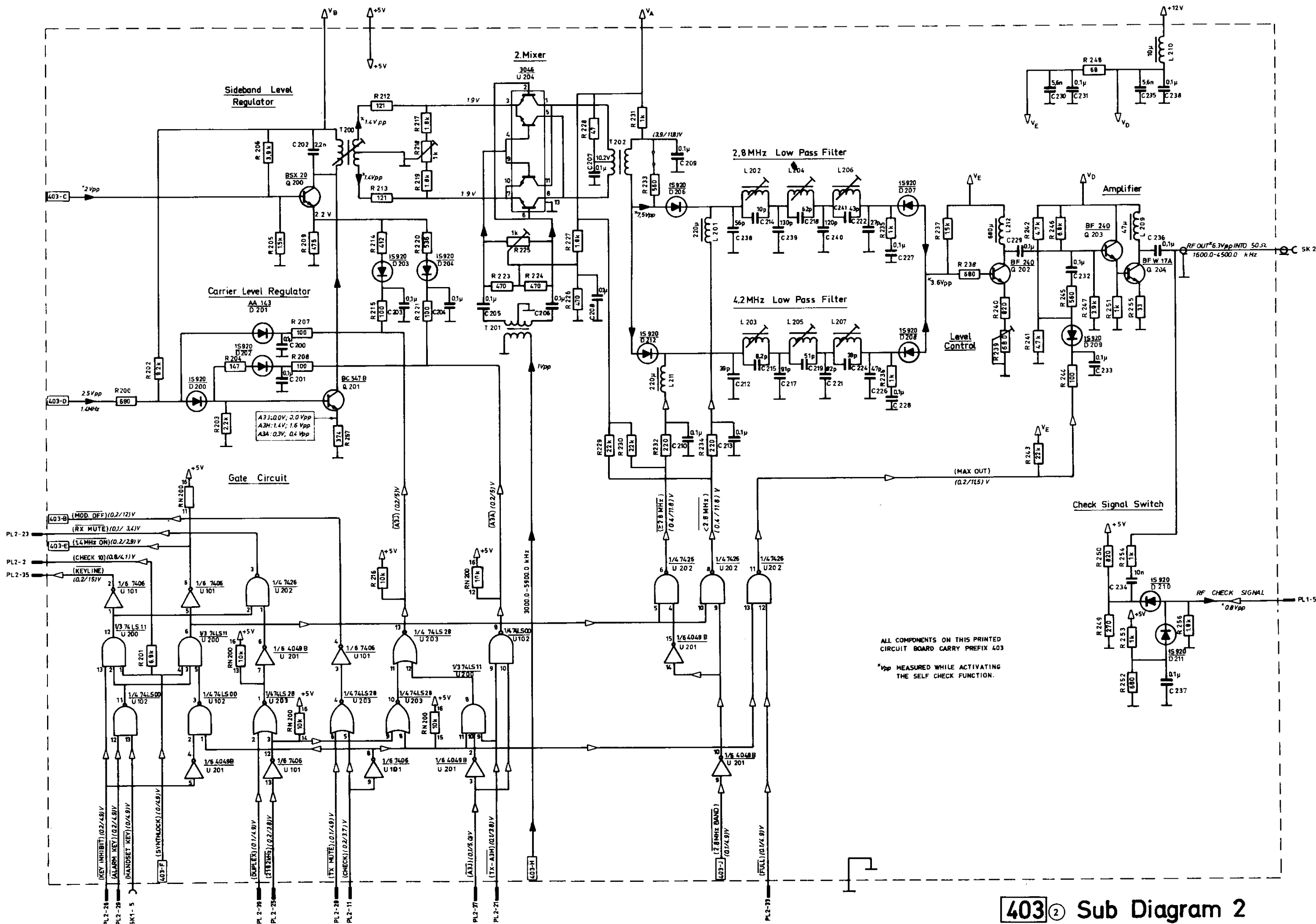
MAIN DIAGRAM
EXCITER 993 4403 ②

18-8



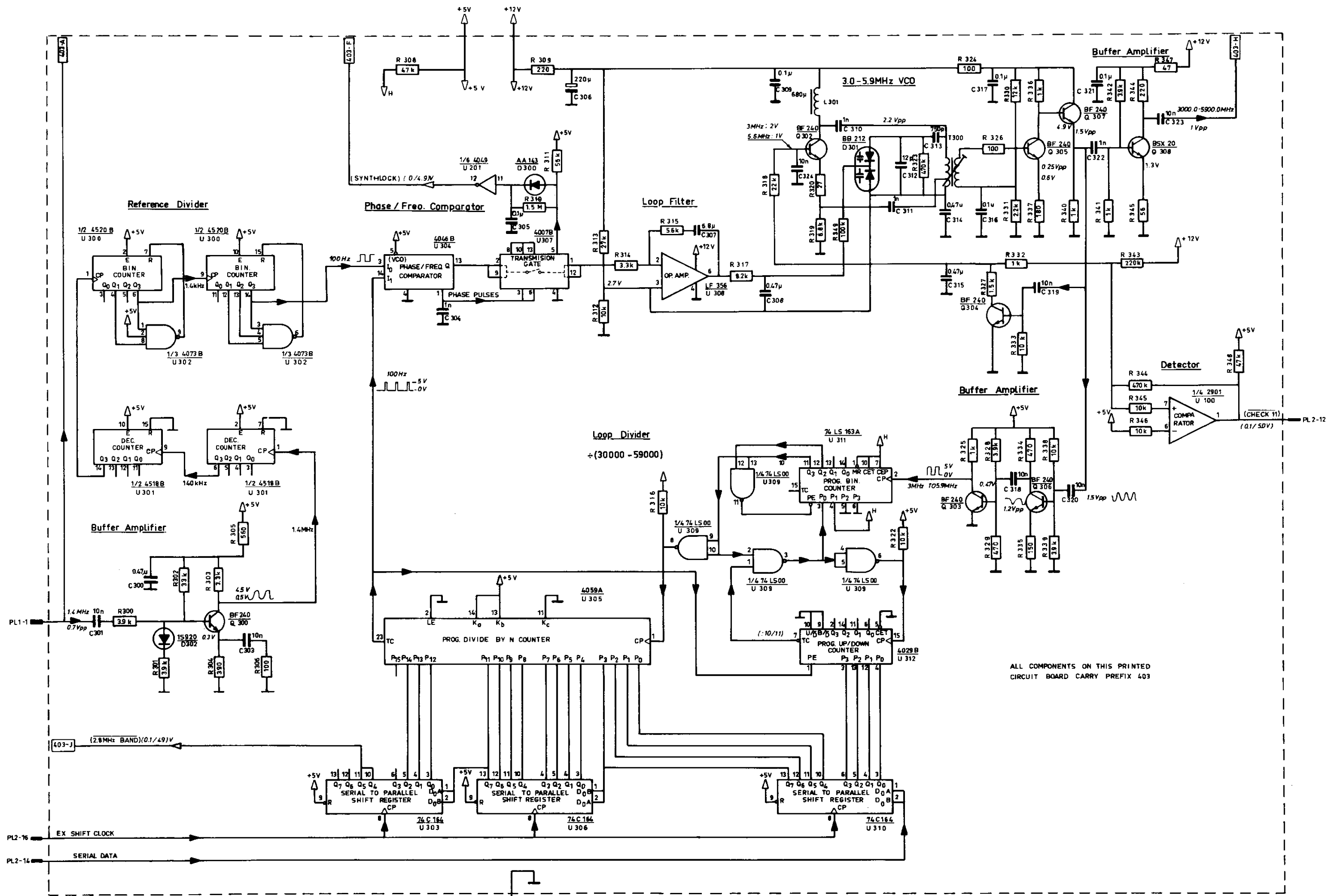
403 ② Sub Diagram 1

8-83



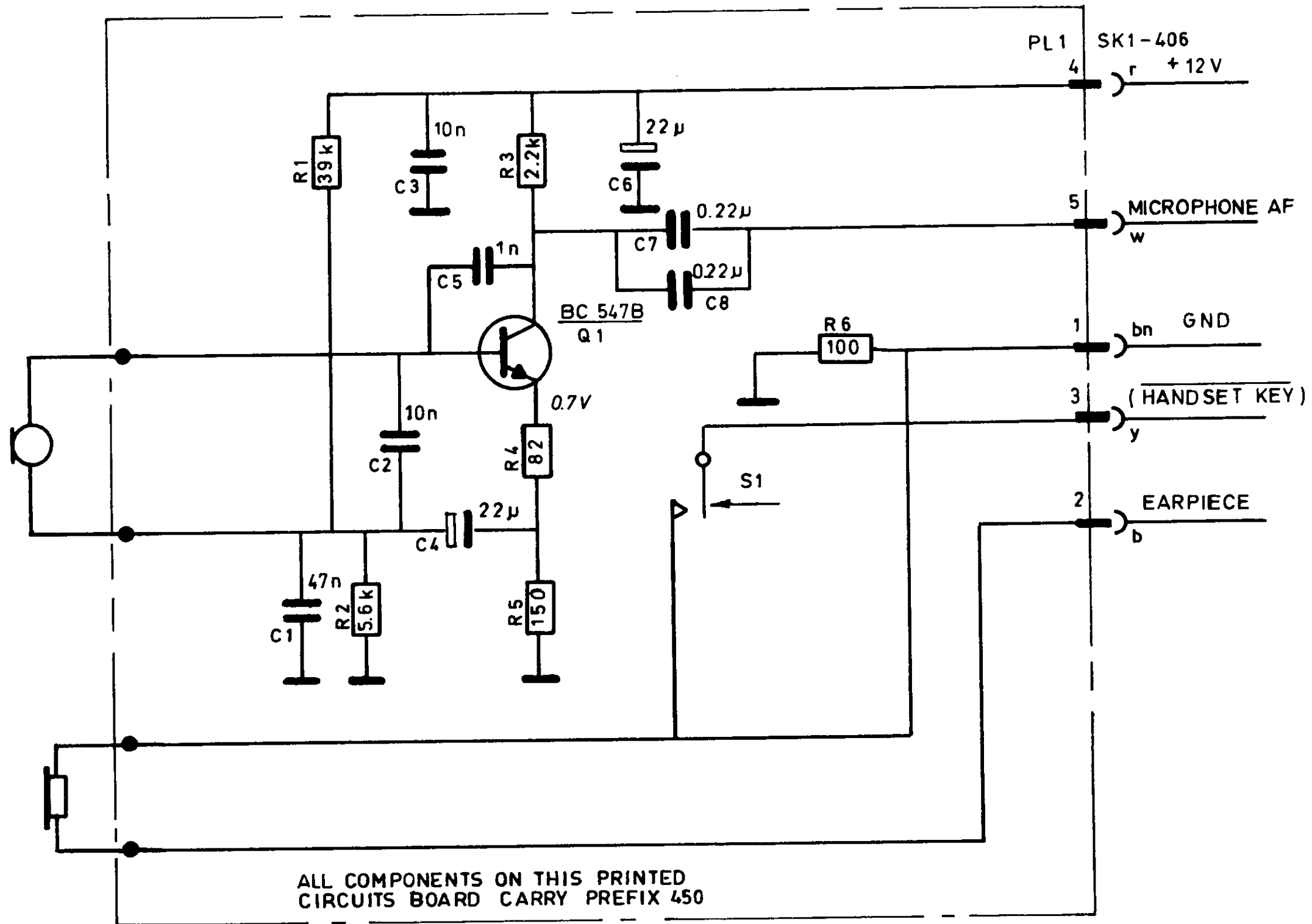
403 Sub Diagram 2

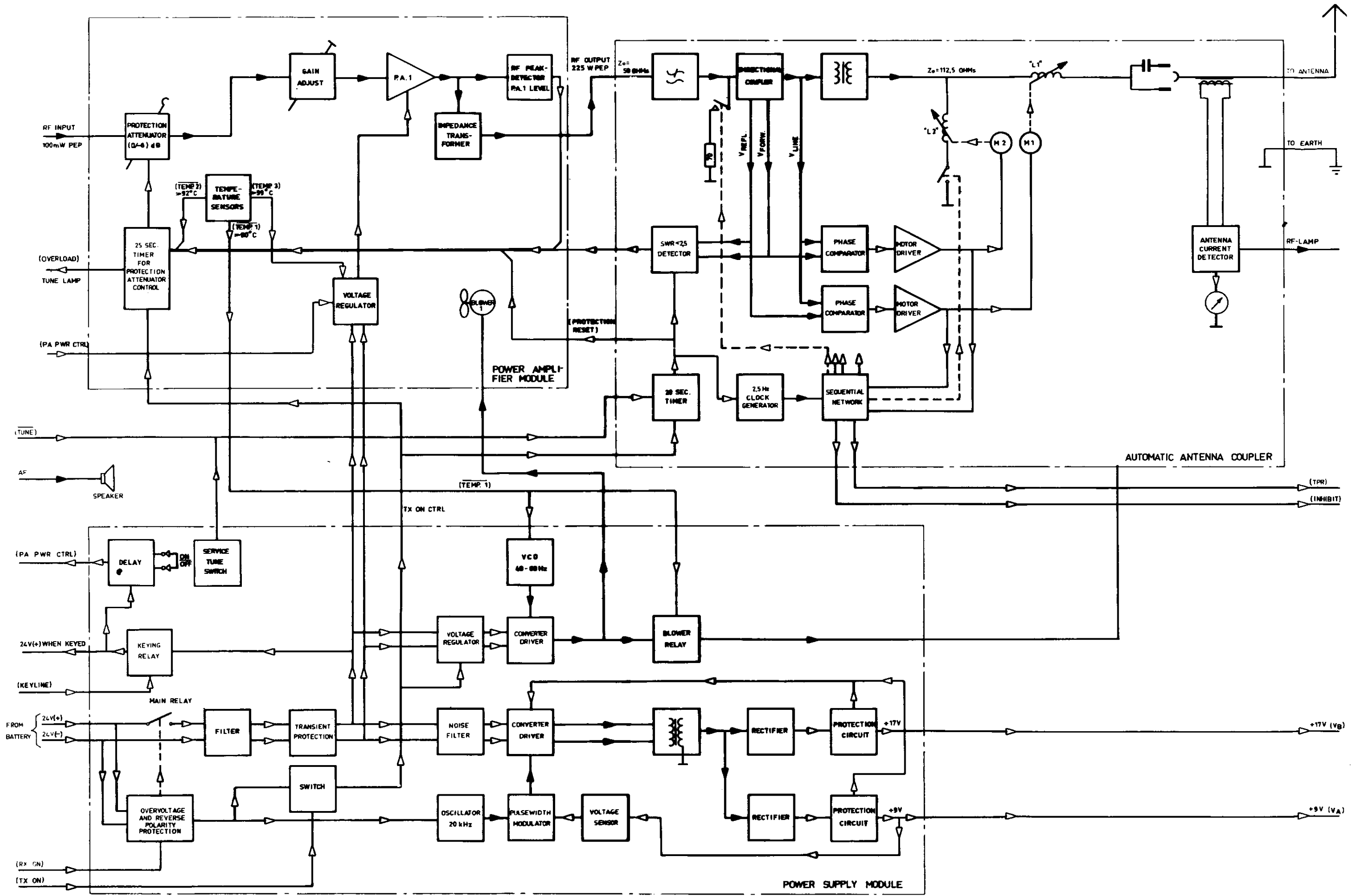
8-85



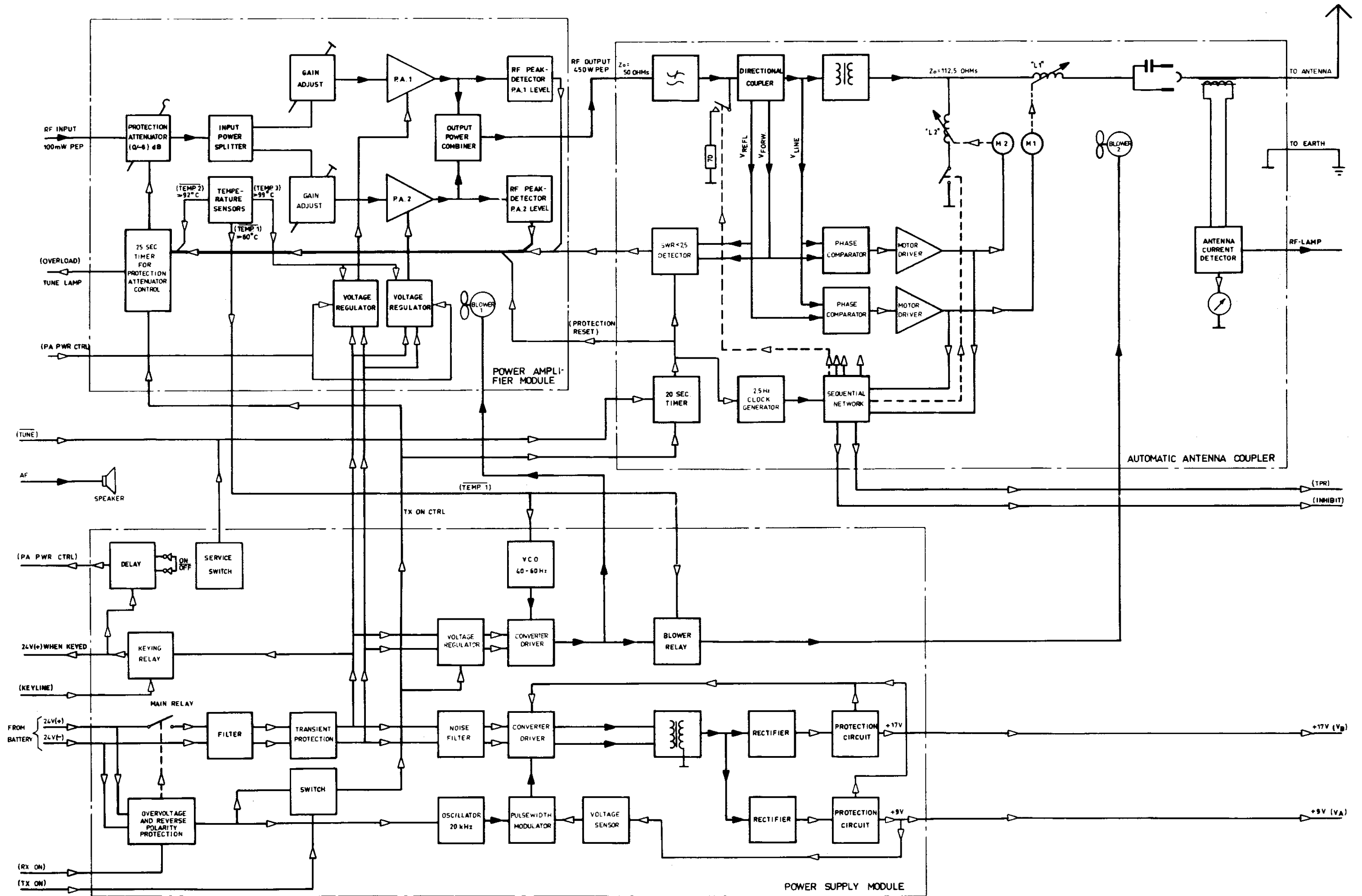
403 Sub Diagram 3

8-87

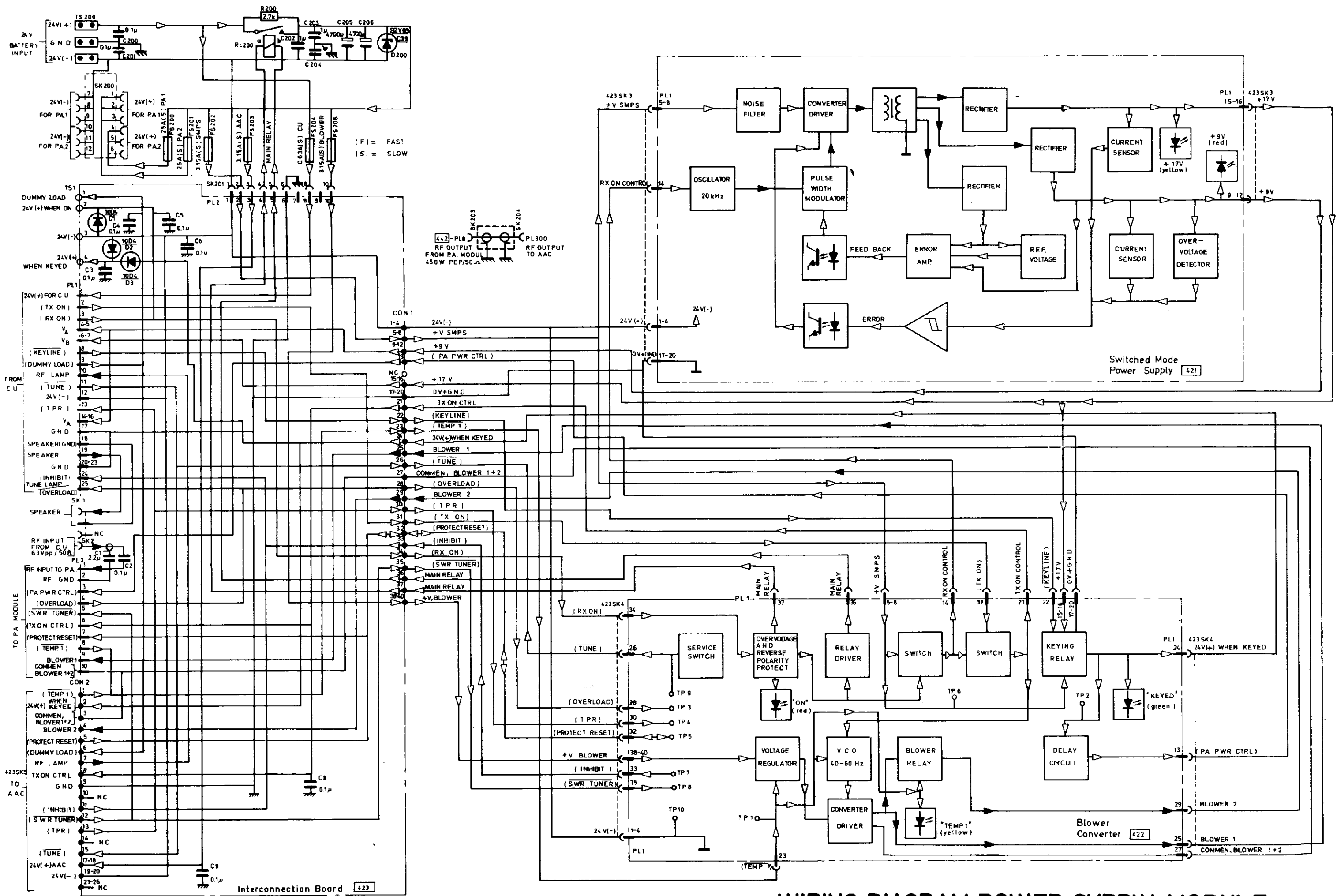




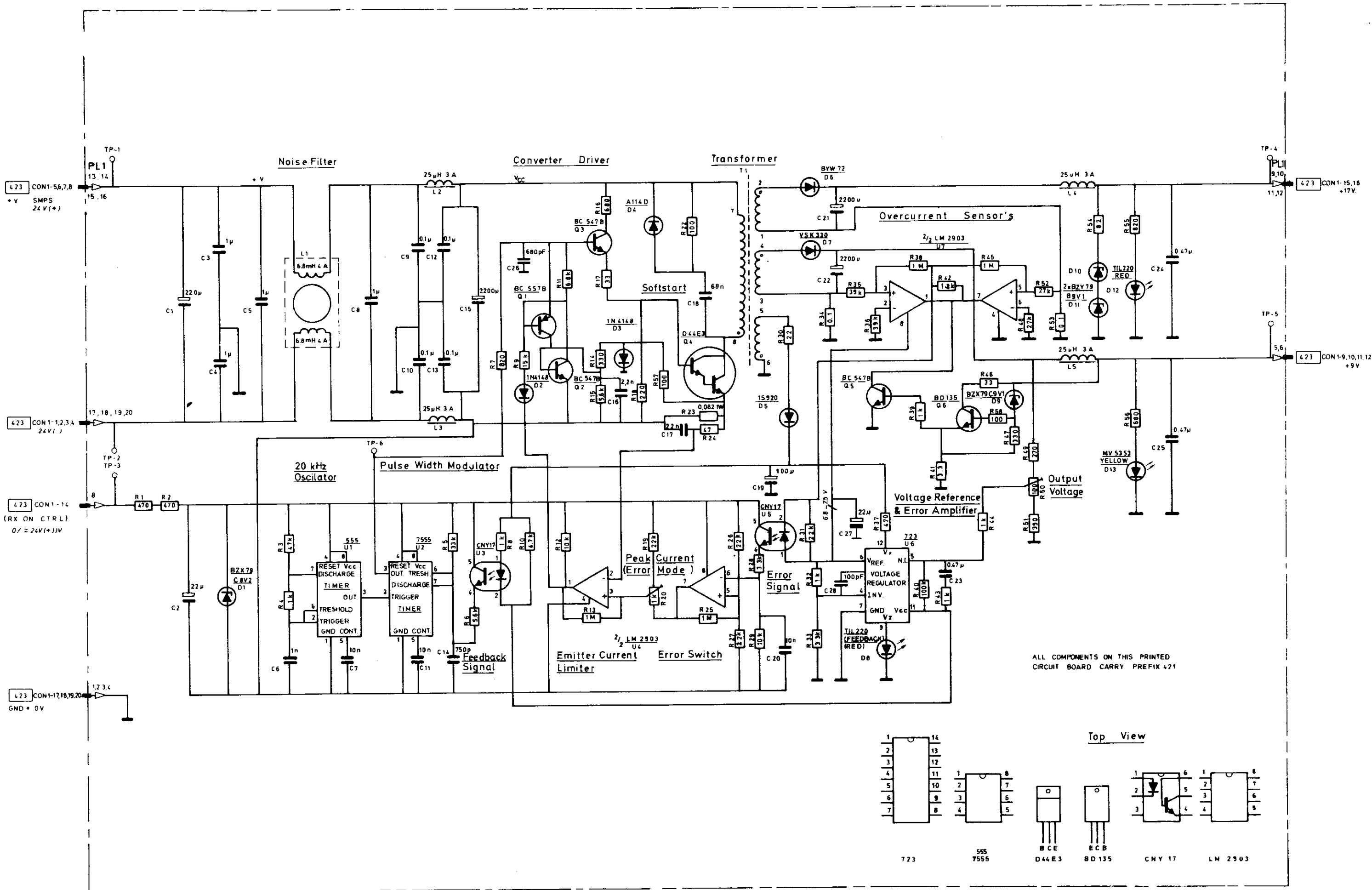
BLOCK DIAGRAM, TRANSMITTER UNIT TU 6200



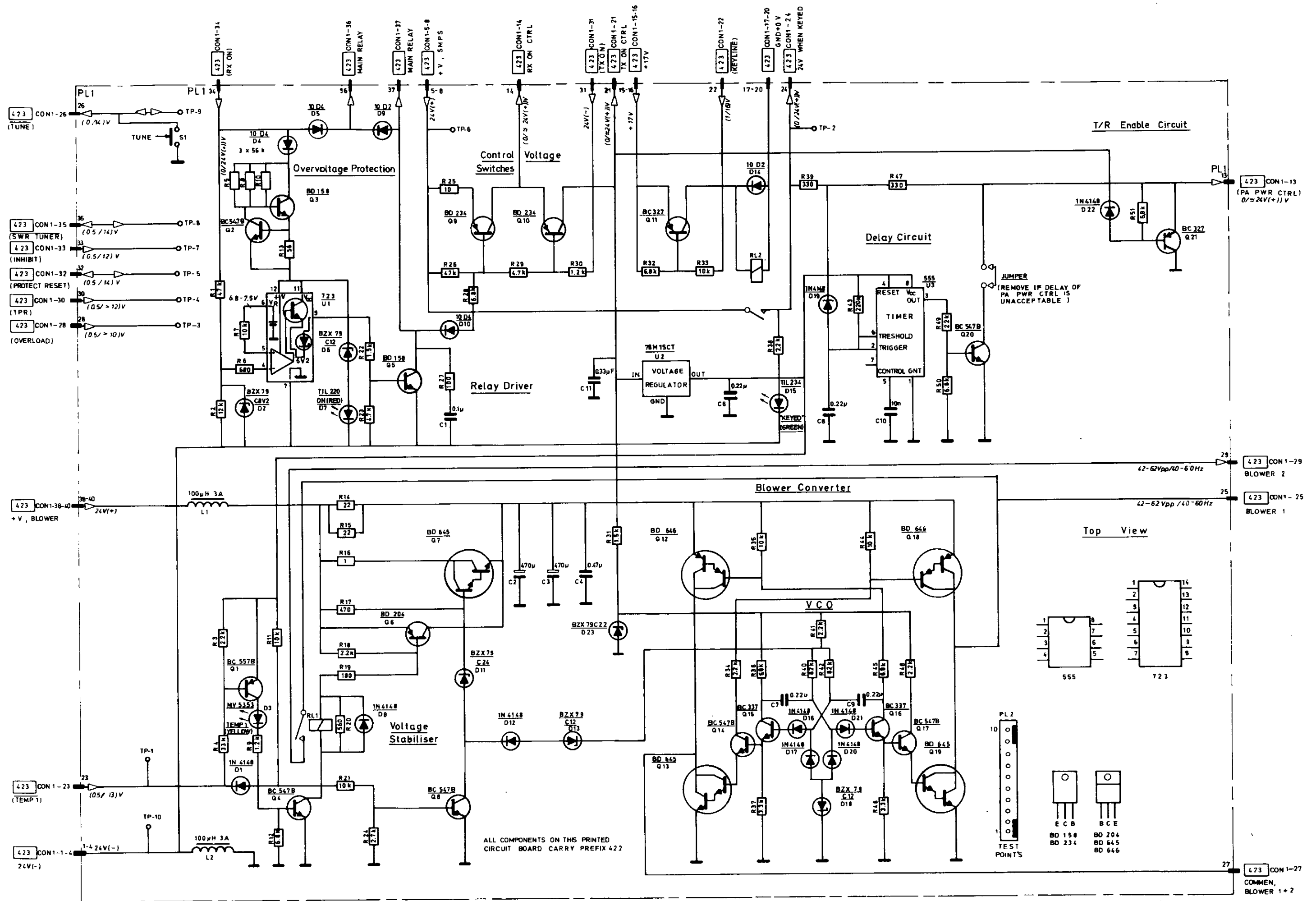
BLOCK DIAGRAM, TRANSMITTER UNIT TU 6400



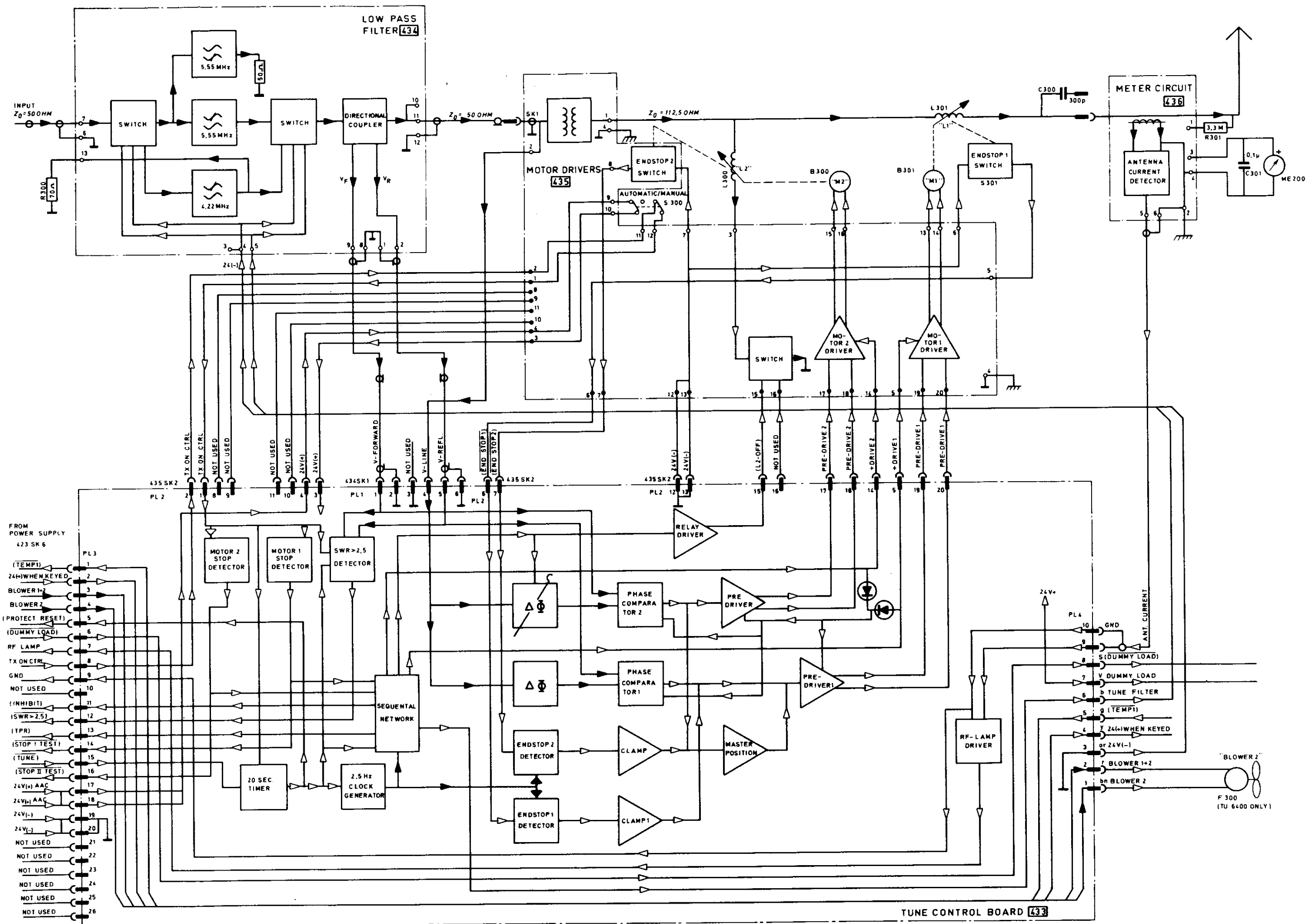
WIRING DIAGRAM, POWER SUPPLY MODULE



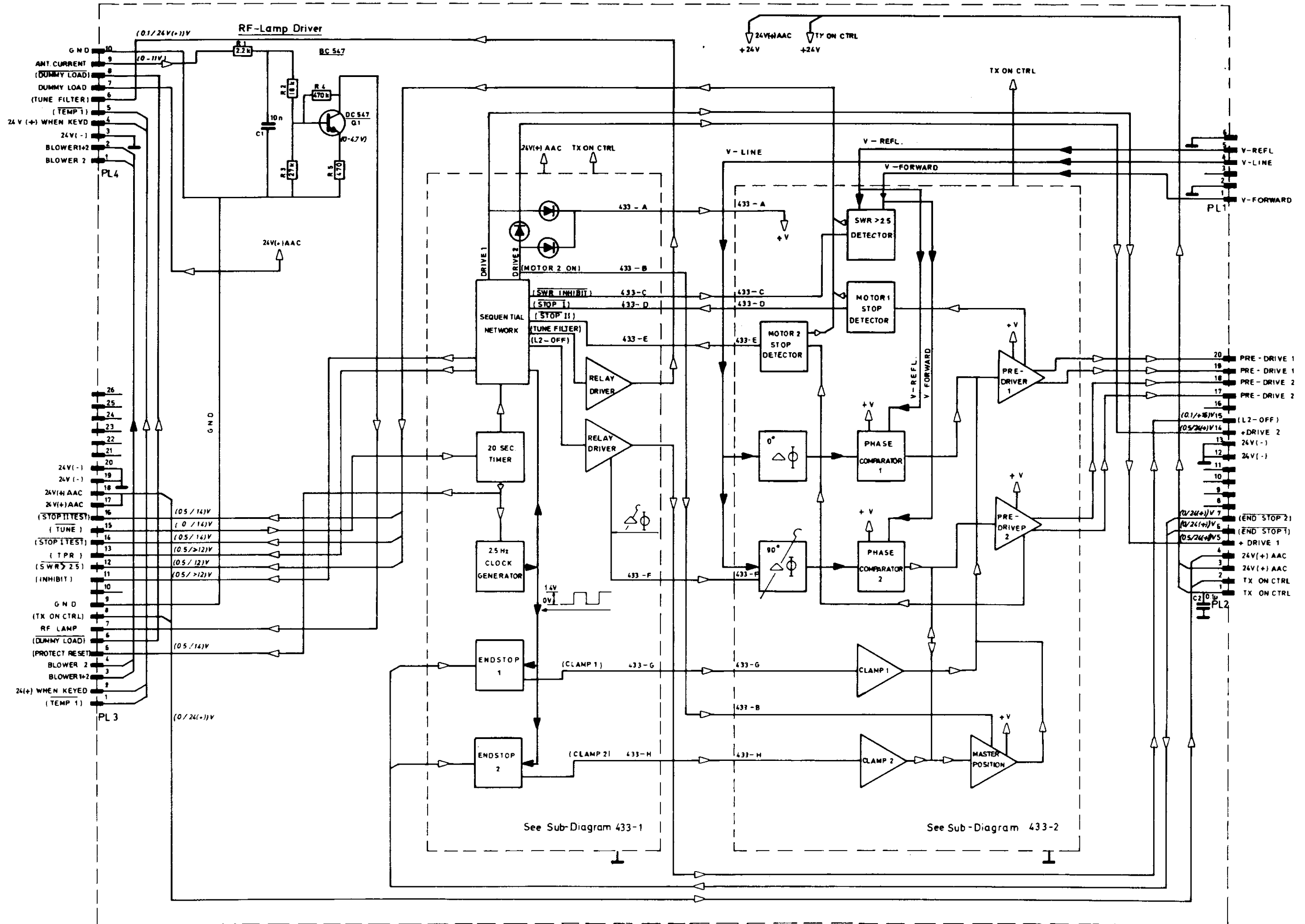
8-97



Blower Converter 993 4 422 ②

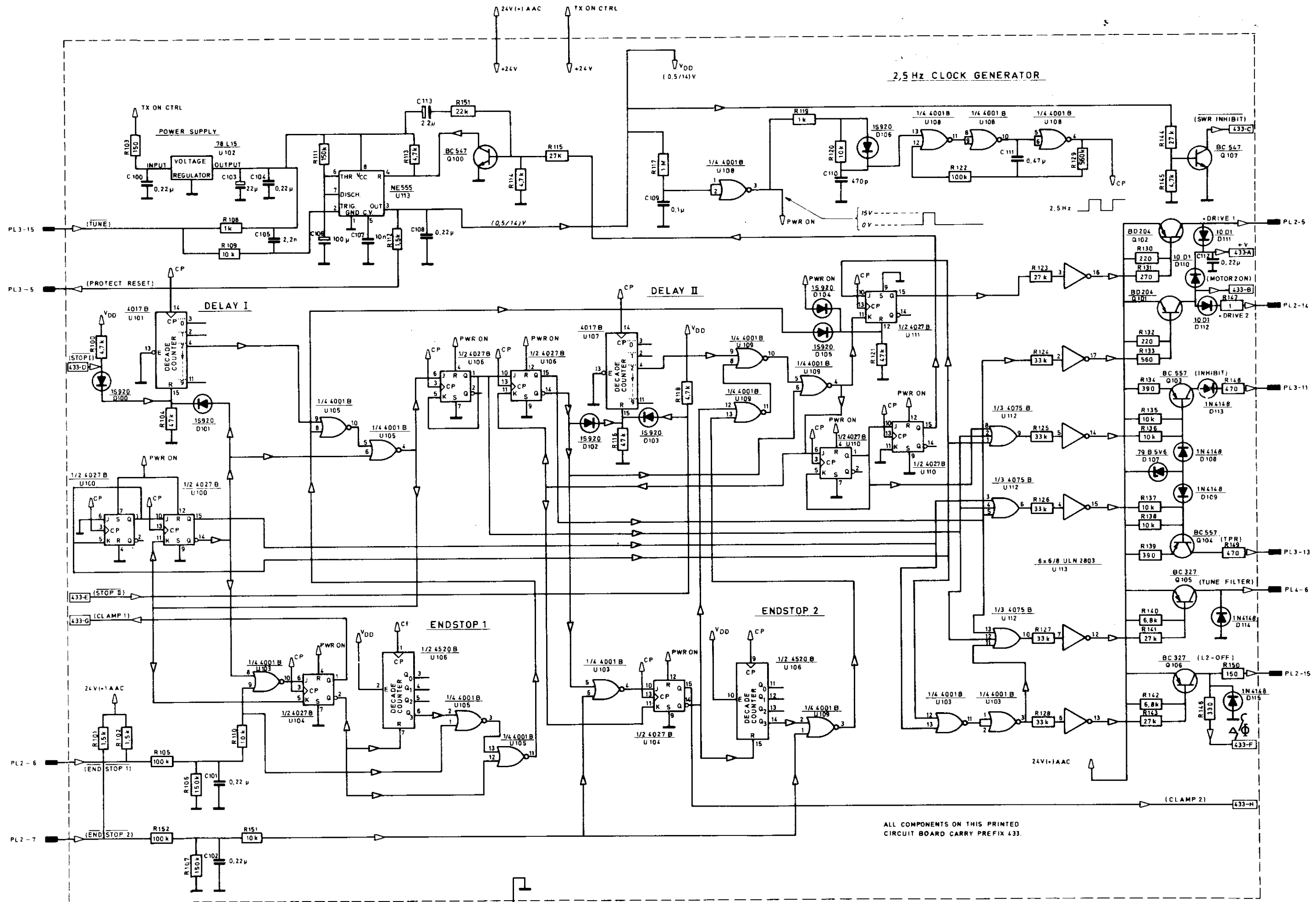


WIRING DIAGRAM, AUTOMATIC ANTENNA COUPLER

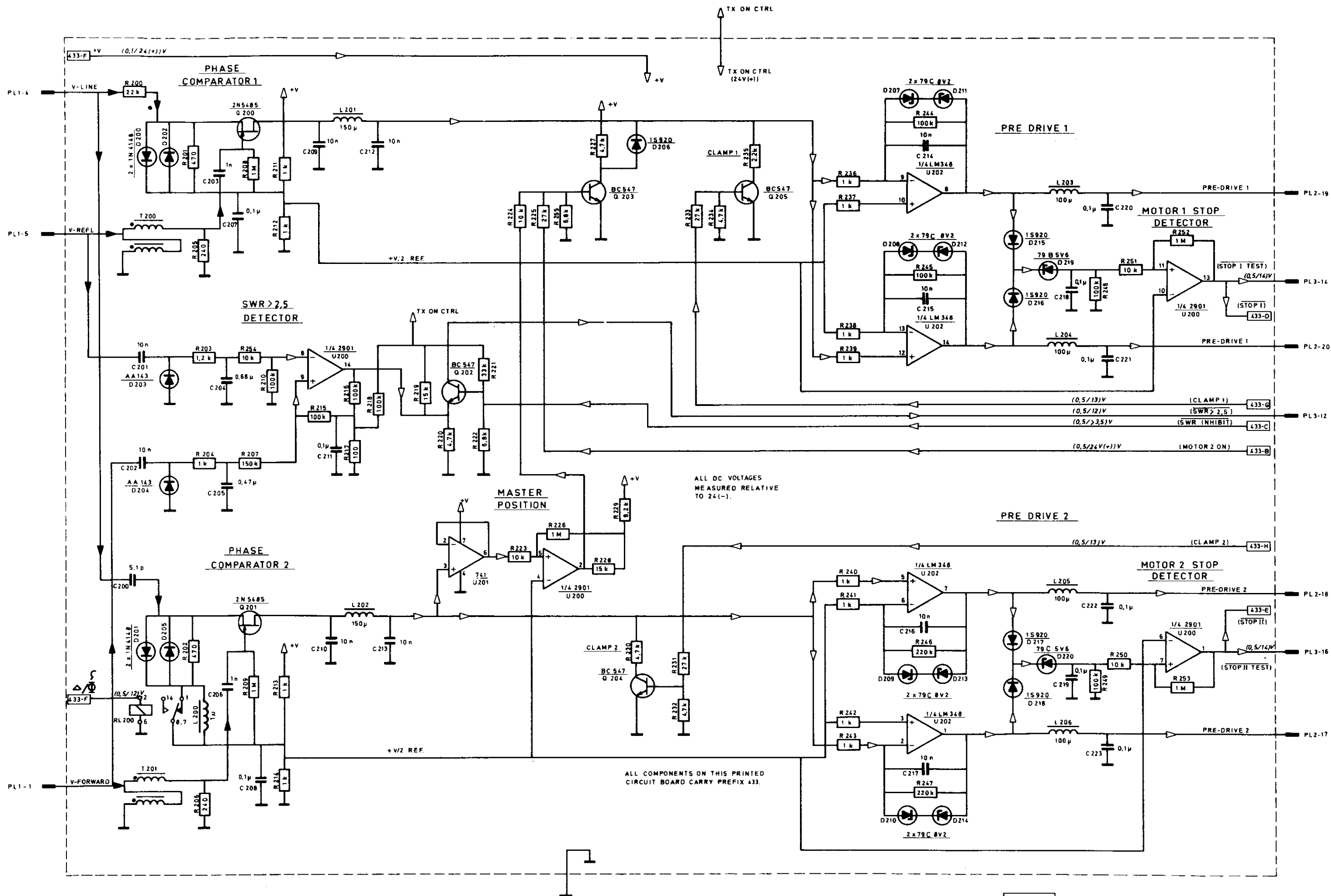


MAIN DIAGRAM
 TUNE CONTROL BOARD ⁹⁹³⁴ 433 ①

8-103

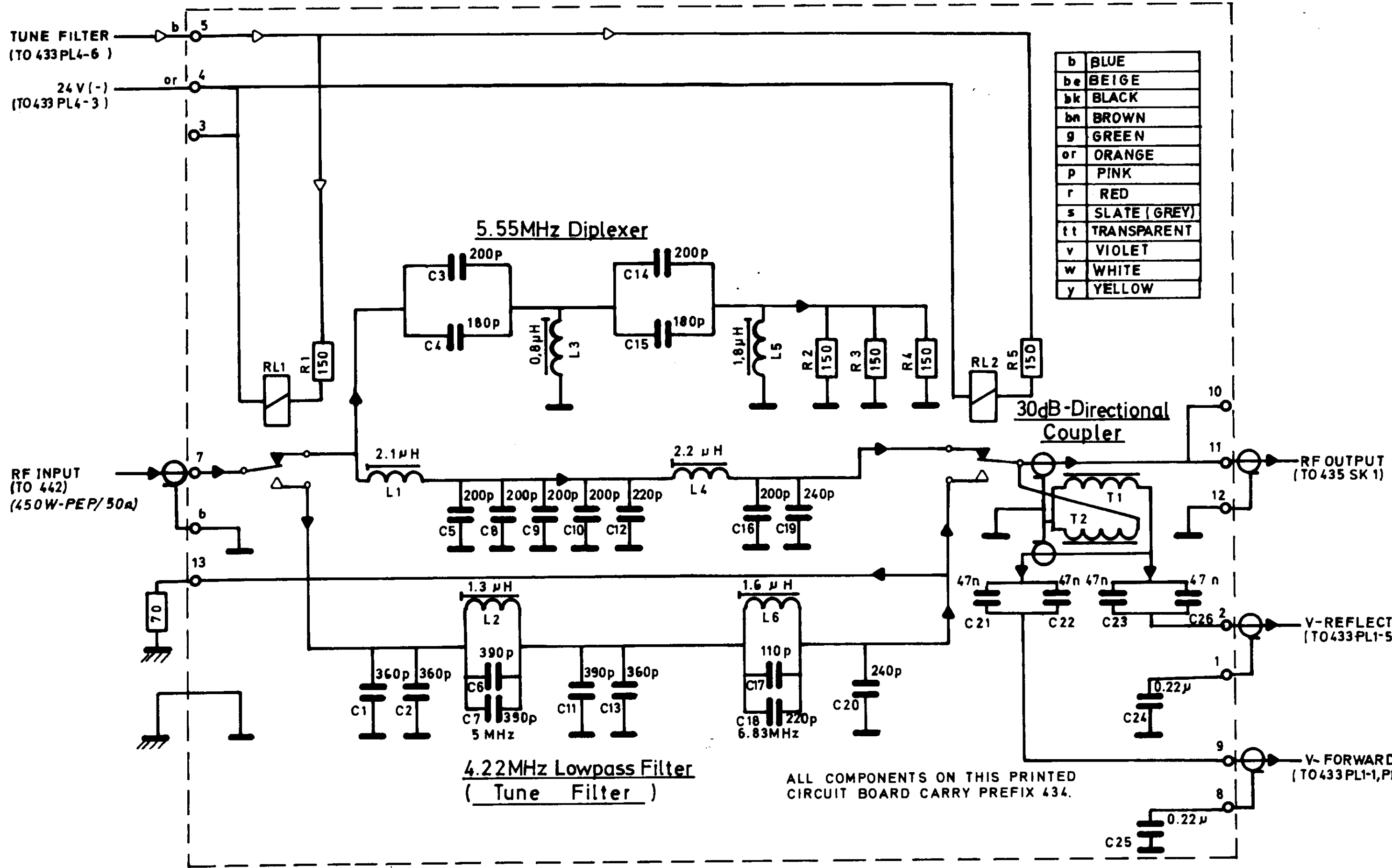


433 ② Sub Diagram 1



433 ② Sub Diagram 2

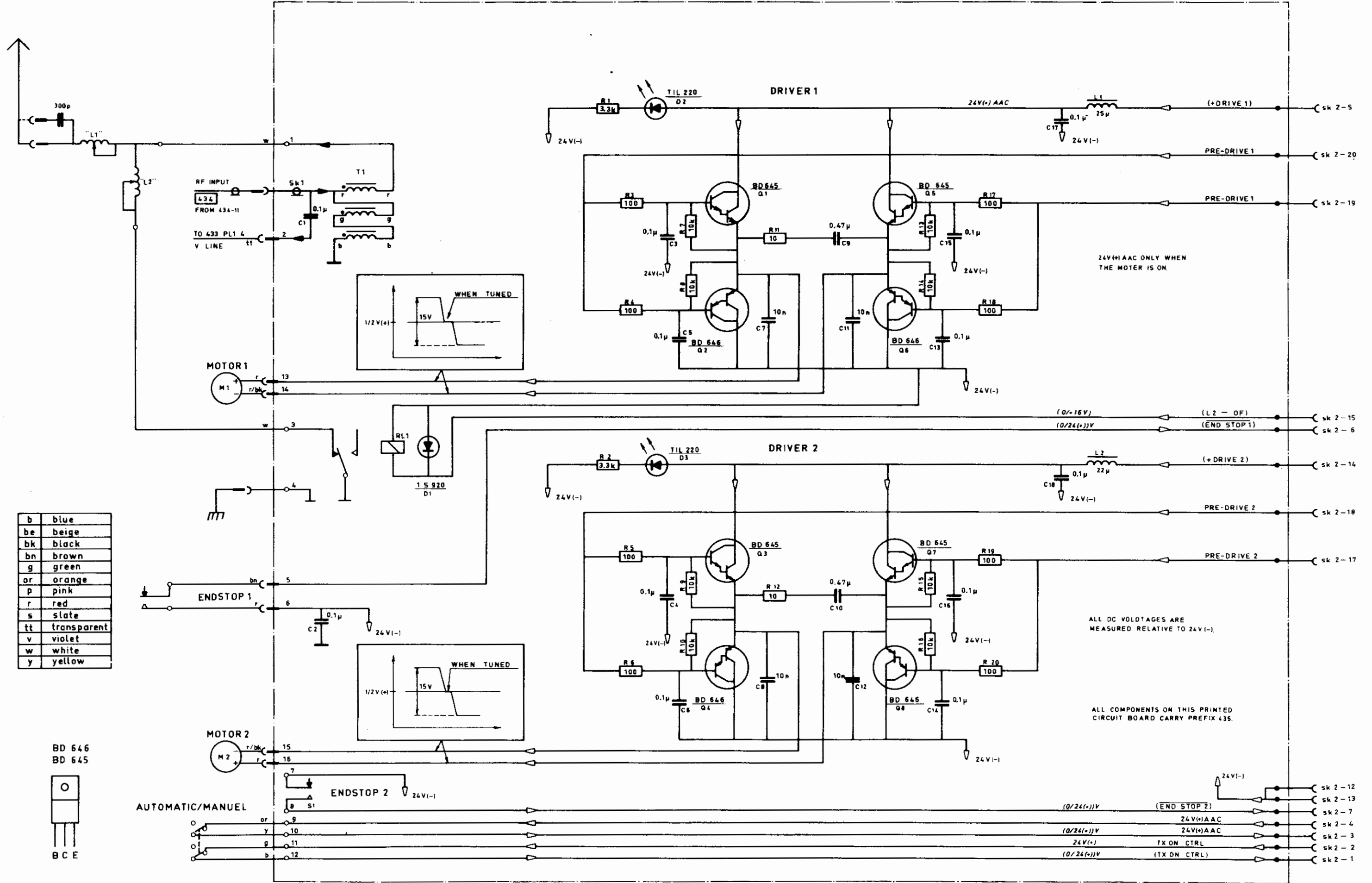
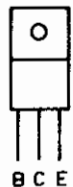
8-107



LP-FILTER 993 4 434 ①

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

BD 646
BD 645



24V(+ AAC ONLY WHEN THE MOTOR IS ON.

ALL DC VOLTAGES ARE MEASURED RELATIVE TO 24V(-).

ALL COMPONENTS ON THIS PRINTED CIRCUIT BOARD CARRY PREFIX 435.

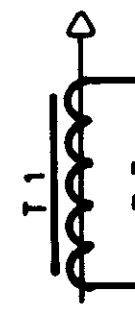
8-111

TO THE ANT.

3.3M

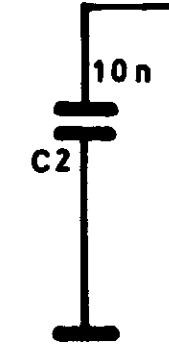
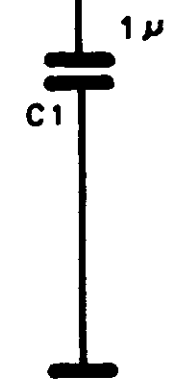
Antenna
Current
Transformer

R1 3.3M
R2 3.3M
R3 3.3M
R4 3.3M



R5 47

AA 143
D1



1S 920
D2

R7 820

R6 8.2k

R8 820

ANT. CURRENT
(TO 433:PL4-9, PL4-10)

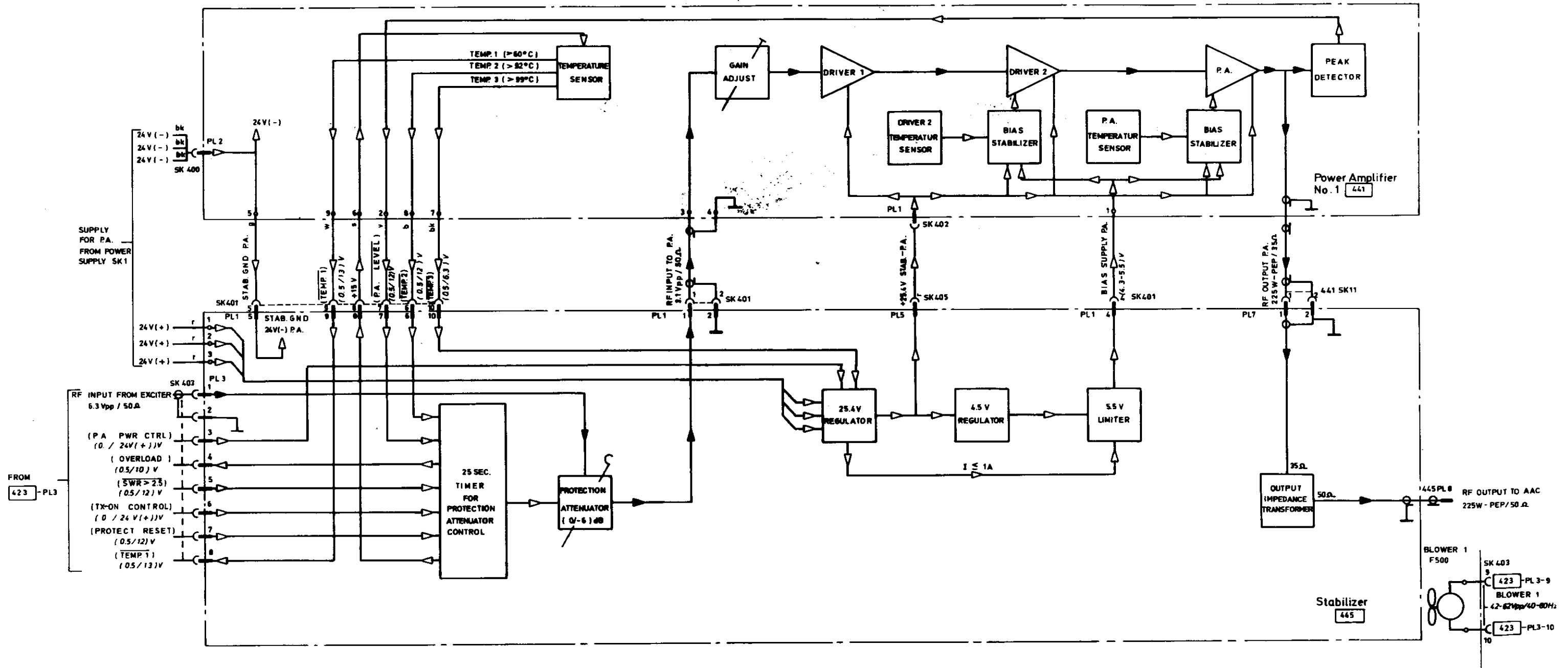
0.1 μ

1 mA

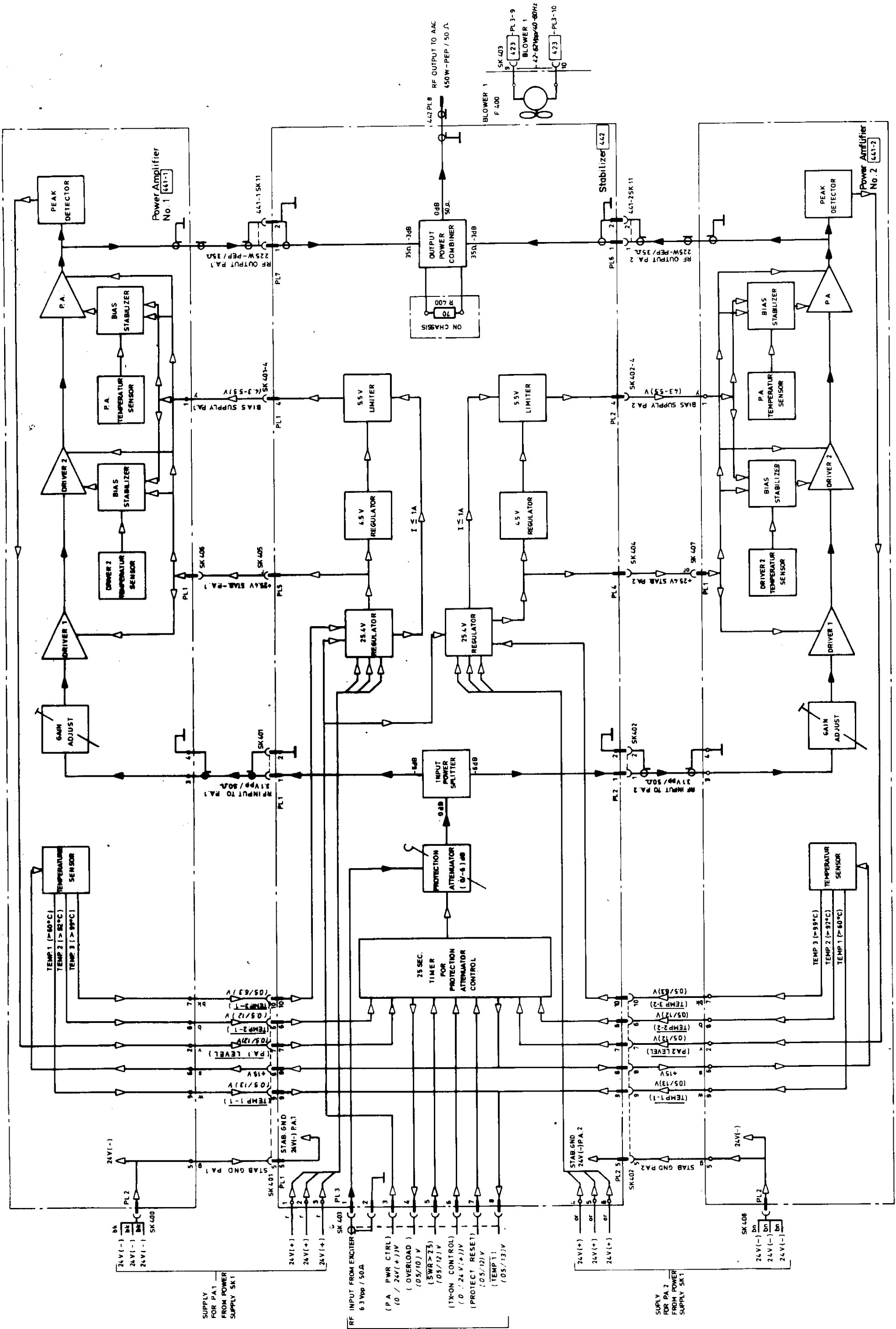
ALL COMPONENTS ON THIS PRINTED
CIRCUIT BOARD CARRY PREFIX 436.

b	BLUE
be	BEIGE
bk	BLACK
bn	BROWN
g	GREEN
or	ORANGE
p	PINK
r	RED
s	SLATE (GREY)
tt	TRANSPARANT
v	VIOLET
w	WHITE
y	YELLOW

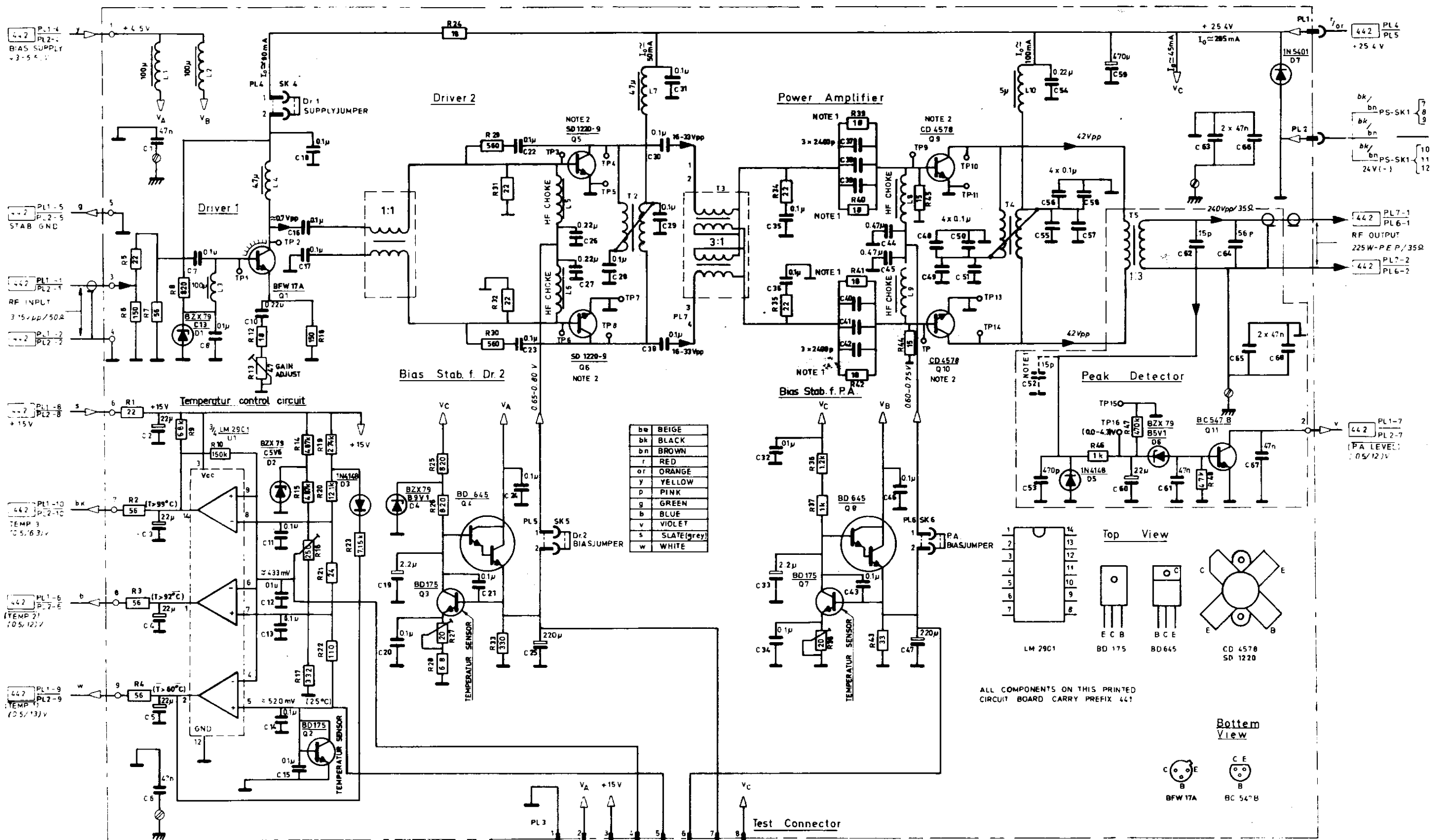
METER CIRCUIT 993 4 **436** ①



WIRING DIAGRAM, POWER AMPLIFIER MODULE (200W)



WIRING DIAGRAM, POWER AMPLIFIER MODULE (400W)



UPPER WIRE COLORS, PL AND SK NUMBERS RELATES TO POWER AMPLIFIER No 1
 (441-1) - LEFT SIDE OFF POWER AMPLIFIER MODUL
 LOWER COLORS AND NUMBERS RELATES TO POWER AMPLIFIER No 2
 (441-2) - RIGTH SIDE OFF POWER AMPLIFIER MODUL

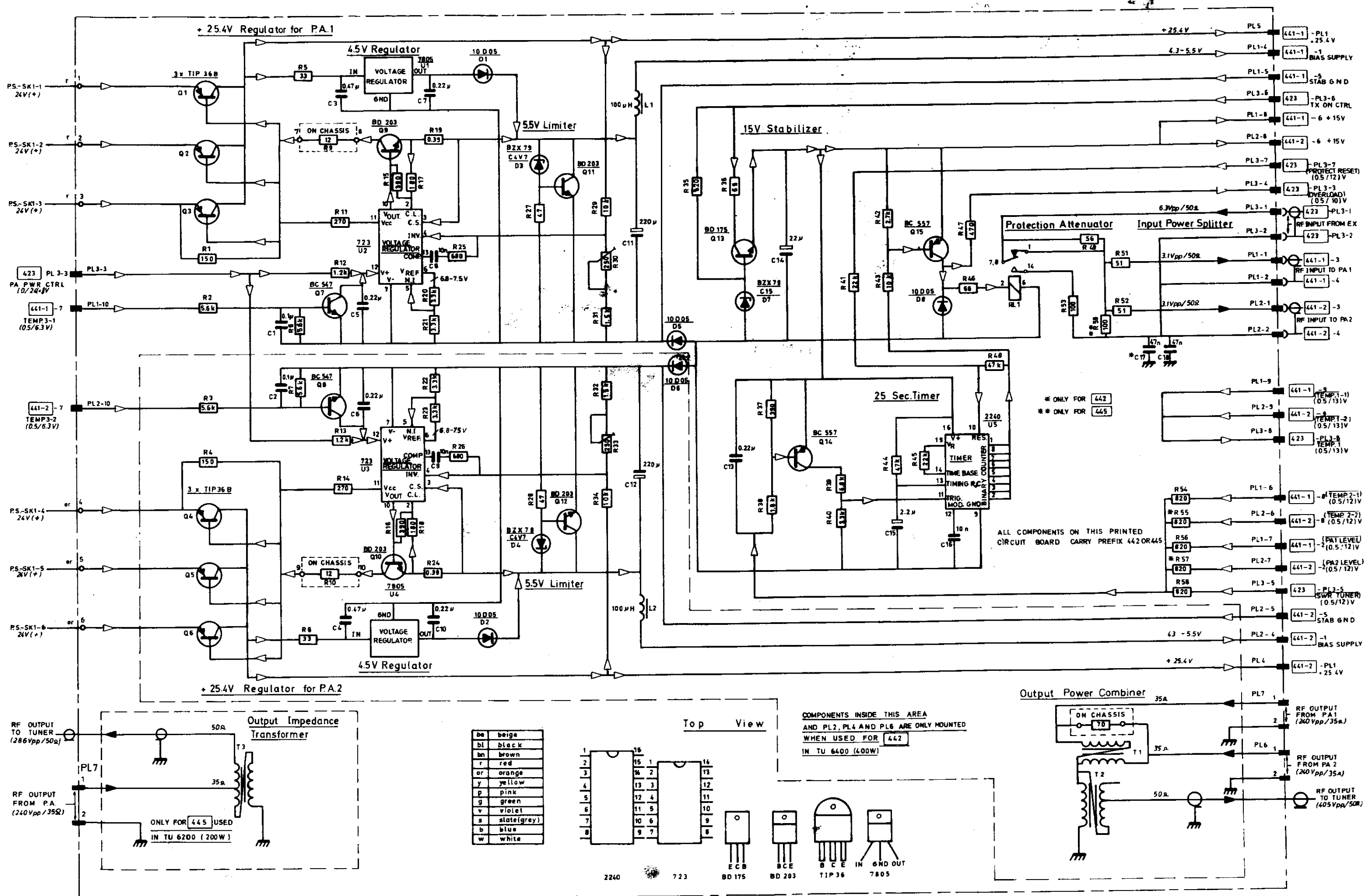
Test Connector
 1 COMMON (0V)
 2 BIAS SUPPLY VA 4.0-5.5V
 3 +15V
 4 TEMP REF 2.433 mV
 5 TEMP SENS 2.520 mV (25°C)
 6 BIAS P.A. 0.60-0.75V
 7 BIAS DRIVER 2 0.65-0.80V
 8 +25.4V

NOTE 1 FACTORY SELECTED
 NOTE 2 Q5/Q6 AND Q9/Q10 ARE MATCHED PAIRS (SAME LETTERS OR COLOURS)
 ALL IDLING CURRENTS AND SIGNAL LEVELS APPLY FOR 26.4V BATTERY VOLTAGE AT TU6000 TERMINALS
 ALL TRANSISTORS EXCEPT Q1 AND Q11 ARE MOUNTED ON THE MAIN HEAT SINK

Power Amplifier

993 4441 ③

8-119



SIGNALS AND 441 WITH ...-1" OR ...-2", e.g. TEMP 1-1, 441-1 OR 441-2, REFER TO POWER AMPLIFIER No.1 (LEFT) RESPECTIVELY No.2 (RIGHT)

Stabilizer

993 4442 1 / 445 1 A