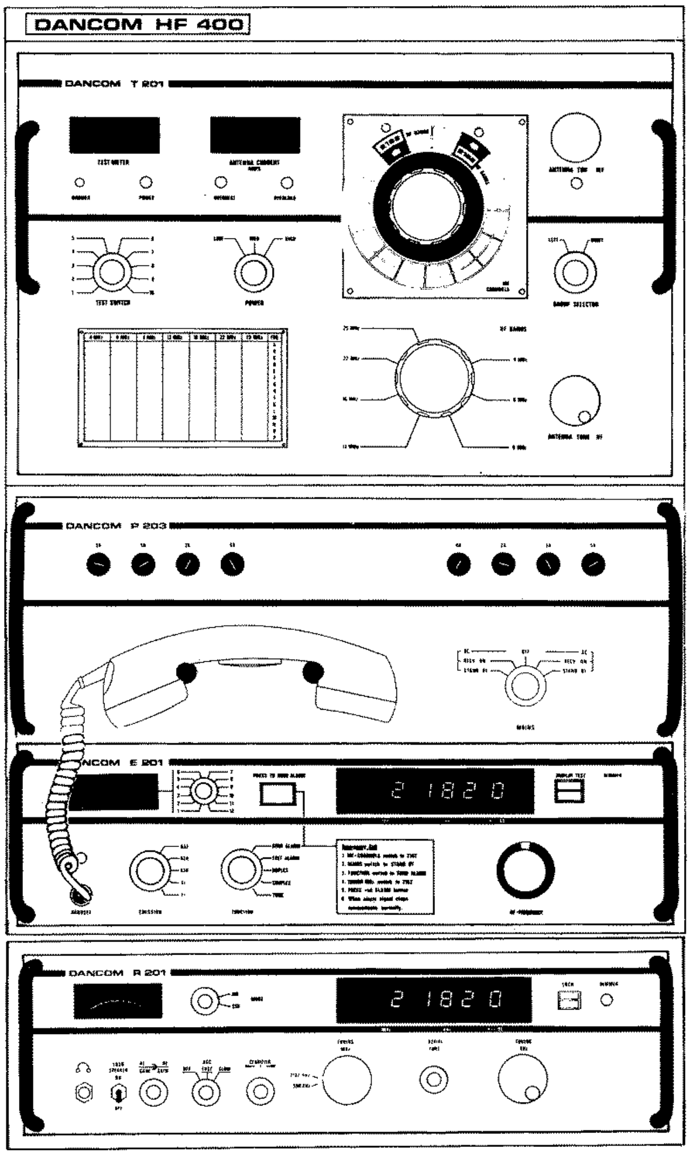
Dancom HF 400 system

Technical manual

Consisting of:

Exciter	E201
Power Supply	P201/P202/P203
Receiver	R201/R203
Transmitter	T201



T E C H N I C A L   D A T A

General: (Transmitter and Receiver)

Modes of operation:		Simplex/Duplex
Power Supply:		24 VDC ±10% (battery)
	or	110/220 VAC ±10% 50-60 Hz
	or	combined 24 VDC - 110/220 VAC
Power consumption:		transmit app. 750 VA
		stand by app. 250 VA
		receive app. 60 VA
Dimensions and weight:		Receiver separate:
		width: 499 mm
		depth: 385 mm
		height: 150 mm
		weight: app. 20 kg
		Transmitter separate:
		width: 499 mm
		depth: 385 mm
		height: 680 mm
		weight: app. 90 kg
		Receiver and Transmitter:
		width: 499 mm
		depth: 385 mm
		height: 830,5 mm
		weight: app. 110 kg
Temperature range:		Spec's fulfilled within
		0°C to 40°C
		Operating
		-15°C to +55°C

Transmitter:

Frequency ranges:	1,6 to 3,8 MHz 4 MHz Marine band 6 MHz Marine band 8 MHz Marine band 12 MHz Marine band 16 MHz Marine band 22 MHz Marine band 25 MHz Marine band
Number of frequencies:	141 spotfrequencies 2182 KHz + 28 in the 1,6-3,8 MHz band 112, i.e. 16 in each marine band
Frequency stability:	
frequency inconstancy at an ambient temp. of 25°C:	long term ±50 Hz
at an ambient temp. between +10°C and +40°C:	short term (15 min.) ±25 Hz
Modes of emissions:	A3J A3A A3H A1 F1
Two-tone alarm generator:	incorporated
Audio response:	$<$ 6 dB, 350-2700 Hz
AF-distortion:	$<$ 10%
Speech compression:	the transmitter contains a compressor which maintains the output power at an almost constant level.
Power output:	full power 400 W PEP medium power 200 W PEP low power 100 W PEP
Antenna impedance:	
in the range 1,6-3,8 MHz:	10 ohms, 250 pF
in the marine bands:	50 ohms, or all normal ship's antennas
Spurious and harmonic suppression:	$>$ 43 dB
Intermodulation products:	3rd order, $>$ 31 dB below PEP 5th order, $>$ 38 dB below PEP 7th order, $>$ 43 dB below PEP

Receiver: R201 and R203

Frequency range:	10 KHz to 1 MHz in 30 bands 500 KHz and 2182 KHz in two fixed positions
Setting accuracy:	±50 Hz
Frequency locking:	the variable frequency oscillator can be locked in steps of 100 Hz
Frequency stability:	
frequency inconstancy at an ambient temp. of 25°C:	long term ±50 Hz
at an ambient temp. between +10°C and +40°C:	short term (15 min.) ±25 Hz
Reception modes:	A3J A3A A3H A3 A2H A2 A1 F1 as option.
Sensitivity:	AM: 3uV for 10 dB S/N CW/SSB: 1 uV for 10 dB S/N
Antenna impedance:	10 KHz to 4 MHz: 10 ohms/250 pF 4 to 30 MHz: 50 ohms
Selectivity:	
R201:	AM: 6 KHz SSB: 2,7 KHz
R203:	wide: 8 KHz intermediate: 2,7 KHz narrow: 1 KHz very narrow: 200 Hz
Clarifier, R201 and R203:	± 250 Hz
Beat frequency oscillator, R203:	± 3 KHz
Audio output:	
Speaker:	4 W into 3,2 ohms
Phones:	1 mW into 2000 ohms
Lines:	10 mW into 600 ohms
Audio response:	< 6 dB, 350-2700 Hz
AF-distortion:	< 10% at full output power
Intermediate frequencies:	1st I.F. 45,1 MHz 2nd I.F. 580 KHz
IF-rejection:	> 60 dB up to 1,6 MHz > 90 dB above 1,6 MHz
Meter:	to read signal level

OPERATION, DISTRESS PROCEDURES

The procedures ALARM SIGNAL TEST and TRANSMISSION OF ALARM SIGNAL are quite identical whether the short-wave transmitter is delivered with an

Exciter E201

Power Supply P201
or Power Supply P202
or Power Supply P203

If the transmitter is delivered with power supply P203, there is a choice between the positions STAND BY AC or STAND BY DC.

If the ship is supplied with emergency batteries, the best will be to choose STAND BY DC as the transmitter will function even if the ship's machinery stops working.

The distress procedures are exactly identical whether

Receiver R201
or Receiver R203

is mounted.

ALARM SIGNAL TEST

1. Turn the MAINS switch on the power supply to position STAND BY.

2. Turn the FUNCTION switch on the exciter to position TEST ALARM.
The two-tone alarm generator starts automatically.

3. Listen to the alarm signal in the microtelephone and be sure that the alarm generator generates alternating two tones and stops automatically after app. 45 seconds.

4. The test can be repeated by pressing the red PRESS TO SEND ALARM button momentary.

TRANSMISSION OF ALARM SIGNAL

In case of emergency follow the "Emergency Call" procedure on the frontplate of the exciter.

Note: The "Emergency Call" procedure includes the instruction "MAINS switch to STAND BY". If the transmitter has not been heated, approximately 34 sec. should pass before point 5 "PRESS red ALARM button" is carried out.

Emergency Call

1. MF-CHANNELS switch to 2182
2. MAINS switch to STAND BY
3. FUNCTION switch to SEND ALARM
4. TUNING MHz switch to 2182
5. PRESS red ALARM button
6. When alarm signal stops communicate normally.

After sending the automatical alarm signal, speak with normal and distinct voice.

Mayday Mayday Mayday, this is ship's call sign 3 times. Over.

When the coast station answers, follow the instructions given and/or send the distress message.

Suggested distress message:

1 Mayday
2 Call sign
3 Position and heading of ship
4 The nature of distress
5 Number of persons on board and number of injured persons, if any
6 Number of lifeboats or life rafts in the sea
7 Type of necessary help, doctor, medicine,fire service etc.

Listen to the coast station and follow the instructions given.

NOTE

Familiarize yourselves with the operation of the two-tone alarm signal by reference of this handbook and the use of the TEST ALARM and SEND ALARM positions of the FUNCTION switch on the exciter.

Under no circumstances, EXCEPT A GENUINE EMERGENCY operate the red PRESS TO SEND ALARM button, when the FUNCTION switch is in position SEND ALARM.

Remember that an abortive alert of the rescue services and other shipping could result in loss of life.

RECEIVER OPERATION

Switching on

Switch on the receiver by turning the MAINS switch on the power supply to position RECV.ON or position STAND BY.

Turn the RF-GAIN fully clockwise.

Turn the AF-GAIN to a suitable output level from the loudspeaker.

Turn the AGC switch to FAST.

Selection of frequency

Select the required frequency by turning the TUNING MHz and TUNING KHz.

Adjust the AERIAL TUNE to maximum signal level on the meter or maximum output power from the loudspeaker.

If the selected frequency should be maintained for a longer period, push the LOCK button.

Selection of SSB Mode (R201)

Turn the MODE switch to position SSB.

Turn the CLARIFIER to optimum voice quality.

If necessary, use the AGC switch in position slow, when listening to a SSB transmission.

Selection of AM Mode (R201)

Turn the MODE switch to position AM.

Selection of Mode (R203)

Turn the MODE switch to the required mode.

Turn the BAND WIDTH switch to the optimum band width.

(Note: BAND WIDTH is out of function when MODE switch is in position SSB).

(Note: The button CLARIFIER/BFO changes function when MODE switch changes from SSB to CW).

TRANSMITTER OPERATIONS

Switching on

Switch on the transmitter by turning the MAINS switch to position STAND BY.

OBSERVE! After having switched ON the transmitter, wait at least 60 seconds before tuning.

NOTE! When the MAINS switch is in position STAND BY, the receiver is also switched ON.

Selection of a MF-frequency

Turn the MF CHANNELS switch to the required frequency.

Turn the GROUP SELECTOR to the position required.

(The selected frequency is shown on the exciter-display).

Turn the FUNCTION switch to position TUNE, and tune to maximum ANTENNA CURRENT by means of ANTENNA TUNE MF.

Selection of an HF-frequency

Turn the MF CHANNELS switch to position HF BANDS.

Turn the HF BANDS switch to the required HF band.

Turn the HF-FREQUENCY switch to the required frequency.

(The selected frequency is shown on the exciter display).

Turn the FUNCTION switch to position TUNE, and tune to maximum ANTENNA CURRENT by means of ANTENNA TUNE HF.

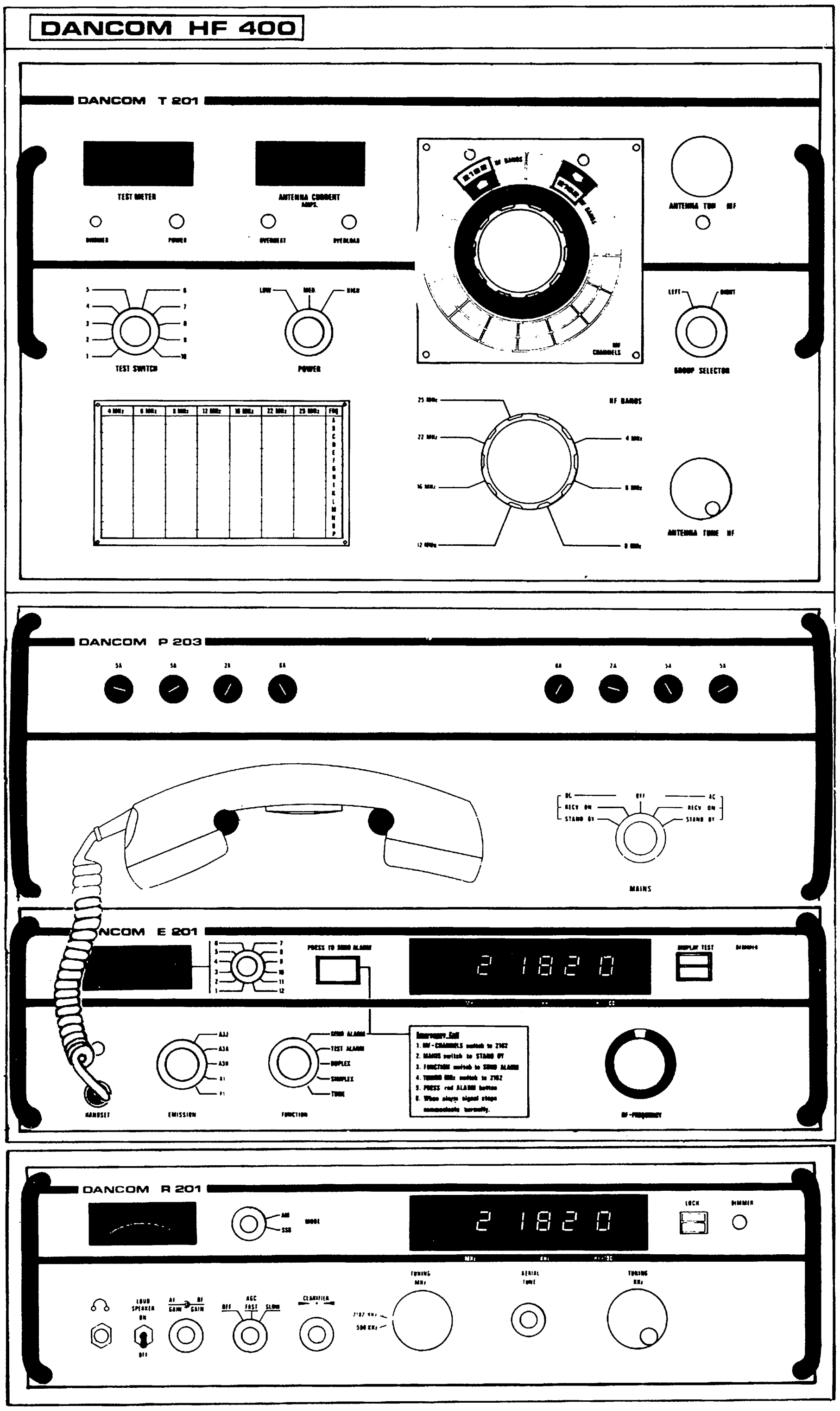
Before transmitting

Select the required mode on the EMISSION switch.

Select SIMPLEX OR DUPLEX as required on the FUNCTION switch.

The transmitter is ready for use.

NOTE! Before transmitting, listen if the selected frequency is occupied.


DANCOM HF 400
DANCOM T 201
TEST METER
ANTENNA CURRENT
TEST SWITCH
POWER
GROUP SELECTOR
HF BANDS
DANCOM P 203
MAINS
DANCOM E 201
2 1820
HANDSET
EMISSION
FUNCTION
DANCOM R 201
2 1820

RECEIVER CONTROLS R201

1. METER showing the received signal strength.

   With the RF-GAIN control in extreme clockwise position the meter deflection starts from 0.

   If the RF-GAIN control is turned counter clockwise, the pointer shows the signal level from where the automatical gain control (AGC) starts.

2. MODE. Switches between AM or SSB reception modes.

   NOTE: When TUNING MHz is placed at one of the emergency frequencies 500 KHz or 2182 KHz, the MODE swtich is out of function. The correct mode is chosen automatically in these positions.

4. DISPLAY. Displays the received frequency between 10 KHz and 30 MHz.

5. OUT OF RANGE INDICATION. If the TUNING KHz has exceeded its coverage range below xx,000,0 MHz or above xx,999,9 MHz, the out of range indication is turned on, and the display is flashing.

6. LOCK. If the lock push button is realeased, the variable frequency oscillator (TUNING KHz) is free running. If the lock push button is activated, the variable frequency oscillator will be locked to each 100 Hz as shown on the display.

   Fine tuning between the 100 Hz settings can be made with the CLARIFIER/ BFO.

7. HEADPHONES. Jack for connection of headphones.

8. LOUDSPEAKER. Switches on and off the loudspeaker.

9. RF-GAIN. The inner button of the double button controls the RF-sensitivity of the receiver.

10. AF-GAIN. The outer button of the double button controls the low frequency output power of the loudspeaker.

11. AGC. Switches the automatical gain control (AGC) between OFF, FAST decay, and SLOW decay. With the button in position OFF, the RF-GAIN control is used as manual sensitivity control.

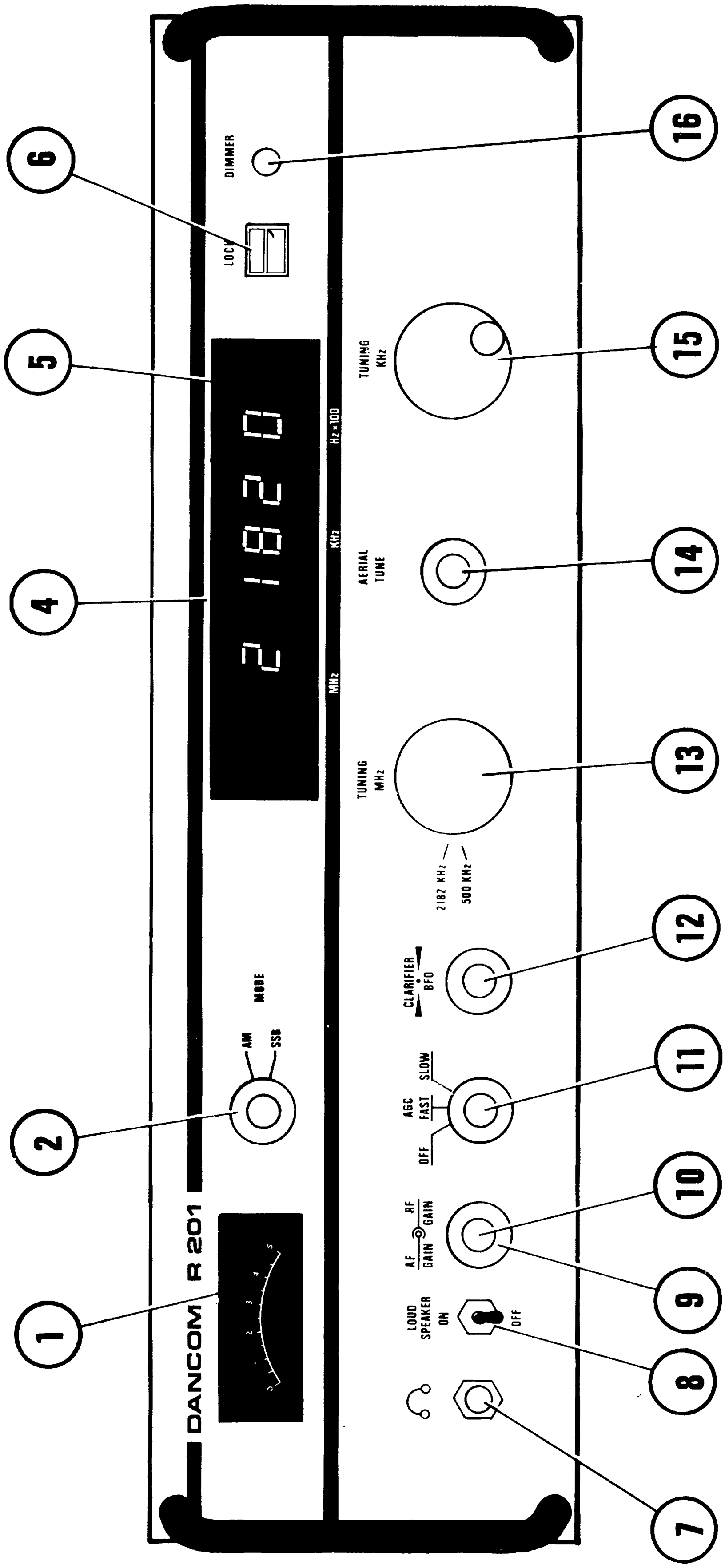
12. CLARIFIER. Fine tuning on SSB. Set to optimum voice quality. Variation range ± 250 Hz.

13. TUNING MHz. Coarse tuning in 1 MHz bands. The frequency setting is shown on the display.

14. AERIAL TUNE. Tunes the aerial tuned circuits to maximum sensitivity. Tune to maximum signal strength on the meter or to maximum output level from the loudspeaker.

15. TUNING KHz. Variable tuning covering 1 MHz. Tunes the frequency between the fixed 1 MHz bands which are tuned with TUNING MHz. The frequency setting (tuning of TUNING KHz) is shown on the display.

16. DIMMER. Controls the light intensity in the display and in the meter dial light.


DANCOM R 201
MODE
AM
SSB
LOCK
DIMMER
MHz
KHz
Hz x 100
TUNING KHz
AERIAL TUNE
TUNING MHz
2182 KHz
500 KHz
CLARIFIER BFO
AGC
OFF
FAST
SLOW
AF GAIN
RF GAIN
LOUD SPEAKER
ON
OFF
1
2
4
5
6
7
8
9
10
11
12
13
14
15
16

RECEIVER CONTROLS R203

1. METER showing the received signal strength.

With the RF-GAIN control in extreme clockwise position the meter deflection starts from 0.

If the RF-GAIN control is turned counter clockwise, the pointer shows the signal level from where the automatical gain control (AGC) starts.

2. MODE. Switches between AM, SSB, CW, and F1 reception modes.

3. BANDWIDTH. Switches between Wide 8 KHz, Intermediate 3 KHz, Narrow 1 KHz, and Very Narrow 200 Hz.

The bandwidth switch does not function when the mode switch is in position SSB. Then the correct filter, which belongs to the SSB-mode, is chosen automatically.

NOTE: When TUNING MHz is placed at one of the emergency frequencies 500 KHz or 2182 KHz both the MODE switch and the BANDWIDTH switch are out of function. The correct mode and bandwidth are chosen automatically in these positions.

4. DISPLAY. Displays the received frequency between 10 KHz and 30 MHz.

5. OUT OF RANGE INDICATION. If the TUNING KHz has exceeded its coverage range below xx,000,0 MHz or above xx,999,9 MHz, the out of range indication is turned on and the display is flashing.

6. LOCK. If the lock push button is released, the variable frequency oscillator (TUNING KHz) is free running. If the lock push button is activated, the variable frequency oscillator will be locked to each 100 Hz as shown on the display.

Fine tuning between the 100 Hz settings can be made with the CLARIFIER/BFO.

7. HEADPHONES. Jack for connection of headphones.

8. LOUDSPEAKER. Switches on and off the loudspeaker.

9. RF-GAIN. The inner button of the double button controls the RF-sensitivity of the receiver.

10. AF-GAIN. The outer button of the double button controls the low frequency output power of the loudspeaker.

11. AGC. Switches the automatical gain control (AGC) between OFF, FAST decay, and SLOW decay. With the button in position OFF, the RF-GAIN control is used as manual sensitivity control.

12. CLARIFIER/BFO. Single button with double function.

    With the MODE switch in position SSB, the button functions as CLARIFIER. Set to optimum voice quality.
    Variation range ± 250 Hz.

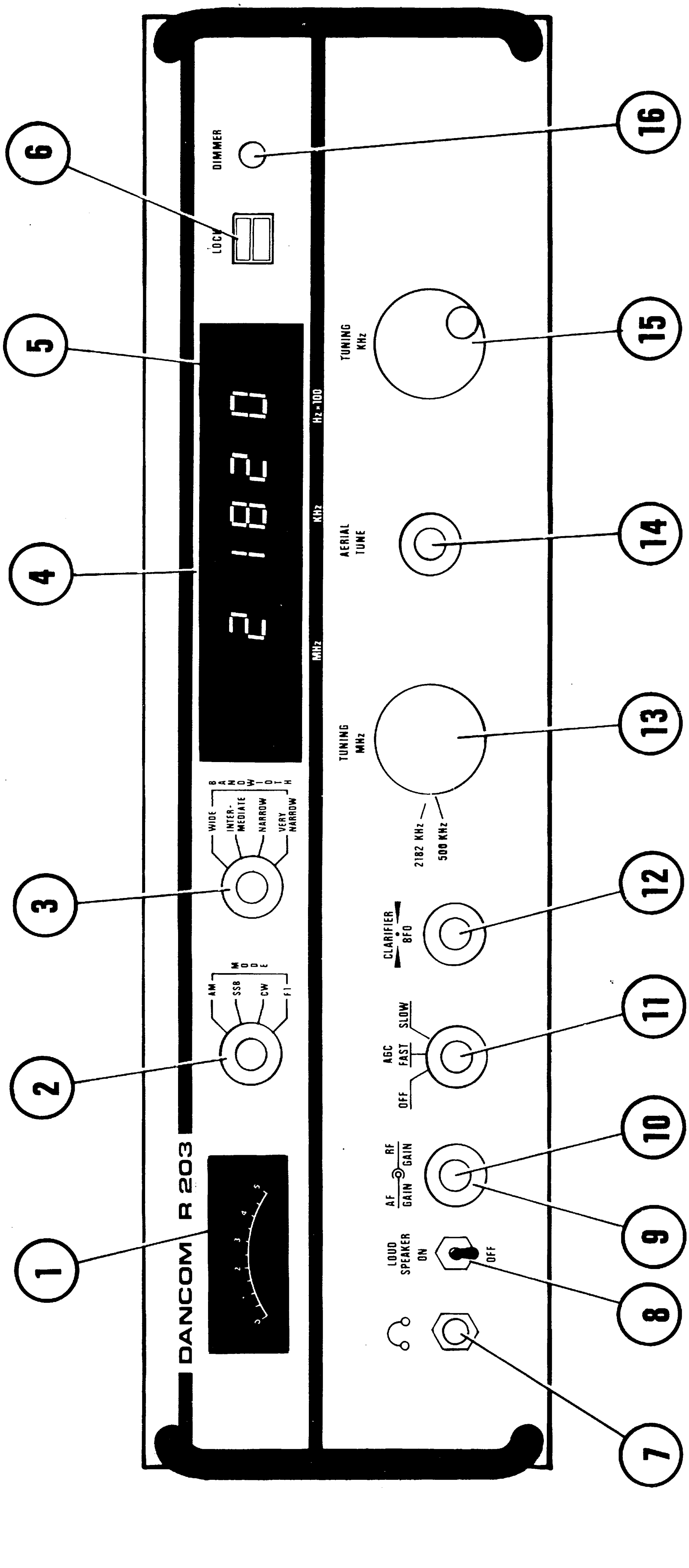
    With the MODE switch in position CW, the button functions as BFO. Set to requested beat-tone in the loudspeaker.
    Variation range ± 3 KHz.

13. TUNING MHz. Coarse tuning in 1 MHz bands. The frequency setting is shown on the display.

14. AERIAL TUNE. Tunes the aerial tuned circuits to maximum sensitivity. Tune to maximum signal strength on the meter or to maximum output level from the loudspeaker.

15. TUNING KHz. Variable tuning covering 1 MHz. Tunes the frequency between the fixed 1 MHz bands which are tuned with TUNING MHz. The frequency setting (tuning of TUNING KHz) is shown on the display.

16. DIMMER. Controls the light intensity in the display and in the meter dial light.


DANCOM R 203
DIMMER
LOCK
TUNING KHz
AERIAL TUNE
TUNING MHz
Hz×100
KHz
MHz
WIDE
INTER-MEDIATE
NARROW
VERY NARROW
BANDWIDTH
AM
SSB
CW
F1
MODE
2182 KHz
500 KHz
CLARIFIER
BFO
AGC
OFF
FAST
SLOW
AF GAIN
RF GAIN
LOUD SPEAKER
ON
OFF
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16

TRANSMITTER CONTROLS, PA-STAGE T201

1. DIMMER. Controls the light intensity in the meters and the channel dial

2. TEST METER. The meter is used together with the Test switch.

3. POWER. Lamp is alight when MAINS switch on power supply is in positior STAND BY.

4. OVERHEAT. The lamp is alight if the overheat protection circuit begins functioning.

5. ANTENNA CURRENT AMPS. The meter shows the antenna current. Is used whe the antenna is tuned.

6. OVERLOAD. The lamp is alight when the overload protection circuit begi functioning.

   NOTE! The lamp is not connected in the first series but the overload protection circuit is built-in and functions normally.

7. The lamp shows the position of the GROUP SELECTOR.

8. CHANNEL SELECTOR. Selects the requested frequency in the MF-band 1,6 - 3.8 MHz and switches to HF-bands.

9. The lamp shows the position of the GROUP SELECTOR.

10. ANTENNA TUNE MF. Tunes the antenna current to maximum when the FUNCTION switch on the exciter is in position TUNE.

11. Behind the cover there is an antenna tuning control for the distress frequency 2182 KHz. Must only be operated by a technician and must be tuned at the installation of the equipment.

12. GROUP SELECTOR. Switches between adjacent channels on the channel dia

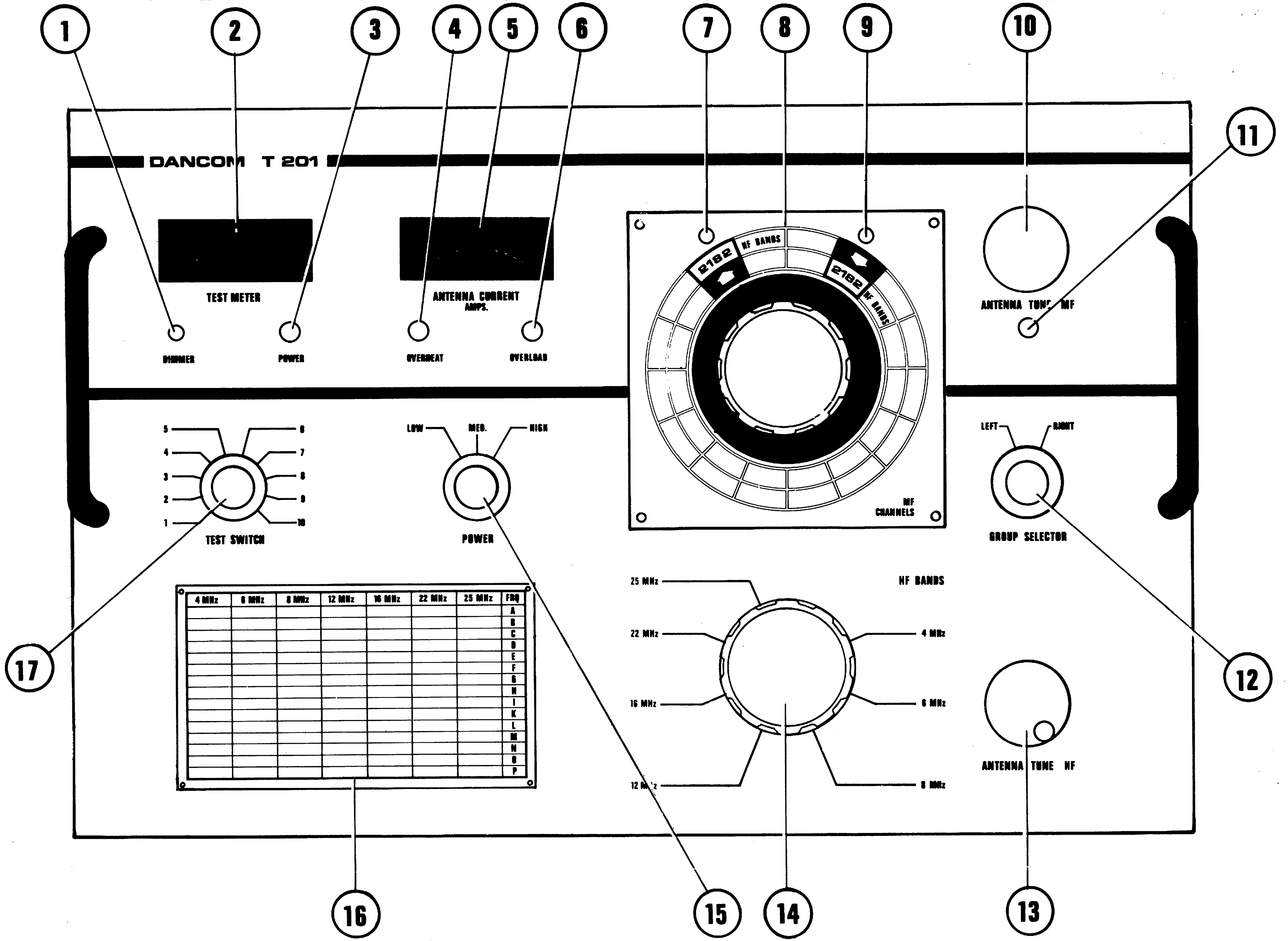
13. ANTENNA TUNE HF. Tunes the antenna current to maximum when the FUNCTION switch on the exciter is in position TUNE.

14. HF-BANDS. Selects the requested HF-band.

15. POWER. Switches between HIGH power 400 W PEP, MED. power 200 W PEP, and LOW power 50 W PEP.

16. FREQUENCY TABLE. Shows the frequencies programmed into the exciter on the HF-bands.

    The letters in the column FRQ. refer to the HF FREQUENCY control on th exciter.


DANCOM T 201
TEST METER
ANTENNA CURRENT
AMPS.
DIMMER
POWER
OVERHEAT
OVERLOAD
HF BANDS
2182
MF CHANNELS
ANTENNA TUNE MF
LEFT
RIGHT
GROUP SELECTOR
TEST SWITCH
LOW
MED.
HIGH
POWER
HF BANDS
25 MHz
22 MHz
16 MHz
4 MHz
6 MHz
8 MHz
ANTENNA TUNE HF

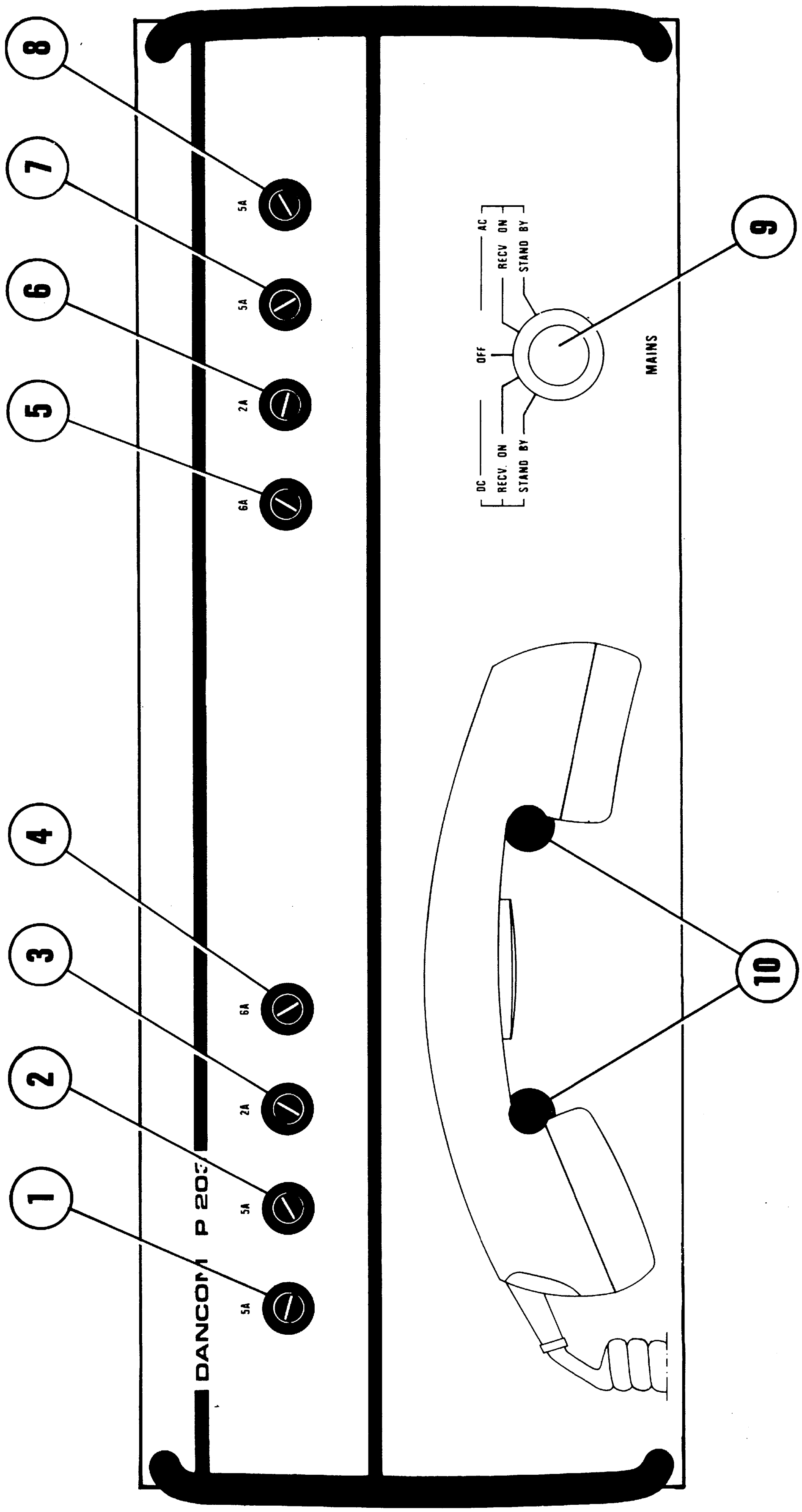
TRANSMITTER CONTROLS, POWER SUPPLY P201-202-203

1	5A FUSE	Receiver	DC mains
2	5A FUSE	Receiver	DC mains
3	2A FUSE	Receiver	AC mains, phase
4	6A FUSE	15 V controlled voltage to PA-stage	
5	6A FUSE		
6	2A FUSE	Exciter	AC mains, phase
7	5A FUSE	Exciter	DC mains
8	5A FUSE	Exciter	DC mains

9 MAINS switch. The receiver is on when the MAINS switch is in position RECV.ON.

When MAINS switch is in position STAND BY, the receiver is on,and the transmitter is stand-by which means current on PA tube filament and blower.

10 Cradle for microtelephone


DANCOM P 20
5A
5A
2A
6A
6A
2A
5A
5A
DC
RECV. ON
STAND BY
OFF
AC
RECV ON
STAND BY
MAINS
1
2
3
4
5
6
7
8
9
10

TRANSMITTER CONTROLS, EXCITER E201

1. Test meter.

2. TEST METER switch. Switches between testpoints inside exciter.

3. PRESS TO SEND ALARM. Keys the transmitter and radiates alarm signal with FUNCTION switch in position SEND ALARM.

4. DISPLAY. Shows the selected frequency.

5. DISPLAY TEST. When the display test is activated, the display wil show 88,888,8 MHz.

6. DIMMER. Controls light intensity in the display and in the meter dial light.

7. HANDSET. Multiconnector for handset.

8. MICROPHONE sensitivity behind cover. Will be adjusted by service technician.

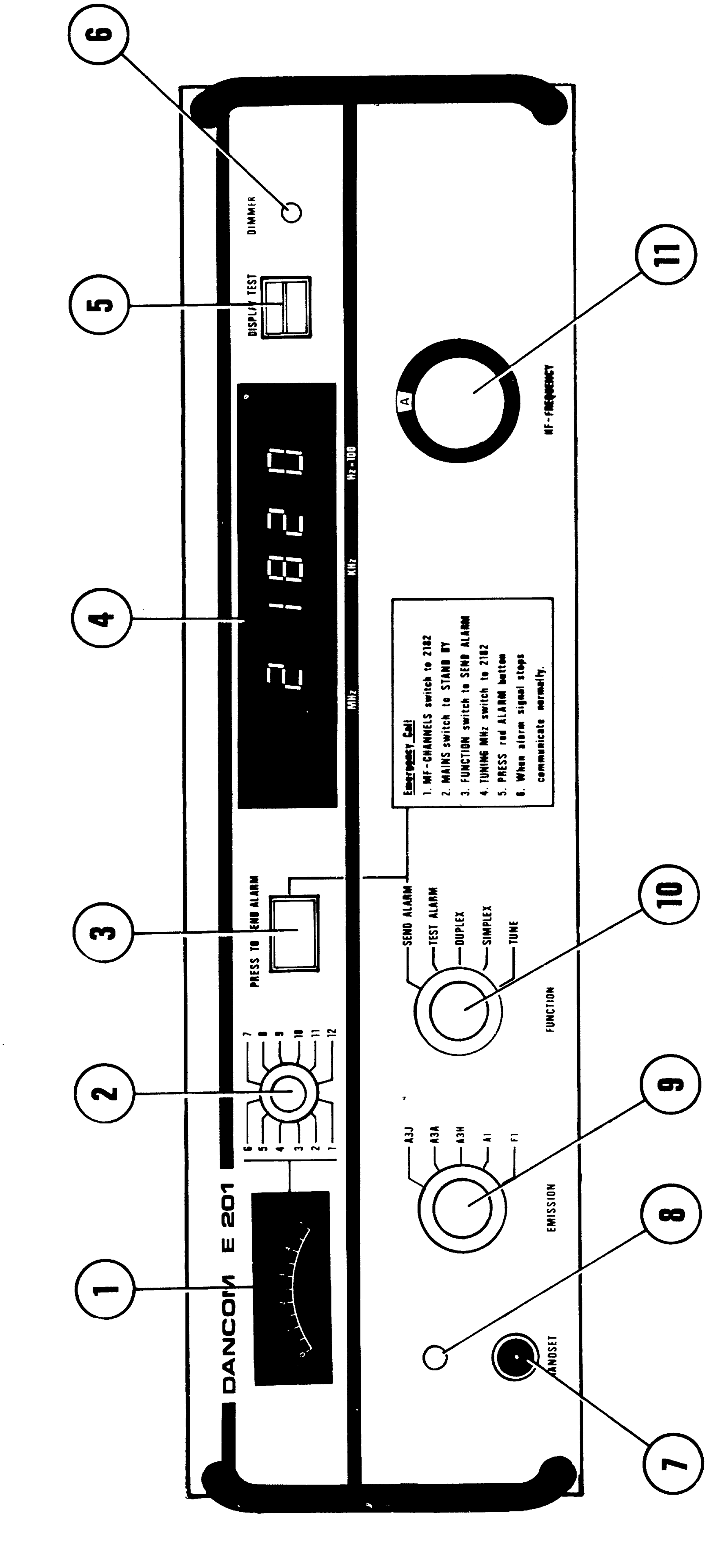
9. EMISSION. Selects emission modes A3J, A3A, A3H, A1 or F1.

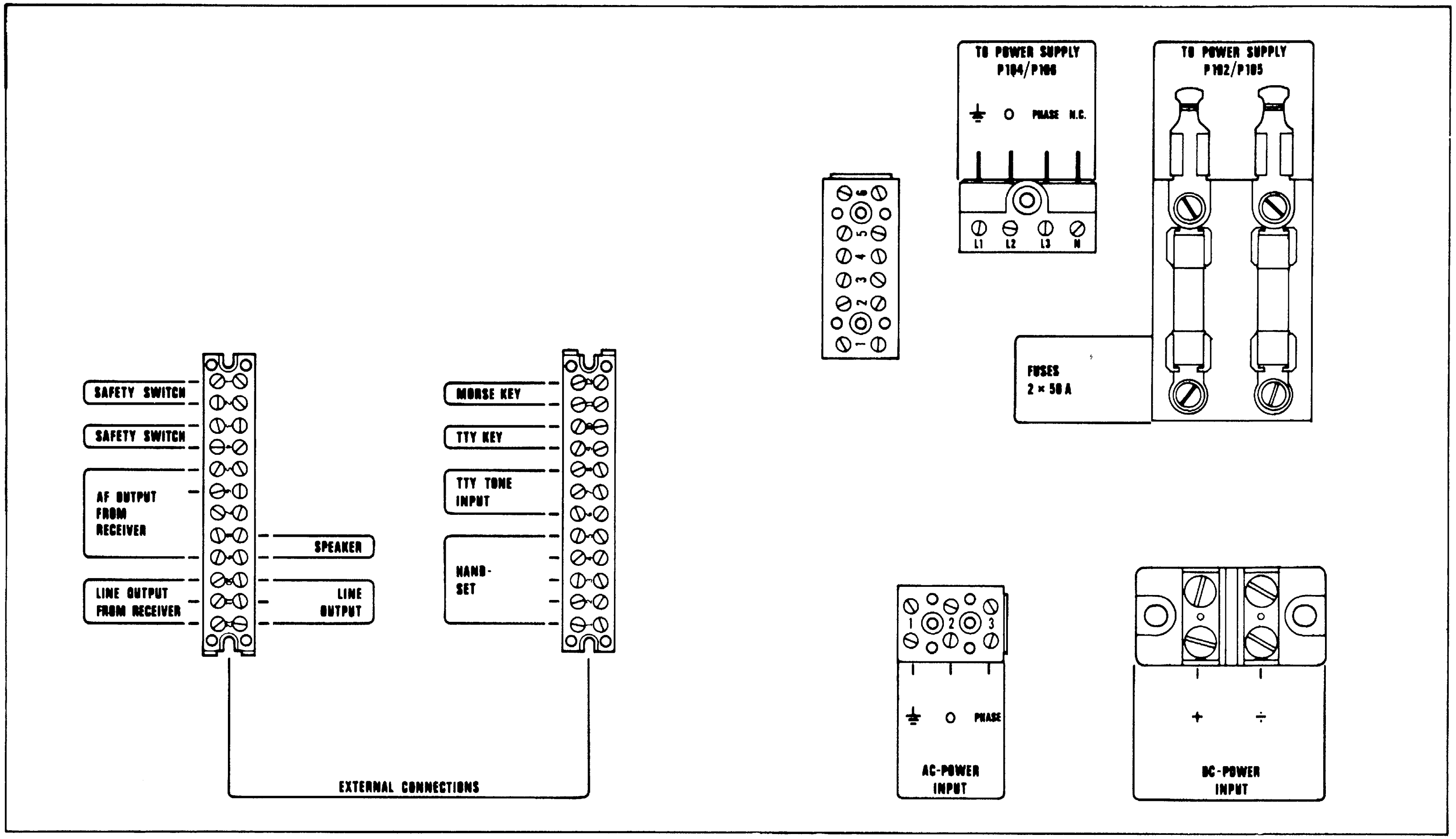
   This switch is out of function when the distress frequency 2182 KH has been selected. The exciter is then automatically programmed fc A3H mode.

10. FUNCTION. Switches between TUNE, SIMPLEX, DUPLEX, TEST ALARM and SEND ALARM.

11. HF-FREQUENCY. Switches between up to 16 programmed frequencies ir each of the maritime HF-bands.

    Note the EMERGENCY CALL instruction.


DANCOM E 201
PRESS TO SEND ALARM
DISPLAY TEST
DIMMER
MHz
KHz
Hz-100
Emergency Call
1. MF-CHANNELS switch to 2182
2. MAINS switch to STAND BY
3. FUNCTION switch to SEND ALARM
4. TUNING MHz switch to 2182
5. PRESS red ALARM button
6. When alarm signal stops
communicate normally.
SEND ALARM
TEST ALARM
DUPLEX
SIMPLEX
TUNE
FUNCTION
A3J
A3A
A3H
A1
F1
EMISSION
HANDSET
MF-FREQUENCY
1
2
3
4
5
6
7
8
9
10
11



Connections to the radiotelephone

TUNING OF THE TRANSMITTER

When the transmitter leaves the factory, it has been tuned on dummy loads:

On the MF-band it has been tuned to 10 ohms in series with 250 pF.

On the HF-bands it has been tuned to 50 ohms.

That means that some of the operations in the following tuning procedures already have been carried out.

The procedures are mentioned as it might be necessary to repeat the tuning after a repair. Besides these procedures will be necessary if a test of the transmitter before the installation on board a ship is required.

When the transmitter has been correctly installed and is ready for tuning of the antenna, pull out the PA-stage (T201) completely and connect the antenna direct to the antenna output on the chassis.

Connect the chassis to the earth band with a short and strong wire.

N O T E!

The antenna current meter may show a very small deflection or none all if the antenna impedance gets very high or if the antenna has resonance at the frequency in question. (See the paragraph about an theory).

In this special case the antenna length can be changed so that the antenna current meter can deflect,or a glow lamp can be used as ant tuning indicator.

TUNING OF THE MF-BAND

1. Remove transmitter from case.

2. Dis-connect antenna and cheat the safety interlock switch until the micro-switch just trips.

3. Switch to Simplex and low power.

4. Refer to Antenna Tuning diagram and table and ascertain the setting of Capacity and approximate Inductance for the left hand (P.A.) drum.

   Place contact screws in these positions with the tool provided. Remember to turn the dial so that the row corresponding to the frequency marked is uppermost.

5. Switch to IK on the test meter switch and operate function switch to tune. Note reading of Cathode current on test meter.

   By means of the metal end of the contact screw insertion tool, short the drum to the contacts on the centre part of the drum until minimum cathode current is found. If a good minima is not found, move the contact in the rear part of the drum and try again. Take out and re-insert the contact screw in the best position.

   The IK reading should in any event not exceed 2 on the meter in Low, Med., or High power.

6. To set up the Antenna drum first place contact screws in positions 19 and 20.

7. Load the transmitter by placing contact screw in position 2.

8. Next program the variometers by placing a contact screw in position 11 for 2182 and position 10 for all other MF frequencies.

9. Tap the antenna coil by placing tap in No 12 position.

   Now try for antenna current indication on antenna current meter by adjusting the variometer with function switch to tune. If there is little or no antenna current, add an extra screw to position 13 upwards until it is possible to obtain antenna current.

10. If it is still not possible to obtain antenna current, add capacity by moving contact from 19 to 21 and go back to para. 6.

11. For frequencies at the low end of the band it may be necessary to program the loading higher than 2 (try 4 or 5) to increase the load.

12. Finally. Remove screw from loading position 2 and short contacts from 1 through to 9, one at a time until maximum antenna current is obtained. Replace contact in optimum position.

    N.B.

    It must be noted that each time the loading tap is changed, the variometer must be re-tuned in order to avoid overload..

    Point 1 up to and including point 5, just as the points 13 and 14 can be done by using a dummy load and need not be done on board the ship.

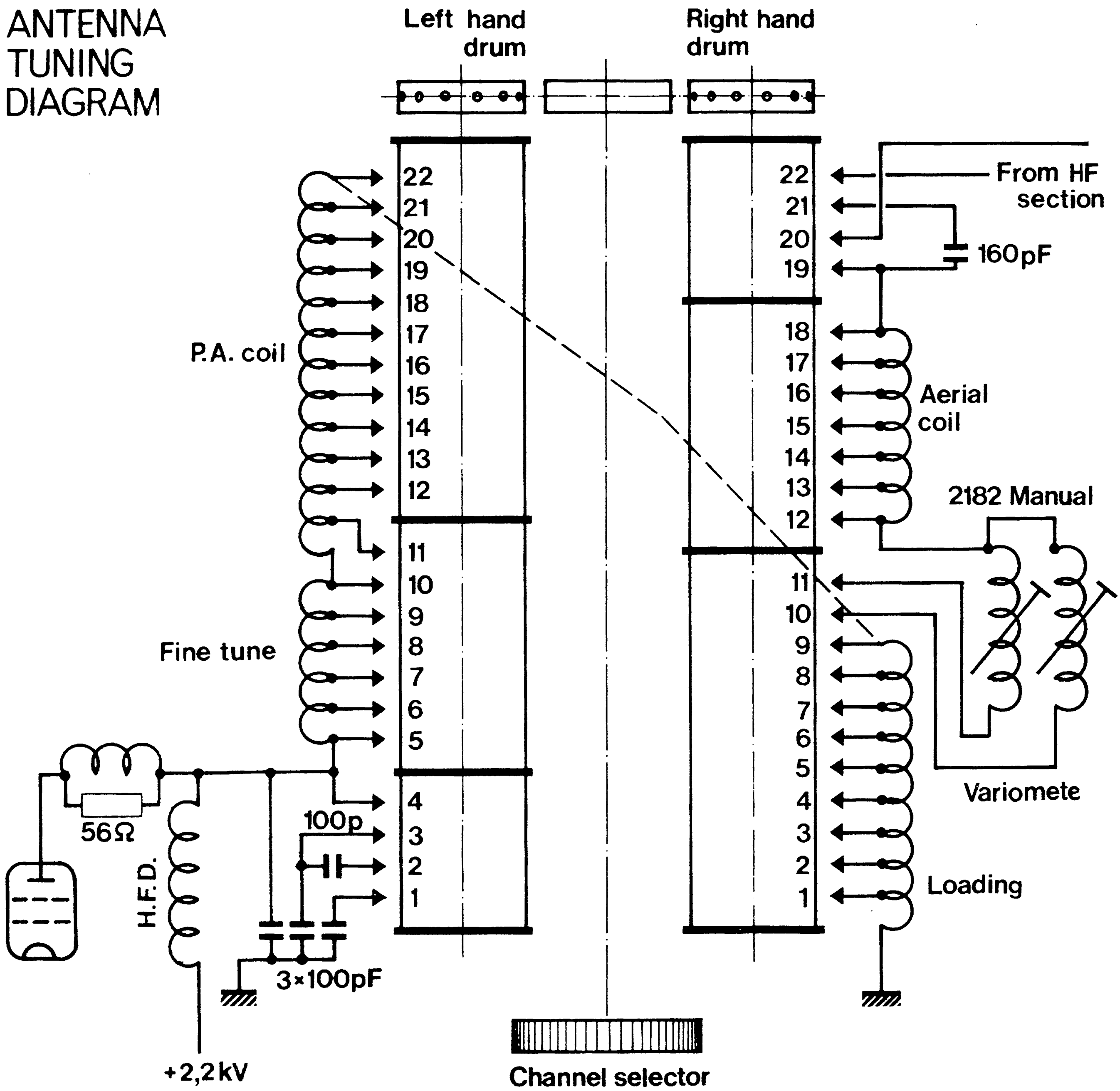
13. Connect counter to aerial. Do not connect counter direct to aerial output on transmitter, but use a link coupling. Remove microphone capsule from handset. Set channel selector on the required frequency and function switch in pos. tune. Then adjust for max. aerial current.

14. Set emission switch to position A3H and check the output frequencies.

PA TUNING TABLE

			PA CAPACITOR ACTUAL		PA COIL APPROX.	
	KHz	BAND	C (pF)	TAP	L (µH)	TAP
f min (KHz)	1600	I	320	1-3-4	31	-
f max (KHz)	2000	I	320	1-3-4	20	15
f min (KHz)	2000	II	270	1-2-4	24	13
f max (KHz)	2600	II	270	1-2-4	14	19
f min (KHz)	2500	III	220	1-4	18,5	16
f max (KHz)	3300	III	220	1-4	10,5	21
f min (KHz)	3200	IV	170	2-4	14,5	18
f max (KHz)	4000	IV	170	2-4	8,5	22

ANTENNA TUNING DIAGRAM



PREPARATIONS BEFORE TUNING ON HF

1. The drum for HF-tuning (PA-tank circuit) has been pre-adjusted at the factory. Contact screws have been inserted according to below table. This pre-adjustment must n e v e r be changed.

Frequency band	Contact screw positions on the drum
4 MHz	1-4-11-12-22
6 MHz	1-3-10-12-22
8 MHz	1-2-9-12-22
12 MHz	8-12-22
16 MHz	7-12-22
22 MHz	6-12-22
25 MHz	5-6-7-8-9-10-11-12-22

2. The placing of contact screws between positions 12 and 22 depends on the actual antenna installation (antenna impedance).

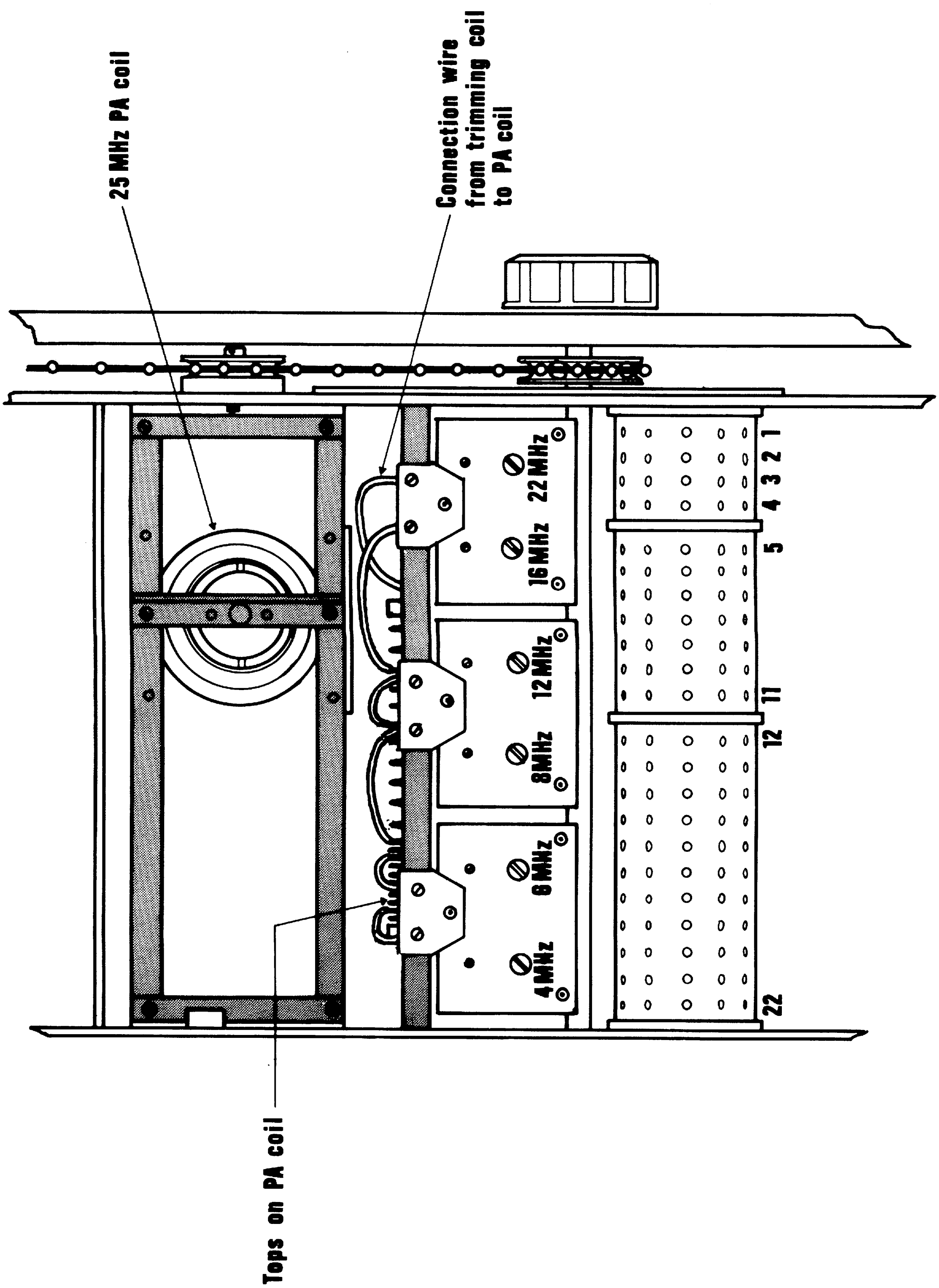
As guidance the positions for a 50 ohms antenna are mentioned:

Frequency band	Contact screw positions on the drum
4 MHz	14
6 MHz	15
8 MHz	16
12 MHz	17
16 MHz	17
22 MHz	no contact screw
25 MHz	no contact screw

3. Connect the trimming coils to the main tuning coil as shown on the drawing.

The points 1, 2, and 3 are instructions about clearing of the transmitter before the installation takes place.

These instructions have normally been carried out before the transmitter leaves the factory.


25 MHz PA coil
Connection wire from trimming coil to PA coil
Tops on PA coil
22 MHz
16 MHz
12 MHz
8MHz
6 MHz
4 MHz
1
2
3
4
5
11
12
22

TUNING OF THE 25 MHz BAND

1. Turn the HF-BANDS switch into position 25 MHz.

2. Select a frequency with the HF-FREQUENCY switch. (If more frequencies are programmed in the exciter, select a medium frequency.)

3. Keep the FUNCTION switch in position TUNE while tuning the ANTENNA TUNE HF to maximum antenna current.

4. Keep the FUNCTION switch in position TUNE while adjusting the adjusting screw in the 25 MHz PA-coil to maximum antenna current.

5. Repeat para. 3 and 4 until the highest possible antenna current is obtained.

6. Check the output power at the highest and the lowest frequency in the band.

N.B! If the 25 MHz band is not going to be used, turn the trimming screw counter clockwise until the extreme position has been reached.

TUNING OF THE 22 MHz BAND

1. Turn the HF-BANDS switch into position 22 MHz.

2. Select a frequency with the HF-FREQUENCY switch. (If more frequencies are programmed in the exciter, select a medium frequency.)

3. Keep the FUNCTION switch in position TUNE while tuning the ANTENNA TUNE HF to maximum antenna current.

4. Keep the FUNCTION switch in position TUNE while adjusting the 22 MHz trimming coil to maximum antenna current.

5. Repeat para. 3 and 4 until the highest possible antenna current is obtained.

6. Check the output power at the highest and the lowest frequency in the band.

TUNING OF THE 16 MHz BAND

1. Turn the HF-BANDS switch into position 16 MHz.

2. Select a frequency with the HF-FREQUENCY switch. (If more frequencies are programmed in the exciter, select a medium frequency.)

3. Turn the ANTENNA TUNE HF capacitor to half of its maximum capacitance.

4. Turn the FUNCTION switch into position TUNE and note the antenna current.

5. Move the connection wire from the 16 MHz trimming coil one tap up the PA-coil.

   Turn the FUNCTION switch into position TUNE and note the antenna current.

6. Move the connection wire from the 16 MHz trimming coil one tap down the PA-coil.

   Turn the FUNCTION switch into position TUNE and note the antenna current.

7. Leave the connection wire on the tap giving the highest antenna current.

8. Adjust the 16 MHz trimming coil to maximum antenna current while keeping the FUNCTION switch in position TUNE.

9. Adjust the ANTENNA TUNE HF to maximum antenna current while keeping the FUNCTION switch in position TUNE.

10. Repeat para. 8 and 9 until the highest possible antenna current is obtained.

11. If the ANTENNA TUNE HF capacitor is at its maximum capacitance when maximum antenna current is obtained, move tap from position 17 into position 16 and repeat the tuning procedure from para. 3 to 10.

12. If the ANTENNA TUNE HF capacitor is at its minimum capacitance when maximum antenna current is obtained, remove the tap in position 17 and repeat the tuning procedure from para. 3 to 10.

13. Check the output power at the highest and the lowest frequency in the band.

TUNING OF THE 12-8-6 and 4 MHz BANDS

Use the 16 MHz tuning procedure para. 1 to 10 and para. 13 when tuning the 12-8-6 and 4 MHz bands. Use the corresponding trimming coils.

T E S T   I N S T R U M E N T   R E A D I N G S

TRANSMITTER T 201

Test switch pos.	DRIVE	ALC	I_{cat}	V_{g1}	V_{g2}	+9V	-9V	+15V
Stand-by	0	0	0	5	0	4-5	4-5	1,5-2
A3J without mod.	0	0	1-2	3,5-4	4-5	4-5	4-5	1,5-2
A3H without mod.1/1 Pwr.	0	1-4	app.2	3,5-4	4-5	4-5	4-5	1,5-2
Tune 1/1 Power	0-0,25	1-4	2-3	3,5-4	4-5	4-5	4,5	1,5-2

EXCITER E 201

Test point	+5V	+9V	Not used	+15V	+35V	No chan. ident.	Output	Reference loop	100 Hz loop	1 MHz loop	10 KHz loop
Test switch pos.	1	2	3	4	5	6	7	8	9	10	11
Stand-by	4,5-5	4,5-5	0	4,5-5	4,5-5	4-5	0	4-5	4-5	4-5	4-5
A3J without mod.	4,5-5	4,5-5	0	4,5-5	4,5-5	4-5	0	4-5	4-5	4-5	4-5
A3H without mod.1/1 Pwr.	4,5-5	4,5-5	0	4,5-5	4,5-5	4-5	app 2,5	4-5	4-5	4-5	4-5
Tune 1/1 Power	4,5-5	4,5-5	0	4,5-5	4,5-5	4-5	app 3	4-5	4-5	4-5	4-5

Adjustment directions for the synthesizer in exciter E 201

CONTENTS:

1. CHECKING OF TCXO

1.1. Check that the output frequency of the TCXO is 10.000.0 MHz. Must lie within ± 30 Hz. Must not be adjusted.

2. ADJUSTMENT OF REFERENCE LOOP

2.1. Adjust C_8 so that the voltage on collector of T_4 is 6 V.

2.2. Adjust L_4 to maximum 8.7 MHz output, app. 0.9 VRMS.

2.3. Short-circuit base on oscillator transistor (T5) to ground in 100 Hz loop.

Adjust L1, L2 and L3 to maximum 52.2 MHz output, app. 195 mVRMS.

2.4. Check all reference outputs from the reference loop i.e. 10 MHz, 10 KHz, 100 Hz, 8.7 MHz and 52.2 MHz.

2.5. Check that the test instrument shows app. 4 in position 8.

3. ADJUSTMENT OF 100 Hz LOOP

3.1. Check 100 Hz reference signal from reference loop.

3.2. Adjust L_1, L_2, L_4, and L_5 to maximum output, app. 400-500 mVRMS (f= 51.7 MHz).

3.3. Adjust L_3 to maximum app. 2 VRMS on collector of T_7.

3.4. Adjust L_7 and L_6 to maximum, app. 400 mVRMS at base of T_{12}.

3.5. Check that T_{12} switches completely on/off.

3.6. Select 25.000.0 MHz on the exciter.

Adjust C_{13} so that the voltage on the collector of T_2 is maximum 15 V.

3.7. Select 25.999.9 MHz on the exciter.

Adjust C_{13} so that the voltage on collector of T_2 is minimum 4 V.

3.8. Repeat 6 and 7 so that the voltage variation on collector of T2 lies symmetrical between max. 15 V and min. 4 V.

3.9. Check that the test instrument shows app. 4 in position 9.

4. ADJUSTMENT OF 1 MHz LOOP

4.1. Adjust L_1 and L_2 to maximum at base of T2, app. 0,5 VRMS.

4.2. Check that the voltage on collector of T_2 is minimum 1,6 VRMS.

4.3. Select 25.000.0 MHz on the exciter.

4.4. Adjust the coarse-tuning voltage with potentiometer R98 on the Display-print.

Measure the voltage across C_{3o} (lead-through capacitor).

Adjust the coarse-tuning voltage to 15 V.

4.5. Adjust the oscillator coil L_3 so that the voltage on C_{17} is 10 V.

4.6. Check the voltage on collector of T_{11}, minimum 0.85 VRMS.

4.7. Short-circuit gate on oscillator transistor (T_6) in 10 KHz loop.

Check the output from the 1 MHz loop, minimum 180 mVRMS.

4.8. Check that the test instrument shows app. 4 in position 10.

5. ADJUSTMENT OF 10 KHz LOOP

5.1. By the following adjustments you have to make sure that the 1 MHz loop and the 10 KHz loop track in frequency.

5.2. For each of the following adjustments it must be checked that the voltage across C_{17} in the 1 MHz loop lies between 5-15 V. I.e. the 1 MHz loop is in lock.

If not, re-adjust on L_3 in the 1 MHz loop so that the voltage across C17 lies within the limits 5-15 V.

5.3. Select 25.000.0 MHz on the exciter.

5.4. Short-circuit C_5 and check that the voltage across C_{11} is 13-14 V.

5.5. Check that the 1 MHz loop is in lock, see point 5.2.

6. ADJUSTMENT OF LOW PASS FILTER L_2 and L_3

6.1. Connect oscilloscope or HF-mV meter to collector of T_{1o}.

6.2. Short-circuit C_{11} to ground.

6.3. The frequency out of T_{1o} must be variable from 0-7 MHz by means of the oscillator coil L_1.

(corresponds to f_{1o} KHz loop 66-73 MHz)

6.4. Adjust the output frequency f_{1o} KHz loop to 68 MHz and check that the drain voltage on T_{12} is minimum 300 mVRMS.

6.5. Adjust the Low Pass filter (L2 and L3) to maximum flat in the range 0-7 MHz. Maximum ripple 3 dB.

6.6. Check that the collector voltage on T_{1o} is minimum 3 V pp.

6.7. Remove the short-circuit C_{11} to ground and short-circuit C5 to ground.

6.8. Adjust (with L_1) the frequency out of T_{1o} to 7 MHz and remove the short-circuit C5 to ground.

6.9. Check that the exciter output frequency fo = 25.000.0 MHz (or f_{1o} KHz loop = 68 MHz).

This shows that the 10 KHz loop goes in lock.

6.1o. Check that the output from the 10 KHz loop is minimum 40 mVRMS

7. ADJUSTMENT OF VCO (in the 25 MHz band)

7.1. Short-circuit C_{11} to ground.

7.2. Adjust L_1 to an exciter output frequency between 25-3 = 22 MHz and 25-1 = 24 MHz.

or

f_{10} KHz loop between 68-3 = 65 MHz and 68-1 = 67 MHz.

7.3. Remove the short-circuit C_{11} to ground and short-circuit C_5 to ground.

7.4. Check that the exciter output frequency lies between 25+2 = 27 MHz and 25+4 = 29 MHz

or

f_{10} KHz loop between 68+2 = 70 MHz and 68+4 = 72 MHz.

7.5. Check that the 1 MHz loop is in lock, see point 5.2.

8. CHECKING OF THE MF-BAND 1,6 - 2,999,9 MHz

8.1. Set the exciter at fo = 1,6 MHz.

(When fo = 1,6 MHz, f_{lo} KHz loop = 44,6 MHz)

8.2. Short-circuit C_5 to ground.

8.3. Check that the output frequency is minimum 4 MHz and maximum 5 MHz.

(f_{lo} KHz loop min. 47 MHz and max. 48 MHz).

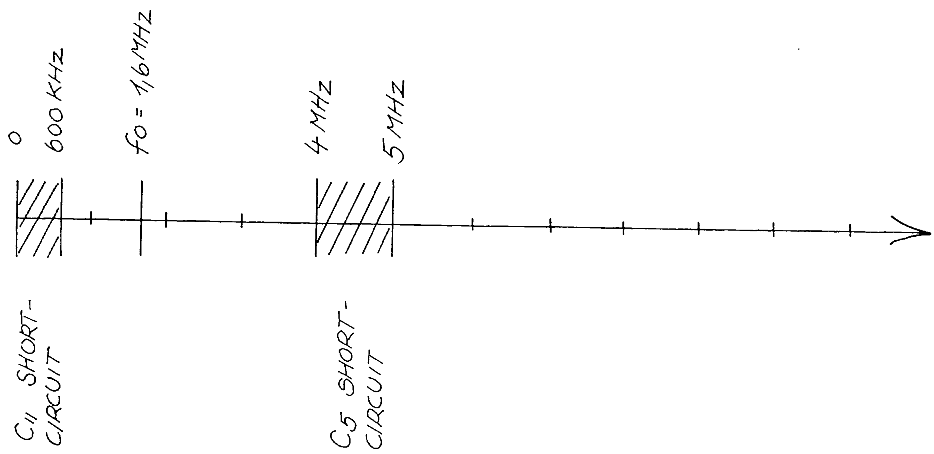
8.4. Remove the short-circuit across C_5 and short-circuit C_{11}.

8.5. Check that the output frequency is less than 0,6 MHz.

(f_{lo} KHz loop less than 43,6 MHz).

8.6. If the points 8.3. and 8.5. are not fulfilled, the resistor R_{lo4} on the display-print must be changed.

8.7. Set the output frequency at 2 MHz and check that the 1 MHz loop is in lock. See point 5.2.



9. CHECKING OF THE MF-BAND 3 - 3.999,9 MHz

(adjustment of coarse-tuning voltage respectively)

9.1. Set the exciter at 3 MHz.

(When fo = 3 MHz, f_{lo} KHz loop = 46 MHz)

9.2. Short-circuit C_5 to ground.

9.3. Check that the output frequency is minimum 5 MHz and maximum 7 MHz.

(f_{lo} KHz loop min. 48 MHz and max. 50 MHz)

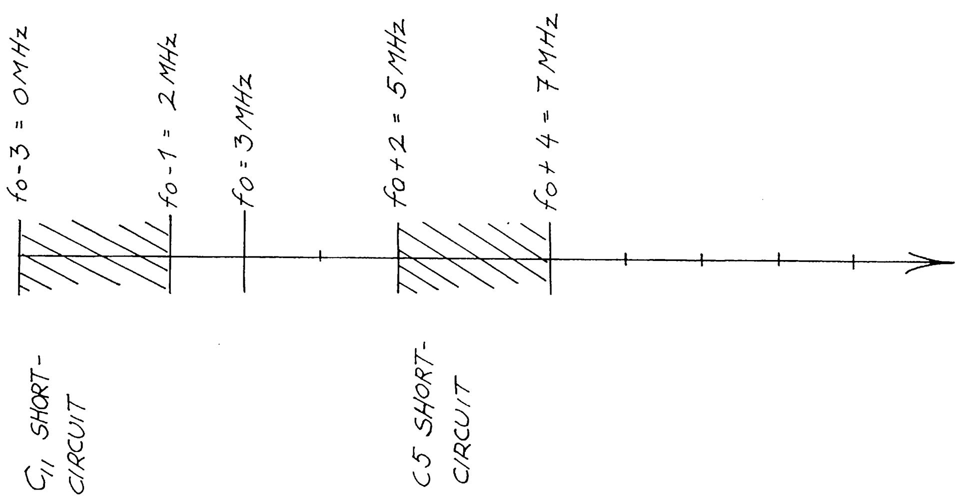
9.4. Remove the short-circuit across C5 and short-circuit C_{11}.

9.5. Check that the output frequency is less than 2 MHz.

(f_{lo} KHz loop less than 45 MHz)

9.6. If 9.3. and 9.5. are not fulfilled, the resistor R_{107} on the display-print must be changed.

9.7. Check that the 1 MHz loop is in lock, see point 5.2.



10. CHECKING OF THE 22, 16, 12, 8, 6, and 4 MHz BANDS

(adjustment of coarse-tuning voltage respectively)

10.1. In the following fo might be one of the above frequencies chosen at random.

fo =	22	16	12	8	6	4 MHz
$f_{lo\ KHz\ loop}$ =	65	59	55	51	49	47 MHz

10.2. Set the exciter at a fo.

10.3. Short-circuit C_{11} to ground.

10.4. Check that the frequency is minimum fo - 3 MHz and maximum fo - 1 MHz.

10.5. Remove the short-circuit across C_{11} and short-circuit C_5.

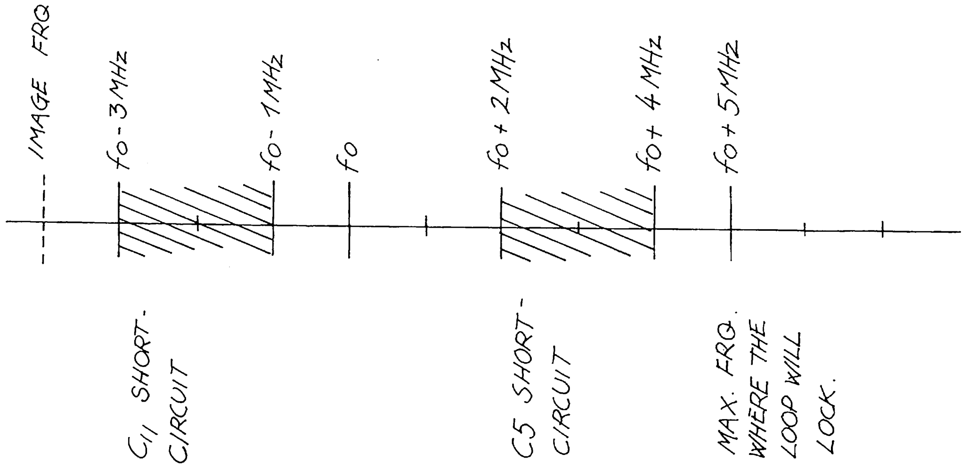
10.6. Check that the frequency is minimum fo + 2 MHz and maximum fo + 4 MHz.

10.7. Select a new fo and repeat 10.3. to 10.6.

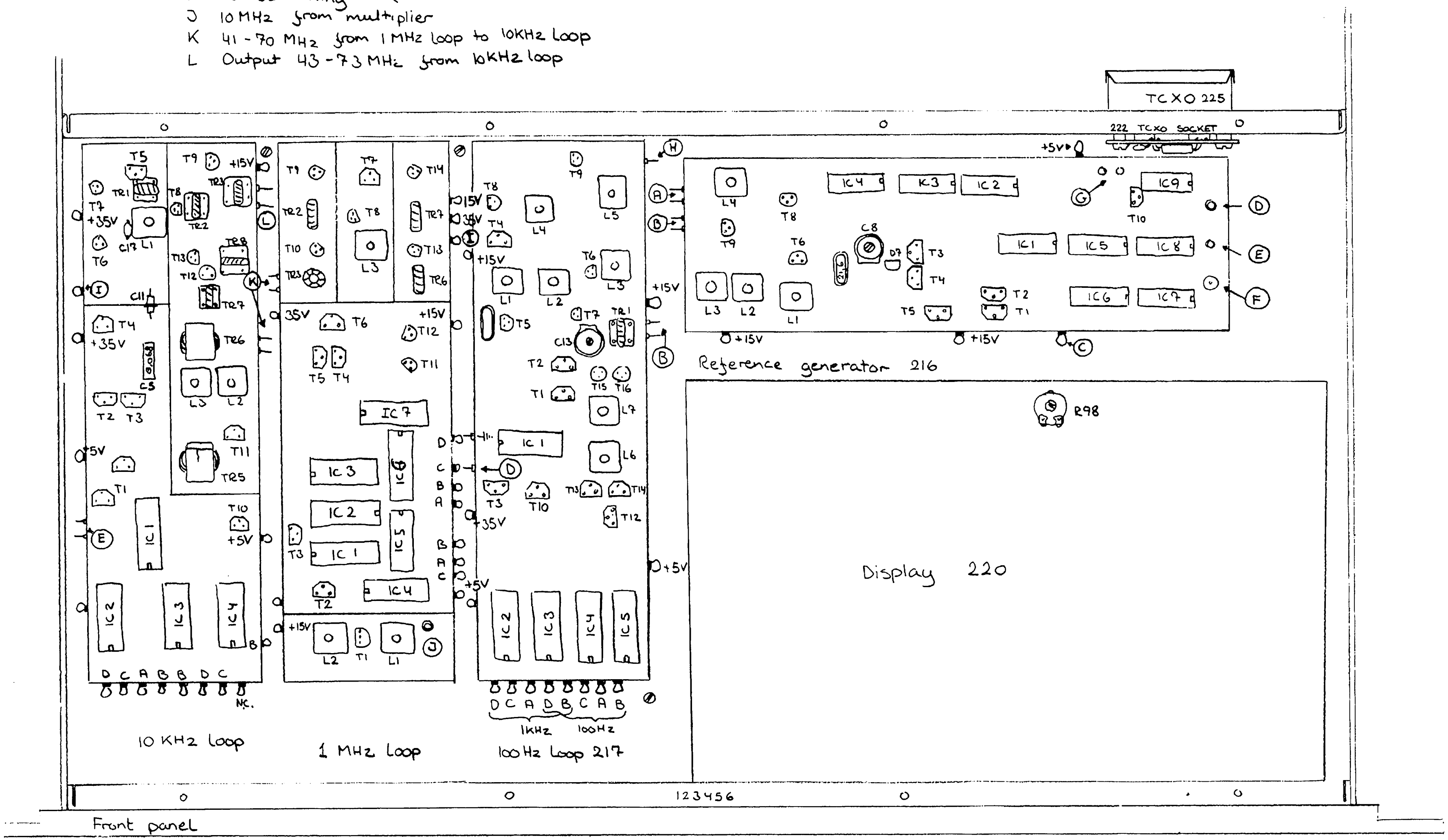
10.8. If points 10.4. and 10.6. are not fulfilled, the coarse-tunin must be changed, i.e. the resistors R_{106}, R_{105}, R_{100}, R_{103}, R_{101}, and R_{102} on the display-print must be changed.

10.9. Check that the 1 MHz loop is in lock, see point 5.2.

10.10. Check that the test instrument shows app. 4 in position 11.



- A 8,7 MHz
- B 52,2 MHz
- C Out of lock
- D 100 Hz
- E 10 KHz
- F 1 MHz
- G 10 MHz from TCXO
- H 51,7 MHz
- I Coarse tuning (C30)
- J 10 MHz from multiplier
- K 41 - 70 MHz from 1 MHz loop to 10 KHz loop
- L Output 43 - 73 MHz from 10 KHz loop



Top wiew

PROGRAMMING THE DANCOM HF 400.

MF-frequency programming.

The HF-400 covers the frequency range 1.6 - 3.8 MHz.
There is room for 14 frequency pairs (28 frequencies).
The diviation between two frequencies forming neighbouring channels must maximum be 1%.

1. Place the MF-frequencies, which you want to have programmed, in the table figure 1.
   Check that the neighbouring channels do not deviate more than 1% from each other.

2. Transfer the frequencies to the MF-channel dial.

3. Transfer the frequencies to the programming table.

   NOTE! WORDS 14 and 30 must not be programmed and WORDS 15 and 31 MUST ALWAYS BE PROGRAMMED TO 2182 MHz.

4. MHz must be programmed in PROMS no. 1 and no. 2.
   100 KHz, 10 KHz are programmed in PROM no. 4 and 1 Khz and 100 Hz are programmed in PROM no. 3.

5. Transfer the programming codes to the programming table.
   See example figure 3.

6. When the programming of a PROM is finished, it ought to be marked with number.

HF-Frequency programming.

The HF-400 covers all maritime HF-bands i.e.:

4.063 -	4.231,0	KHz
6.200 -	6.345,5	KHz
8.195 -	8.459,5	KHz
12.330 -	12.689,0	KHz
16.460 -	16.917,5	KHz
22.000 -	22.374,0	KHz
25.070 -	25.110,0	KHz

There is room for 16 frequencies in each band.

1. Arrange the frequencies, wich you want to have programmed, and enter these directly in the programming tables.

2. Transfer the frequencies to the frequency table.

3. MHz are programmed permanently in the HF-400, thus these are not to be programmed.
   100 KHz and 10 KHz are programmed in PROMS with even numbers and 1 KHz and 100 Hz in PROMS with uneven numbers.

   Transfer the programming codes to the programming tables. See example figure 3.

4. When the programming of a PROM is finished, it ought to be marked with number.

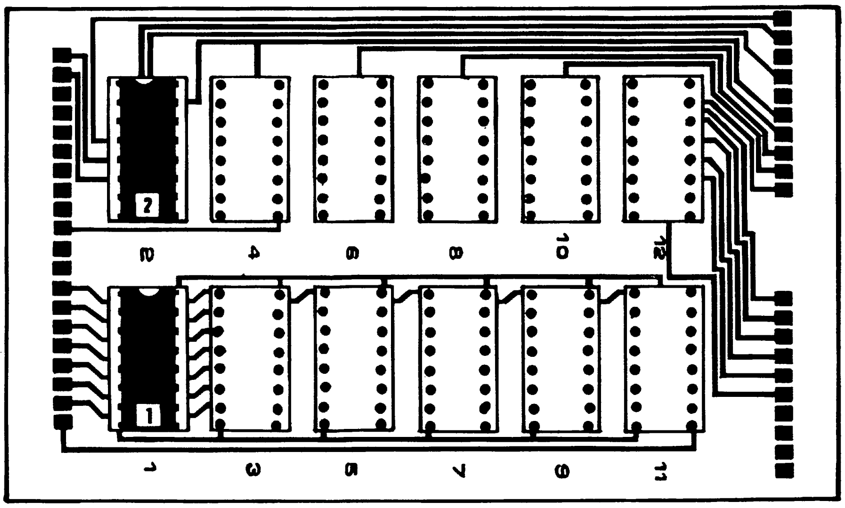
   When the PROM is placed in the socket of the promboard, it is very important that the PROM is faced correctly.

CHECK OF THE PROGRAMMING.

Check that the PROM is placed correctly in the socket of the promboard.

PROMBOARD MODULE 219.

Extra PROMS Dancom stock no 36.117



Mount the programmed promboard in an exciter (E 201).

Connect a frequency counter to the output of the exciter.

(Warning! The exciter gives 1 W PEP in 50 ohms).

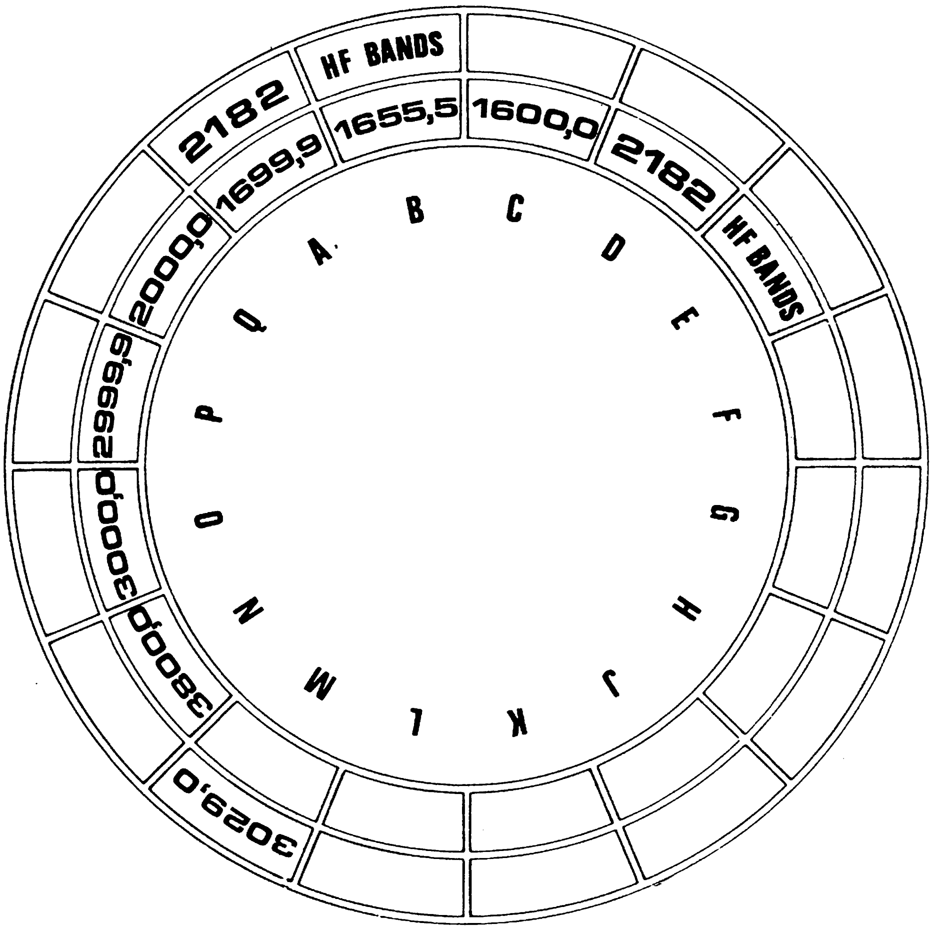
Check each frequency both on the frequency counter and on the display of the exciter.

PROGRAMMING CODE.

Mhz code on MF.			PROM NO. 1			PROM NO. 2	
MHz		PIN	9 7 6 5	4 3 2 1		9 7 6 5	4 3 2 1
		BIT	7 6 5 4	3 2 1 0		7 6 5 4	3 2 1 0
1			0 0 1 0	0 0 0 1		0 0 0 0	0 0 1 1
2			0 0 1 0	0 0 1 0		0 0 0 0	0 0 1 1
2182			0 0 0 0	0 0 1 0		0 0 0 0	0 0 1 1
3			0 0 1 0	0 0 1 1		0 0 0 0	1 0 0 1

100-10-1 Khz & 100 Hz code on MF & HF						PROM NO : 4-6-8-10-12			PROM NO : 3-5-7-9-11	
MHz	100KHz	10KHz	1KHz	100Hz	PIN	9 7 6 5	4 3 2 1		9 7 6 5	4 3 2 1
					BIT	7 6 5 4	3 2 1 0		7 6 5 4	3 2 1 0
x	0	x	x	x			0 0 0 0			
x	1	x	x	x			0 0 0 1			
x	2	x	x	x			0 0 1 0			
x	3	x	x	x			0 0 1 1			
x	4	x	x	x			0 1 0 0			
x	5	x	x	x			0 1 0 1			
x	6	x	x	x			0 1 1 0			
x	7	x	x	x			0 1 1 1			
x	8	x	x	x			1 0 0 0			
x	9	x	x	x			1 0 0 1			
x	x	0	x	x		0 0 0 0				
x	x	1	x	x		0 0 0 1				
x	x	2	x	x		0 0 1 0				
x	x	3	x	x		0 0 1 1				
x	x	4	x	x		0 1 0 0				
x	x	5	x	x		0 1 0 1				
x	x	6	x	x		0 1 1 0				
x	x	7	x	x		0 1 1 1				
x	x	8	x	x		1 0 0 0				
x	x	9	x	x		1 0 0 1				
x	x	x	0	x					0 0 0 0	
x	x	x	1	x					0 0 0 1	
x	x	x	2	x					0 0 1 0	
x	x	x	3	x					0 0 1 1	
x	x	x	4	x					0 1 0 0	
x	x	x	5	x					0 1 0 1	
x	x	x	6	x					0 1 1 0	
x	x	x	7	x					0 1 1 1	
x	x	x	8	x					1 0 0 0	
x	x	x	9	x					1 0 0 1	
x	x	x	x	0						1 1 0 0
x	x	x	x	1						1 1 0 1
x	x	x	x	2						1 1 1 0
x	x	x	x	3						1 1 1 1
x	x	x	x	4						0 1 0 0
x	x	x	x	5						0 1 0 1
x	x	x	x	6						0 1 1 0
x	x	x	x	7						0 1 1 1
x	x	x	x	8						1 0 0 0
x	x	x	x	9						1 0 0 1

MF CHANNEL DIAL AND HF CHANNEL DIAL FOR TEST PROMS.



4 MHz	6 MHz	8 MHz	12 MHz	16 MHz	22 MHz	25 MHz	FRQ
4000.0	6000.0	8000.0	12000.0	16000.0	22000.0	25000.0	A
4555.5	6555.5	8555.5	12555.5	16555.5	22555.5	25555.5	B
4999.9	6999.9	8999.9	12999.9	16999.9	22999.9	25999.9	C
						25111.1	D
						25222.2	E
						25444.4	F
						25888.8	G
						25010.1	H
						25020.2	I
						25040.4	K
						25080.8	L
							M
							N
4063.0	6200.0	8195.0	12330.0	16460.0	22000.0	25070.0	O
4147.0	6272.0	8327.0	12510.0	16689.0	22187.0	25090.0	P
4231.0	6345.0	8459.0	12689.0	16917.0	22374.0	25110.0	R

Fig. 3a

H.F.400 S.S.B. RADIO TELEPHONE

TRANSMITTER GENERAL DESCRIPTION

System Principle

The Dancom H.F.400 transmitter system is one of the latest designs in single sideband synthesized M.F./H.F. transmitters working on the marine bands. The transmitter system consists of three units situated on separate racks. Each unit covers one main function, the S.S.B. exciter, the P.A. stage and the power supply.

The S.S.B. exciter changes the low frequency audio tones and keying signals into the required S.S.B. signal in the range 400 KHz. - 30 MHz. From the carbon microphone the speech signal is fed to the microphone amplifier which is mounted on the same print module as the test tone and alarm generators. From here the signal is fed to the compressor unit and then to the balanced modulator in the S.S.B. generator. At the compressor input keying signals are gated in and side-tone generated. The balanced modulator is fed with 8.7 MHz. from the synthesizer and the mixed product from the modulator, now a S.S.B. signal, is filtered and amplified in such a way that the S.S.B. generator output is an 8.7 MHz. S.S.B. signal. This S.S.B. signal is then mixed with approximately 51.7 MHz. and then passband filtered. The signal, now at about 43 MHz., is then mixed with a frequency between 43 MHz. to 73 MHz. to produce an S.S.B. signal in the range 0 - 30 MHz. The mixer oscillator frequencies are produced by the synhesizer. The output from the second mixer is then fed through a wide band amplifier to the exciter output terminal. The signal leaves the exciter in the range 400 KHz. to 30 MHz. at a level of one watt into fifty ohms.

Situated in the exciter rack is the frequency synthesizer and programmer. The synthesizer runs off a 10 MHz. TCXO compensated to $\pm$ 3 p.p.m. between 0^{o}c - 60^{o}c. From this frequency are generated the mixer frequencies mentioned above. The first and second mixer carrier frequencies are capable of being adjusted to set the exciter output frequency.

The first mixer frequency gives fine output adjustment and the second mixer frequency gives course output adjustment. The output frequency is capable of being set at 100 Hz. intervals in the 0 - 30 MHz. band. Each frequency is phase locked to the TCXO.

The programmer converts the front panel frequency selection, via its preset memory, into logic levels. These levels, when applied to the synthesizer, cause it to produce the suitable mixer frequencies. These mixer frequencies cause the exciter to produce the selected output frequencies to drive the P.A. stage. The programmer also sets the selected output frequency on the front panel digital read-out.

The signal from the exciter is fed to the power amplifier rack. The signal enters the P.A. circuits via an attenuator circuit. This attenuator network sets the drive levels for medium and low output power levels. From the attenuator circuits the signal passes through a wideband driver onto the grid of the P.A. valve. The driver output is sampled to operate an A.L.C. circuit this is used to regulate the output level from the S.S.B. generator.

The P.A. valve is a force cooled tetrode type R.C.A.8122 working with a 2.2 Kv. anode voltage and 400 volt screen grid voltage. 2.2 Kv from the power supply chassis is fed to the screen grid regulator. The screen grid regulator reduces the 2.2 Kv to a stable 400 volts.

System Principle

A pair of drums operate contacts to enable correct loading, aerial tuning and P.A. anode tuning to be selected for each medium frequency. At H.F. the correct conditions are selected by a separate drum. Two aerial tune controls are used, one for M.F. and one for H.F.

The power amplifier rack contains its own power supply. This operates from a stabilized 15 volt line derived from the power supply rack and provides A.C. heater and cooling fan voltages, and the L.T. D.C. voltages required by the P.A. rack circuits.

The power supply rack P203 contains two separate chassis, one for 220/110 VAC input and one for 24 VDC input. These power supplies provide the 2.2 Kv for the P.A. valve and stabilized 15 volts for the P.A. rack power supply. A switch on the front of the power supply rack selects receive only and stand-by states for either A.C. or D.C. inputs. This switch determines the supply selection for the whole H.F. 400 system, including the receiver. The exciter obtains its power supplies from its own D.C./A.C. convertor and regulator circuits located on the exciter rack, but switched from the power supply rack front panel.

oooOOOooo

Analogue Signal Path

Alarm Signal Generator

This module feeds the compressor with alarm tone, test tone, or an amplified signal from the microphone.

The alarm generator consists of a LC oscillator which at 250 m sec. intervals oscillates alternatively on the frequencies 1300 Hz and 2200 Hz. The change in frequency is obtained by a unijunction oscillator which gives 250 m second pulses to a two-divider which then controls the first oscillator.

The 1300 Hz and 2200 Hz signals are fed to the compressor via a driver transistor.

The alarm tone generator starts automatically when the mode switch is placed in Test Alarm, and it stops again automatically after 45 seconds by means of a unijunction timer.

The alarm generator starts transmitting when the Mode selector is in position Send Alarm and the red button is pressed. It stops after 45 seconds and switches automatically to the microphone amplifier by means of a transistor switch.

The microphone amplifier consists of a single transistor stage to match and amplify the microphone signal direct to the compressor input level.

The test tone generator consists of an astable multivibrator which oscillates at 2400 Hz. This signal is divided to 1200 Hz and both signals are fed to the compressor via a resistance network when the Mode selector is in position Tune.

Compressor

The compressor processes the input signal in such a way that the input to the SSB-exciter does not exceed 400 m Vpp when the signal to the compressor varies between 0 - 10 Vpp.

Compressor

A typical compression characteristic is shown in Figure 1.

The compressor also handles the tone inputs from the telex and W/T keys. These inputs are gated by switching the supplies to the pre-amplifiers.

The sidetone and A.2 oscillator is also situated on the compressor board.

S.S.B. Generator

By means of the S.S.B. Generator five types of modulation are produced, A.1, A.3.A., A.3.H., A.3.J. and F.1. The carrier frequency used by the exciter circuit is 8.7 MHz. derived from the synthesizer.

The carrier frequency, together with the L.F. from the speech compressor or the alarm generator, is then fed to the balanced mixer. The resultant double side band signal is then taken through a crystal filter which suppresses the lower side band, leaving the upper side band which is fed to the Mode switch. Depending on the mode required this switch controls the correct relationship of carrier and side band.

The switching is performed by diodes and the resultant levels summed in an F.E.T. summing amplifier. From the summing amplifier the signal passes through an F.E.T. attenuator. This attenuator is controlled from the A.L.C. circuit in the P.A. chassis. The signal is then amplified and fed to the first mixer module. The amplifier gain is selected via a transistor switch from two preset levels so as to reduce the output level by 3 dB in F.1. mode.

First Mixer

From the S.S.B. generator the signal is fed to the first mixer, where in an active F.E.T. balanced mixer the signal is combined with a frequency of approximately 51.7 MHz. The resultant 43 MHz. signal is passband filtered and fed through a keying diode onto the second mixer.

The 51.7 MHz. first mixer frequency is derived from the synthesizer 100 Hz. loop and can be varied in 100 Hz. steps, between 51.6901 MHz. and 51.7 MHz., a range of 9.9 KHz.This variation is produced on demand from the programmer and "fine tunes", the transmitter frequency to a 100 Hz. step.

Second Mixer

The signal passes from the 43 MHz. first mixer filter onto the second mixer via two buffer stages. The second mixer is a passive diode balanced mixer and combines the 43 MHz. S.S.B. signal with a 43 MHz. to 73 MHz. frequency to produce a signal in the range 0-30 MHz. This signal is fed into a low pass filter and onto a wideband amplifier.

The 43 MHz. - 73 MHz. second mixer frequency is derived from the synthesizer 10 KHz. loop and can be varied in 10 KHz. steps. This enables the transmitter frequencies to be programmed in the range 0-30 MHz. in the 10 KHz. steps. This is the course adjustment of transmitter frequency, and when combined with the programming of the range 0-30 MHz. at discreet frequencies 100 Hz. apart.

Wideband Amplifier

From the second mixer stage the signal enters the wideband amplifier, via a keying diode. The amplifier employs four stages and raises the signal to a level of one watt P.E.P. into a 50 ohms line.

Wideband Amplifier

A drive level sensing circuit is fed from the output of the amplifier and operates the test meter. From the wideband amplifier the signal is fed to the attenuator circuit in the P.A. rack.

Attenuator Network & Wideband Driver

From the wideband amplifier in the exciter rack the signal passes through the attenuator network in the P.A. rack. This attenuator sets the drive levels for the P.A. in the high, medium and low power modes.

The signal then passes into the wideband driver. The driver accepts the signal from the wideband amplifier (maximum 1 watt 50 ohms) and increases it to approximately 40 Vpp to drive the P.A. valve.

The output of the driver passes through lowpass or bandpass filters (M.F. or H.F.) onto the grid of the P.A. valve.

P.A. Stage

The P.A. amplifies the signal from the driver (maximum 40 Vpp) up to a level of maximum 400 W PEP.

The amplifier consists of an air-cooled tetrode Type RCA 8122.

The M.F. Aerial Circuit

The transmitter is designed to be connected to a capacitive aerial and is, therefore, equipped with a variable coil which can be tuned to compensate for the aerial capacitive reactance. If the aerial is not capacitive, a built-in capacitance can be inserted in series with the aerial.

In series with the aerial there is a variometer with which the aerial can be matched.

Through a tap on the P.A. coil the effective part of the aerial impedance can be matched and through this, the P.A. stage can be loaded correctly. The aerial current is detected by the aerial current detector and is indicated by a moving coil instrument on the front panel.

The H.F. Aerial Circuit

A contact on the M.F. aerial tuning drum connects the H.F. drum to the aerial in the H.F. position. The H.F. drum sets up both the P.A. and aerial tuning on the one drum. Some capacitors are available to effectively "shorten" the aerial on difficult frequencies.

The aerial circuit forms a   circuit, the output capacitor is variable and provides fine tune over the band. Extra capacitors can be added in parallel with this variable capacitor by programming the drum.

Other components in the   circuit can also be programmed.

Aerial current detection is common to the M.F. aerial.

Most of the power supplies required for the P.A. stage are generated in the P103 power supply. The 24 volt relay supplies, the 15 volt stabilized supplies and the 2.2 K volts anode voltage are supplied by the P201 and/or P202 supplies situated in the power supply rack.

Automatic Level Control Circuit

The A.L.C.-circuit ensures that the maximum output of the transmitter in position Full Power is exactly 400 W PEP, in position Medium Power 200 W PEP and in position Low Power 50 W PEP which means that the A.L.C. circuit must compensate for any amplification changes in other circuits within ± 2 dB. The A.L.C. also ensures 100% modulation when transmitting in A3H.

The average detector and its associated A.F. detector feed a voltage to a diode switch, which is also fed a voltage from the peak detector. This switch passes the higher of these voltages to the differential amplifier. This then controls the output of the exciter by altering the output level of the S.S.B. generator via the A.L.C. attenuator.

ooo000ooo

Frequency Synthesizer

TCXO

The temperature controlled crystal oscillator is the heart of the synthesizer. The crystal temperature drift is compensated for by a combination of trimming capacitors of suitable temperature coefficient. Over the range 0-60°c the drift is less than three parts per million. This sets the temperature stability of the system.

The oscillator is factory set and cannot be reset without equipment that is not normally available in a service workshop. The TCXO is plugable and, therefore, is easily replaced. It is identical to the receiver TCXO.

Reference Generator

The reference generator provides the reference frequencies used in the mixer frequency generator loops. All these frequencies are phase locked to the TCXO.

Decade dividers provide the 100 Hz., 10 KHz. and 10 MHz. frequencies. A phase locked divider loop provides 52.2 MHz. and 8.6 MHz.The divider ratio is fixed and is in two parts: - 3 and - 87.

The V.C.O. runs at 26.1 MHz. and its second harmonic is used for the 52.2 MHz output. The 26.1 MHz. when - 3 gives the 8.7 MHz. output.

The phase sensitive detector operates at 100 KHz.

100 Hz. Loop

The 100 Hz. loop provides the first mixer frequency of between 51.6901 MHz. and 51.7 MHz. at 100 Hz. increments.

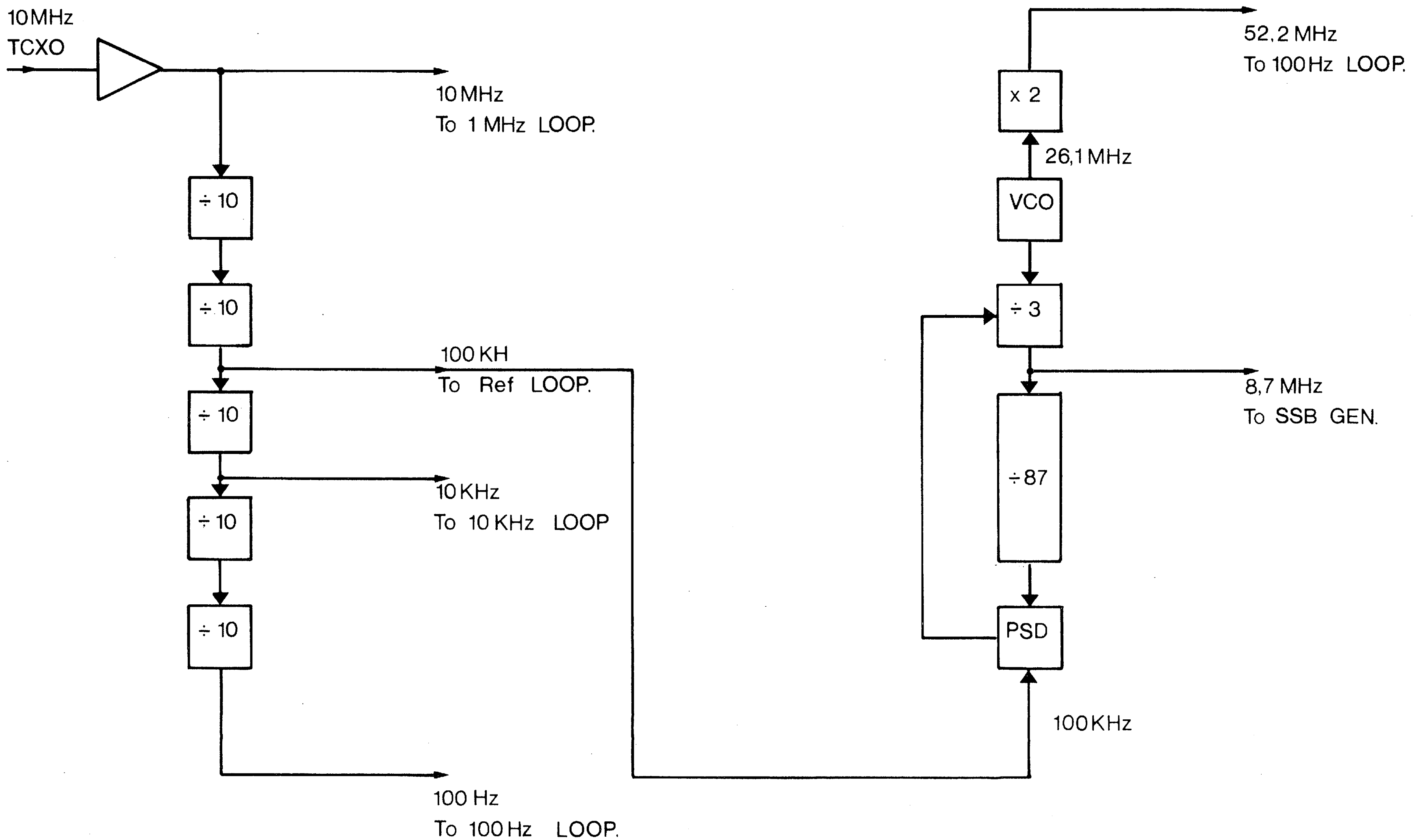
The phase locked loop divider loop also incorporates a mixer stage. The mixer frequency is 52.2 MHz. generated in the reference loop. The effect of this mixer is to cause the V.C.O. to run at 100 Hz. multiplied by the programmed divider ratio, 1 subtracted from 52.2 MHz.

The divider ratio can be set between 5000 and 5099, giving a range of 9.9 KHz.

The phase sensitive detector operates at 100 Hz.

The V.C.O. is a crystal oscillator running at approximately 25.85 MHz., pulled by the voltage from the phase detector. The second harmonic 51.7 MHz. is used to operate the first mixer and to continue the loop.

REFERENCE GENERATOR



100 Hz. Loop

The programmable divider receives its divide number from the programmer circuits.

1 MHz. Loop

The 1 MHz. loop provides the mixer frequency used in the 10 KHz. loop. This frequency is in the range 41 MHz. to 70 MHz. at 1 MHz. increments.

The phase locked loop is a straightforward divider loop. The phase detector operates at 500 KHz. divider down from the 10 MHz. TCXO frequency coming from the reference generator. A fixed - 2 ratio in the feedback loop enables the output to be stepped at 1 MHz. intervals.
The divider ratio can be set between 41 and 70.

To enable the V.C.O. to operate over the range 41 - 70 MHz. course tune volts are fed to the V.C.O. from the programmer. This enables the loop to remain sensitive to small drifts in frequency or phase.

The programmable divider receives its divide number from the programmer circuits

10 KHz. Loop.

This loop provides the second mixer frequency. This frequency is in the range 43 - 73 MHz. at discreet intervals of 10 KHz.

The phase locked loop is a divider loop incorporating a mixer stage. The effect of this mixer stage is to cause the V.C.O. to run at 10 KHz. multiplied by the programmed divide ratio plus the mixer input. This input comes from the 1 MHz. loop and is in the frequency range 41 - 70 MHz. in 1 MHz. steps.

The divider ratio can be set between 200 and 290 giving a range of 90 KHz.

The phase detector operates at 10 KHz.

The V.C.O. operates over the range 43 MHz. to 72.99 MHz. and receives course tune volts from the programmer. The divider ratio also comes from the programmer.

Programmer & Display

The transmitter frequency is selected on the front panels. The M.F. frequency is selected on the P.A. chassis, the H.F. band is selected on the P.A. chassis and the H.F. frequency is selected on the exciter chassis. These selections are made by multi-position switches.

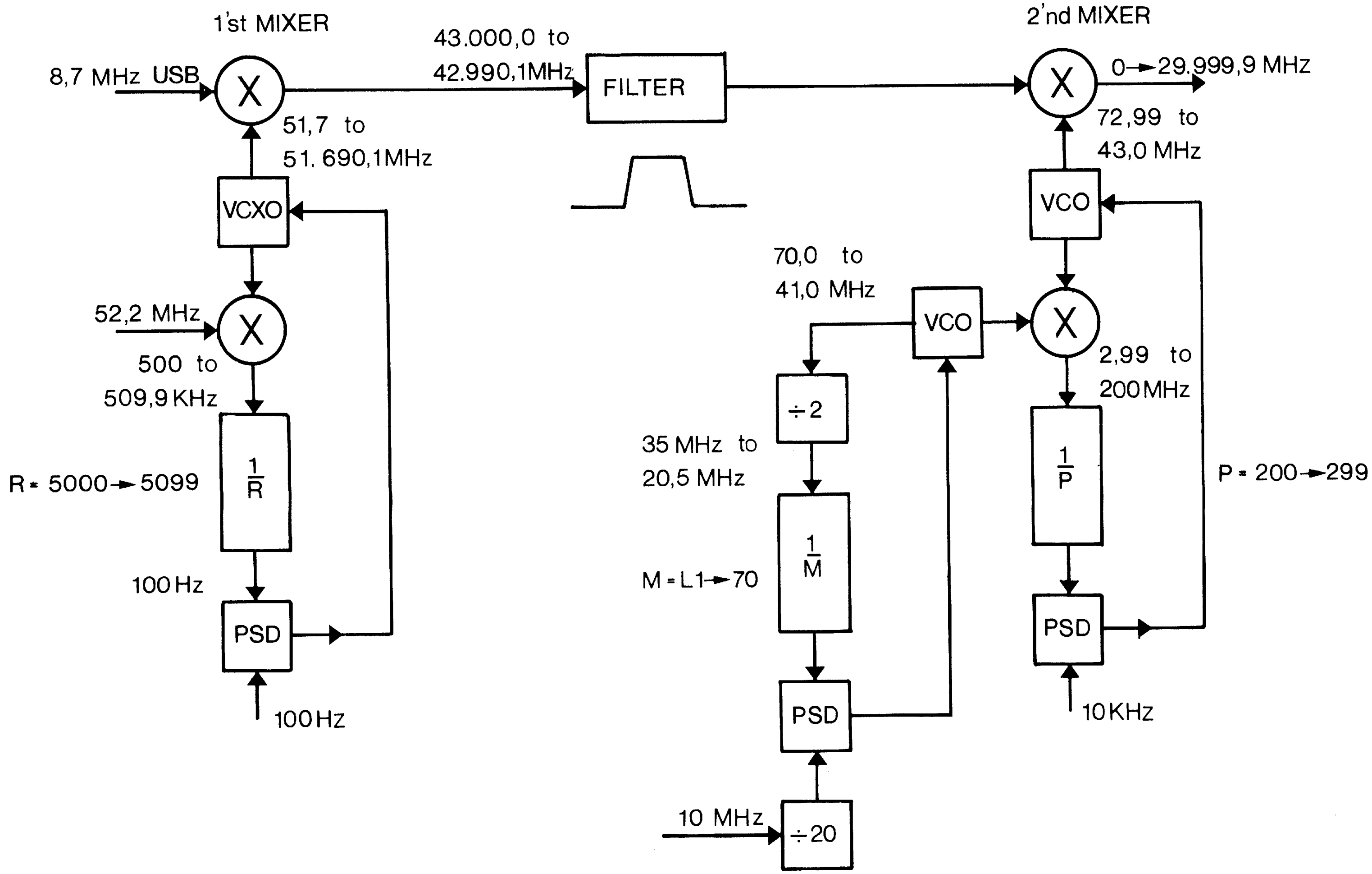
These switched lines are converted into binary information to gain access to the memory. The memory is a programmable read-only memory (PROM) and converts the front panel information into suitable divide numbers to operate the synthesizer loop. The PROMS are factory programmed and cannot be re-programmed.

The output from the PROMS that drives the dividers also drives the display. A fault, therefore, in the programming will show on the display, but a fault in the dividers will not.

The programmer supplies are over voltage protected to prevent any accidental damage.

The switch input from the H.F. bands switch operates the V.C.O. course tuning vo tage selection. This voltage is used in the 10 KHz. and 1 MHz. loops. A test facility is available on the display logic that enables all eights to be display

TRANSMITTER SYNTHESIZER LOOPS.



Programmer & Display

A dimmer circuit alters the display brilliance.

ooo000ooo

Power Supplies

Screen Grid Regulator

The screen grid voltage is regulated at about 400 volts. A fine preset can adjust the volts up to a maximum of 423 volts.

The high voltage feed for the regulator is 2.2 K volts generated in P201/2/3. The 400 volts output is shunt regulated, the excess voltage being dropped across high power resistors bolted to the P.A. chassis.

Power Supply P103

This power supply is fed with 15 volts D.C. from power supplies P201/2/3.

The power supply consists of a controlled inverter (60Hz.) the output of which is transformed to 13.6 volts A.C. (filament current to the P.A. tube) and 220 volts A.C. (blower). This inverter also feeds four stabilized power supplies which give the following voltages:- +9 and -9 volts D.C for small signal circuits, - 40 volts D.C. (grid bias), and -68 volts D.C. which is used for blocking the tube during starting.

Power Supply P201

This power supply is fed with 110/240 volts A.C. 50/60 Hz. and gives the following D.C. voltages:- +15 volts, +24 volts, +1100 volts and 2200 volts.

The A.C. input is filtered and fed to the transformer primaries. Adjustment of links accommodates 110 volts or 220 volts inputs. One transformer supplies the P.A. valve anode voltage of 2.2 K volts, the other transformer supplies 24 volts. These outputs are rectified and smoothed.

A regulator circuit supplies a stable 15 volts from the 24 volt supply. This runs P103 in the P.A. rack.

Power Supply P202

This power supply must be fed with 24 volts D.C. and gives the following D.C. voltages:- +15 volts, +24 volts, +1100 volts and +2200 volts.

The D.C. - D.C. converter consists of two equal astable push/pull couplings, which are connected in parallel, with common driver transformer.

The converter gives +15 volts to Power Supply P103 and +2.2 K volts to the anode of the output tube.

The converter transistors are protected with an overload protection circuit. This functions when the 2.2 K volts winding is loaded with more than 400 ma.

Power Supply P203

This rack number refers to the normal equipment layout that includes P201 and P202 in the same rack. This layout enables the power amplifier to be run from either A.C. or D.C. supplies, the selction being made by a switch located on the front

Power Supply P203

panel of the P203 rack.

The 2.2 K volts from either chassis is combined via a diode network. The 15 volt regulator is removed from chassis P202 and the diode network is fixed in its place. In this case both P201 and P202 use the remaining 15 volt regulator on P201.

Exciter Power Supply

The exciter has its own independent A.C./D.C. input power supply. This uses a common transformer, the secondary of which produces +35 volts, +15 volts, +5 volts, ±9 volts.

These D.C. supply outputs are all stabilized, the +35 volts and the -9volts supply use discrete components, the others are integrated circuits.

The common transformer is driven directly off 110/220 volts A.C. or off a 24 volts D.C. to A.C. converter, using two separate primaries.

The D.C.-A.C. converter consists of two transistors operating push/pull into a split primary on the common transformer. A separate driver transformer supplies the base current.

Relays are operated such that the converter transistors are isolated when there is 110/220 volts driving the common transformer.

The compressor processes the input signal in such a way that the input to the SSB-exciter does not exceed 400 m Vpp when the signal to the compressor varies between 0 to 10 Vpp.

A typical compression characteristic is shown in fig. 1.

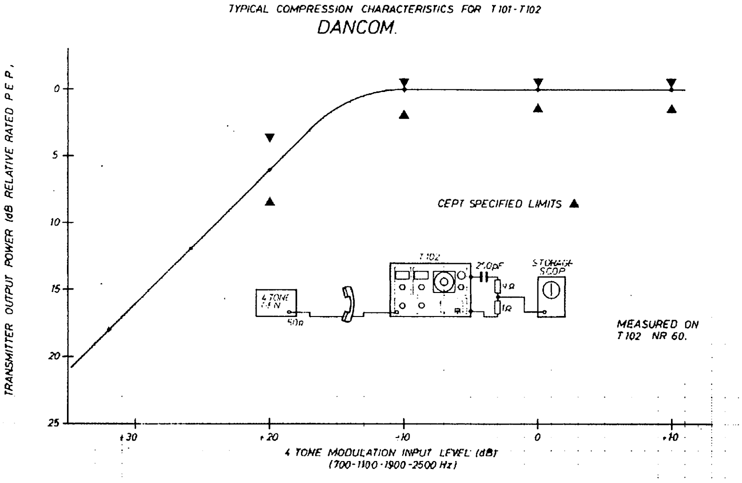
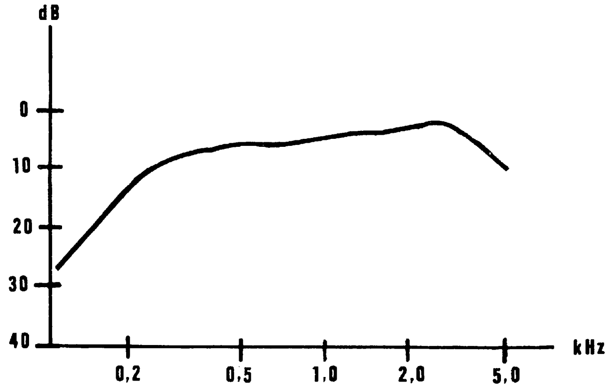


Fig I

MICROPHONE CAPSULE

Nominal resistance 100 ohms and a nominal impedance at 60 ohms. Resistance at 20 mA 140 ohms ± 20%. Resistance at 56 mA 90 ohm ± 20%. Max. current 60 mA.

Frequency response of the microphone capsule.



Sound pressure: 10µ Bar

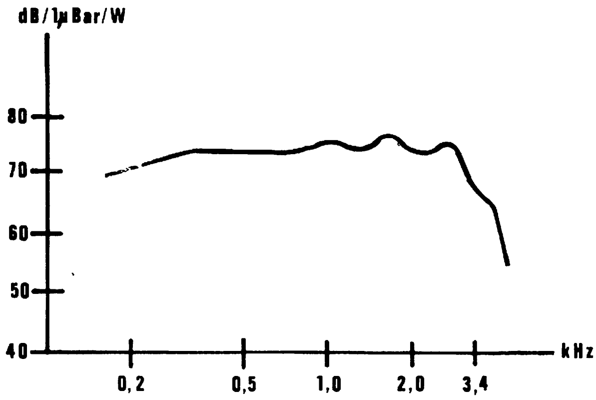
Microphone current: 40mA

No load.

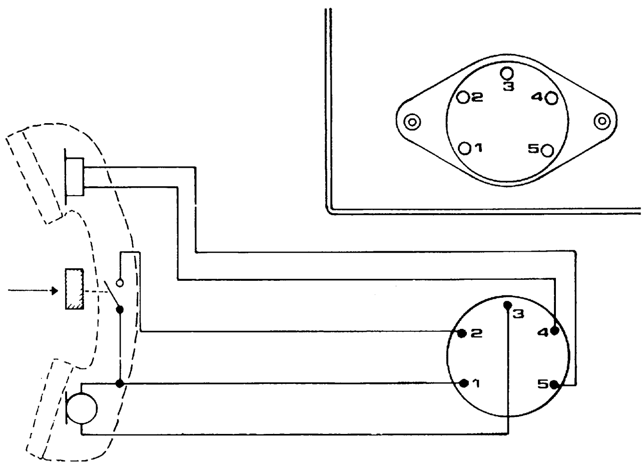
TELEPHONE CAPSULE

Nominal impedance 400 ohms at 800 Hz.

Frequency response of the receiver capsule.



MICROTELEPHONE CONNECTION DIAGRAM



LOCATION DIARAMS FOR EXCITER BOARDS

TOP VIEW

Fig A.

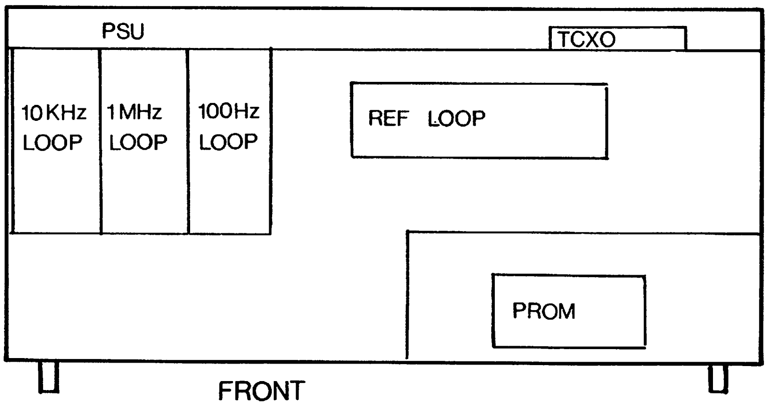
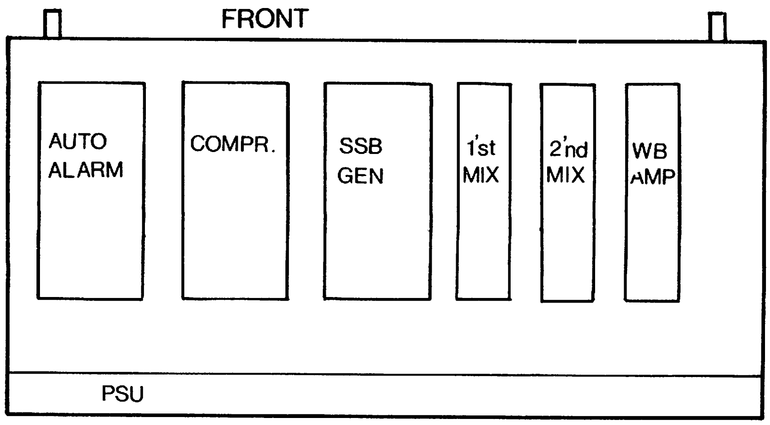
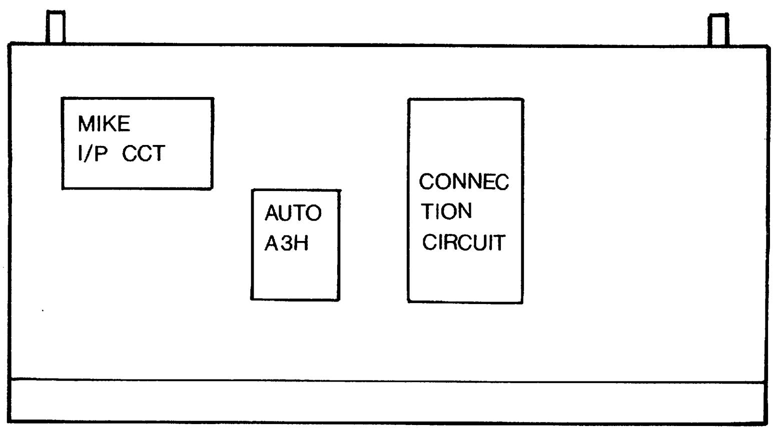


Fig B.



BOTTOM VIEW

Fig B.



UNDER

C I R C U I T   D I A G R A M S.

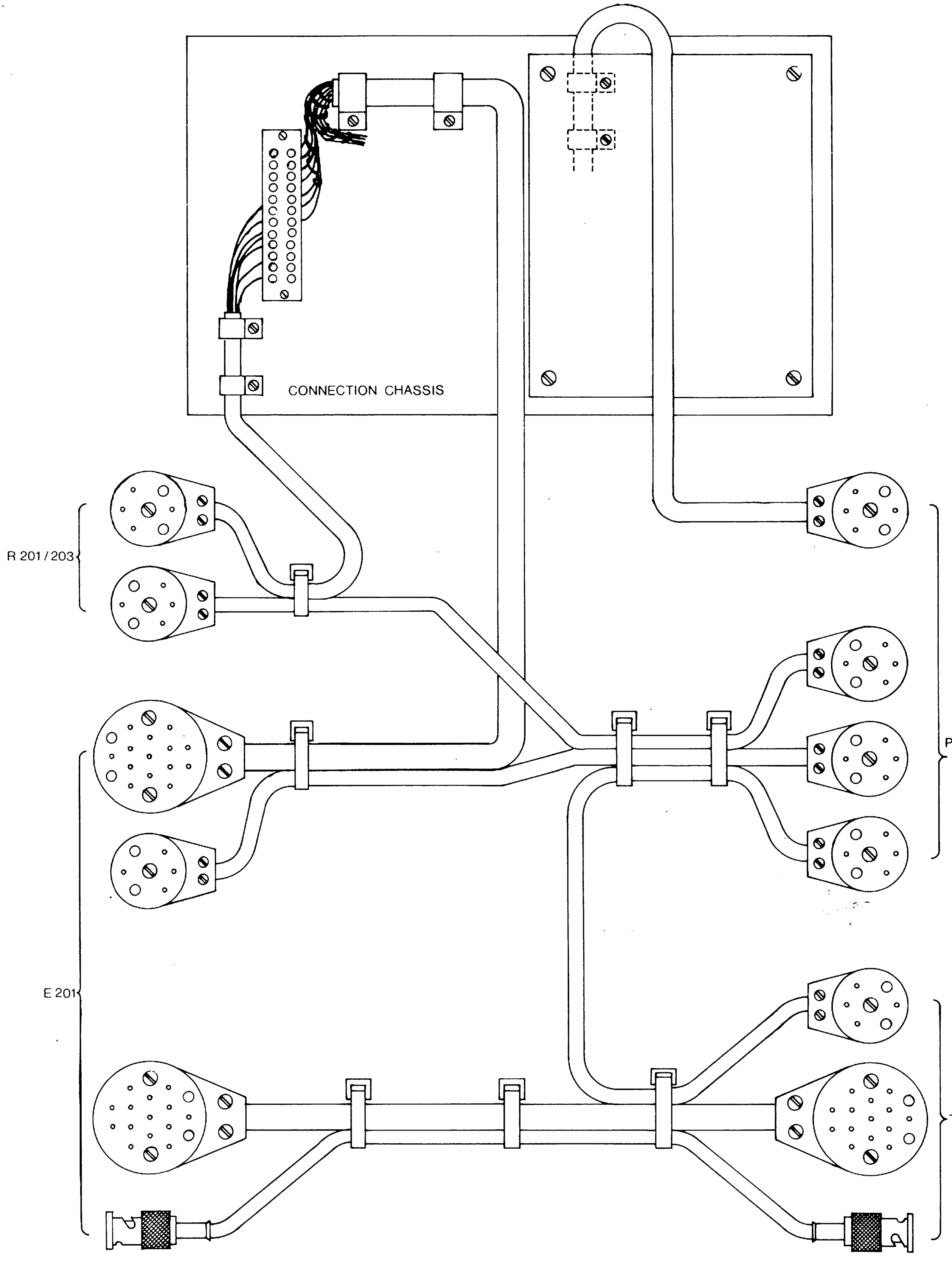
FOR:

TRANSMITTER T 201.

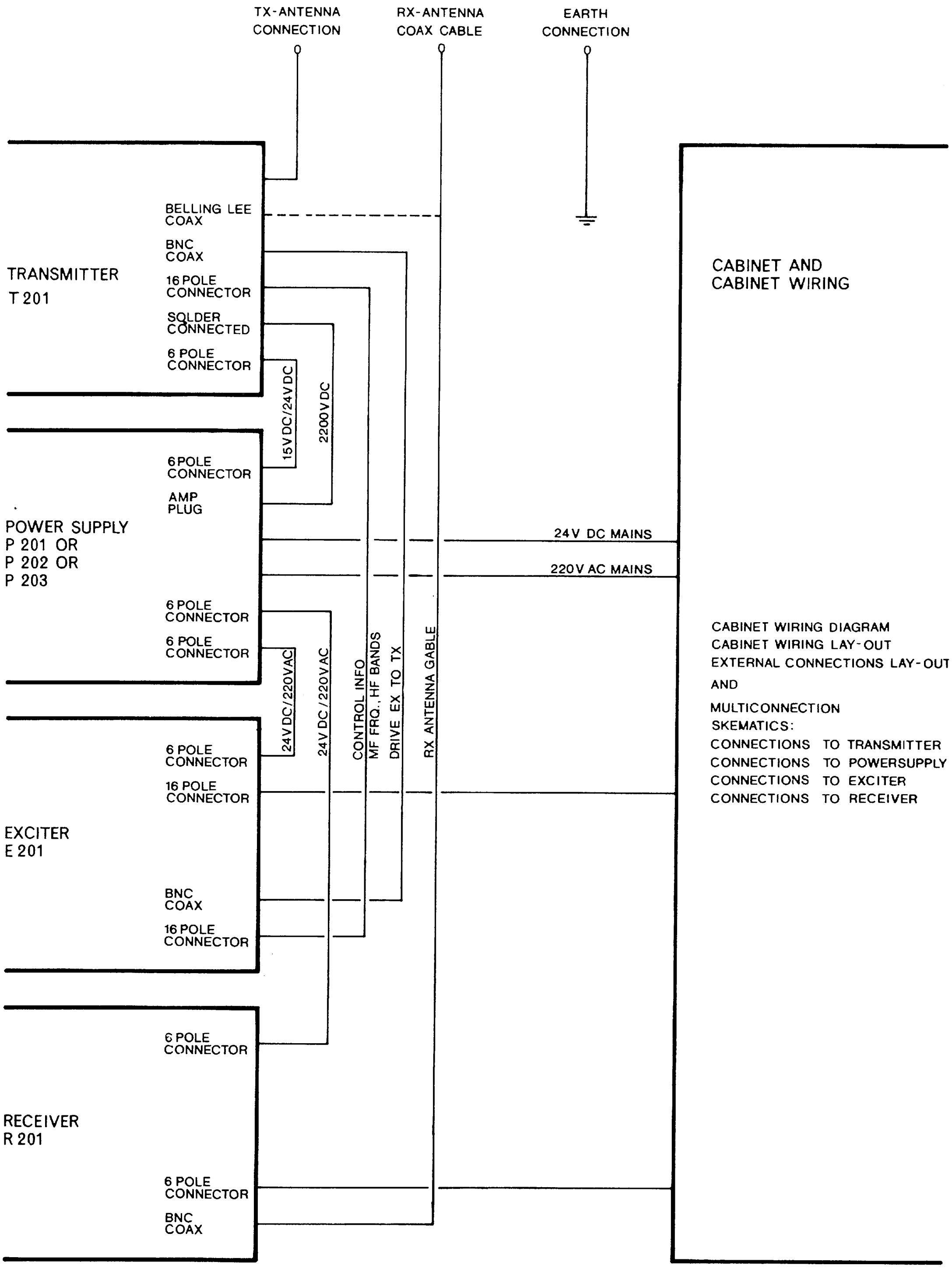
POWER SUPPLY P 203.

CABINET WIRING.

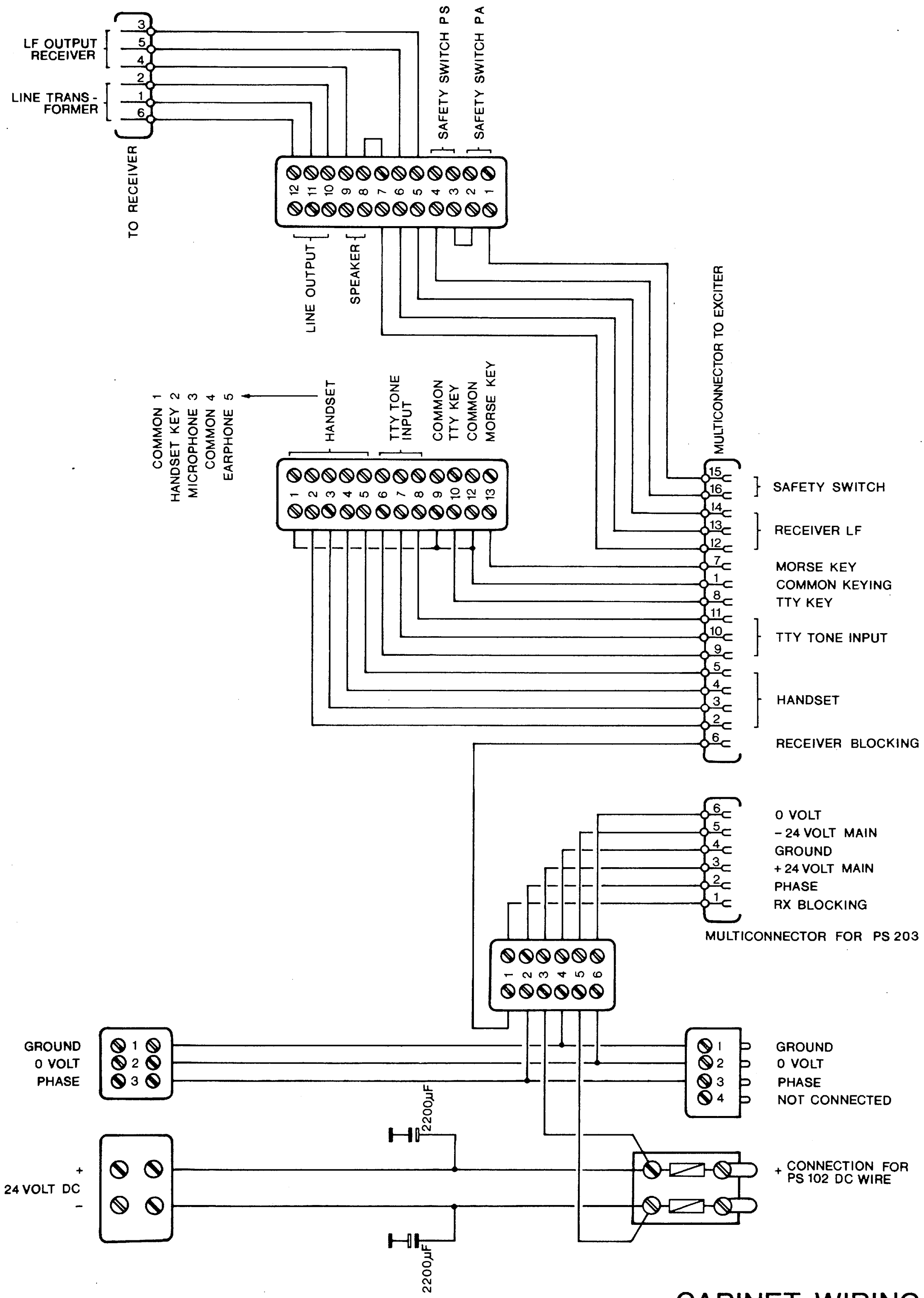
CONTENTS:



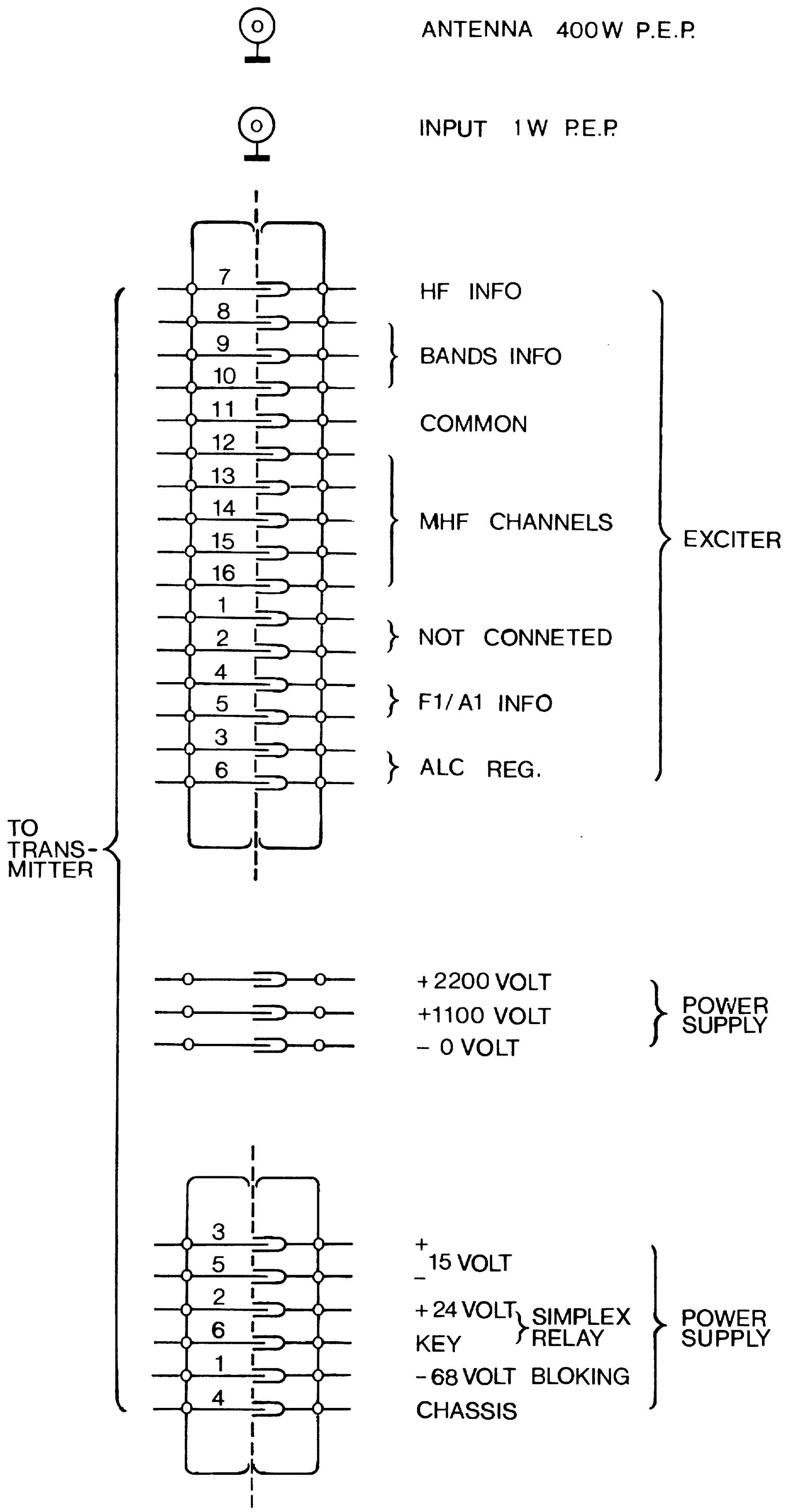
LAY OUT FOR CABINET WIRING
DRAWING NO. 01.0203



SYSTEM HF 400 INTERCONNECTIONS
(SIMPLIFIED)
DRAWING NO 01.0205

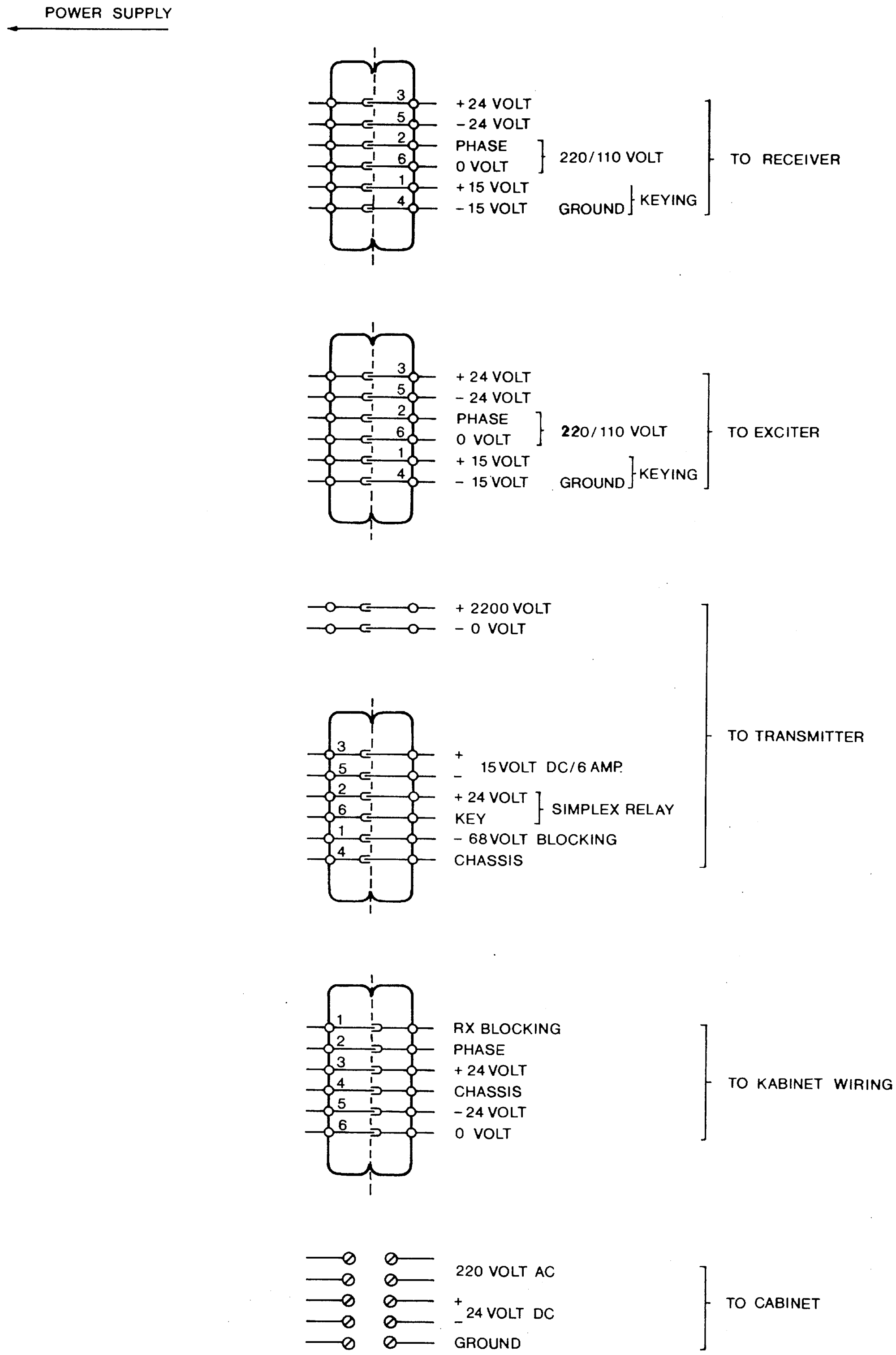


CABINET WIRING
DRAWING NO. 01.0206

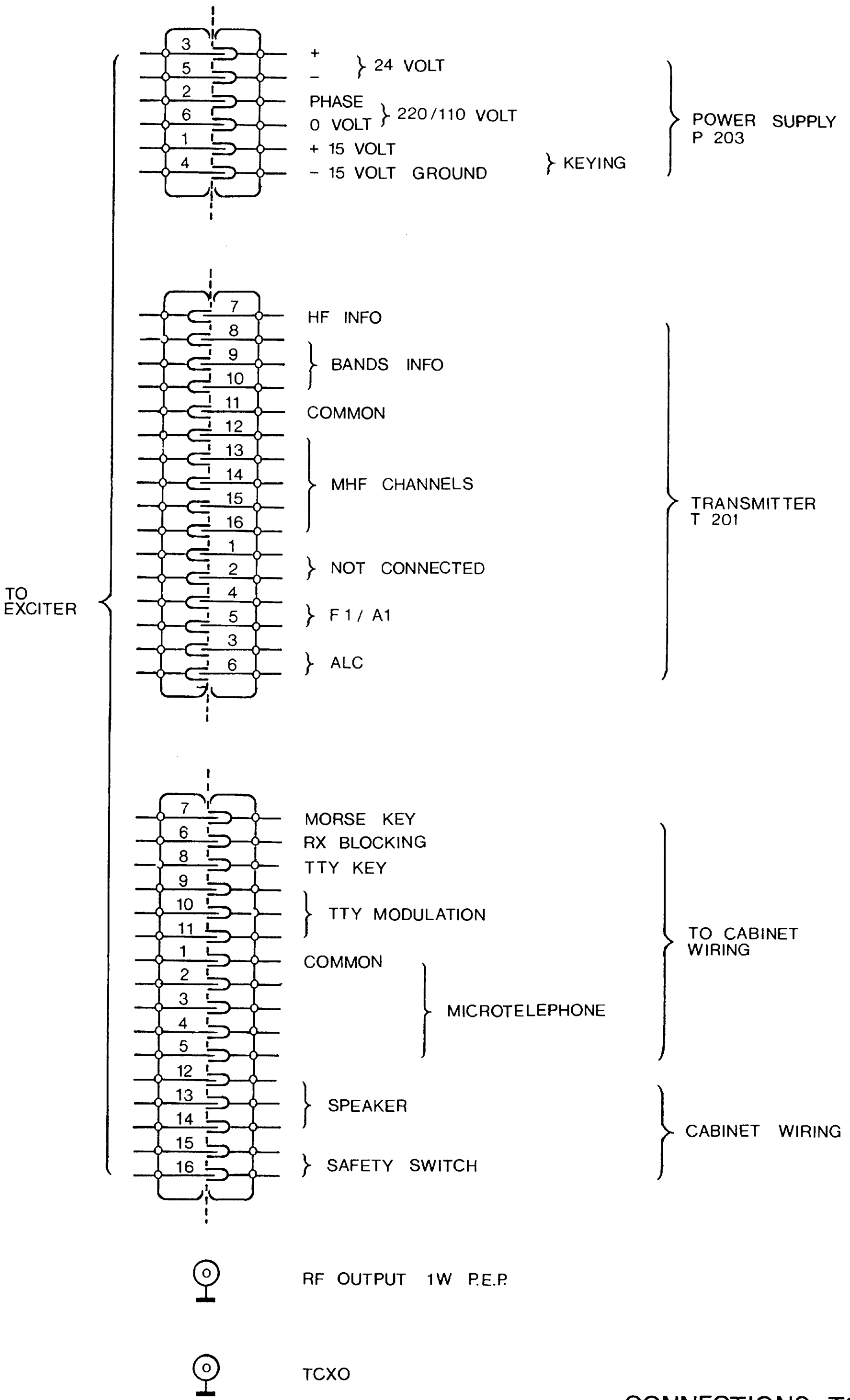


CONNETIONS
TO TRANSMITTER

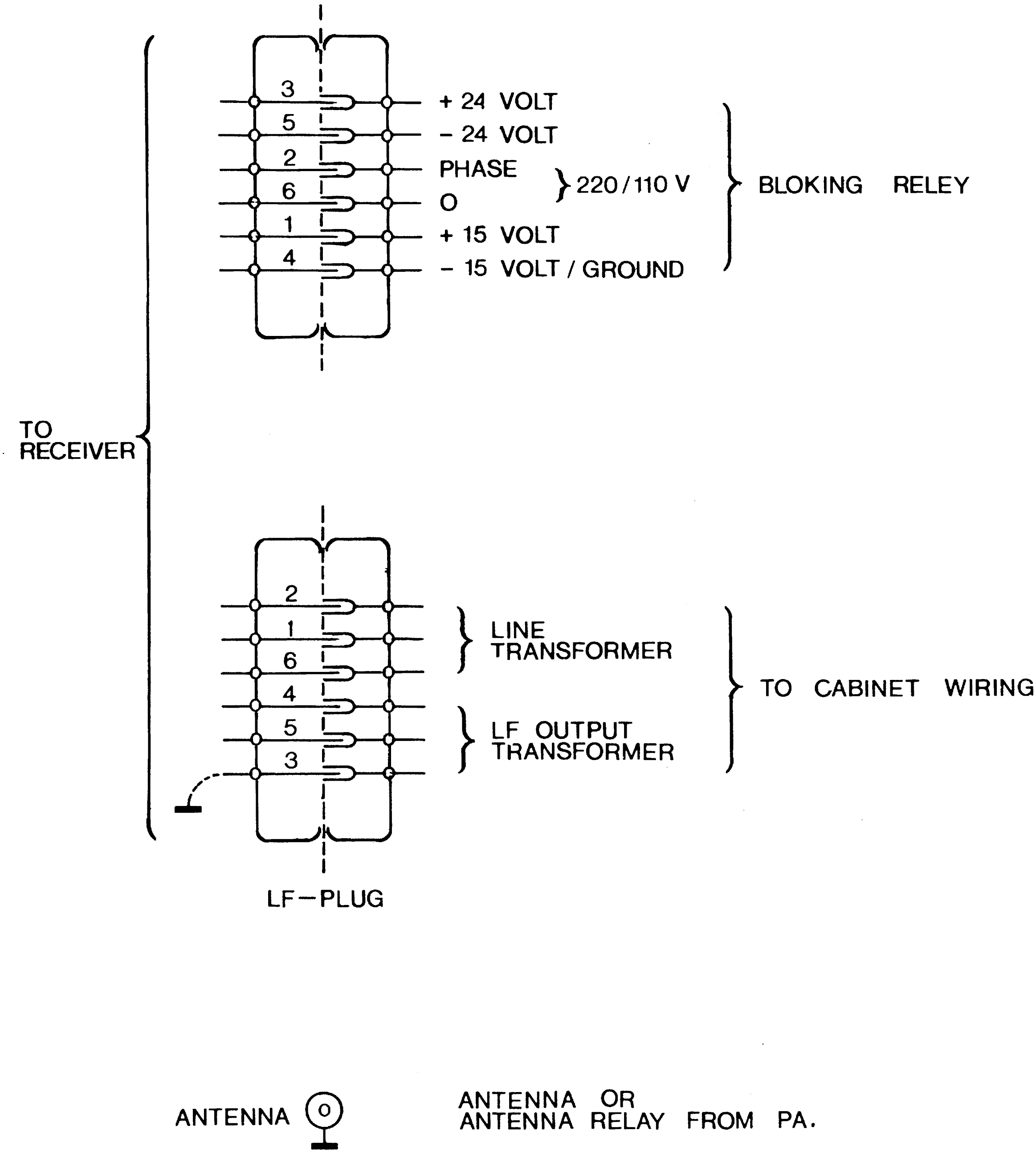
01.0207



CONNECTIONS TO POWER SUPPLY
DRAWING NO. 01.0208

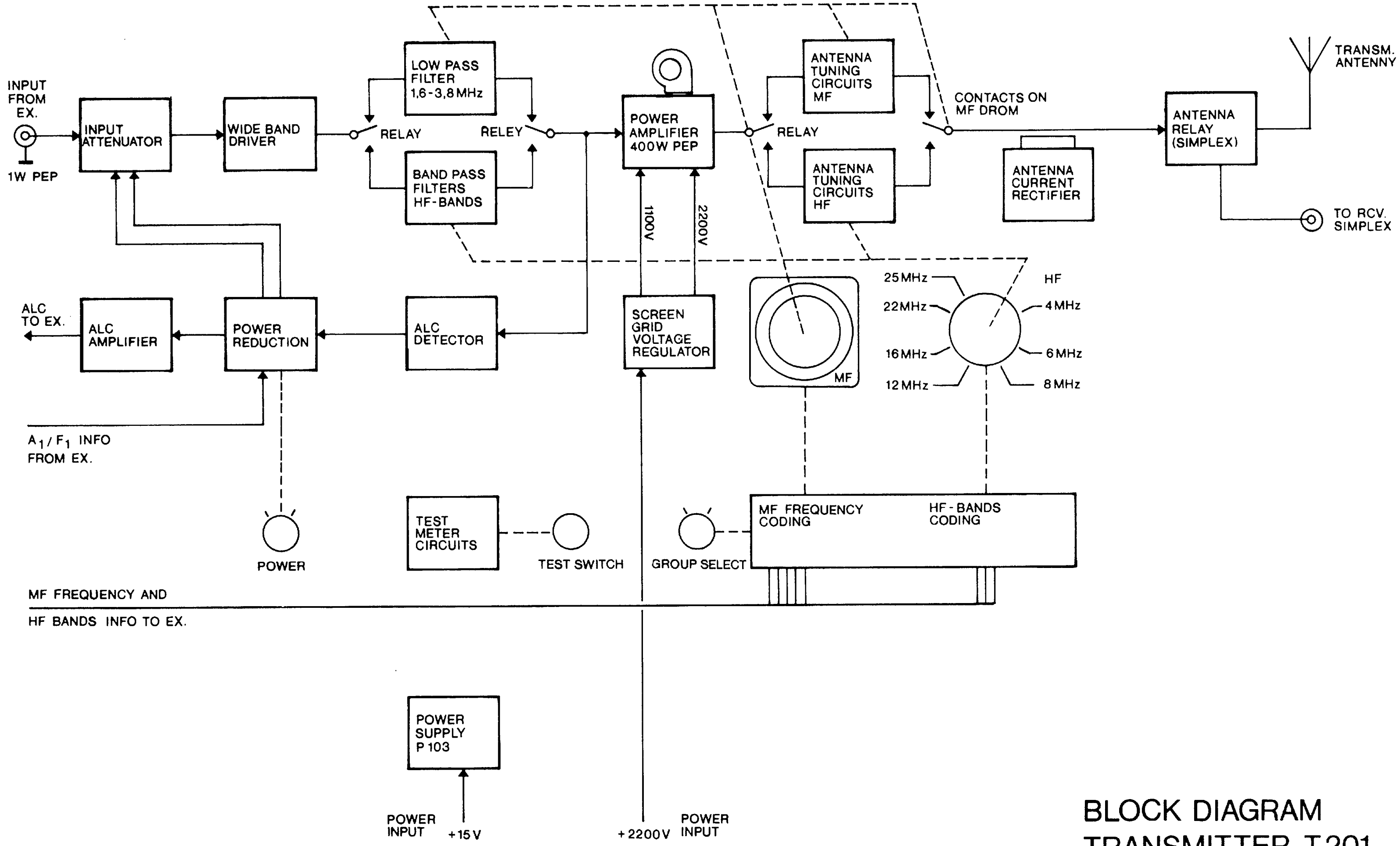


CONNECTIONS TO
EXCITER
01.0209

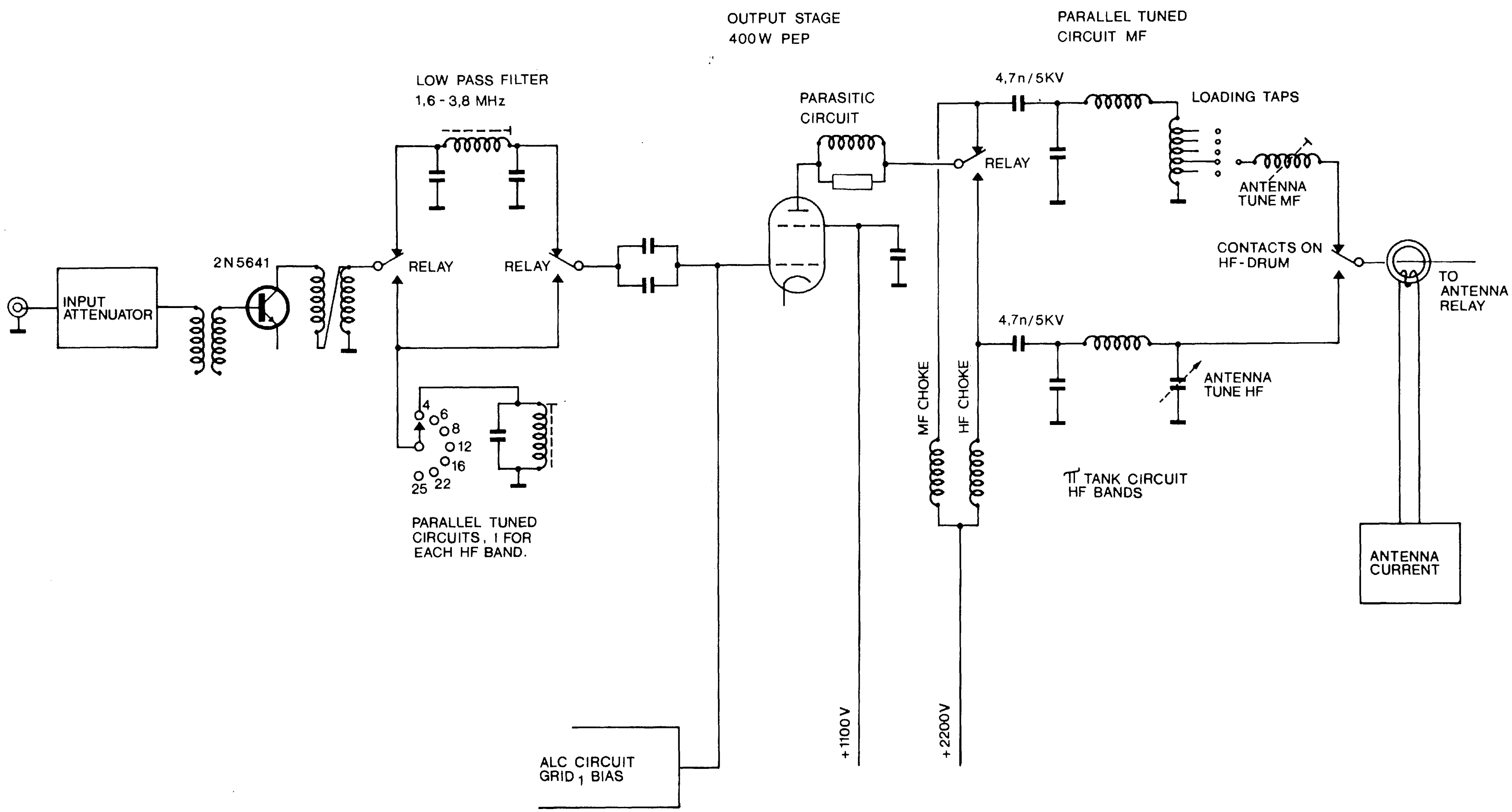


CONNECTION TO RECEIVER

01.0210

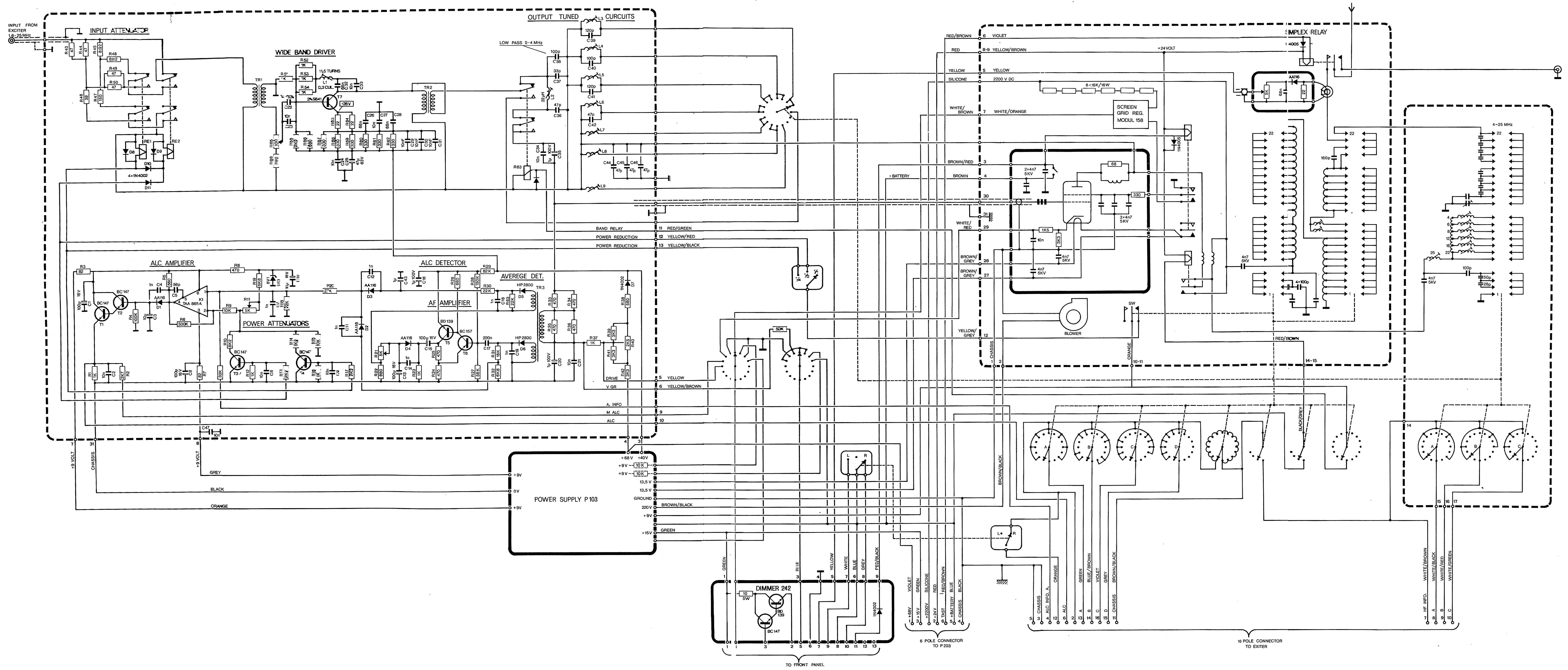


BLOCK DIAGRAM
TRANSMITTER T201
DRAWING NO. 01.0211



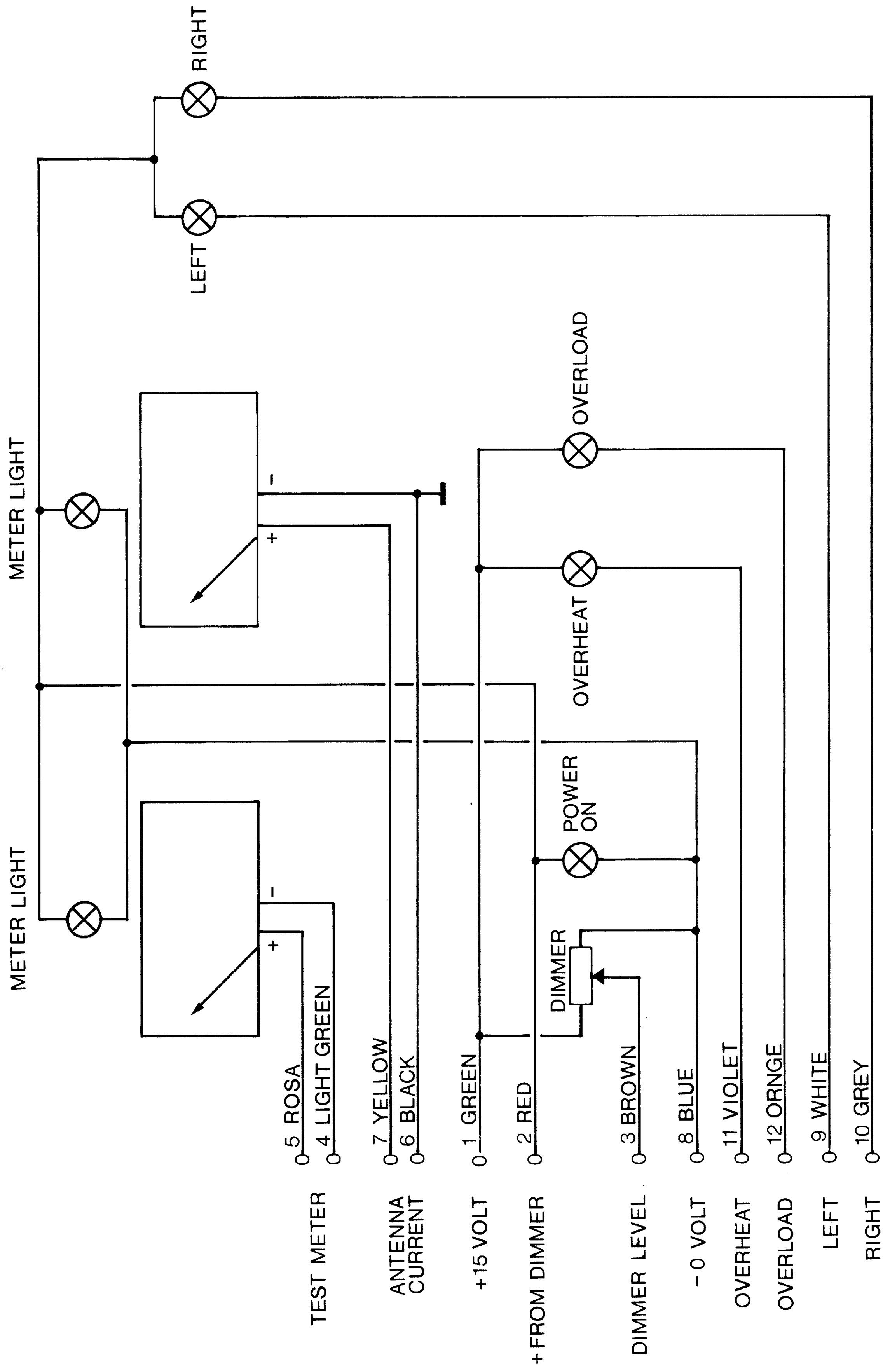
SIMPLIFIED SIGNAL PATH

DRAWING NO. 01.0212

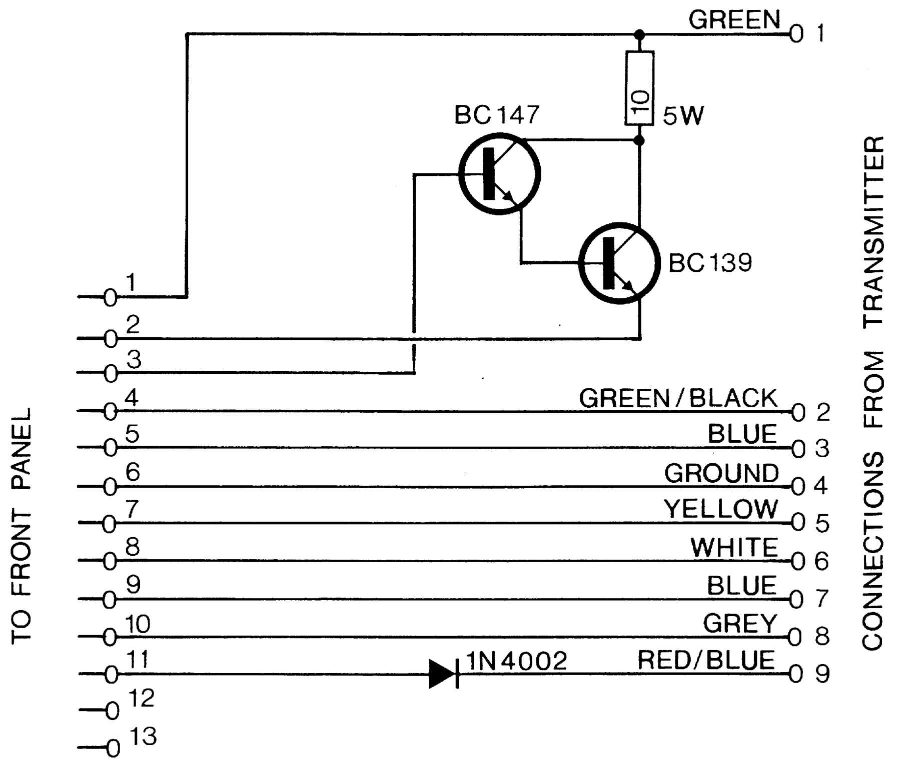


BLOCK DIAGRAM T 201
DRAWING No. 01.0211

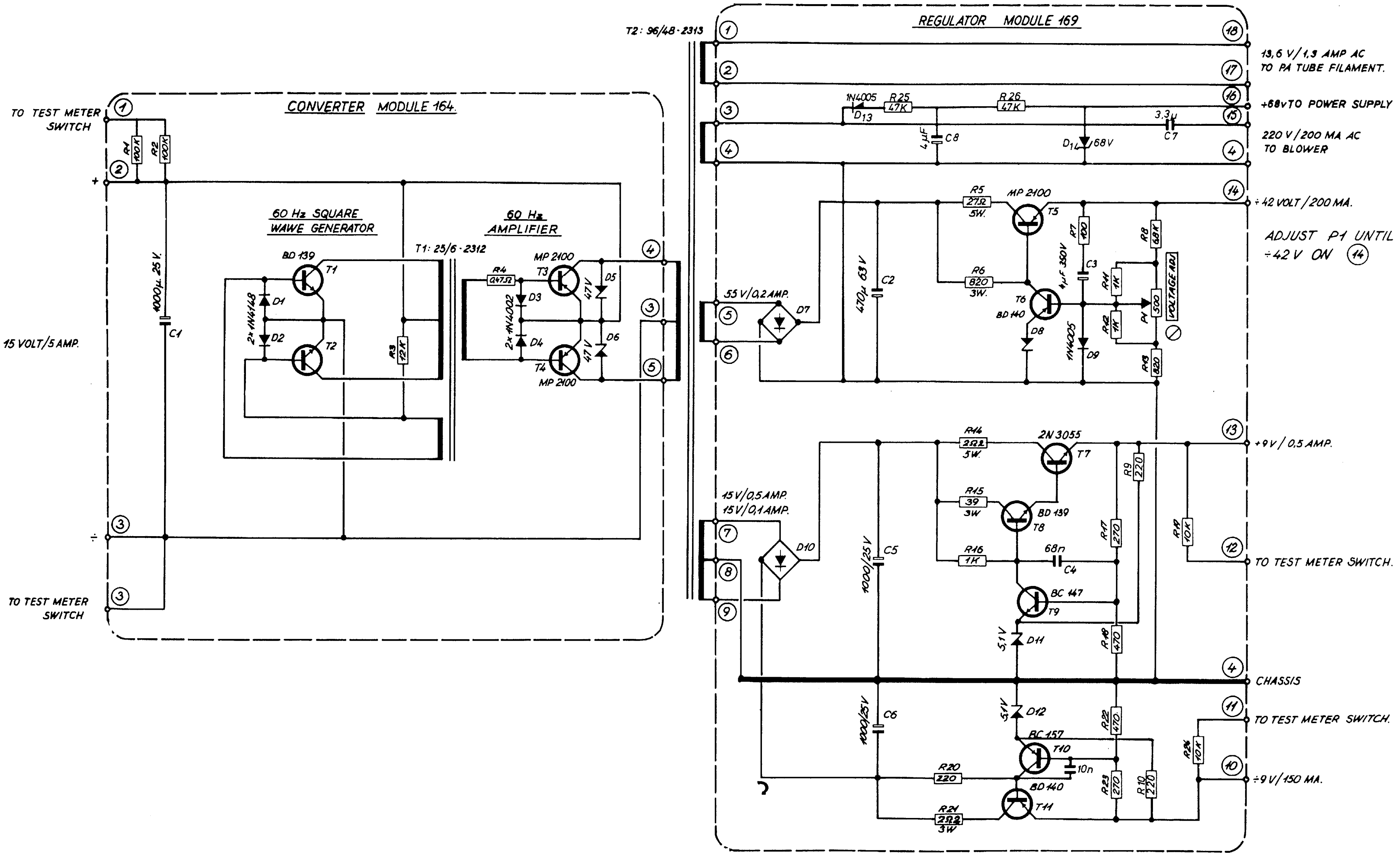
BLOCK DIAGRAM T 201
DRAWING No. 01.0211



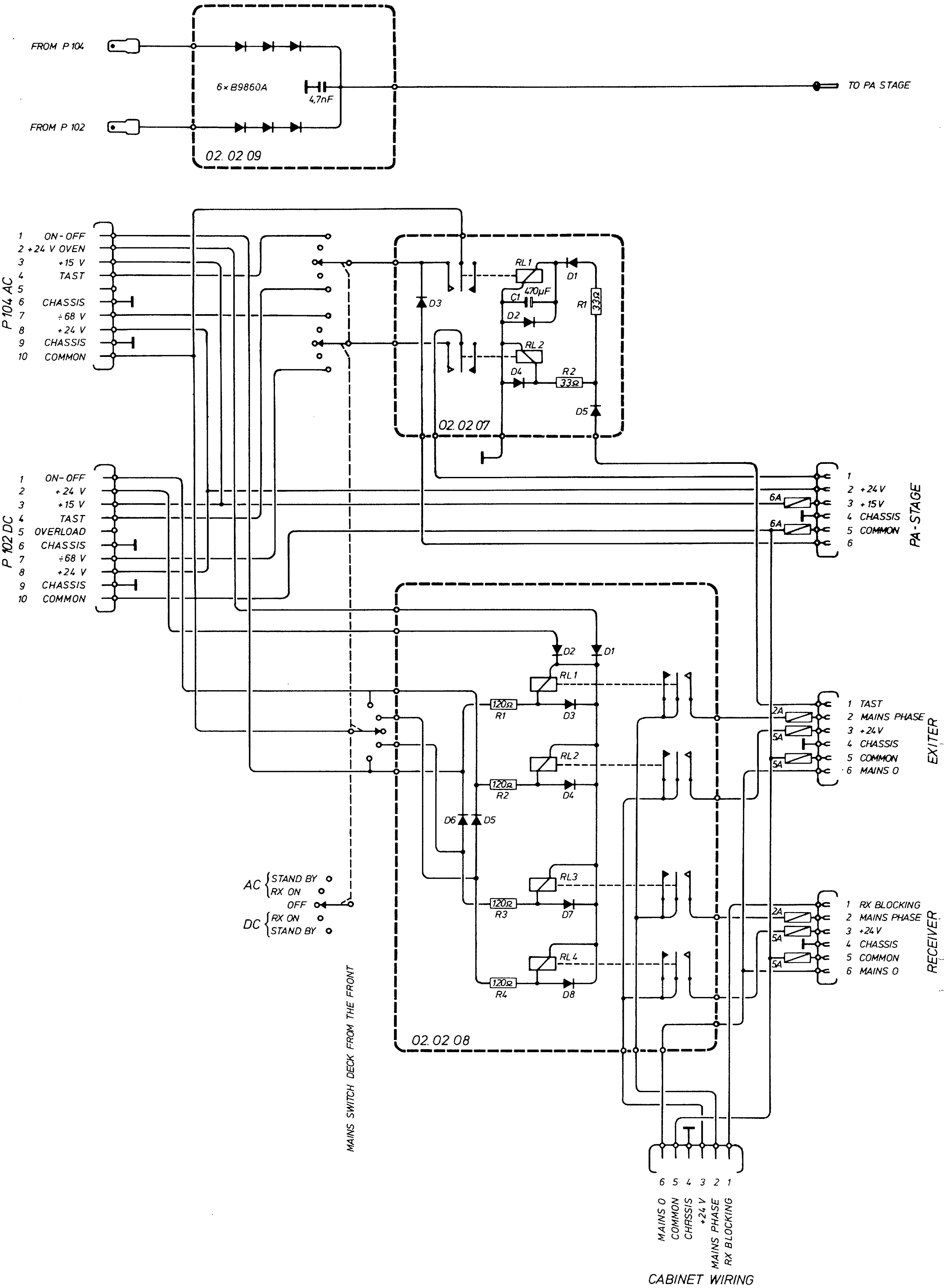
PA FRONTPANEL WIRING
DRAWING NO. 01.0214



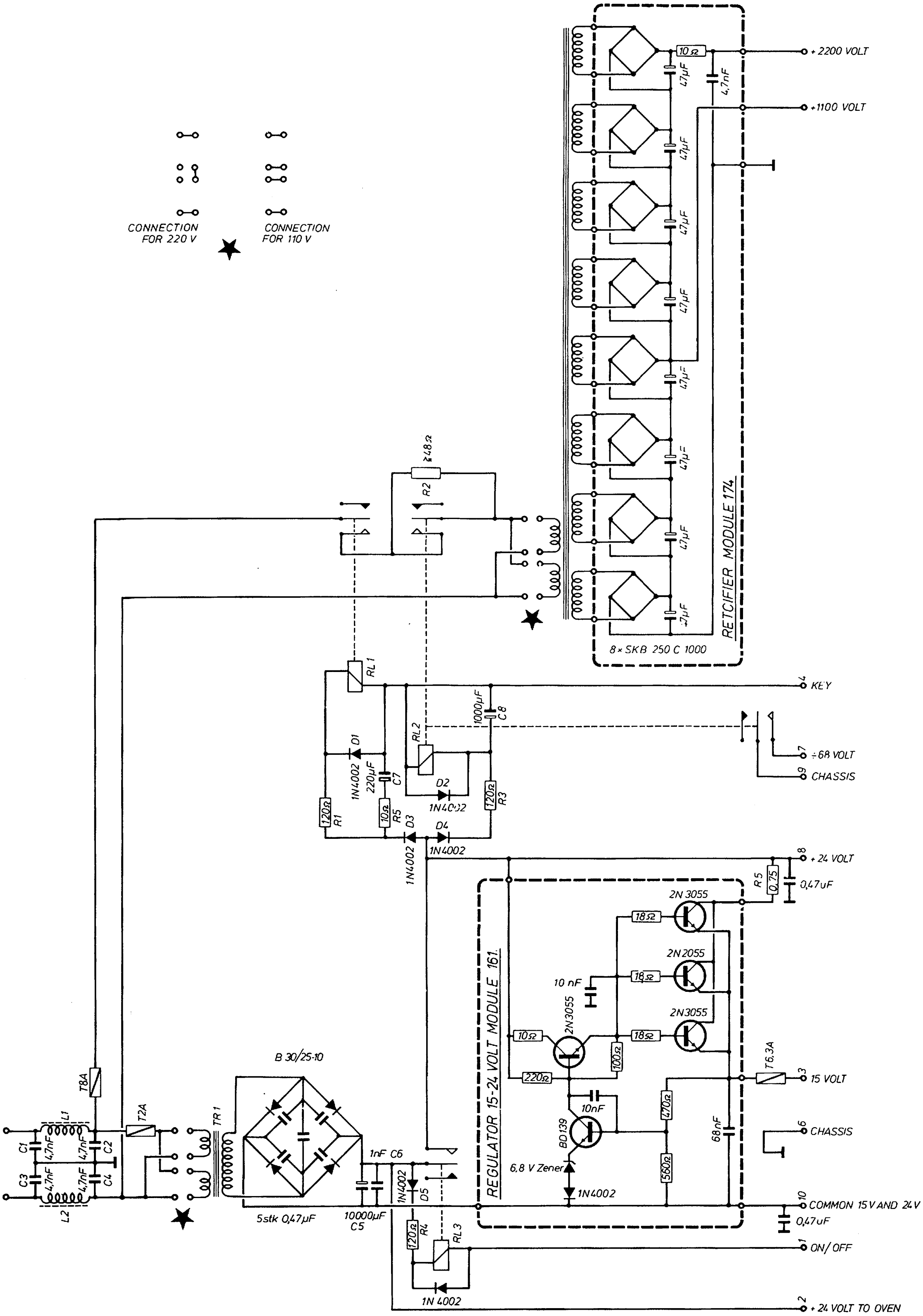
DIMMER 242
DRAWING NO. 01.0217



POWER SUPPLY P 103

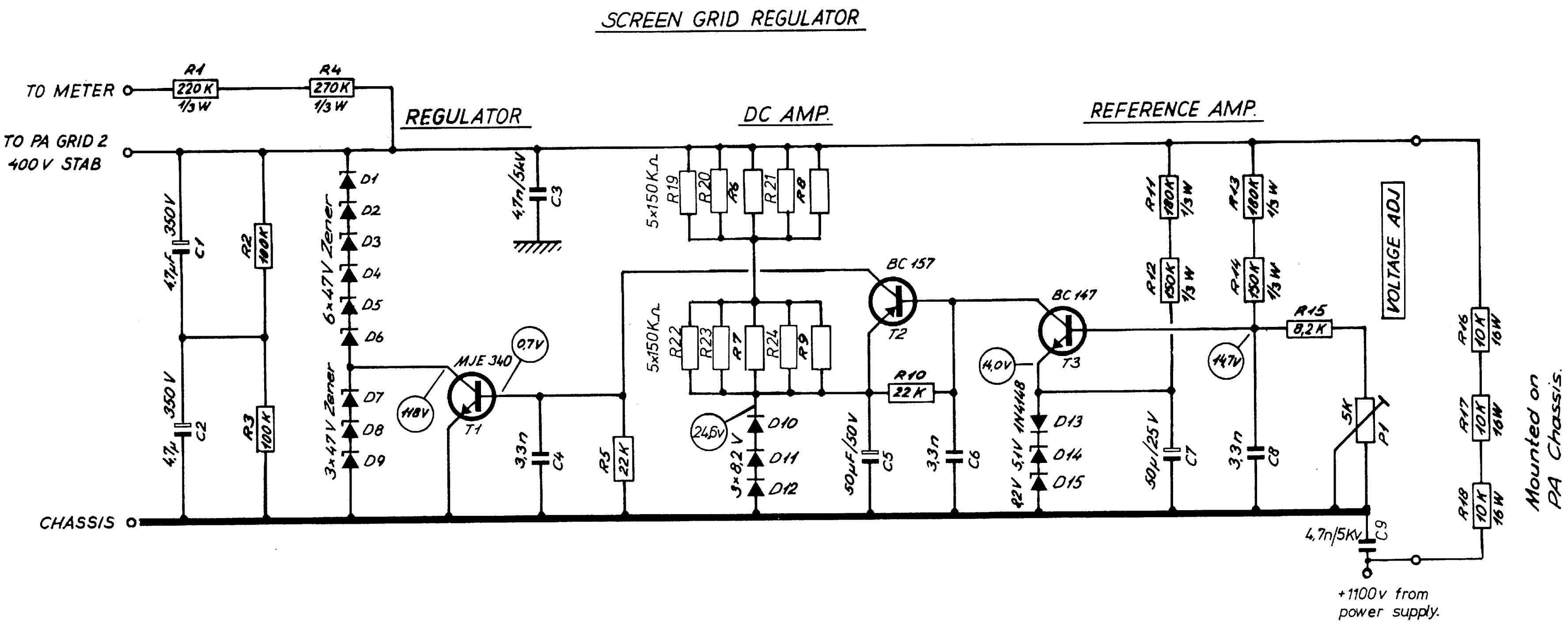


FUNCTIONAL DIAGRAM
P 203

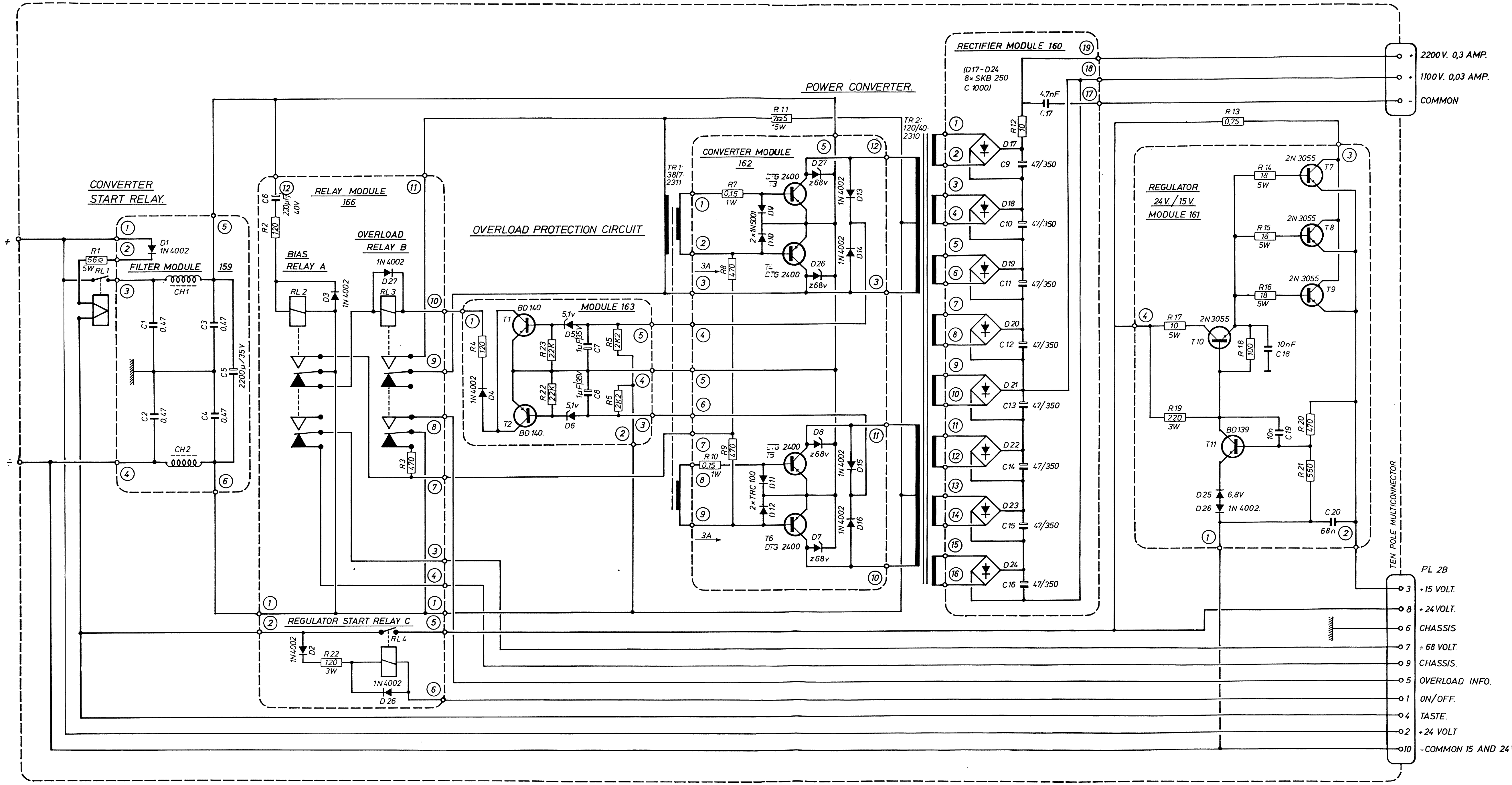


POWER SUPPLY P 104
MODULE No. 189

01.0199



SCREEN GRID REGULATOR 158.
01.0134



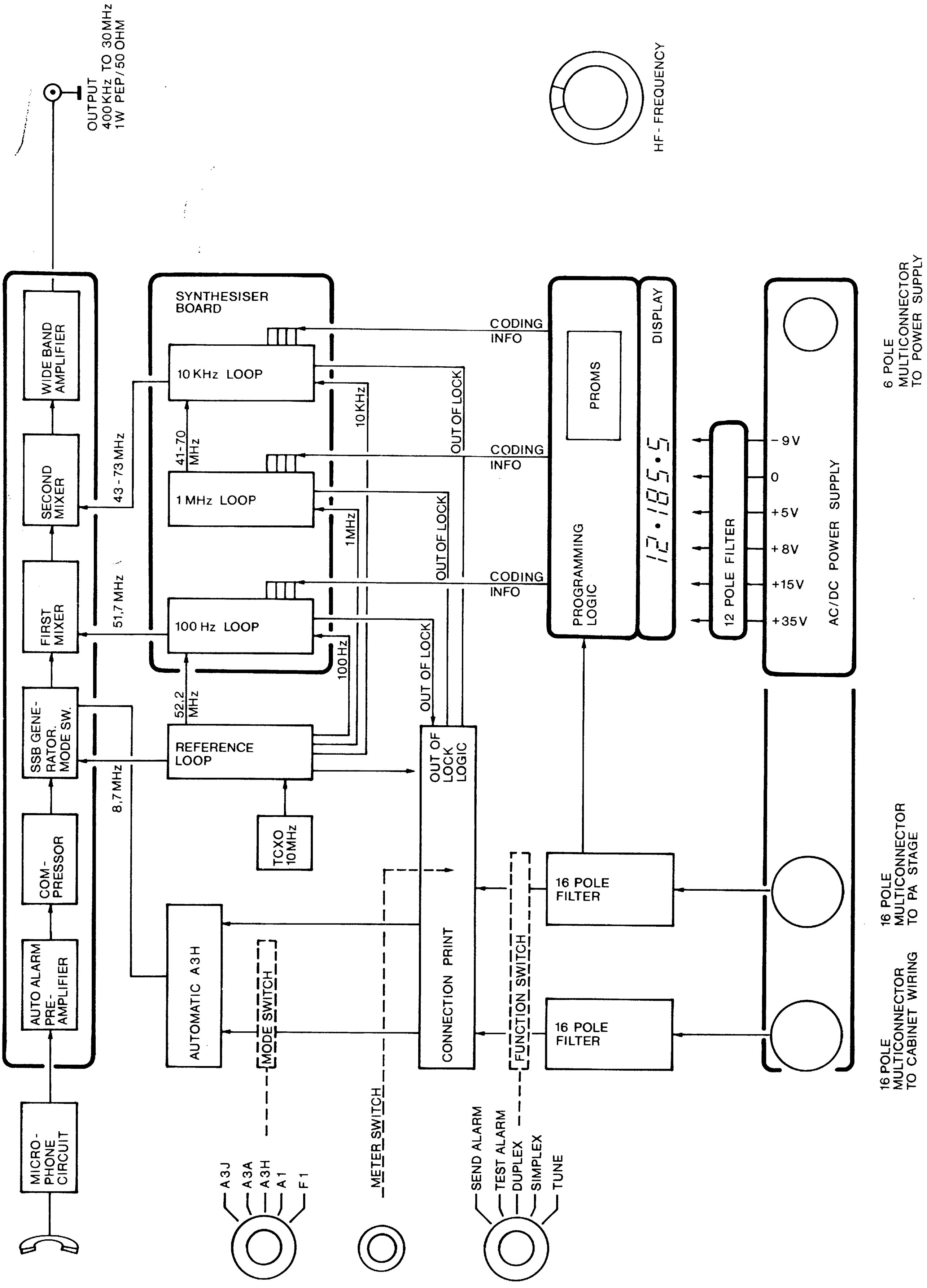
POWER SUPPLY P102
01.0148

C I R C U I T   D I A G R A M S.

FOR:

EXCITER E201/202.

CONTENTS:



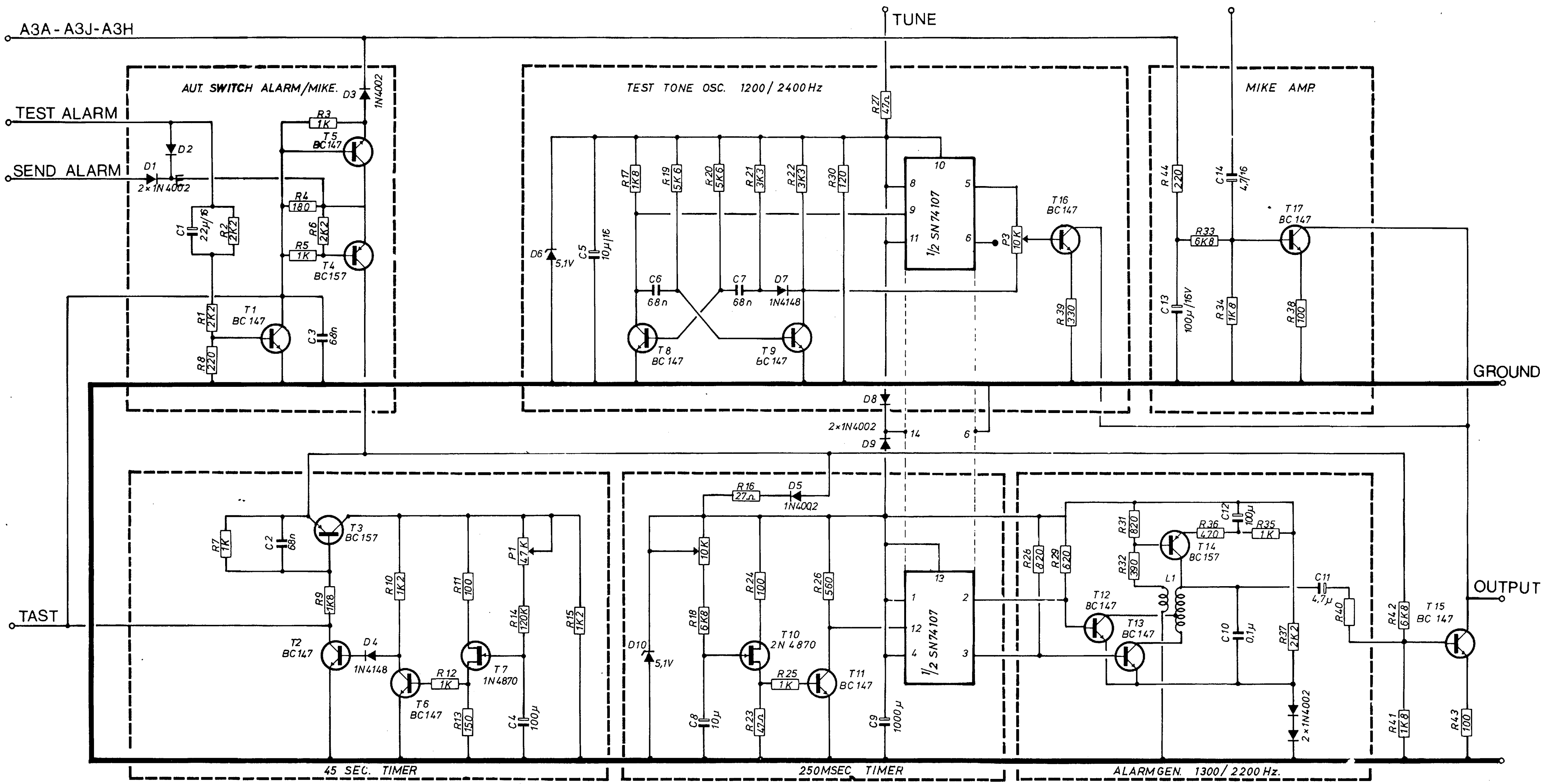
BLOCK DIAGRAM

EXCITER E 201

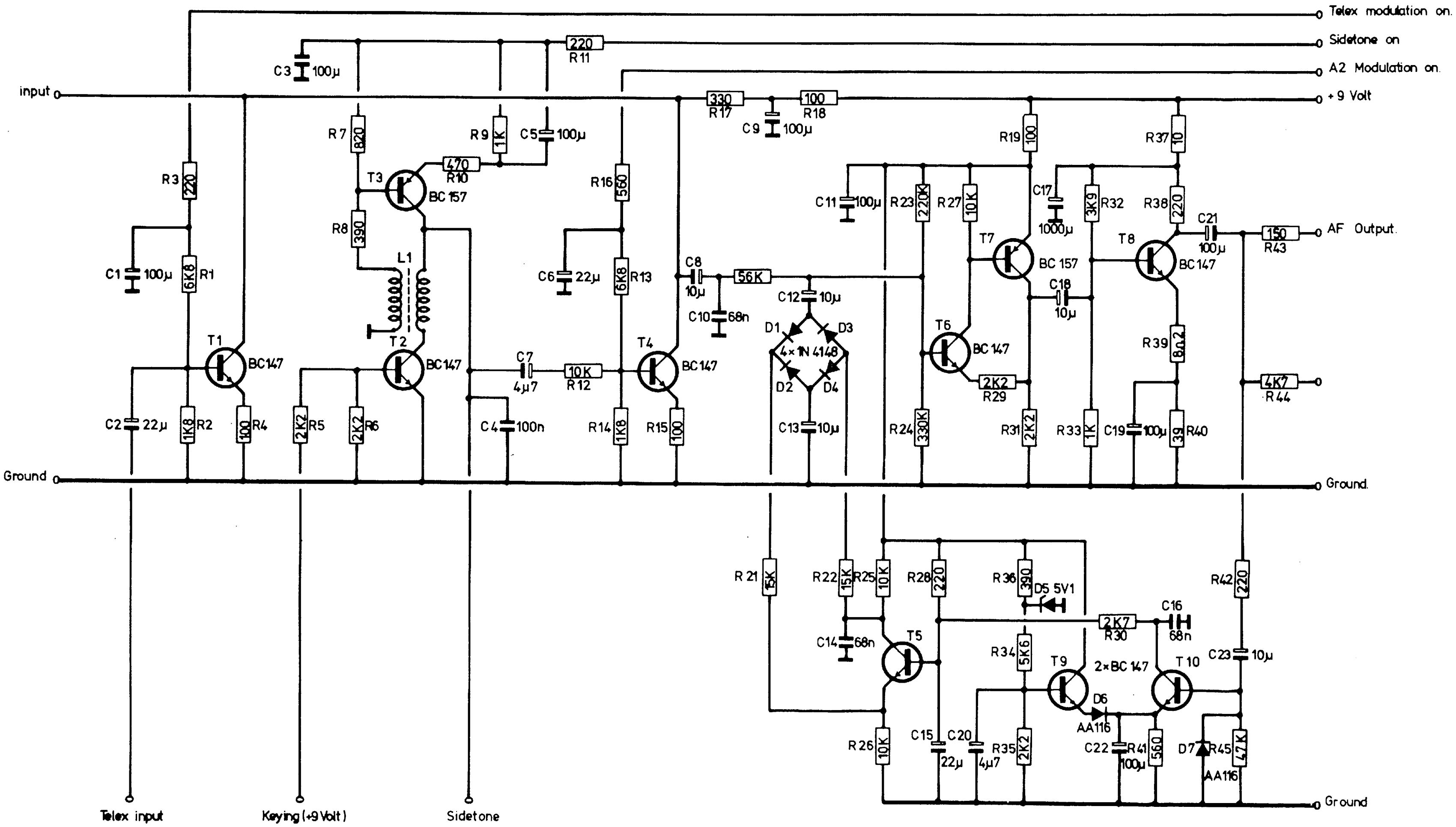
DRAWING NO. 01.0220

INTERNAL CONNECTONS TO SIGNAL PATH BLOCK DIAGRAM
KEYING RELAY
EMISSION MODE SWITCH
AUTOMATIC A3H RELAY
FUNCTION SWITCH
EXTERNAL CONNECTIONS
METER SWITCH
100Hz LOOP LOOK
10KHz LOOP LOOK
1MHz LOOP LOOK
REFERENCE LOOP LOOK
NONE PROGRAMMED CHANNEL
KEY BLOCKING LOGIC
CONNECTION PRINT 02.0223
KEYING RELAY
TO KEYING CIRCUIT
PRESS SWITCH TO SEND ALARM
ALARM KEY
TEST ALARM
SEND ALARM
TEST TONE ON
MICROPHONE
COMMON
MICROPHONE INPUT 02.0266
TELEPHONY MODULATION ON
A 2 MODULATION ON
TELEGRAPHY SIDE TONE ON
TELEGRAPHY KEYING
TELEX MODULATION ON
TELEX MODULATION TONES
MODULATION SIGNAL SWITCH
TELEX MODULATION INPUT CIRCUIT
HANDSET COMMON
SIDE TONE TO HANDSET
LOUDSPEAKER SWITCHING
EMISSION MODE SWITCH
POWER REDUCTION
KEYING CIRCUIT
TO KEYING RELAY
3dB POWER REDUCTION
CARRIER BLOCKING
EXITER MUTING
AUTOMATIC A3H
270
FROM DISPLAY UNIT
A3H A3A A3J A2 A1 F1
DUPLEX
TEST ALARM
SEND ALARM
SIMPLEX
TUNE
*PLACED ON CIRCUIT BOARD 02 0266
PART OF 6 POLE CONNECTOR TO POWER SUPPLY (P203)
5 POLE CONNECTOR ON FRONT PANEL
16 POLE CONNECTOR TO CABINET WIRING
PART OF 16 POLE CONNECTOR TO TRANSMITTER
SAFETY SWITCH
TELEX KEY
MORSE KEY
TRANSMITTER KEYING
COMMON
RECEIVER BLOCKING
HANDSET KEY
MICROPHONE INPUT
EARPHONE
TELEX MODULATION INPUT
LF FROM RECEIVER
LOUDSPEAKER
A1/F1 INFO.
FUNCTIONAL DIAGRAM
E 201
DRAWING NO. 01.0222

SIGNAL PATH
E 201-2-3
DRAWING NO. 01.0223

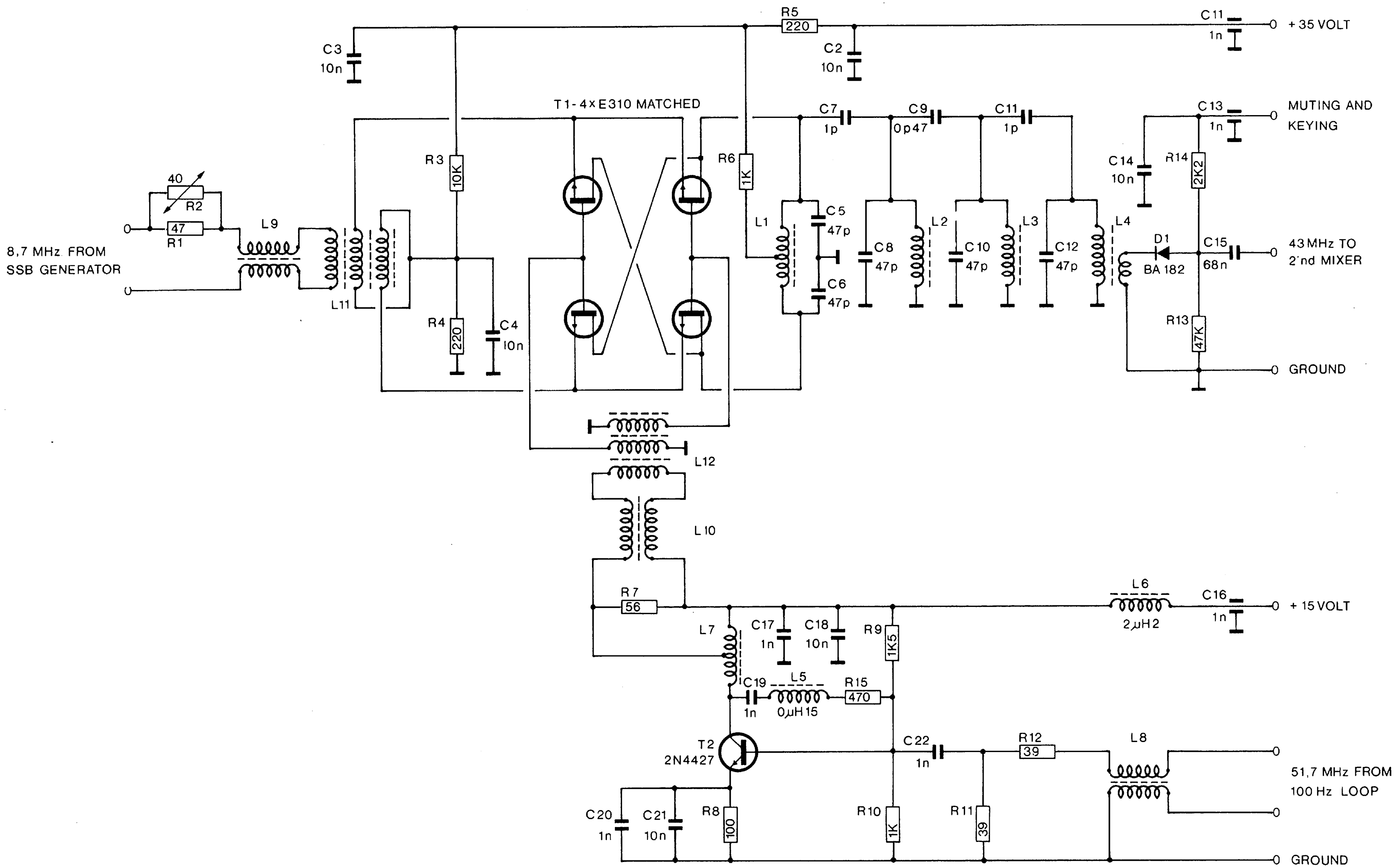


ALARM SIGNAL GENERATOR
01.0224



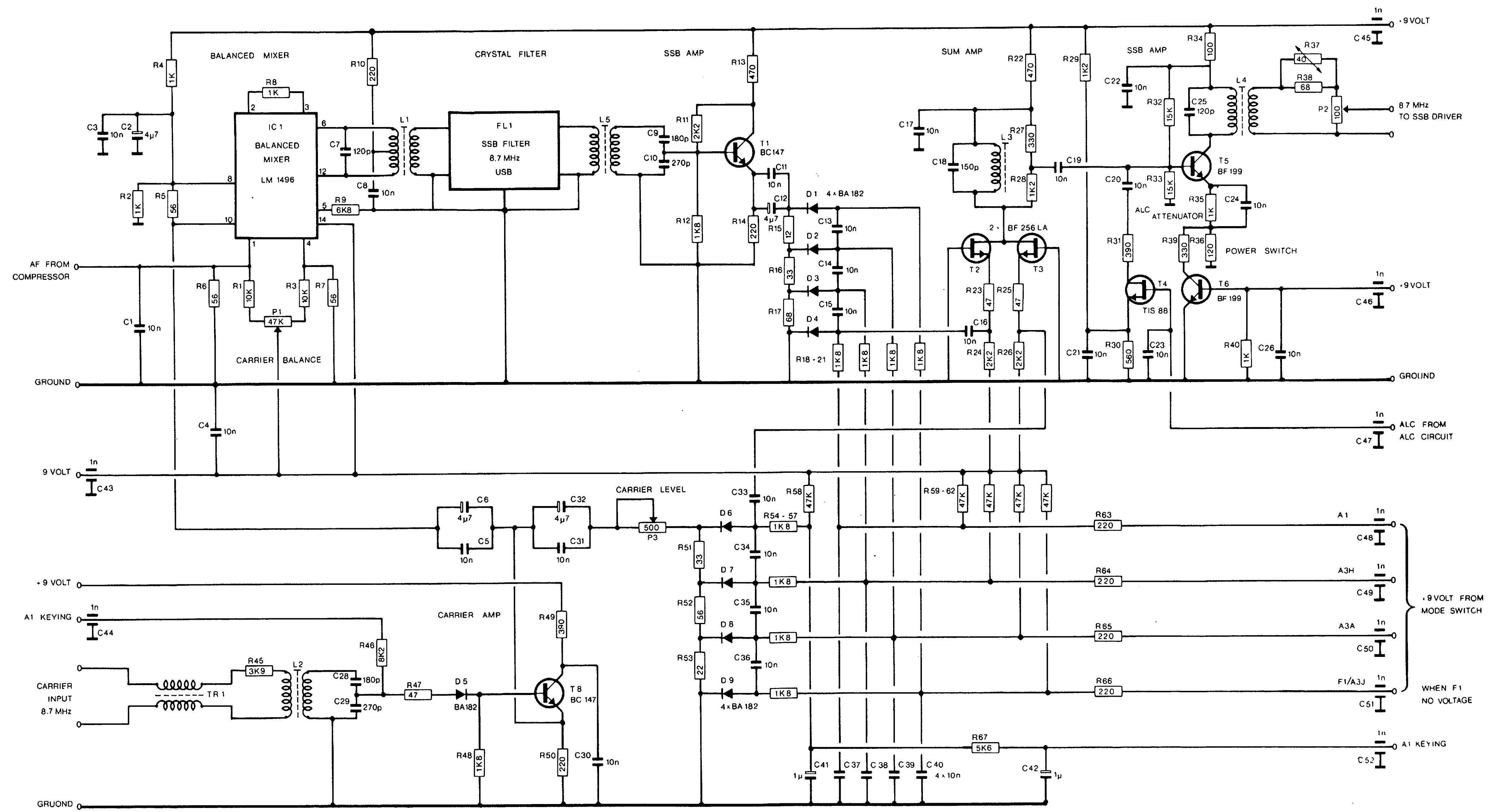
COMPRESSOR.
MODULE 212.

01.0225

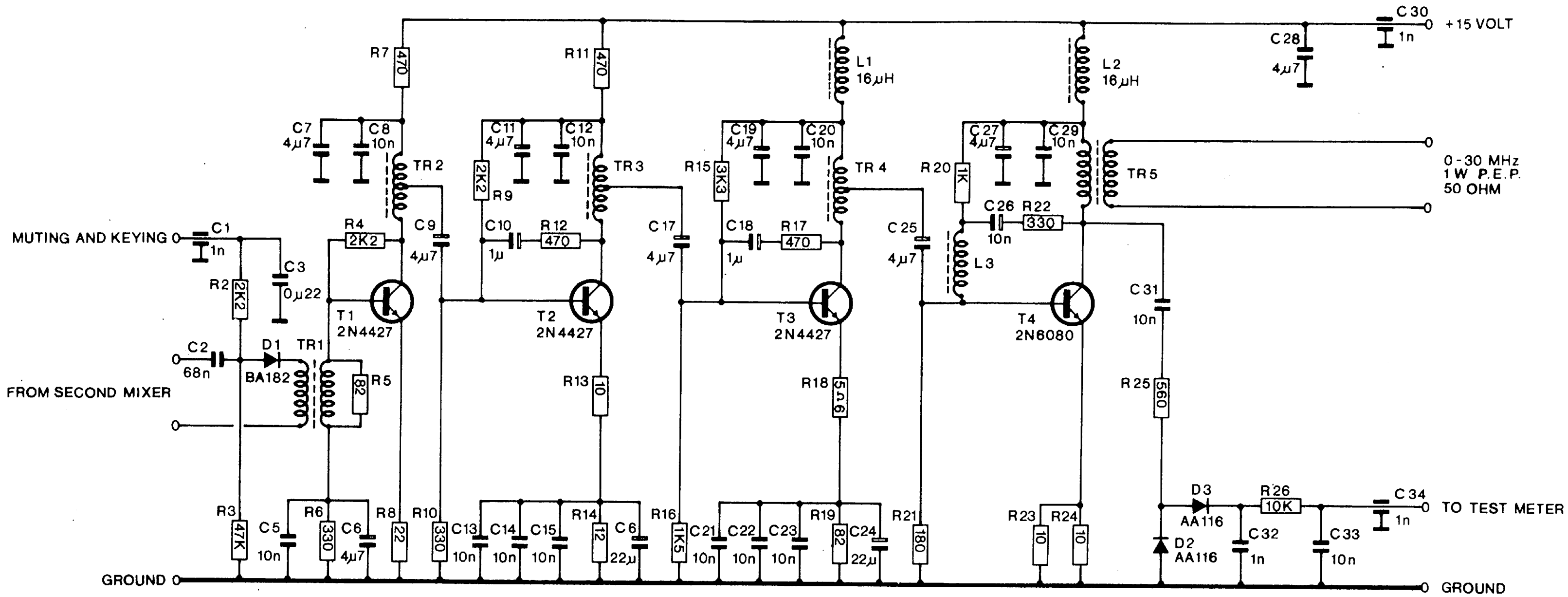


1'st MIXER 211

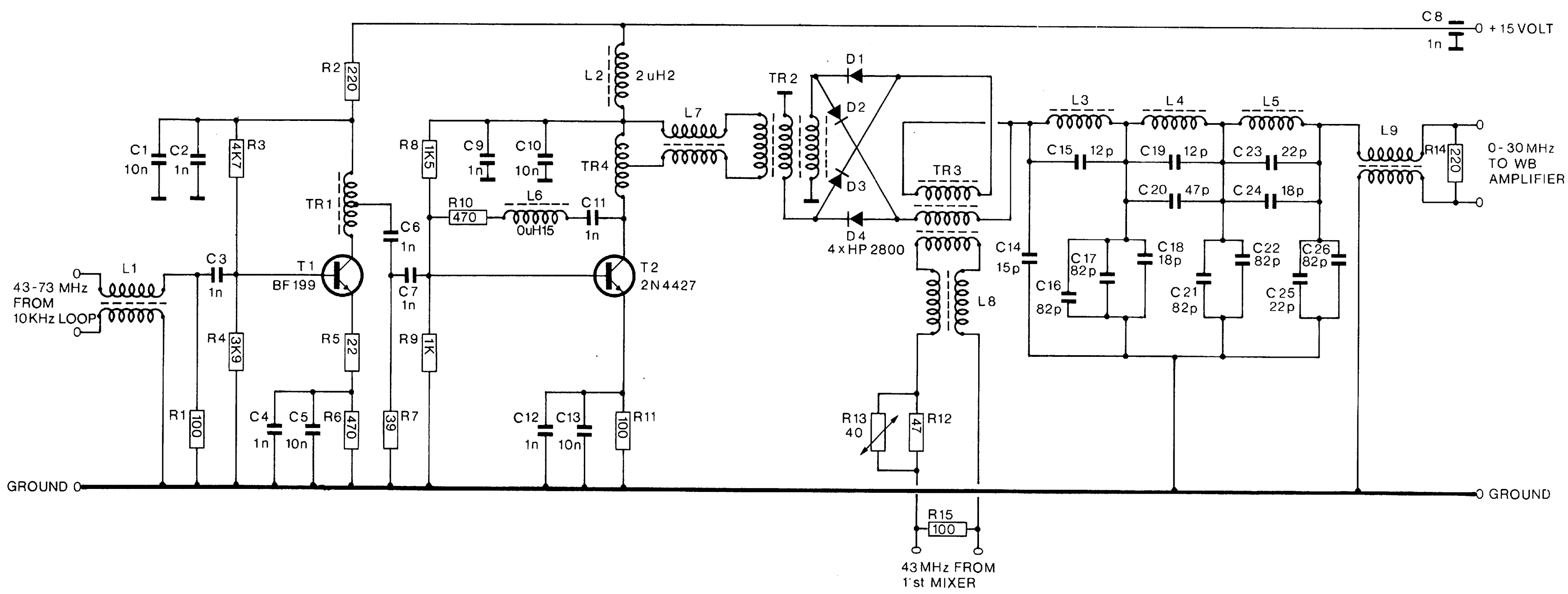
DRAWING NO. 01.0227



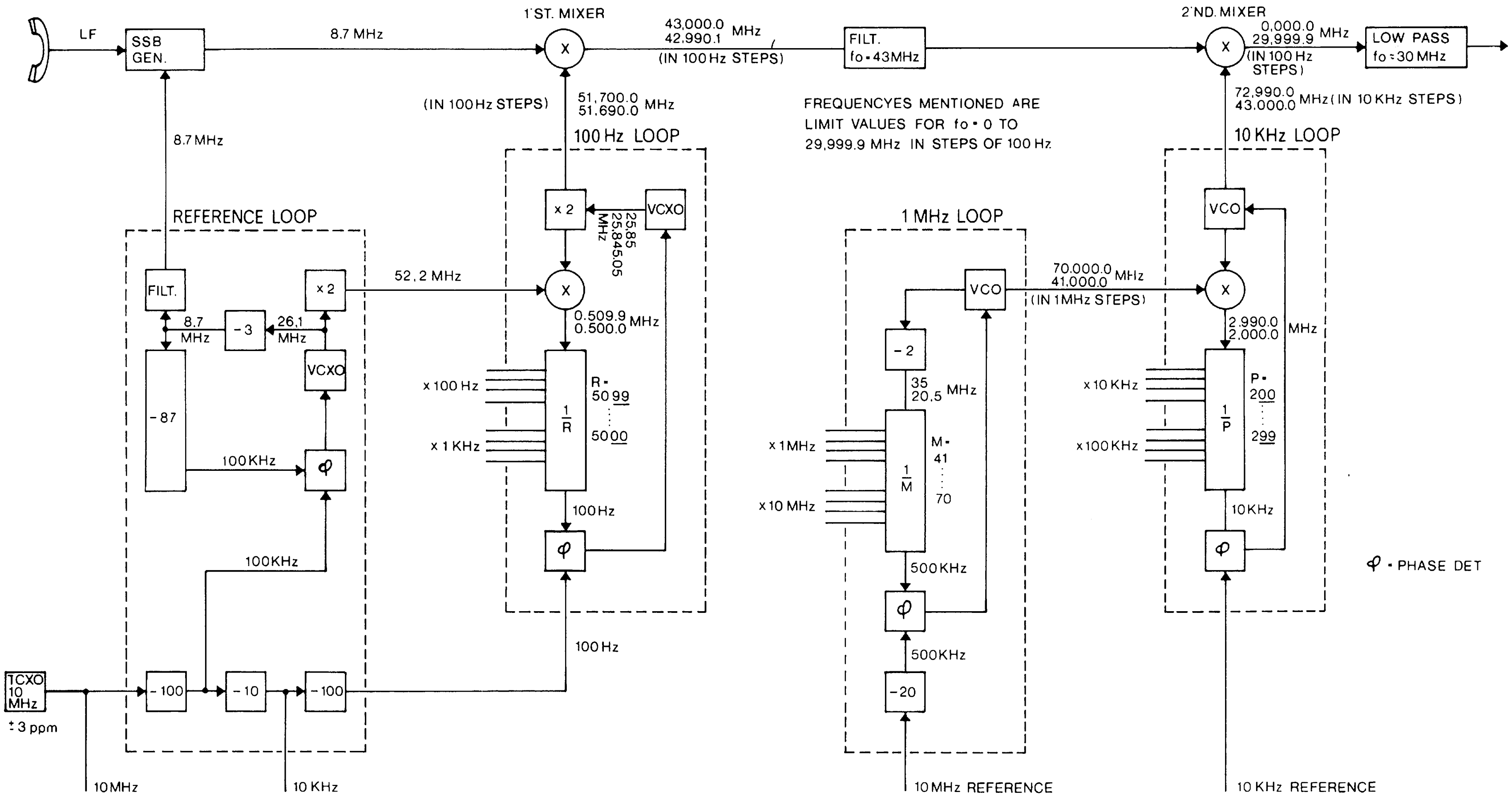
SSB GENERATOR MODULE 213



WB AMPLIFIER 215
DRAWING NO. 01.0229



2'nd MIXER 214.
DRAWING No. 01.0228

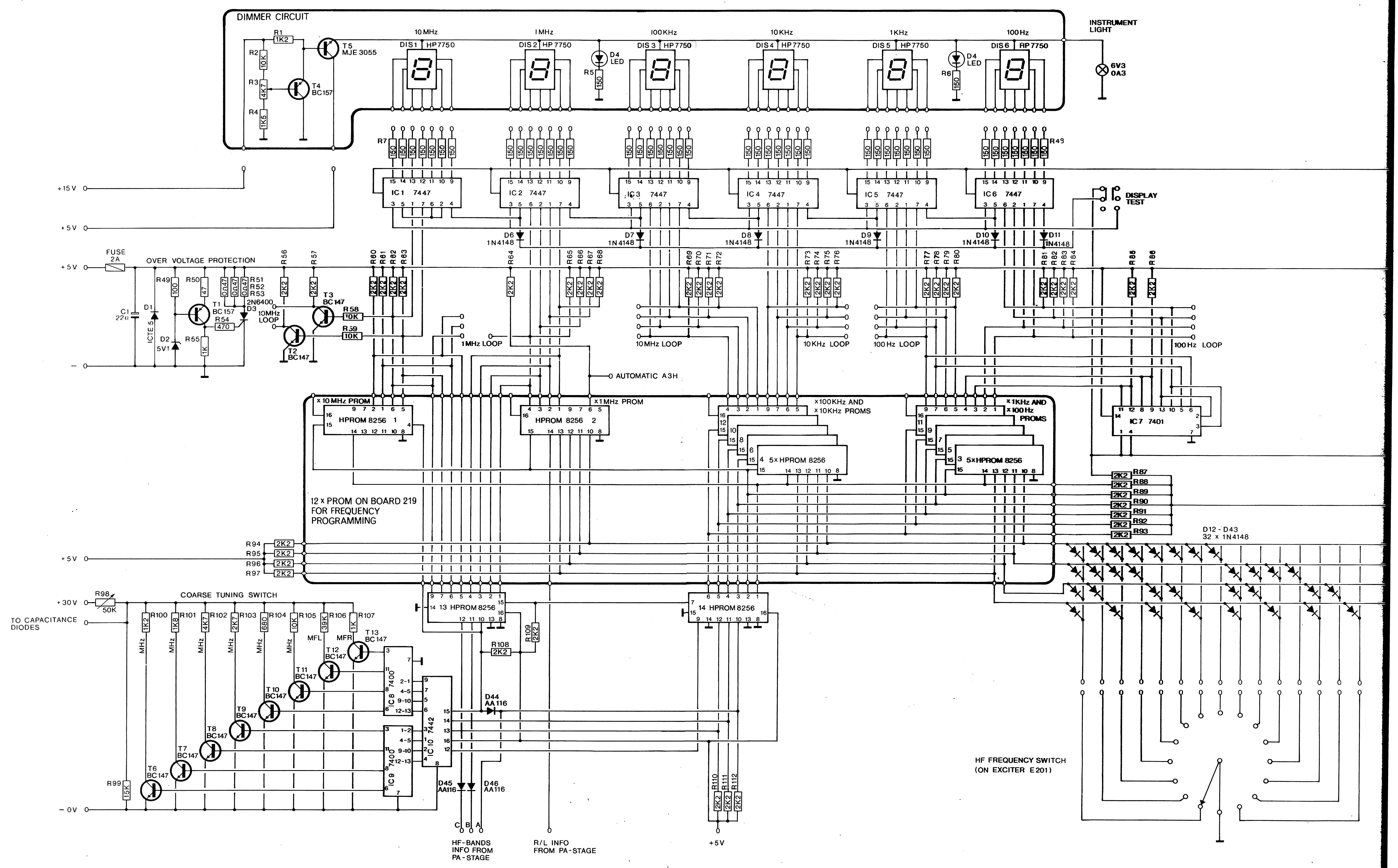


EXAMPLE: (ALL PROGRAMABLE DIVIDERS = DOWN COUNTERS)

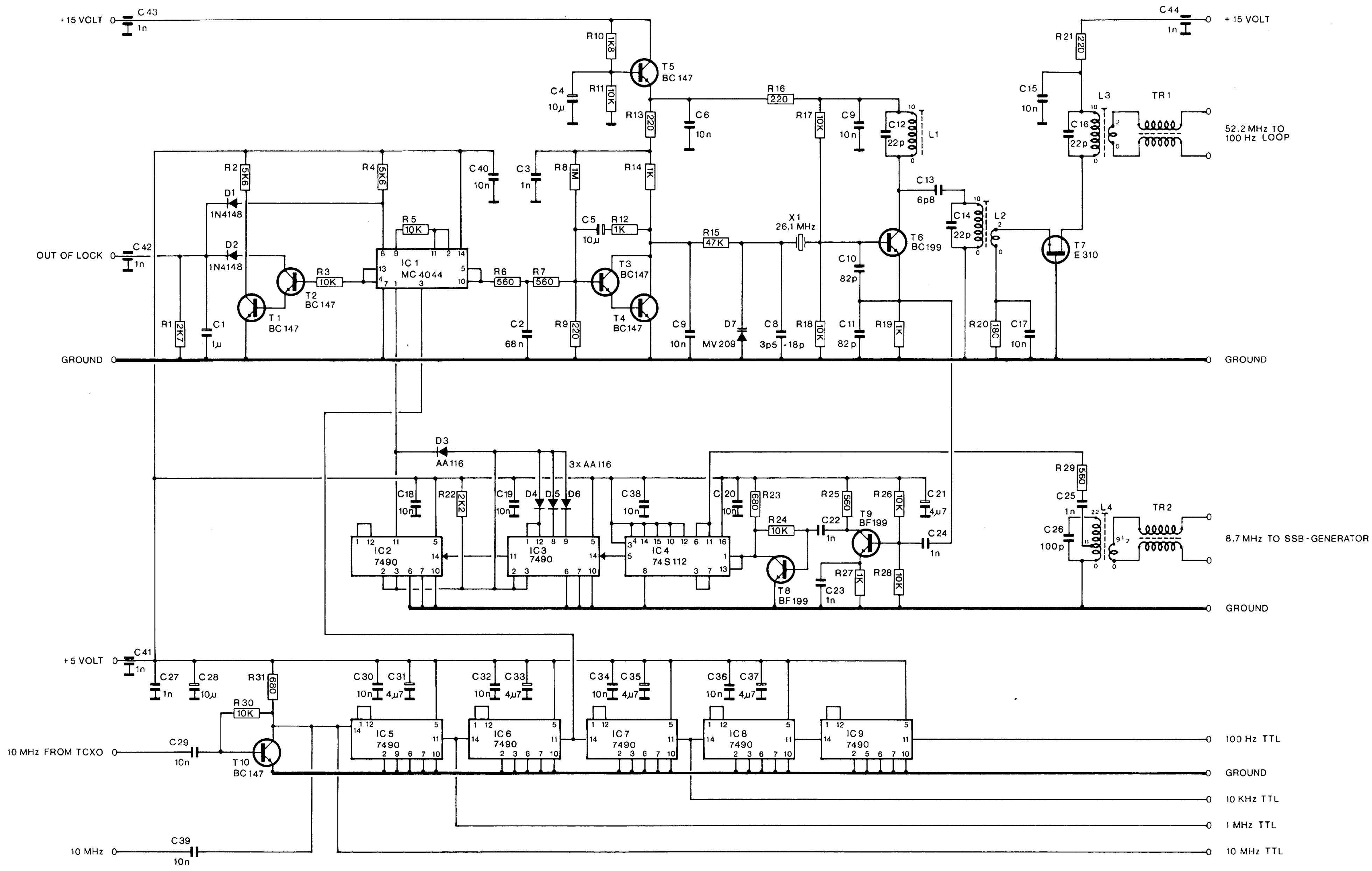
M = 57 => N = 57 - 41 = 16
P = 255
R = 5073

$f_o = \frac{16}{N} \cdot \frac{55}{P} \cdot \frac{7.3}{R}$ MHz

FREQUENCY GENERATION
BLOCK DIAGRAM E 201
DRAWING NO. 01.0230

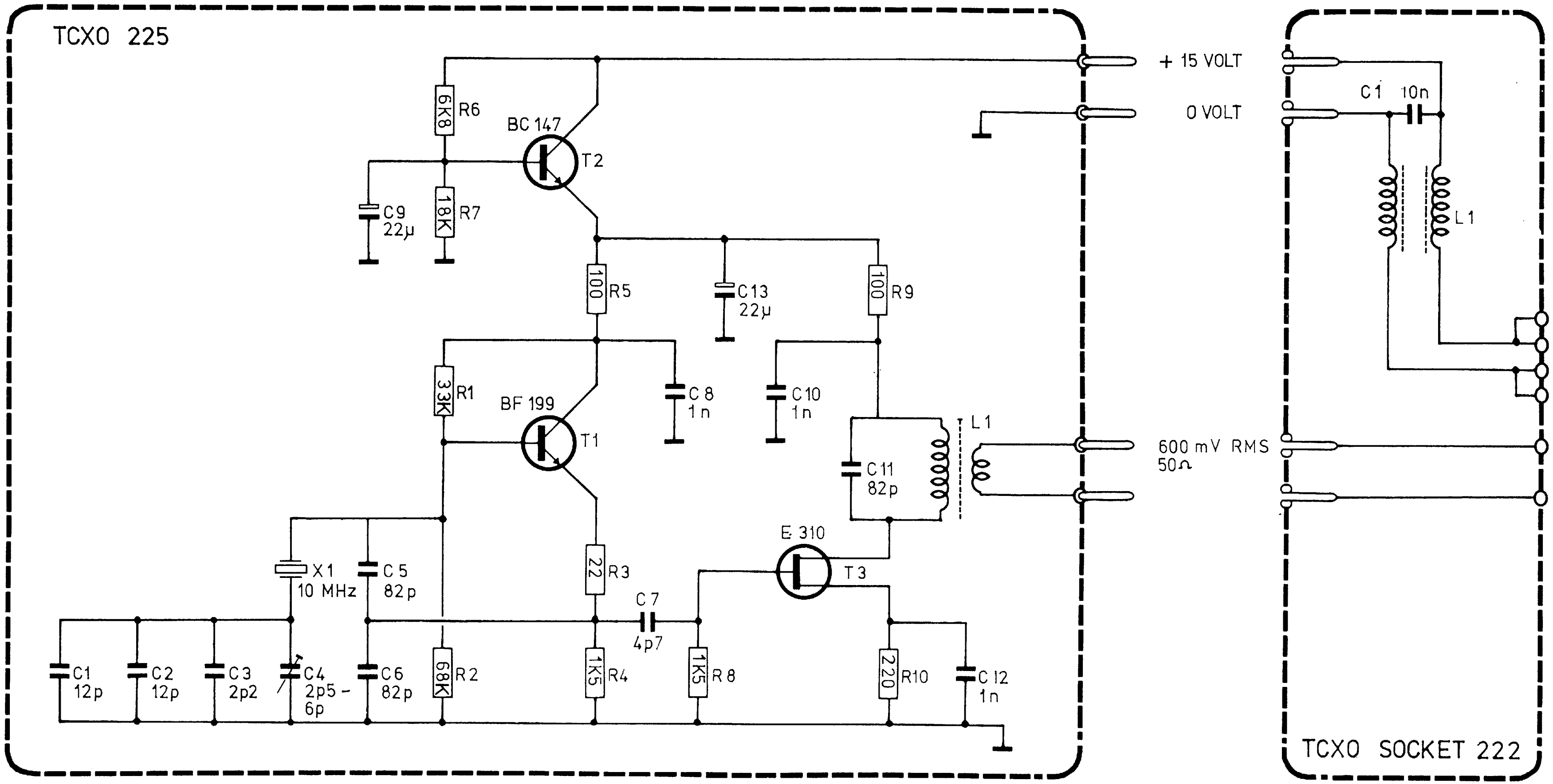


DISPLAY 220 AND PROM
DRAWING NO. 01.0231



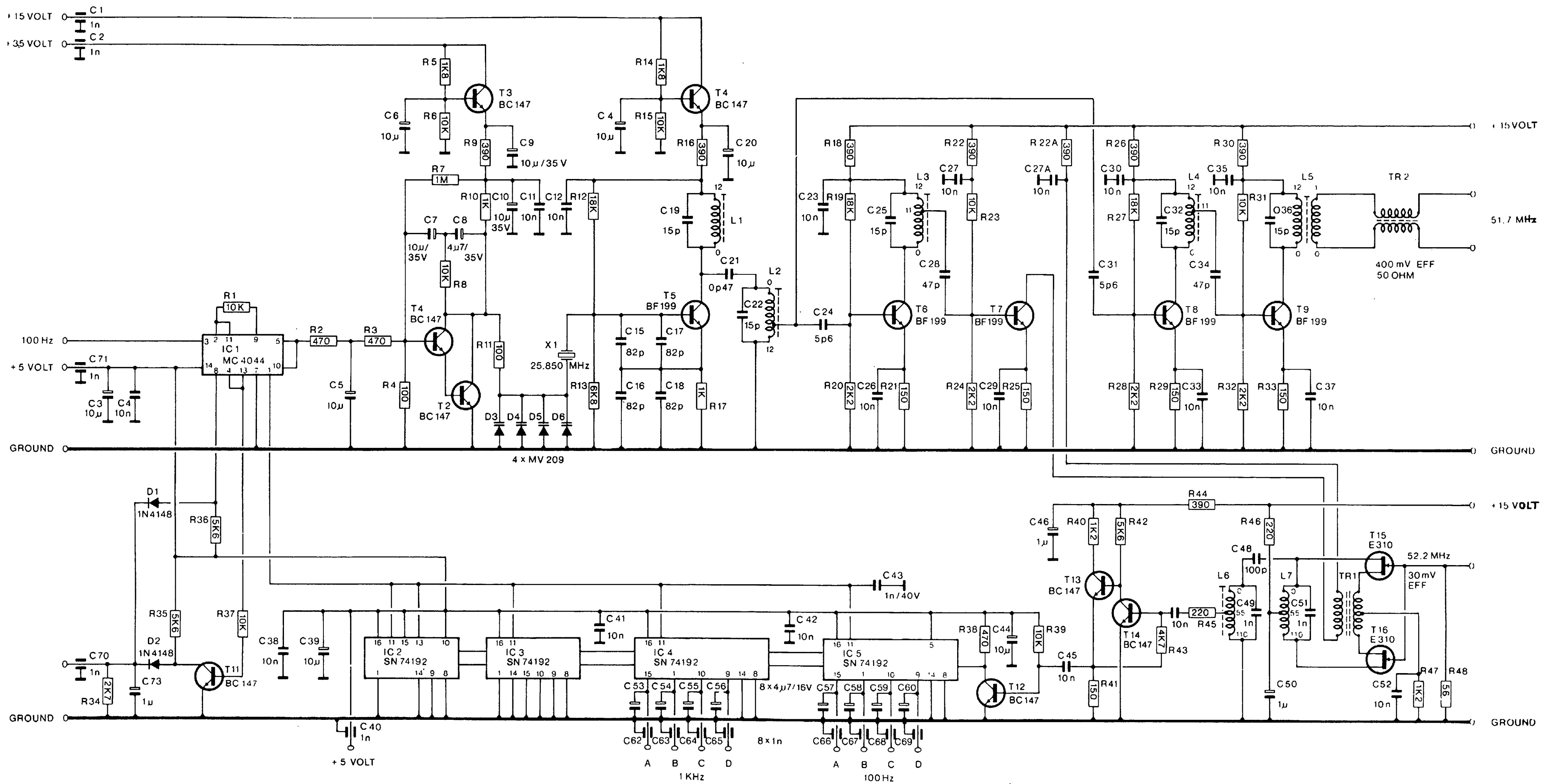
REFERENCEGENERATOR 216

DRAWING NO. 01.0232



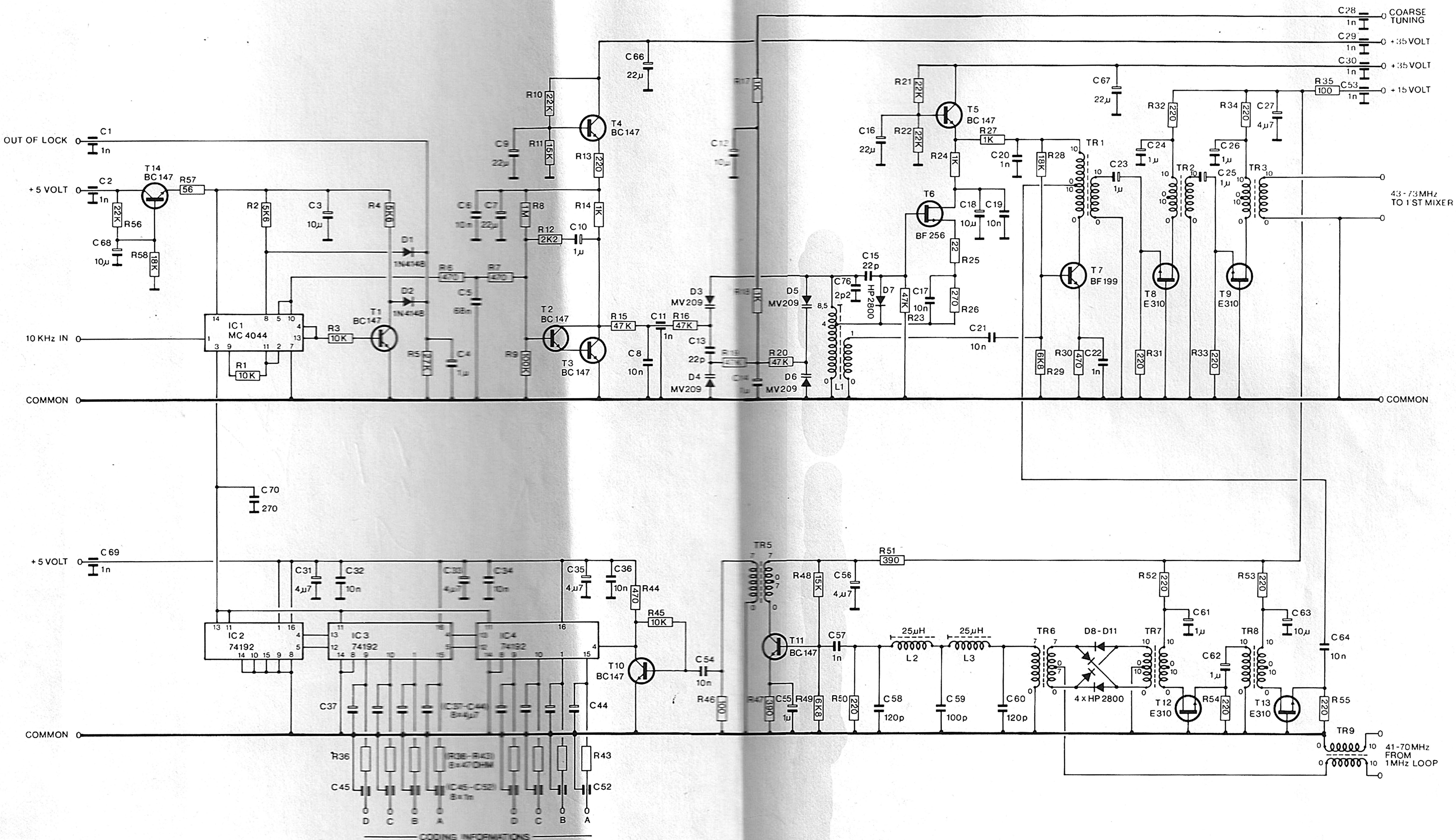
C1 AND C2 : TEMP. COMPENSATION CAPACITORS.
MUST NEVER BE CHANGED

TCXO MODULE 225
TCXO SOCKET MODULE 222

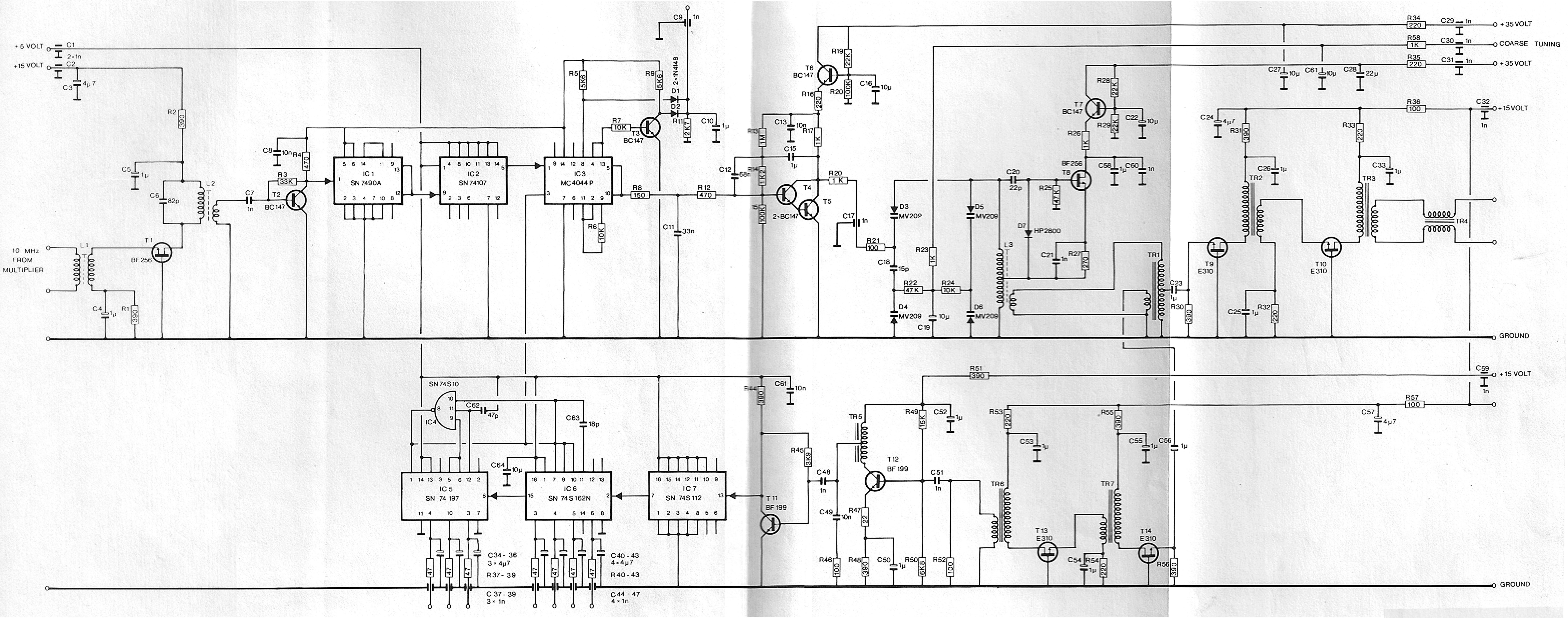


100 Hz LOOP 217

DRAWING NO. 01.0234

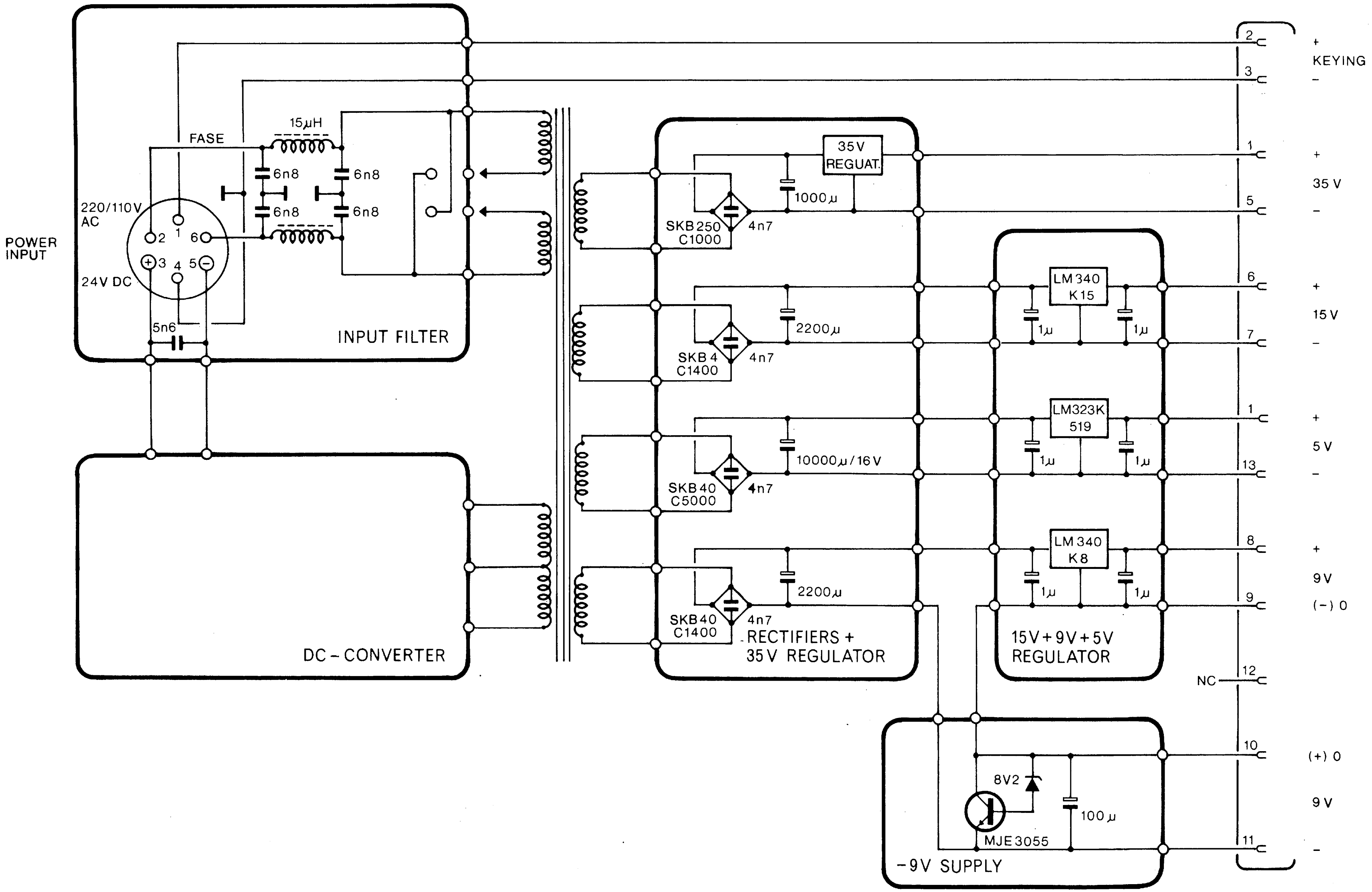


10 KHz LOOP 218
DRAWING NO. 01.0235A

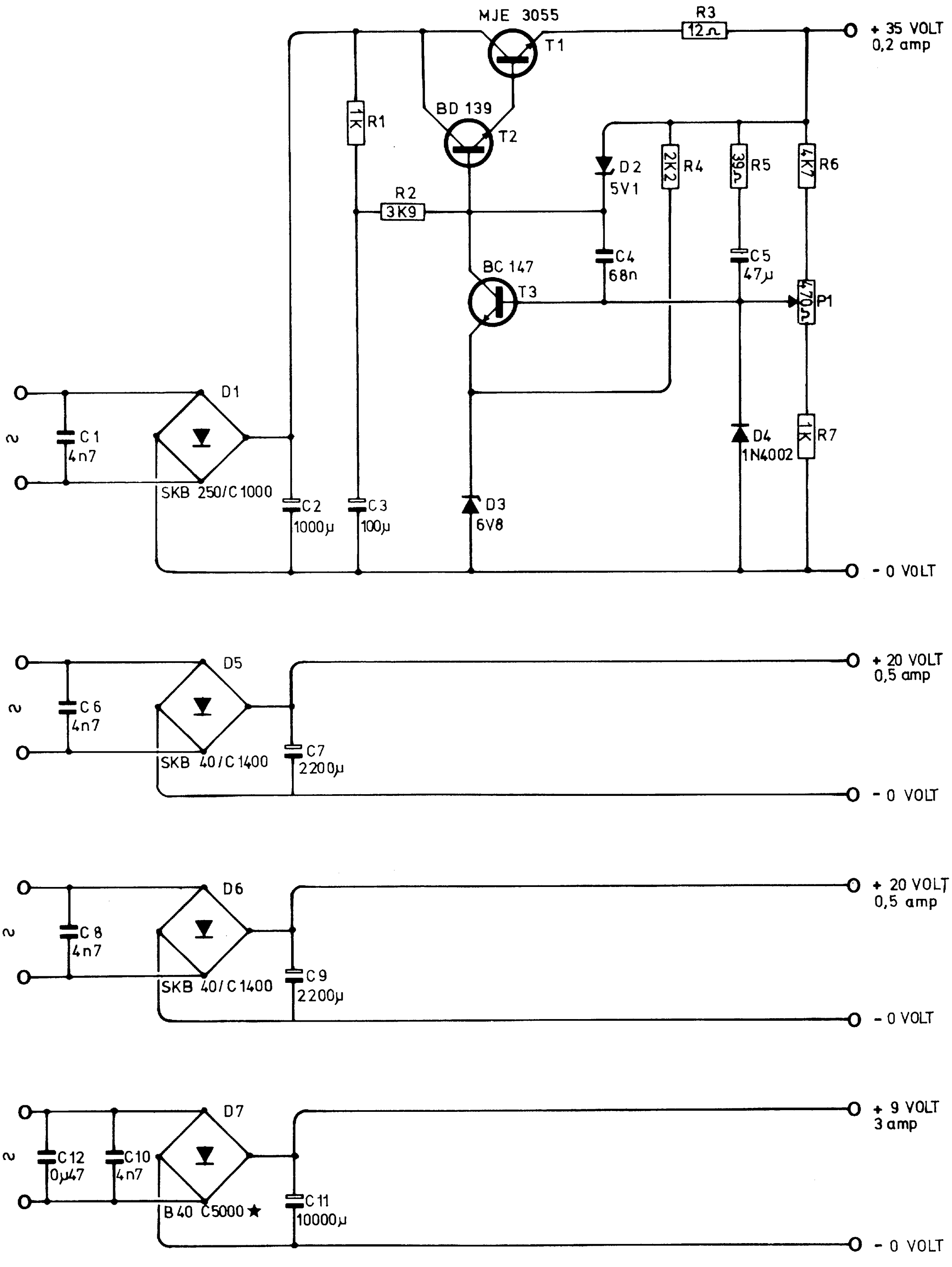


1 MHz LOOP

MODULE 02.0230



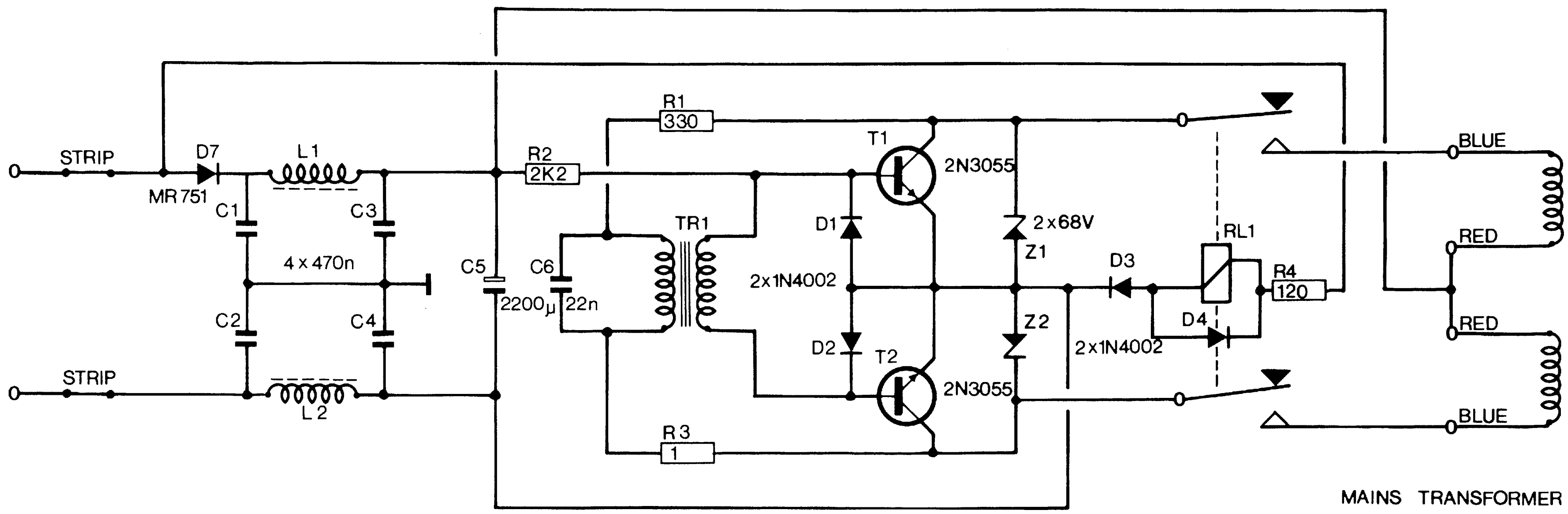
WIRING DIAGRAM FOR REAR PANNEL E 201
DRAWING NO. 01.0237



★ NOT PLACED AT CIRCUIT BOARD

RECTIFIER 35 VOLT
REGULATOR

MODULE 210



DC - CONVERTER

MODULE 201

01.0239

H.F.400 S.S.B. RADIO TELEPHONE

CEIVER GENERAL DESCRIPTION

System Principle

The Dancom H.F.400 receiver is a synthesized system capable of being tuned continuously from 10 KHz. to 30 KHz. The unit is self contained in one rack. The receiver tuning has two preset positions for 500 KHz. and 2182 KHz. The power input can be 24 volts D.C. or 110/220 volts A.C.

The receiver comes in two variations, the R201 and the R203. The R203 has the extra mode positions to enable more efficient reception of telegraphy and telex signals.

The R201 and the R203 are completely interchangeable in the H.F.400 system and can be supplied in a separate cabinet if required.

The receiving system can be separated into the analogue signal path circuitry and the frequency synthesizer.

The input signal enters the receiver via an aerial protection circuit and then enters the bands unit. In the bands unit the signal is filtered by pre-selector tuned sets switched by the bands switch. From here the signal is passed into the first mixer.

The first mixer combines the incoming signal with a variable mixer frequency to give an output af 45.1 MHz. This passes through a crystal filter and onto the second mixer. The second mixer can be fed with one of two mixer frequencies. These are spaced 1.5 KHz. apart and give the effect of moving the mixer output relative to the I.F. amps so that the number of I.F. filters can be reduced.

From the second mixer the signal enters the appropriate I.F. filter at either 580 KHz. or 581.5 KHz. and then passes onto the first I.F. amplifier. The signal then passes through a second I.F. amplifier. The second I.F. amplifier gain can be adjusted by the R.F. gain control. Both I.F. amplifiers have A.G.C.

From the I.F. amplifiers the signal is then detected in either an S.S.B. or an A.M. detector. The A.F. is then passed onto an A.F. pre-amplifier and into either a balanced 600 ohms output transformer, or into an integrated circuit A.F. power amplifier to drive a loudspeaker.

To provide the correct mixer frequencies a frequency synthesizer is used. All the synthesizer frequencies are derived from a TCXO running at 10 MHz. This TCXO is identical to that used in the H.F.400 transmitter system.

The first local oscillator sweeps between 46.1 MHz and 75.1 MHz. and determines the receiving frequency. The frequency counter on the receiver front panel is measuring the variable frequency oscillator and displays the frequency the receiver is tuned to. A frequency lock circuit pulls the V.F.O. to the nearest 100 Hz.

The second mixer oscillator is delivered from the TCXO and can be offset by 1.5 KHz to achieve the correct I.F. filtering. It can also be fine tuned in the S.S.B. mode to provide clarifier operation of ± 250 Hz.

The carrier reinsertion oscillator is a separate crystal oscillator operating at 5.8 MHz. This is divided by ten to give 580 KHz. fed to the product detector.

The B.F.O. oscillator is a V.C.O. operating at 580 KHz. and uses the S.S.B. detector to obtain the beat-tone for C.W. working. The V.C.O. has a range of ±3 KHz.

Analogue Signal Path

Aerial Protection

The aerial input is passed through an aerial protection network. This network limits any high voltages on the aerial to a safe level. A maximum of 30 volts pp is allowable on the aerial. A voltage dependent resistor limits the input current, and diodes clip the output to 1.2 volts pp.

Bands Unit

The MHz. multi-position frequency selector switch selects appropriate pre-selector tuned circuits. These are lowpass or bandpass filters and are tuned by the aerial tune knob on the front panel. This tune control must be used to track the local oscillator so as to obtain maximum sensitivity.

The frequency selector switch also operates a potential divider network to set up the course tune volts to the loop V.C.O.'s. The frequency selector switch also switches the B.C.D. lines to the coder. This is discussed under frequency synthesizer.

From the pre-selector filters the signal passes on to the H.F.

H.F. Amplifier

The signal enters the H.F. amplifier via conventional protection diode network. The amplifier is a dual gate MOSFET. The output of this amplifier is coupled into a lowpass filter to pass up to 30 MHz. Coupling transformer L 1 determines the low frequency characteristic.

The amplifier and filter combination is tested with 50 ohms source and 50 ohms termination.

From the H.F. amplifier the signal enters the H.F. converter.

H.F. Converter

The H.F. converter converts the input signal, which is in the range 0-30 MHz., to a fixed 45.1 MHz. The mixer is a balanced F.E.T. mixer which drives into a crystal filter.

The V.F.O. output, modified in the summing loop, is fed to the mixer in the range 45.1 MHz. to 75.1 MHz.

The bandpass crystal filter is centred on 45.1 MHz. and gives maximum rejection at the image frequency of 46.26 MHz.

After the crystal filter the signal enters the second mixer. This mixes the 45.1 MHz. signal down to about 580 KHz. The second mixer frequency is 45.68 MHz. or 45.6815 MHz. coming from the clarifier loop. The choice of two mixer frequencies enables the I.F. signal to be moved 1.5 KHz with reference to the I.F. filters. Thus moving the frequency effectively alters the I.F. frequency characteristic.

In A.3.J. the second mixer output is 580 KHz. $\pm$ 200 Hz. The small change comes from the effect of the clarifier control on the clarifier loop.

In other modes the output is 581.5 KHz.

From the second mixer the resultant signal enters the I.F. Filters.

I.F. Filters

I.F. Filters

The signal enters the I.F. filters from the H.F. converter at either 580 KHz. or 581.5 KHz. There are four filters in the R203 and two filters in R201. The appropriate filter is switched at the input and output ports by diodes. Thus only one filter is ever operative.

The S.S.B. filter is centred on 581.5 KHz. Thus the input signal is 580 KHz. in the S.S.B. position and the filter passes the U.S.B. In all other modes the input frequency is 581.5 KHz. This enables the S.S.B. filter to be used for A.3.J. or as an intermediate filter in other modes.

In the R203 the S.S.B. filter is automatically selected in S.S.B. modes and the filter selection control is inoperative. In other modes the appropriate filter has to be selected.

In the R201 the filter circuits are all automatically selected appropriate to the receive mode selected.

The choice of bandwidths on the R203 is 8 KHz., 2.7 KHz., 1 KHz. and 200 Hz.

The automatic selection on the R201 is 6 KHz. for A.M. and 2.7 KHz. for S.S.B., CW, F1.

The signal passes through the selected filter and onto the first I.F. amplifier.

First I.F. Amplifier

The signal enters the first I.F. amplifier from the filter bands. This is a single transistor gain controlled stage. The output passes through another bandpass filter centred on 581.5 MHz. and onto the second I.F. amplifier.

The output from the bandpass filter is sampled, amplified and detected and then operates an A.G.C. amplifier. This in turn operates an F.E.T. which shunts the negative feedback in the first I.F. amplifier. Thus A.G.C. action around this single stage is achieved.

Second I.F. Amplifier and Detectors

The signal from the bandpass filter following the first I.F. amplifier enters a second I.F. amplifier consisting of three tuned stages centred on 581.5 KHz. The first two stages are gain controlled and the third stage is only used for the A.M. detector.

The second I.F. stage feeds the S.S.B. product detected which is fed with a stable 580 KHz. derived from a crystal oscillator. The output from this detector enters a gated audio pre-amplifier which is enabled when the S.S.B., Cw or F1 mode is selected.

The third I.F. stage feeds a conventional diode detector which is used for the A.G.C. and A.M. detection. The detected A.M. is fed to a gated pre-amplifier which is enable in A.M. mode only.

The A.G.C. voltage is fed to an A.G.C. amplifier and is then switched such that the I.F. stage gain is controlled either by the A.G.C. amplifier or the manual R.F. gain control. A transistor switch alters the A.G.C. attack time by switching a capacitor in or out of circuit.

A.F. Amplifiers

The A.F. comes from the appropriate detector through the enabled pre-amplifier and onto the A.F. gain control potentiometer. Two lines come off the potentio-

A.F. Amplifiers

meter. One is full output to the 600 ohms line driver and the other is controlled and given to the integrated circuit loudspeaker amplifier.

The loudspeaker output power is approximately 3W into 4 ohms.

The balanced 600 ohms line output power is 10 mV.

ooo000ooo

Frequency Synthesizer

TCXO

The temperature controlled crystal oscillator is the heart of the synthesizer. The crystal temperature drift is compensated for by a combination of trimming capacitors of suitable temperature coefficient. Over the range 0-60^{o} c the drift is less than three parts per million. This sets the temperature stability of the system.

The oscillator is factory set and cannot be reset without equipment that is not normally available in a service workshop. The TCXO is plugable and, therefore, is easily replaced. It is identical to the transmitter TCXO.

TCXO Multiplier

The TCXO Multiplier use the 10 MHz. TCXO signal and splits it two ways. The signal is then outputed to the frequency counter and the 1 MHz. loop.

The 10 MHz. signal is also routed through a harmonic multiplier where the fifth harmonic is used to give 50 MHz. out to the clarifier loop.

V.F.O.

The variable frequency oscillator controls the variable tuning of the receiver. The V.F.O. control is a variable inductance in the gate circuit of an F.E.T. oscillator. This oscillator is capable of being locked on frequency by a control voltage obtained from a "pull in" circuit situated on the counter and display circuit. With the lock circuit engaged the receiver stabilizes at 100 Hz. intervals. The "pull in" circuit has a long time constant.

The V.F.O. can be set to oscillate between 2.1 MHz. and 3.1 MHz. thus fulfilling the requirement of a continuously variable range of 1 MHz.

The V.F.O. supply can be switched off by gating the supply buffer. This enables the distress oscillator to set the receive frequency.

The V.F.O. output is buffered and passes onto the distress oscillator board.

Distress Frequency Oscillator

The V.F.O. output is fed onto the D.F.O. board to be switched with the distress oscillator output. Switching diodes ensure that the output from the board is only one of these two sources.

The D.F.O. oscillator is a transistor with two circuits in its base. These are diode gated such that either the 2600 KHz. or the 2282 KHz. crystal is operative. These crystal circuits can be pulled from the "pull in" circuit so as to keep them on frequency.

Distress Frequency Oscillator

The output of the D.F.O. board is, therefore, 2600 KHz., 2282 KHz. or variable 2.1 - 3.1 KHz. These set the receiver frequency to 500 KHz., 2182 KHz. or 0-1 MHz. variable. The latter is later combined with 1 MHz. discreet steps to give 0-30 MHz. variable.

These outputs appropriately gated and buffered pass onto the counter and also the summing loop.

Summing Loop

One of the outputs from the D.F.O. is fed to the summing loop. This is a signal in the frequency range 2.1 MHz. - 3.1 MHz. and is used to "fine tune" the first mixer frequency.

The summing loop is a phase locked mixer loop. The P.S.D. operates at the V.F.O./ D.F.O. frequency and drives the V.C.O. to operate in the range 45.1 to 75.1 MHz. This output is buffered out to the first mixer.

The V.C.O. output is fed back via a mixer to the phase sensitive detector. An input from the 1 MHz. loop in the range 43 MHz. - 72 MHz. is mixed with the output 45.1 MHz. - 75.1 MHz. to produce the 2.1 MHz. - 3.1 MHz. that operates the P.S.D.

Thus the output of the summing loop to the first mixer steps at 1 MHz. with 0-1 MHz. variable tuning so defining the receiver operating frequency range.

To enable the V.C.O. to operate over a wide range and yet keep the loop sensitive, course tuning volts are fed to the V.C.O. from the bands switch.

1 MHz. Loop

This loop provides the 1 MHz. steps between 43 MHz. - 72 MHz. to drive the summing loop mixer. It is very similar to the 1 MHz. loop in the transmitter and operates at similar frequencies.

An input from the TCXO, via the multiplier, is divided down to 500 KHz. and operates the P.S.D.

The error output from the P.S.D. drives the V.C.O. at stepped frequencies between 43-72 MHz. The output of the V.C.O. is divided by two, enters a programmable divider, and is applied to the P.S.D. at 500 KHz.

The programmable divider operates ratios between 43 and 72. The instruction comes from the coder.

The P.S.D. operates at 500 KHz but because of the - 2 in the feedback loop the V.C.O. output steps at 1 MHz.

To enable the V.C.O. to operate over a wide range, and so keep the loop sensitive, course tuning volts are fed to the V.C.O. from the bands switch.

Clarifier Loop

The clarifier loop is of a similar configuration to the summing loop, that is a phase locked mixer loop.

The P.S.D. operates at the crystal oscillator frequency of 4318.5 KHz. or 4320 KHz. The 4320 KHz. can be pulled ± 100 Hz. by the clarifier control. The 4318.5 KHz. oscillator is used in all modes except A.3.J. so as to place the I.F. signal in the centre of the I.F. filters.

Clarifier Loop

The P.S.D. error signal drives a TCXO operating at approximately 2284.040 KHz. The second harmonic output from this is buffered and taken to the second mixer. The output frequencies are 45.680 MHz ± 200 Hz. or 54.6815 MHz.

This output is also fed back to the loop mixer, mixed with 50 MHz., and fed back into the phase detector. The 50 MHz. signal is derived from the TCXO multiplier.

Carrier Reinsertion & B.F.O.

When the S.S.B. detector is in use for A.3.J. working, the 580 KHz. carrier reinsertion frequency is derived from a stable fixed frequency crystal oscillator. This oscillator runs at 5.8 MHz. and is fed to a decade divider. The divider output is diode gated into a 580 KHz. amplifier and then onto the product detector, situated on the second I.F. board.

When the S.S.B. detector is used for C.W. working, a frequency of about 581.5 KHz. is derived from a variable frequency oscillator. The exact output frequency can be varied by ± 3 KHz by the B.F.O. front panel control. Varicap diodes are used to vary the oscillator frequency. The oscillator output is diode gated into the 580 KHz. amplifier and then is fed onto the product detector situated on the second I.F. board.

Coder

The coder encodes front panel MHz. information into a suitable form for operating the display and dividers. The information is taken off the two multipole switch wafers and converted into binary by a matrix. The information is coded differently for the display than the divider. A truth table gives the output.

A third wafer is used to operate a resistor network to give course tuning to the V.C.O.'s.

Counter & Display

The display shows the frequency that the receiver is tuned to. The MHz. information comes from the front panel switch and the remaining information is counted off the V.F.O. output.

The MHz. information operates directly on the display drivers. The KHz. and Hz. information is counted off the 2.1 - 3.1 MHz. V.F.O. output, the count is stored and the store operates the display driver. The counter is reset to 900 KHz. to compensate for the 100 Hz. offset in V.F.O. frequency. An out of range indication is given by the 100 KHz. counter output. This senses when the count is below 2.1 MHz. or above 3.1 MHz. The out of range signal operates a gated multivibrator, which in turn operates on the display driver zero blanking circuit, causing the display to flash.

The counter counts down to 10 Hz. but only 100 Hz. are displayed. The 10 Hz. count is used to operate the frequency lock circuit. This 10 Hz. output number is compared with decimal 5 in B.C.D. and the difference operates the pull in circuit. Thus the V.F.O. or D.F.O. is pulled to 50 Hz. above the displayed frequency. This prevents the display's last figure from alternating. The integrator uses the error signal to slowly pull the V.F.O./D.F.O. frequency.

The TCXO input frequency is divided down to operate the counting system. From these dividers the input gate, reset, etc. pulses are derived.

The display incorporates zero blanking so that no zeroes appear before a num-

Counter & Display

ber.

A dimmer circuit dims the L.E.D. display.

ooo000ooo

Power Supplies

The receiver is completely self-contained as regards power supplies. It can be run from 110/220 A.C. or 24 V D.C. The power source is selected on the P103 front panel. The principle of the receiver power supply system is very similar to the exiter power supply system.

A D.C. converter working in push pull mode converts 24v. D.C. into an A.C. waveform fed to the primary of a common transformer. Another primary winding takes the 110V/220V A.C. input.

The selected input drives the transformer to obtain +35 V, +15 V, +15 V, +5 V from regulators on the transformer secondaries.

The 15 V, 15 V and 5 V regulators are integrated circuits, and the 35 V regulator is made of discreet components.

The power supply chassis also holds the A.F. speaker amplifier and line driver amplifier. These are discussed under "Analogue Signal Paths".

ooo000ooo

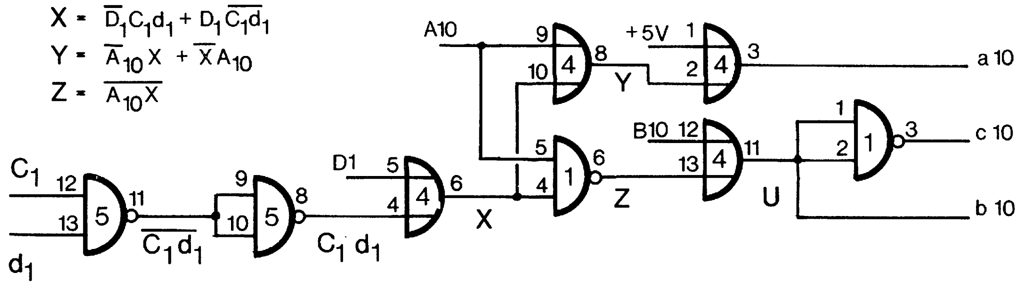
RECIEVER CODER TRUTH TABLE

BAND MHz	Display TEN'S $D_{10}C_{10}B_{10}A_{10}$	Display ONE'S $d_1\ c_1\ b_1\ a_1$	$\overline{C_1}$ $\overline{d_1}$	C_1 d_1	X	Y	Z	U	$\frac{1}{M}$	Devider TEN'S $D_{10}C_{10}B_{10}A_{10}$	Devider ONE'S $d_1\ c_1\ b_1\ a_1$	
500 Khz	0 0 0 0	0 0 0 0	1	0	0	0	1	1	43	0 1 0 1	0 1 1 0	56
2182 Khz	0 0 0 0	0 0 1 0	1	0	0	0	1	1	45	0 1 0 1	0 1 0 0	54
0	0 0 0 0	0 0 0 0	1	0	0	0	1	1	43	0 1 0 1	0 1 1 0	56
1	0 0 0 0	0 0 0 1	1	0	0	0	1	1	44	0 1 0 1	0 1 0 1	55
2	0 0 0 0	0 0 0 1	1	0	0	0	1	1	45	0 1 0 1	0 1 0 0	54
3	0 0 0 0	0 0 1 1	1	0	0	0	1	1	46	0 1 0 1	0 0 1 1	53
4	0 0 0 0	0 1 0 0	1	0	0	0	1	1	47	0 1 0 1	0 0 1 0	52
5	0 0 0 0	0 1 0 1	1	0	0	0	1	1	48	0 1 0 1	0 0 0 1	51
6	0 0 0 0	0 1 1 0	1	0	0	0	1	1	49	0 1 0 1	0 0 0 0	50
7	0 0 0 0	0 1 1 1	0	1	1	1	1	1	50	0 1 0 0	1 0 0 1	49
8	0 0 0 0	1 0 0 0	1	0	1	1	1	1	51	0 1 0 0	1 0 0 0	48
9	0 0 0 0	1 0 0 1	1	0	1	1	1	1	52	0 1 0 0	0 1 1 1	47
10	0 0 0 1	0 0 0 0	1	0	0	1	1	1	53	0 1 0 0	0 1 1 0	46
11	0 0 0 1	0 0 0 1	1	0	0	1	1	1	54	0 1 0 0	0 1 0 1	45
12	0 0 0 1	0 0 1 0	1	0	0	1	1	1	55	0 1 0 0	0 1 0 0	44
13	0 0 0 1	0 0 1 1	1	0	0	1	1	1	56	0 1 0 0	0 0 1 1	43
14	0 0 0 1	0 1 0 0	1	0	0	1	1	1	57	0 1 0 0	0 0 1 0	42
15	0 0 0 1	0 1 0 1	1	0	0	1	1	1	58	0 1 0 0	0 0 0 1	41
16	0 0 0 1	0 1 1 0	1	0	0	1	1	1	59	0 1 0 0	0 0 0 0	40
17	0 0 0 1	0 1 1 1	0	1	1	0	0	0	60	0 0 1 1	1 0 0 1	39
18	0 0 0 1	1 0 0 0	1	0	1	0	0	0	61	0 0 1 1	1 0 0 0	38
19	0 0 0 1	1 0 0 1	1	0	1	0	0	0	62	0 0 1 1	0 1 1 1	37
20	0 0 1 0	0 0 0 0	1	0	0	0	1	0	63	0 0 1 1	0 1 1 0	36
21	0 0 1 0	0 0 0 1	1	0	0	0	1	0	64	0 0 1 1	0 1 0 1	35
22	0 0 1 0	0 0 1 0	1	0	0	0	1	0	65	0 0 1 1	0 1 0 0	34
23	0 0 1 0	0 0 1 1	1	0	0	0	1	0	66	0 0 1 1	0 0 1 1	33
24	0 0 1 0	0 1 0 0	1	0	0	0	1	0	67	0 0 1 1	0 0 1 0	32
25	0 0 1 0	0 1 0 1	1	0	0	0	1	0	68	0 0 1 1	0 0 0 1	31
26	0 0 1 0	0 1 1 0	1	0	0	0	1	0	69	0 0 1 1	0 0 0 0	30
27	0 0 1 0	0 1 1 1	0	1	1	1	1	0	70	0 0 1 0	1 0 0 1	29
28	0 0 1 0	1 0 0 0	1	0	1	1	1	0	71	0 0 1 0	1 0 0 0	28
29	0 0 1 0	1 0 0 1	1	0	1	1	1	0	72	0 0 1 0	0 1 1 1	27

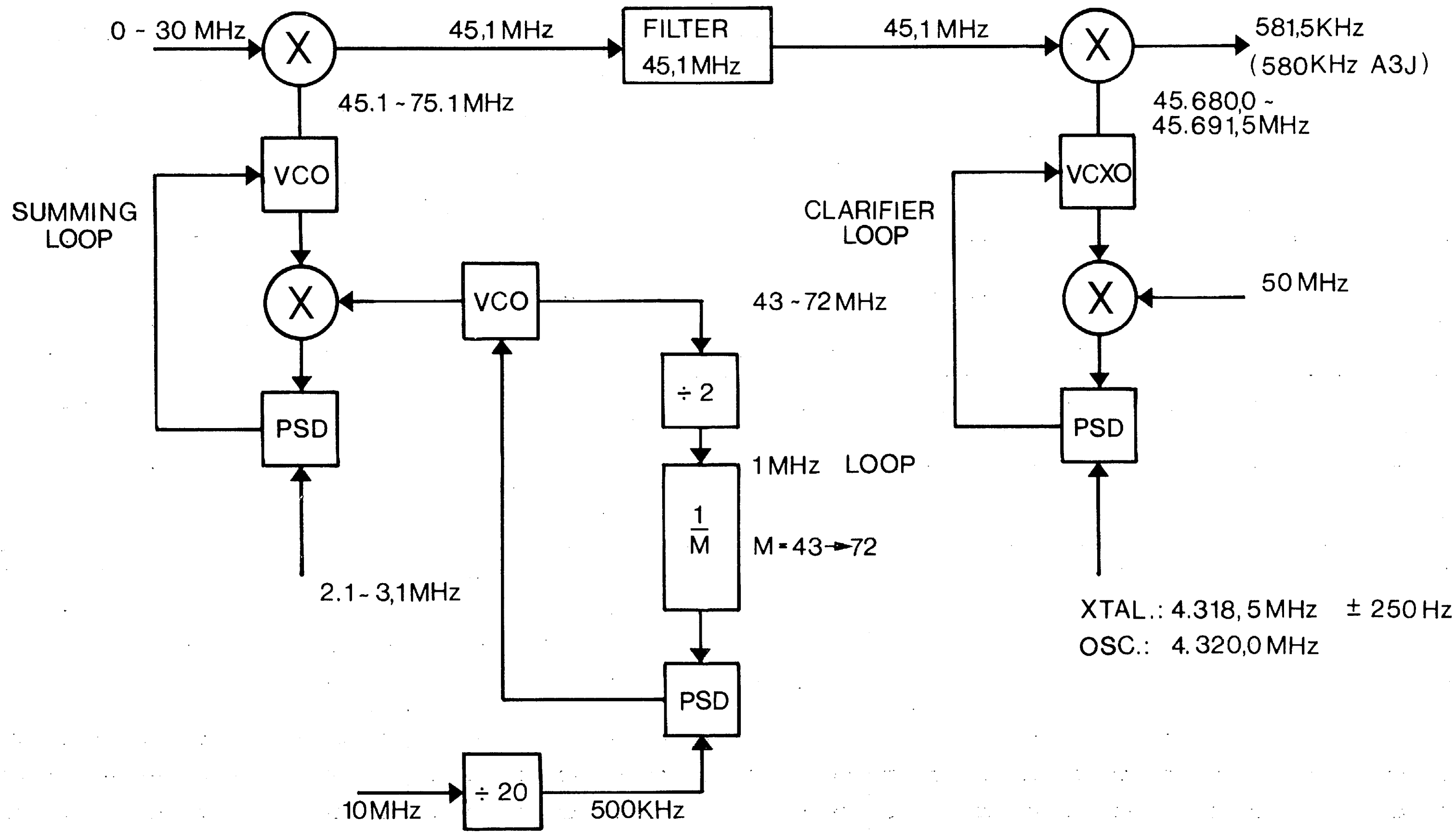
$X = \overline{D_1}C_1d_1 + D_1\overline{C_1d_1}$

$Y = \overline{A_{10}}X + \overline{X}A_{10}$

$Z = \overline{A_{10}X}$



RECEIVER SYNTHESIZER LOOPS.

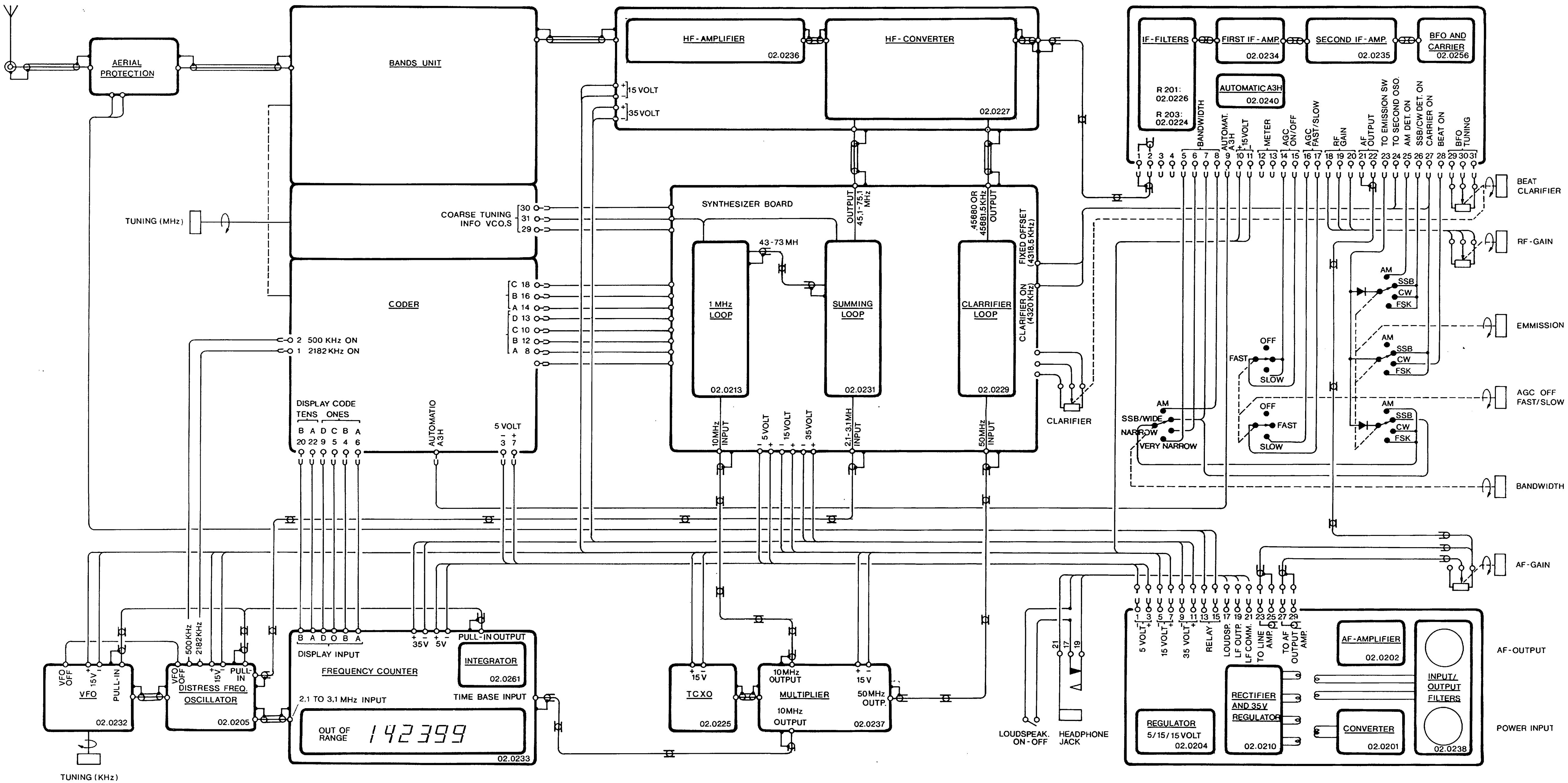


C I R C U I T D I A G R A M S.

FOR:

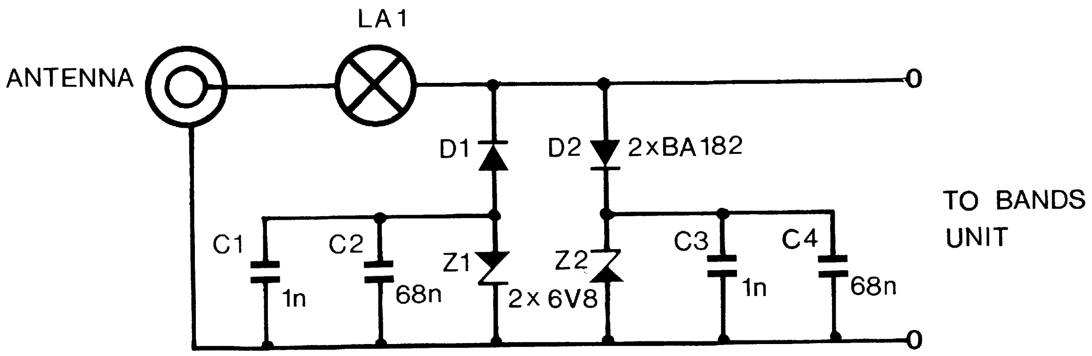
RECEIVER R 201.

CONTENTS:



WIRING DIAGRAM

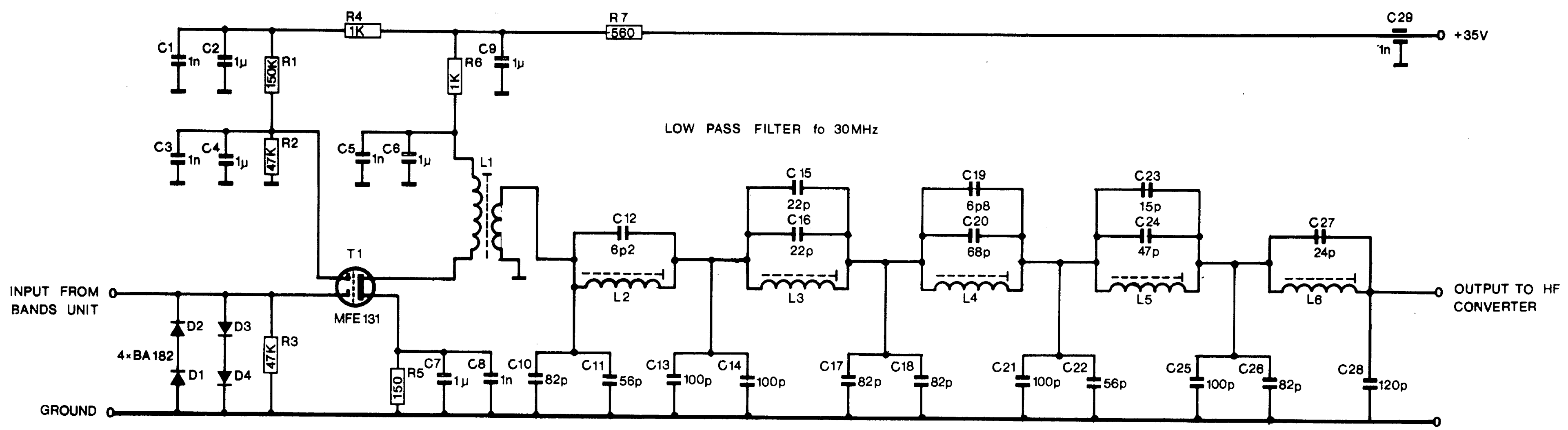
FOR RECEIVERS R 201-203



AERIAL PROTECTION
MODULE 239

01.0242

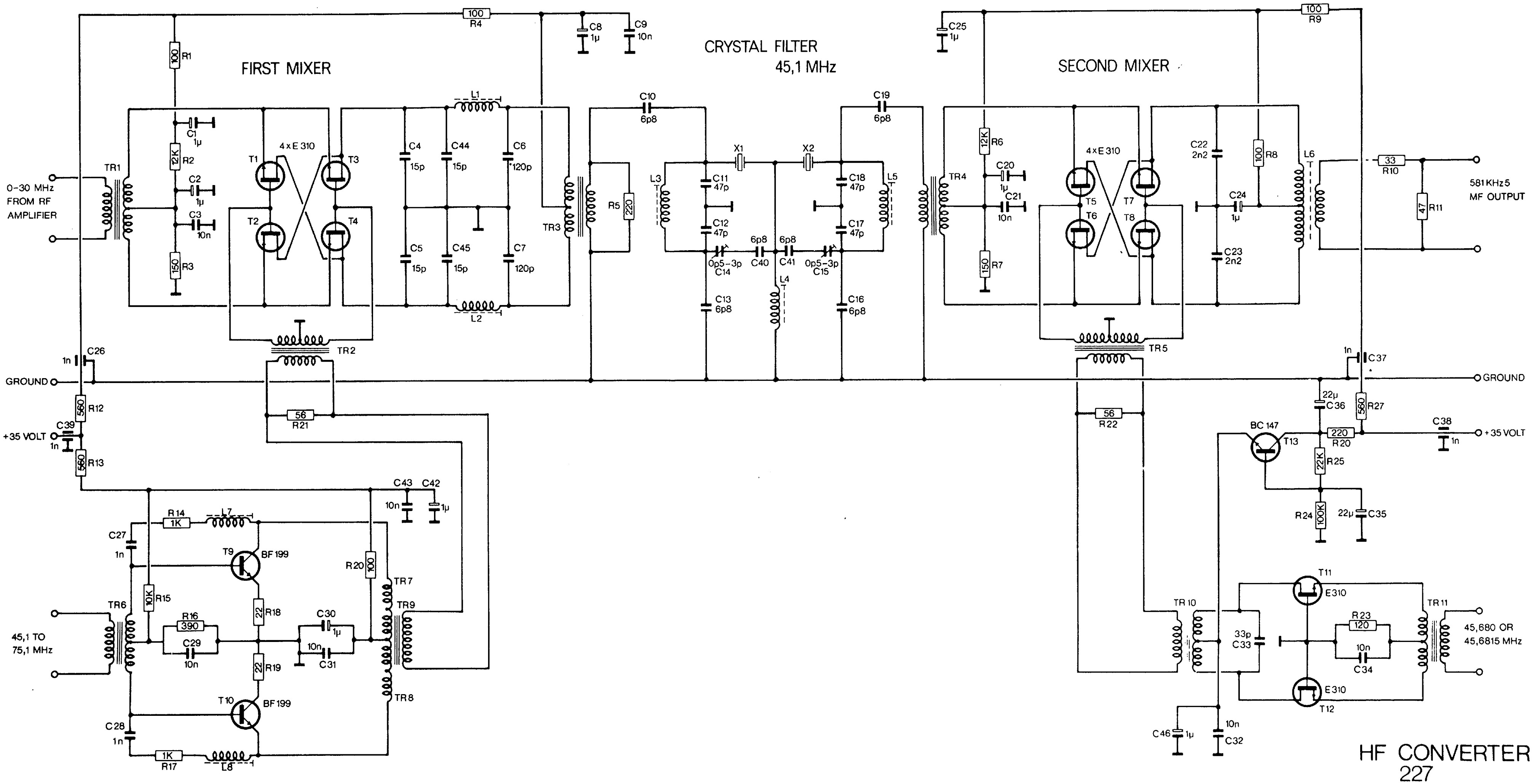
BAND'S UNIT AND CODER
UNIT NO. 02.0228
DRAWING NO. 01.0243



HF AMPLIFIER

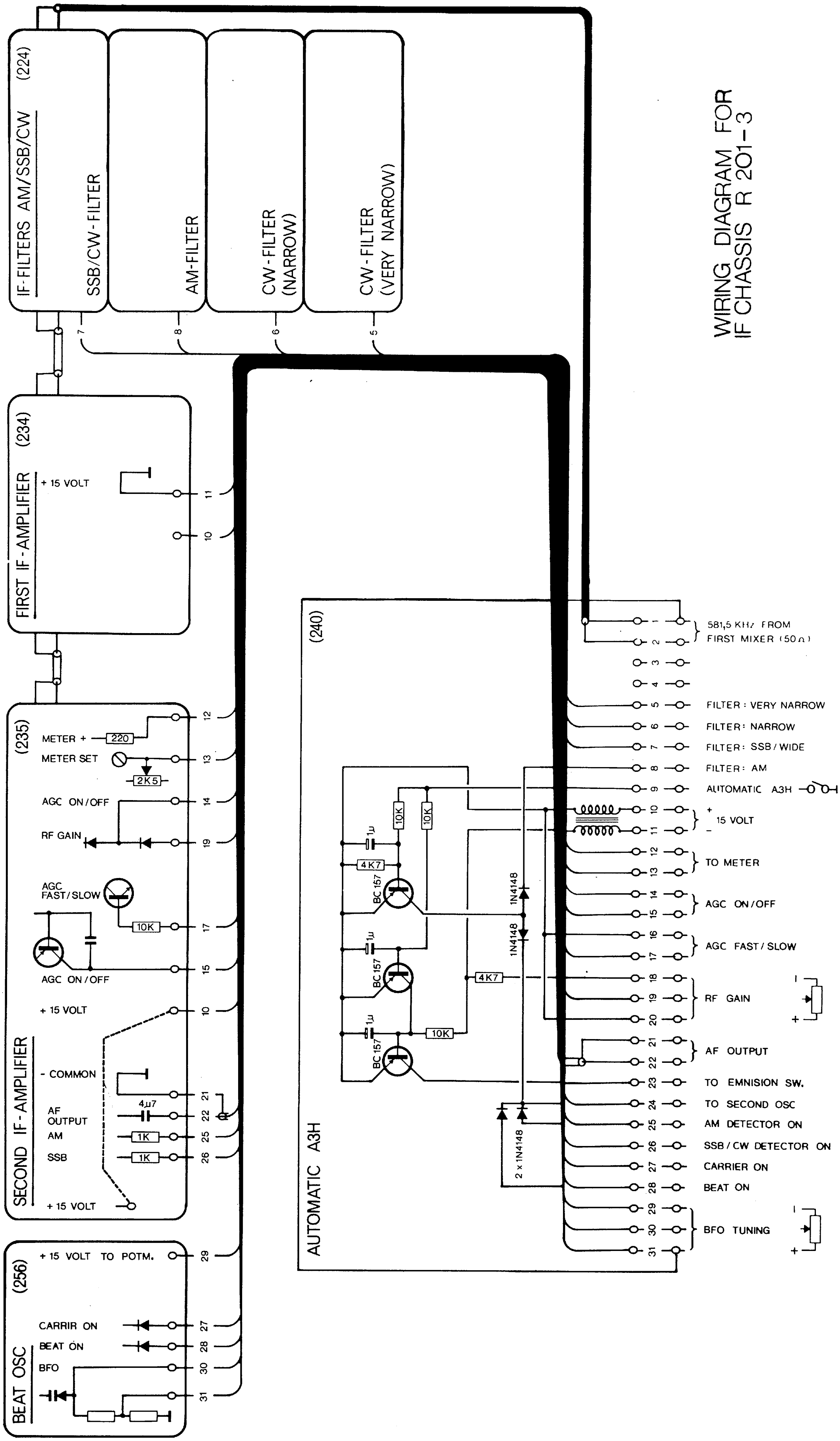
MODULE 02.0236

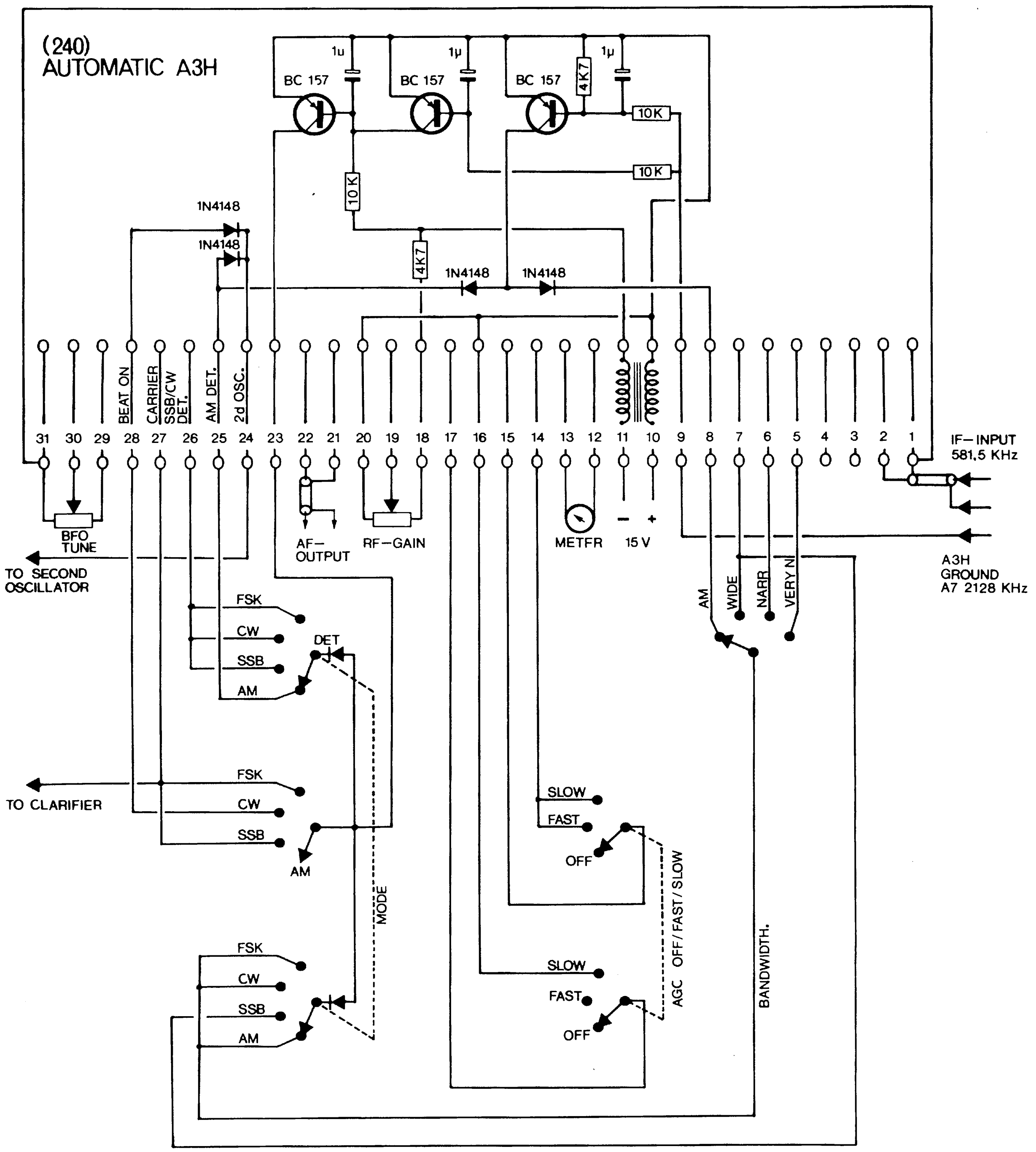
01.0244



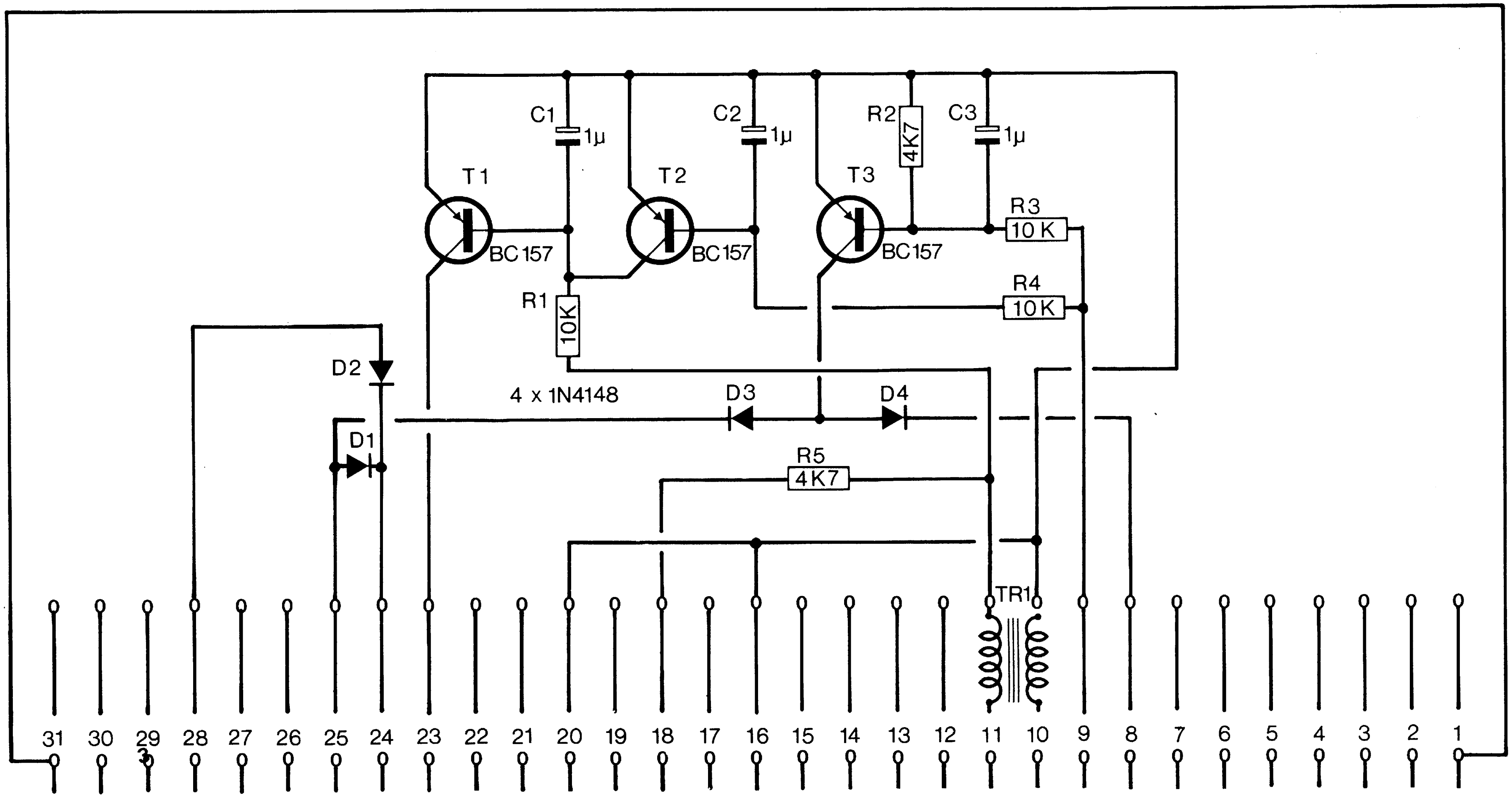
HF CONVERTER
227

WIRING DIAGRAM FOR IF CHASSIS R 201-3

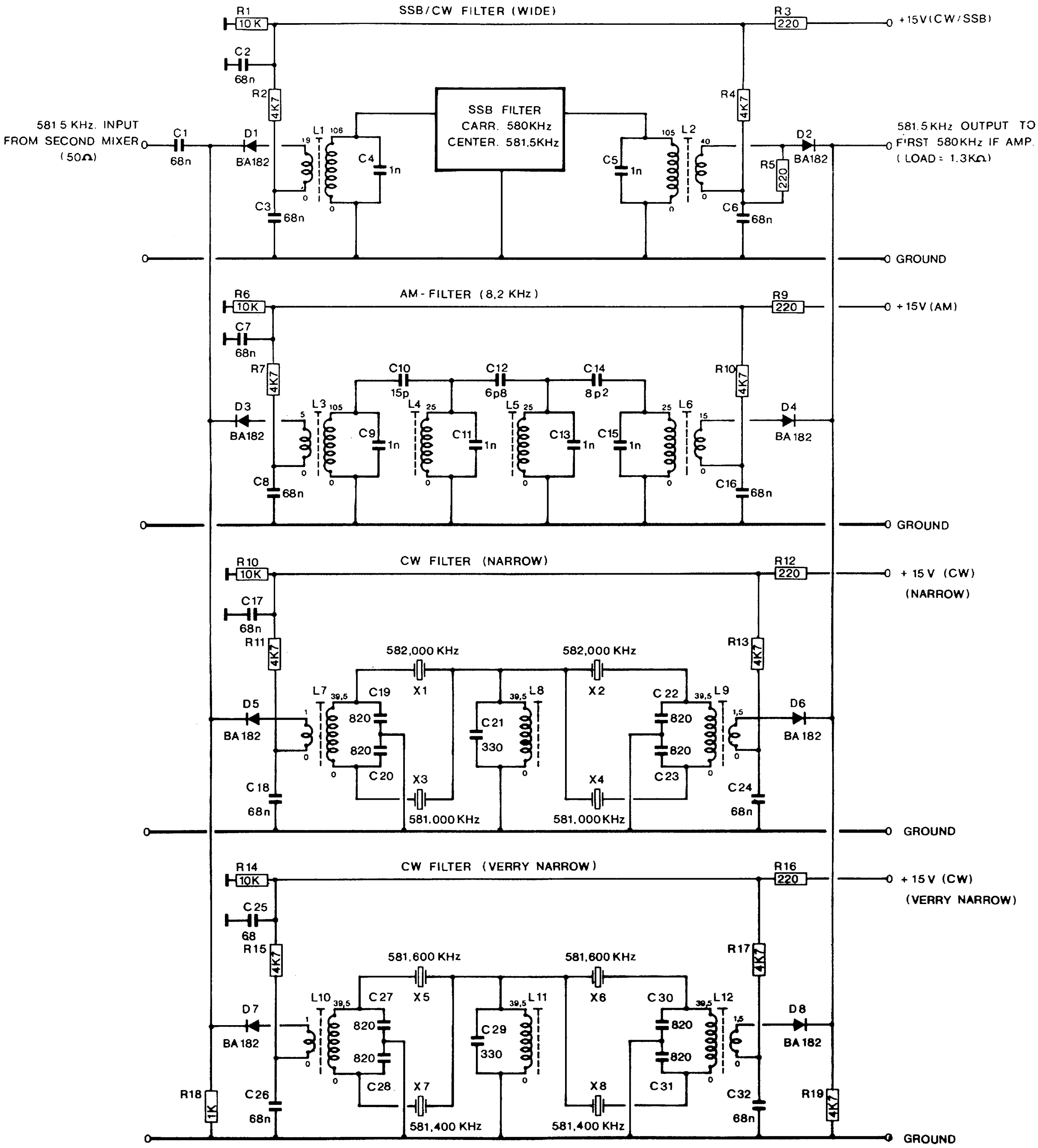




SIMPLIFIED DIAGRAM
FOR IF SWITCH FUNCTIONS
R201–3

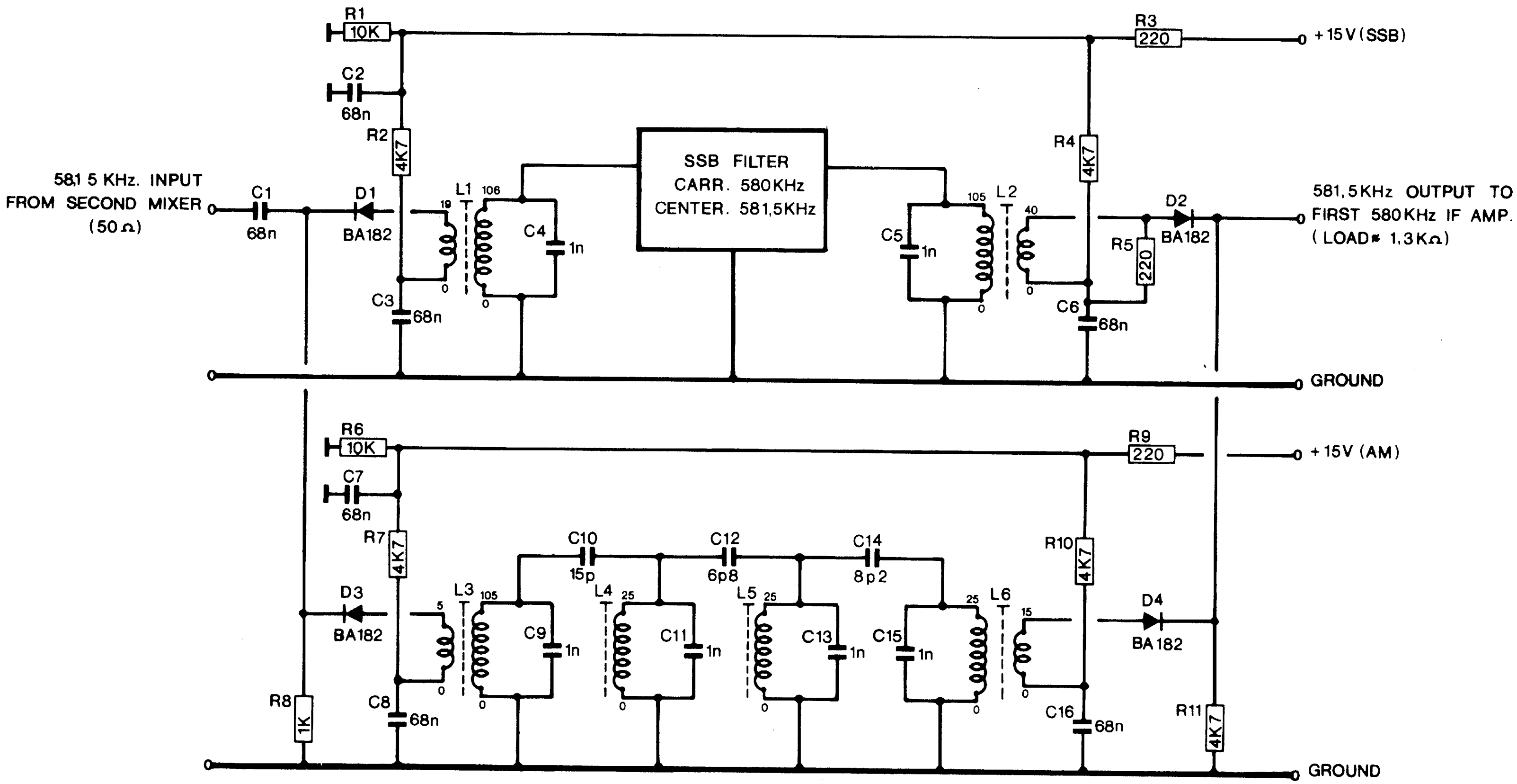


AUTOMATIC A3H
MODULE 240



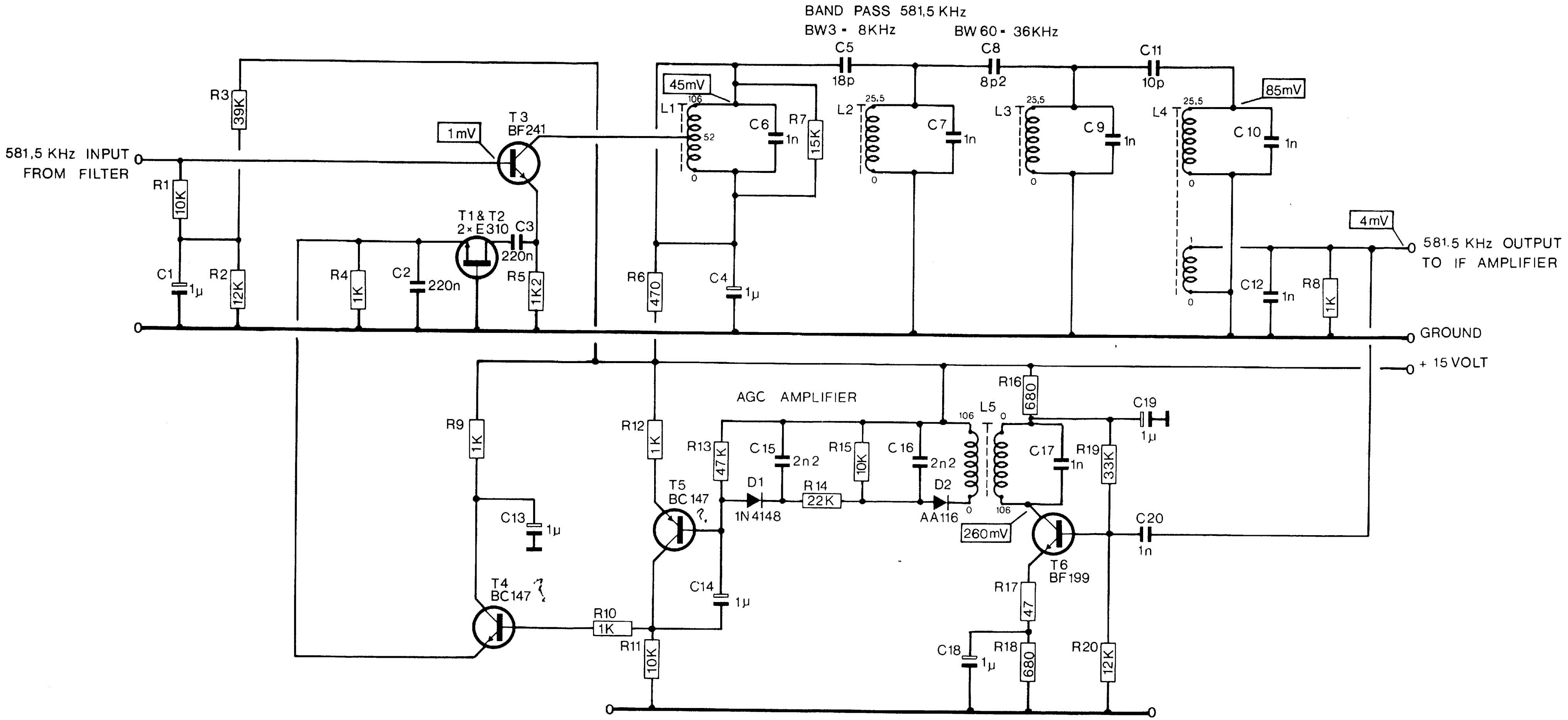
IF FILTERS AM/SSB/CW

01.0249

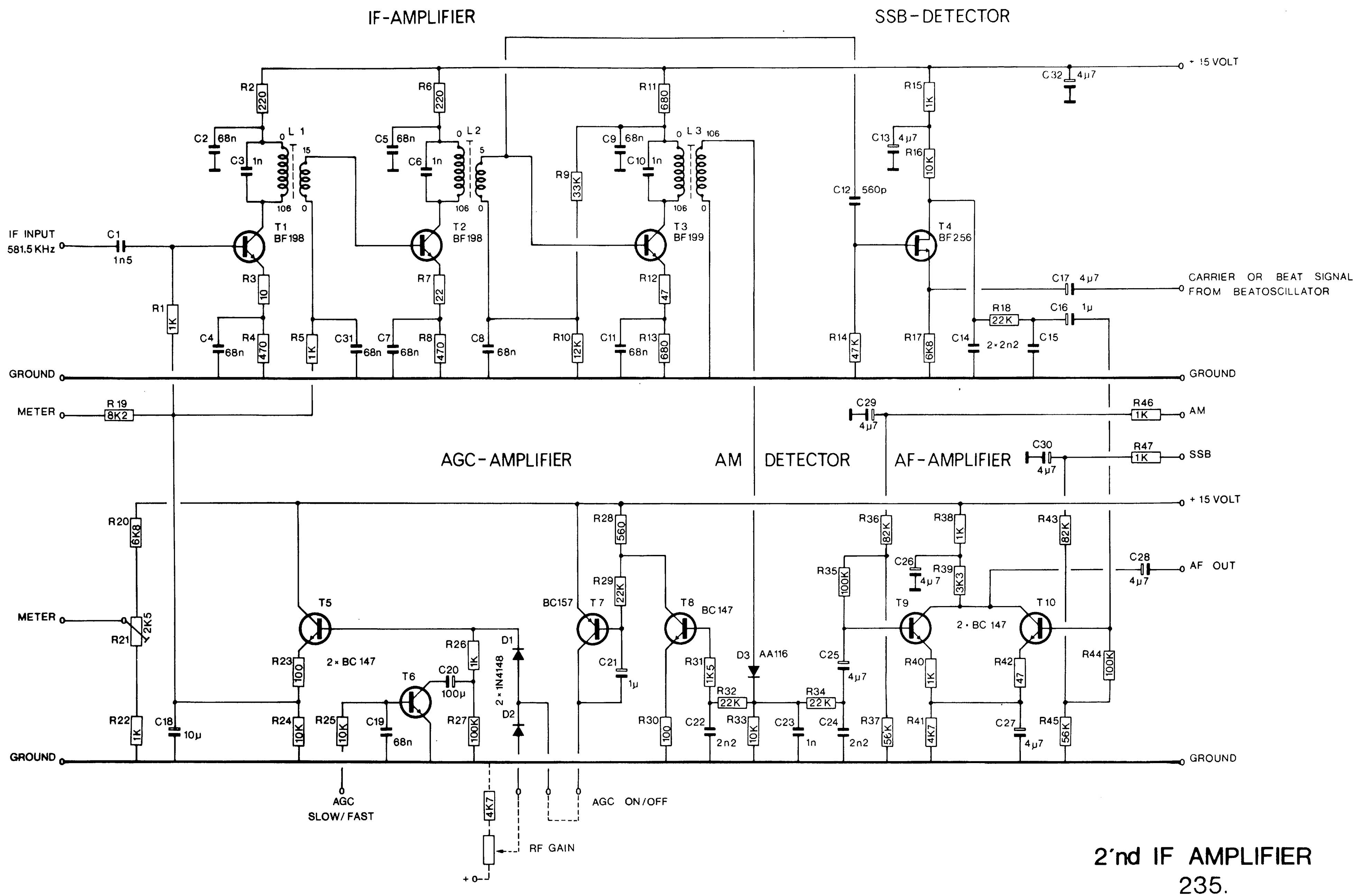


IF FILTERS AM/SSB

MODULE 02.0226

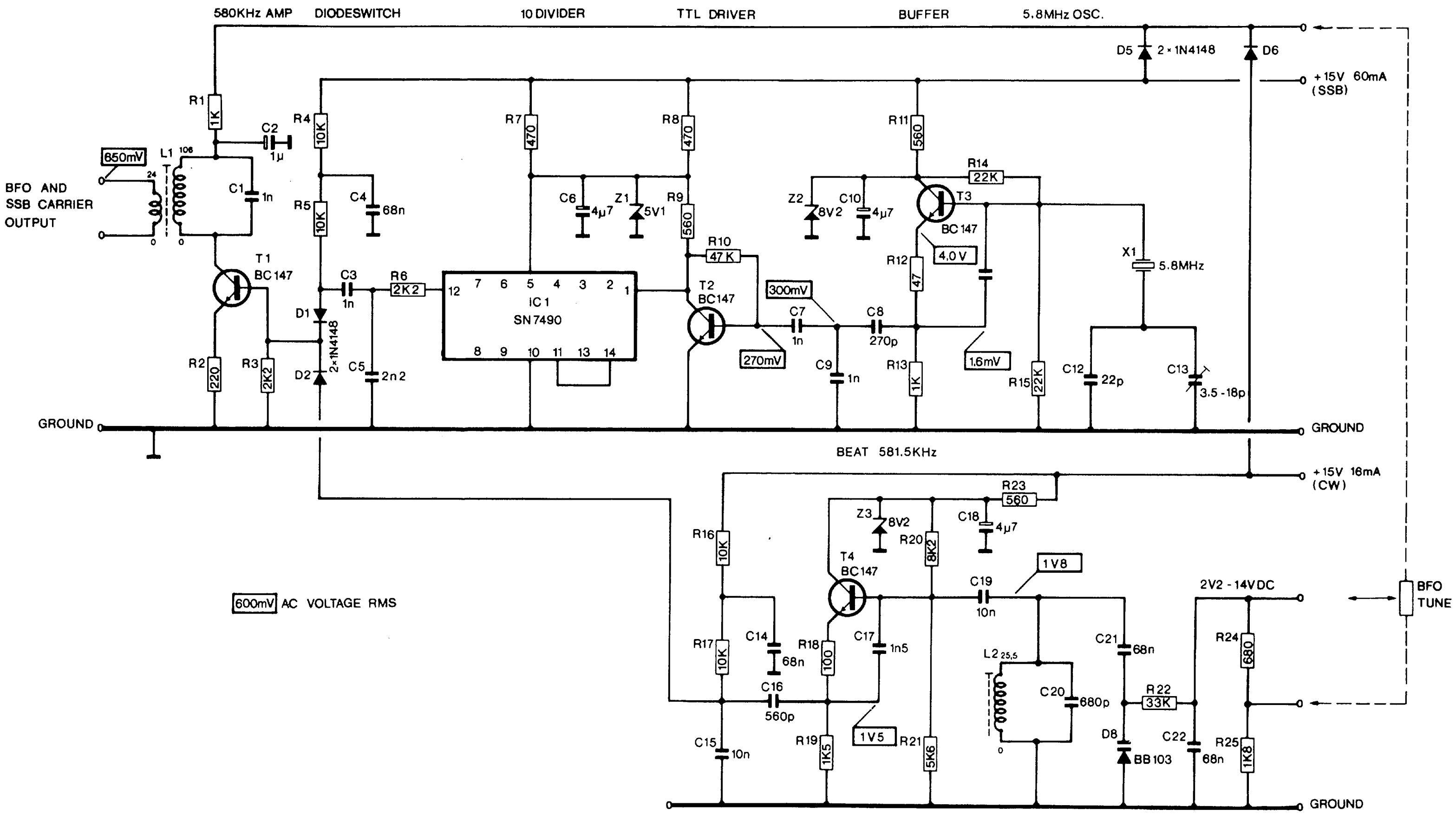


FIRST IF-AMPLIFIER
MODULE 234



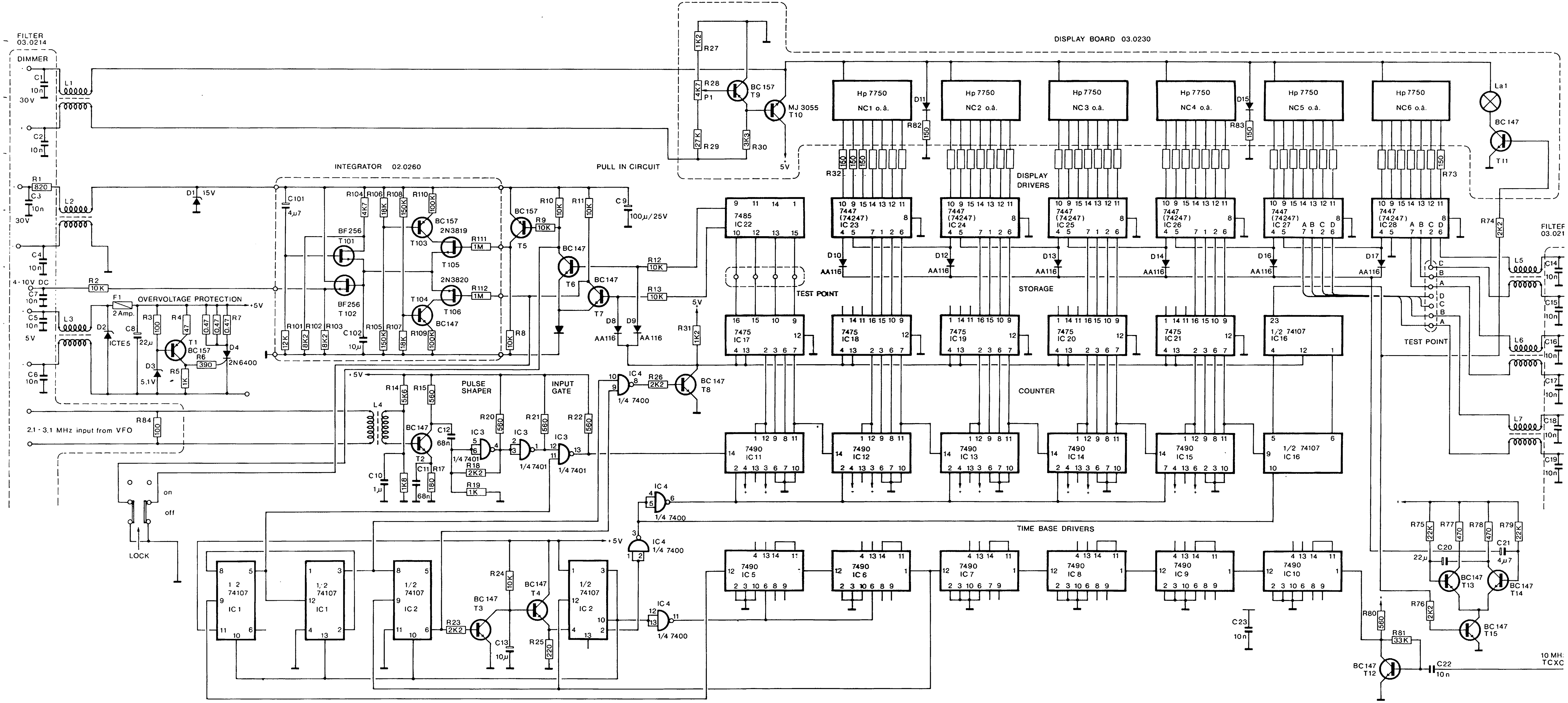
2'nd IF AMPLIFIER

235.



BEAT OSCILLATOR

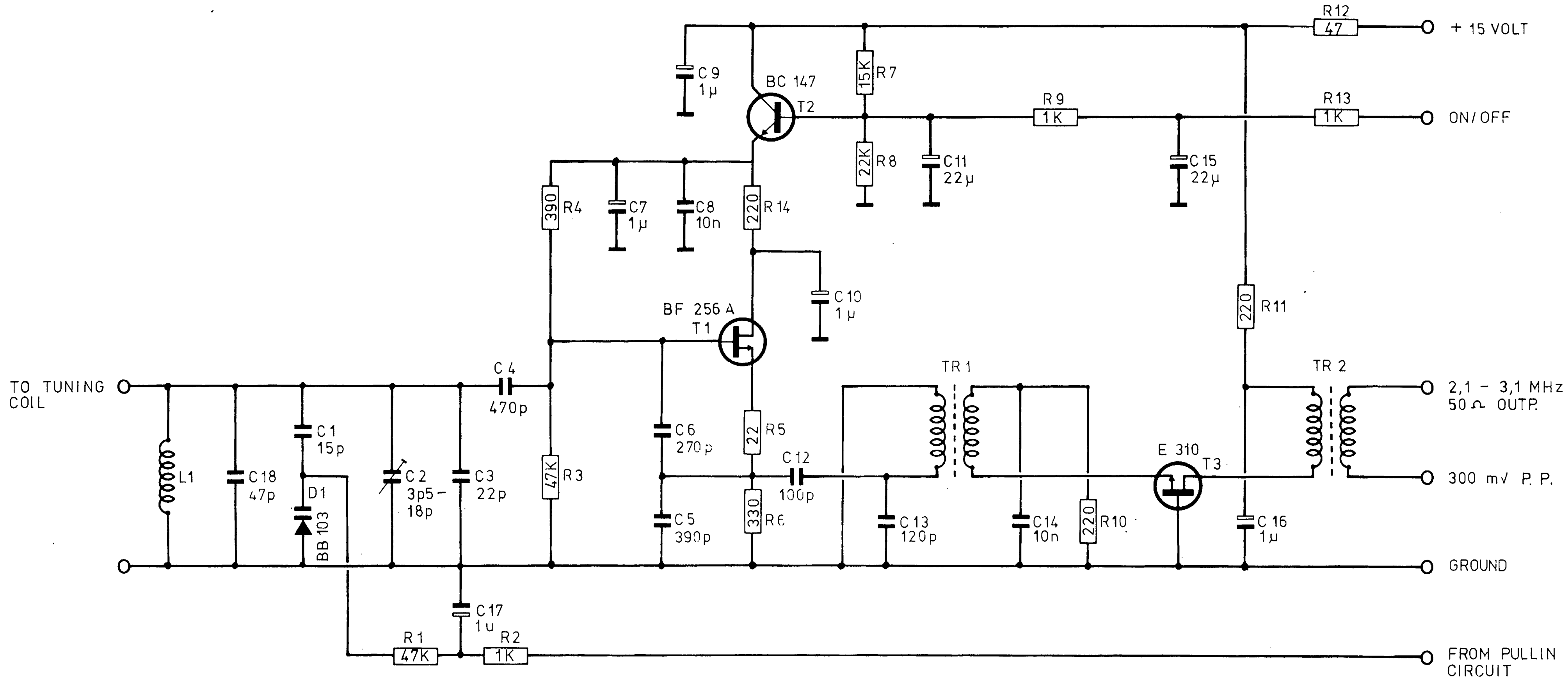
MODULE 02.0256



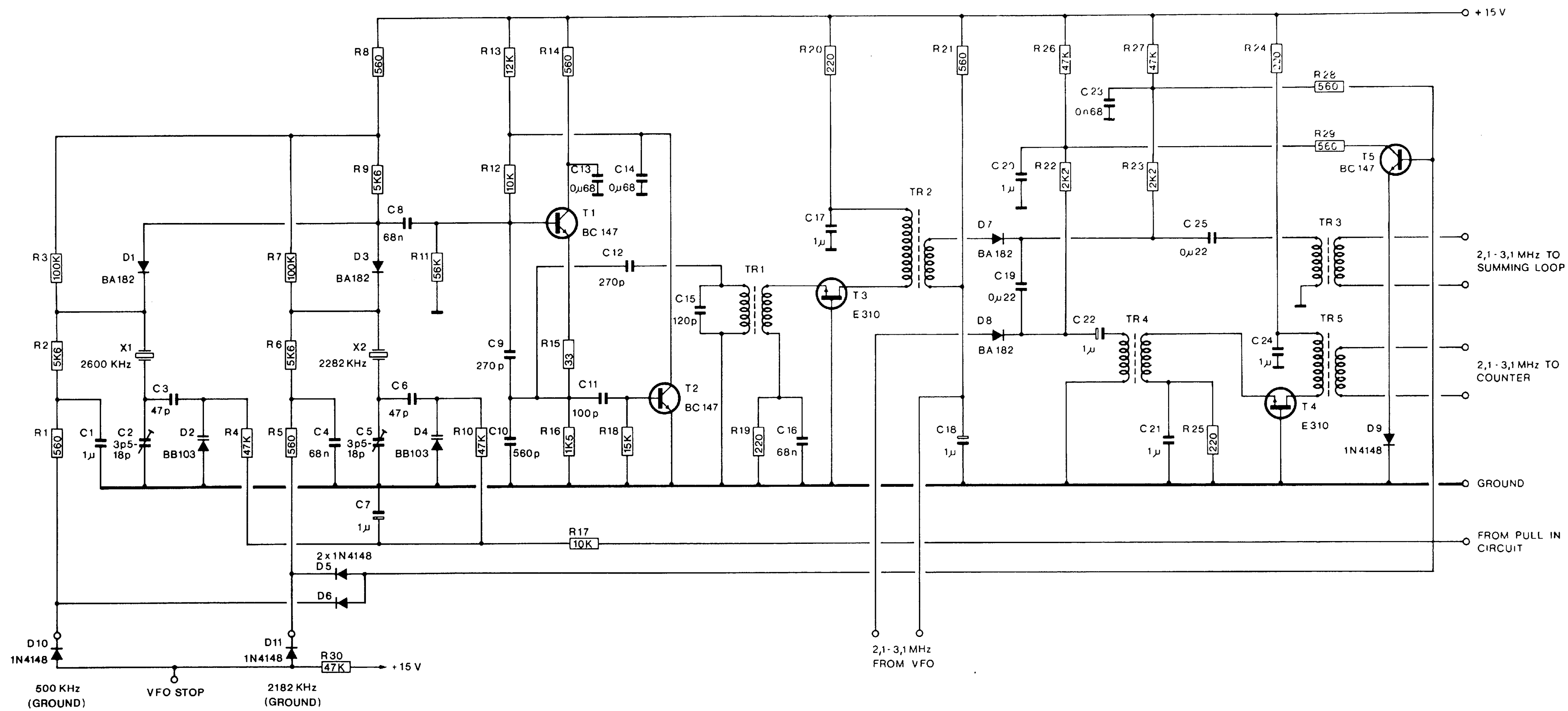
COUNTER & DISPLAY.

MODULE 233.

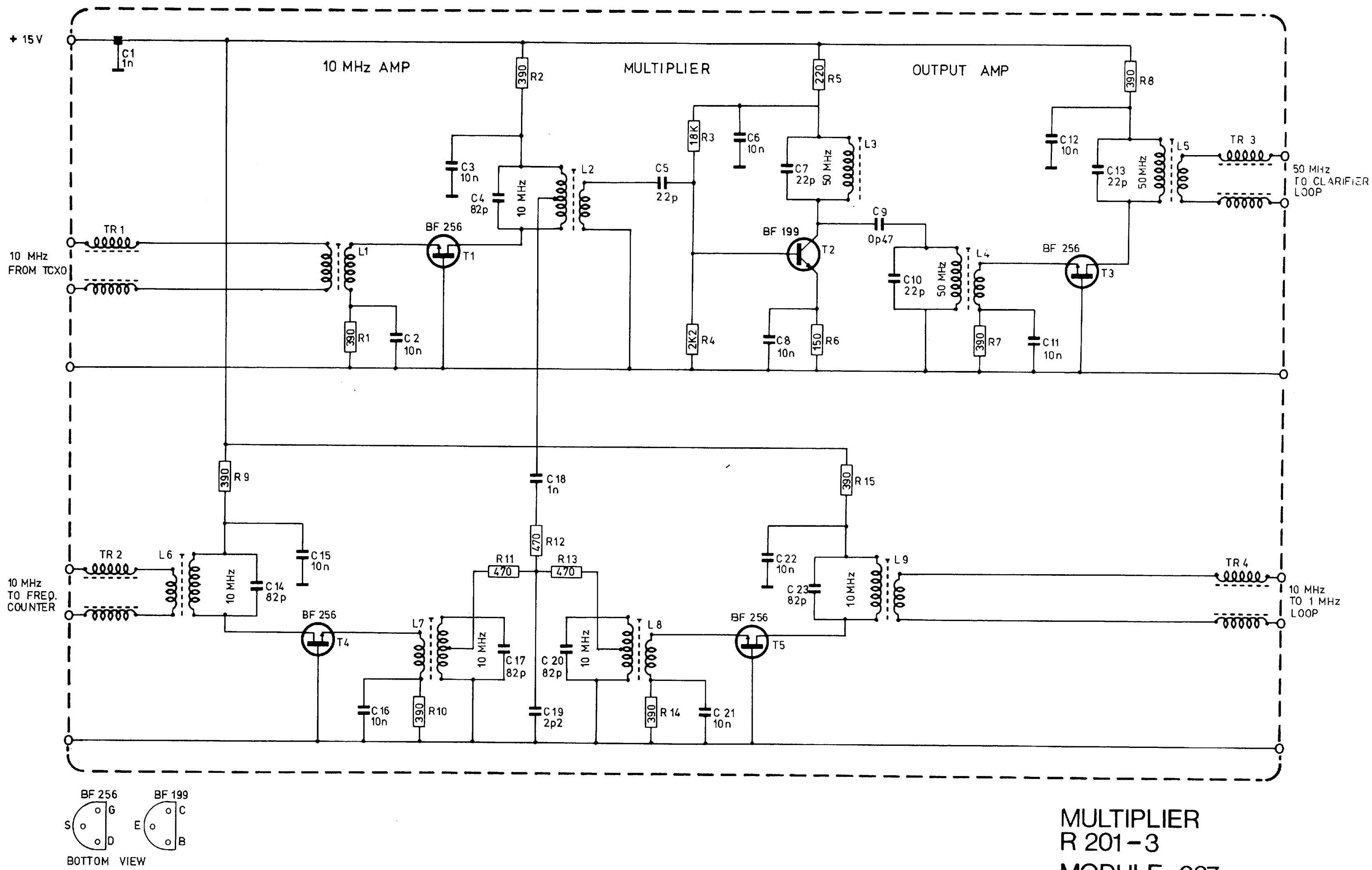
01.02



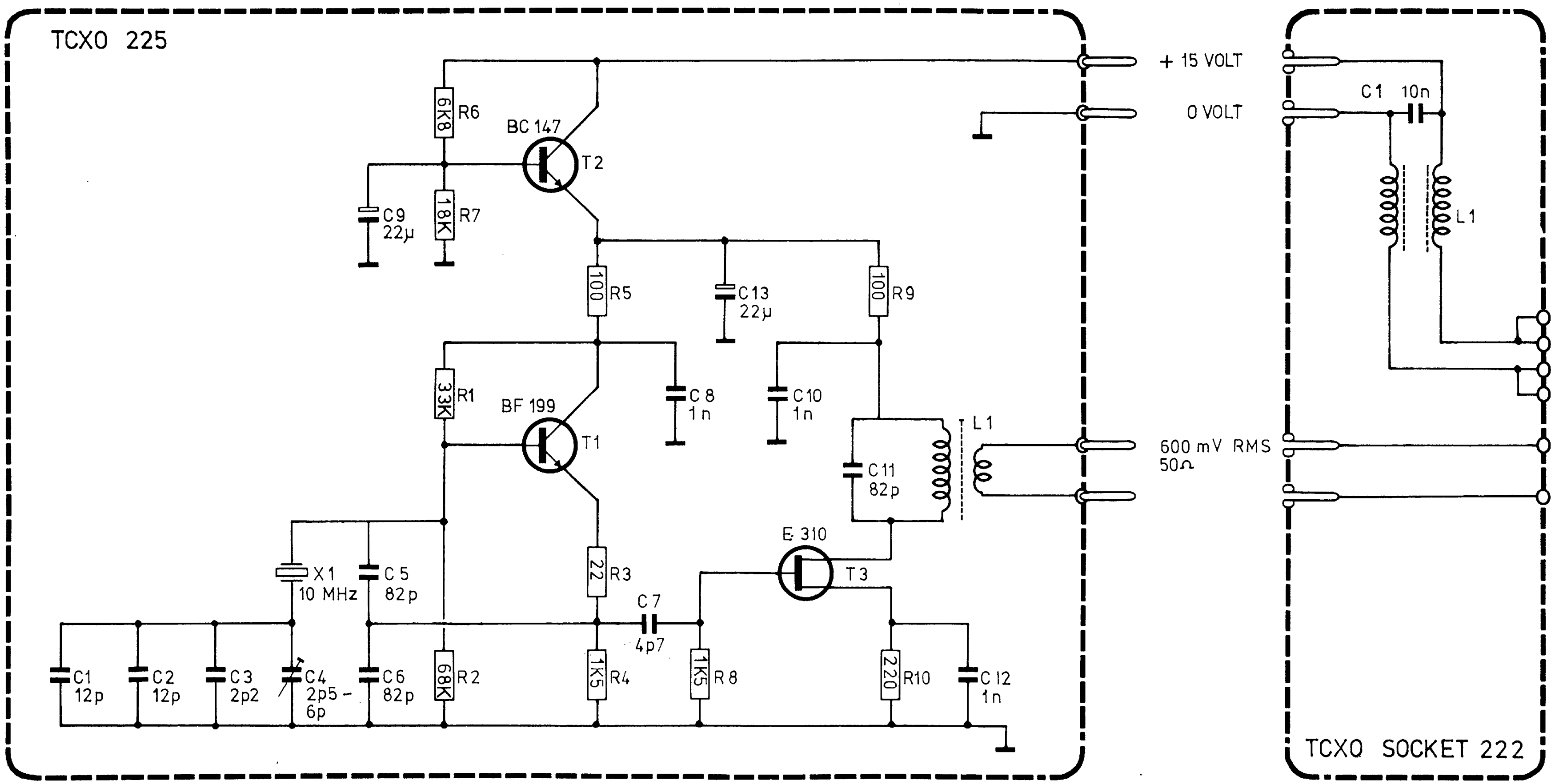
VFO
MODULE 232



DISTRESS FREQ. OSC.
MODULE 205.

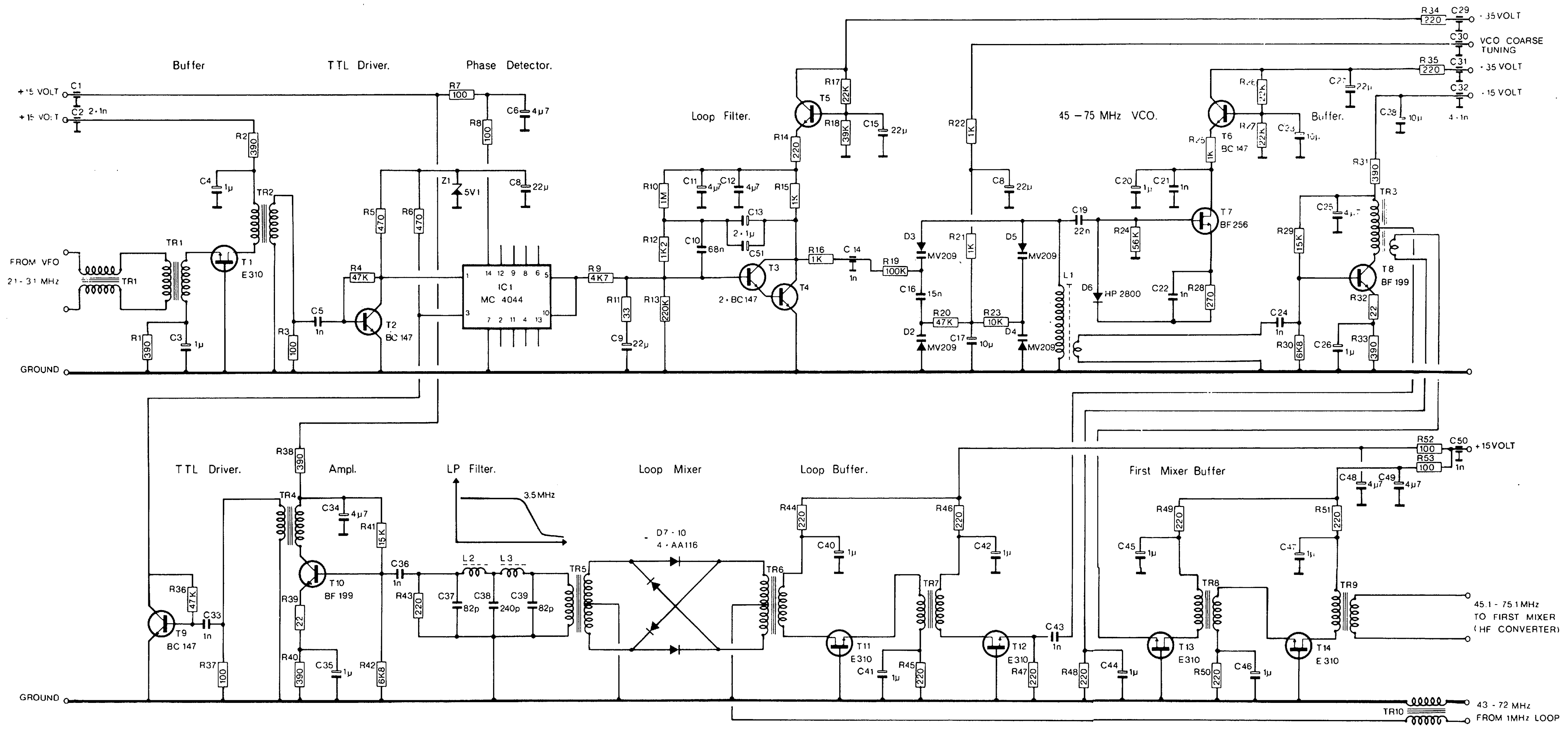


MULTIPLIER
R 201-3
MODULE 237



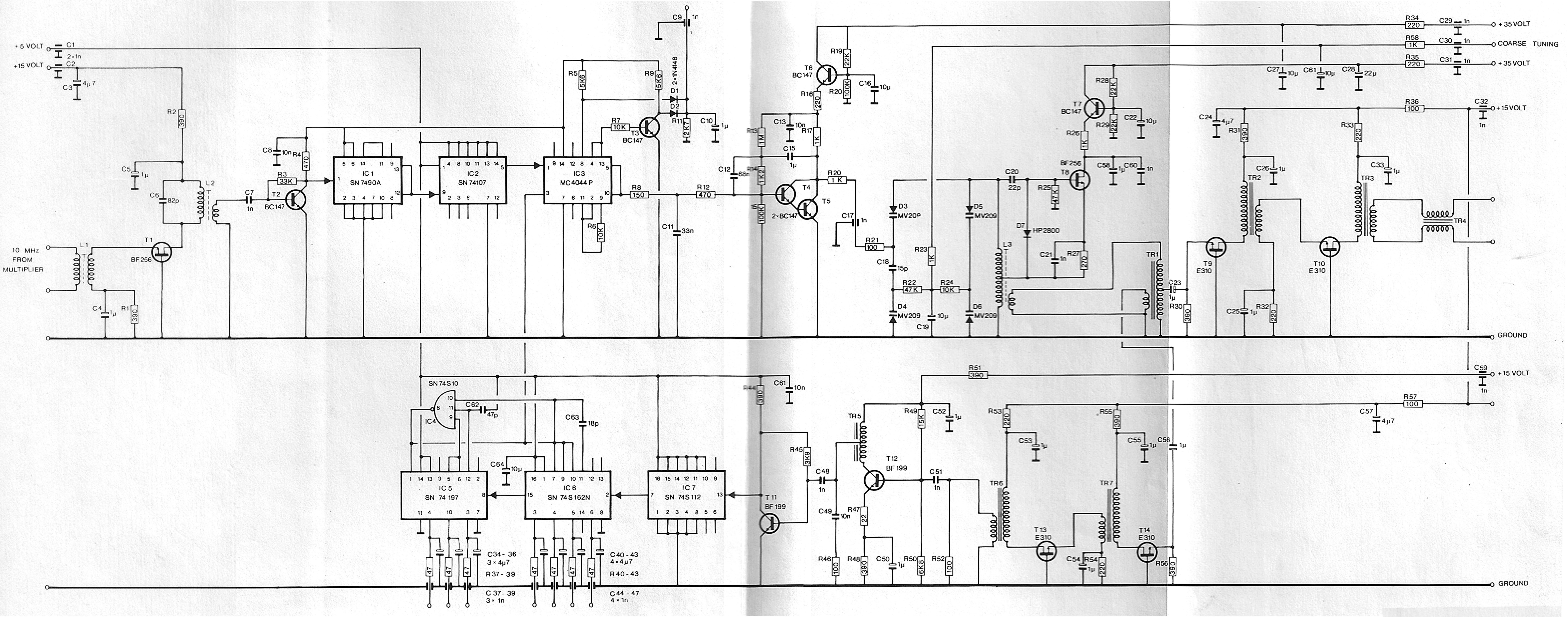
C1 AND C2 : TEMP. COMPENSATION CAPACITORS.
MUST NEVER BE CHANGED

TCXO MODULE 225
TCXO SOCKET MODULE 222



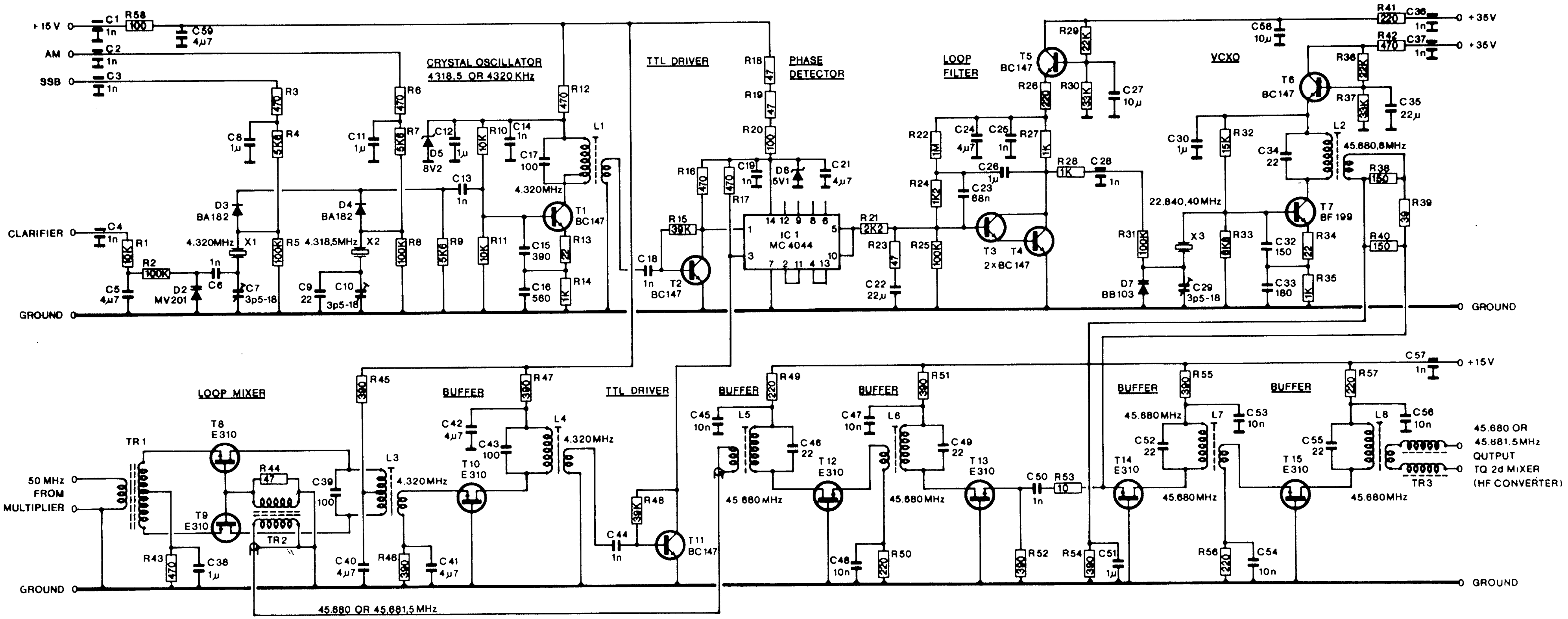
SUMMING LOOP

MODULE 02.0231

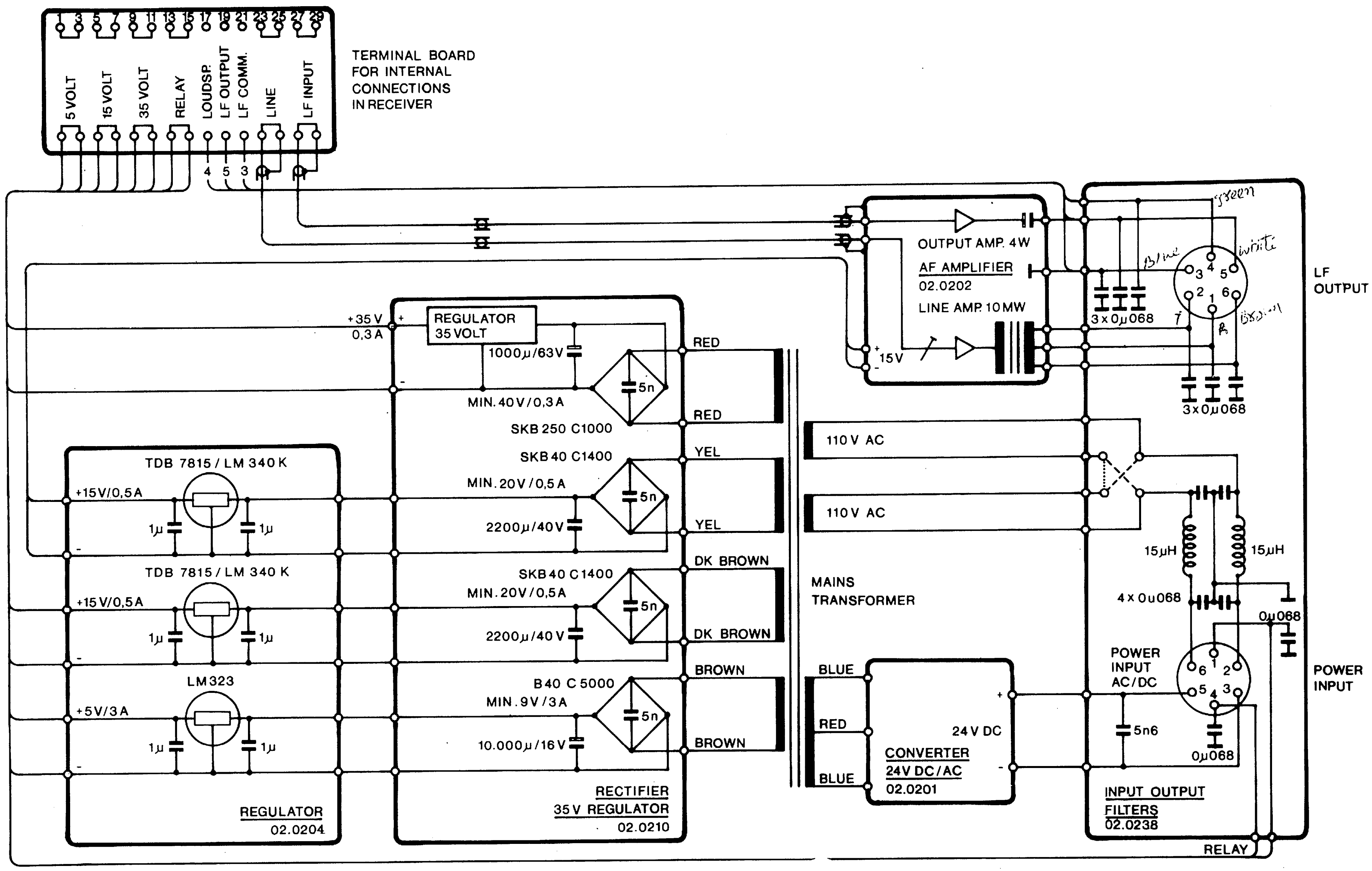


1 MHz LOOP

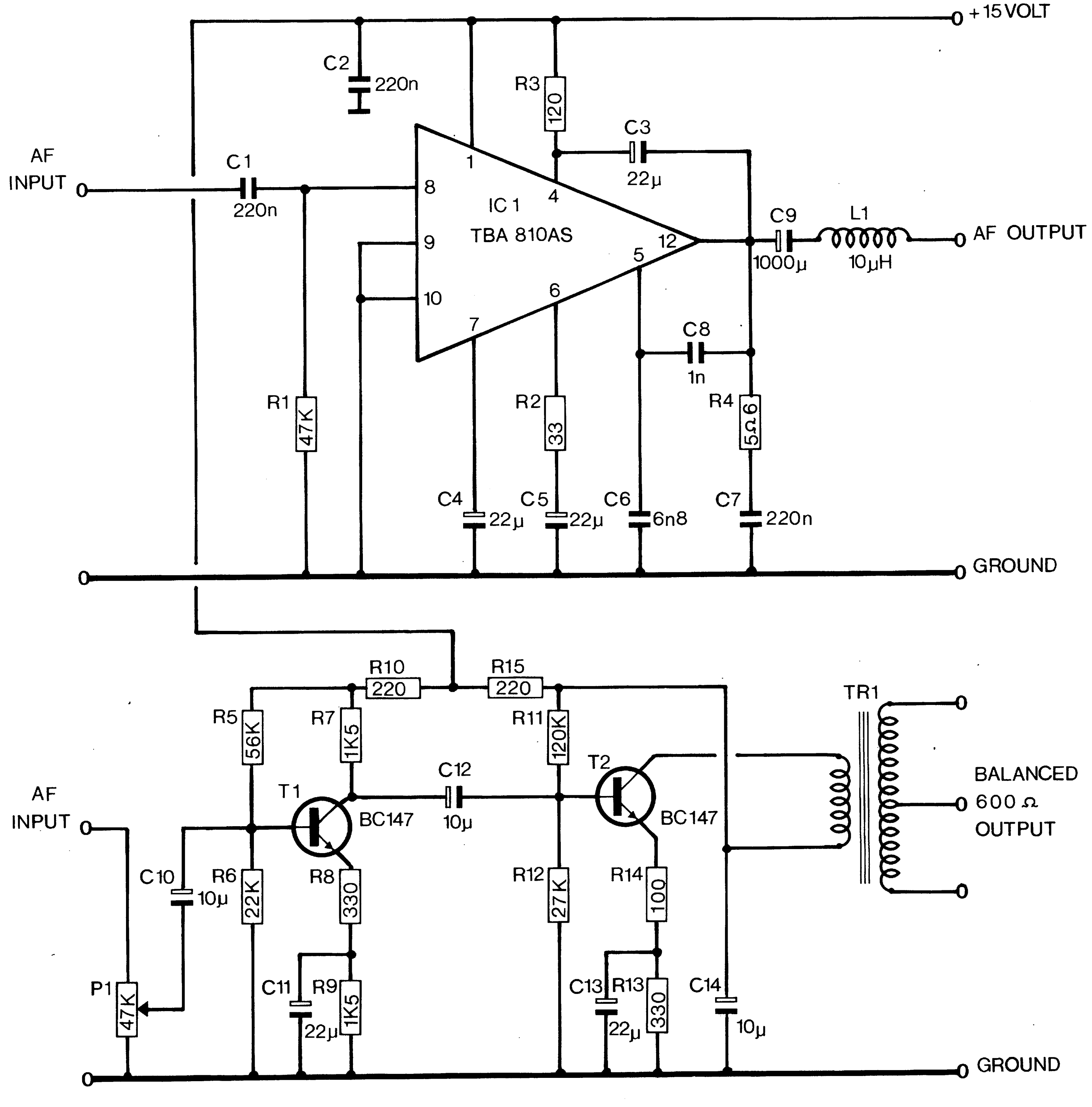
MODULE 02.0230



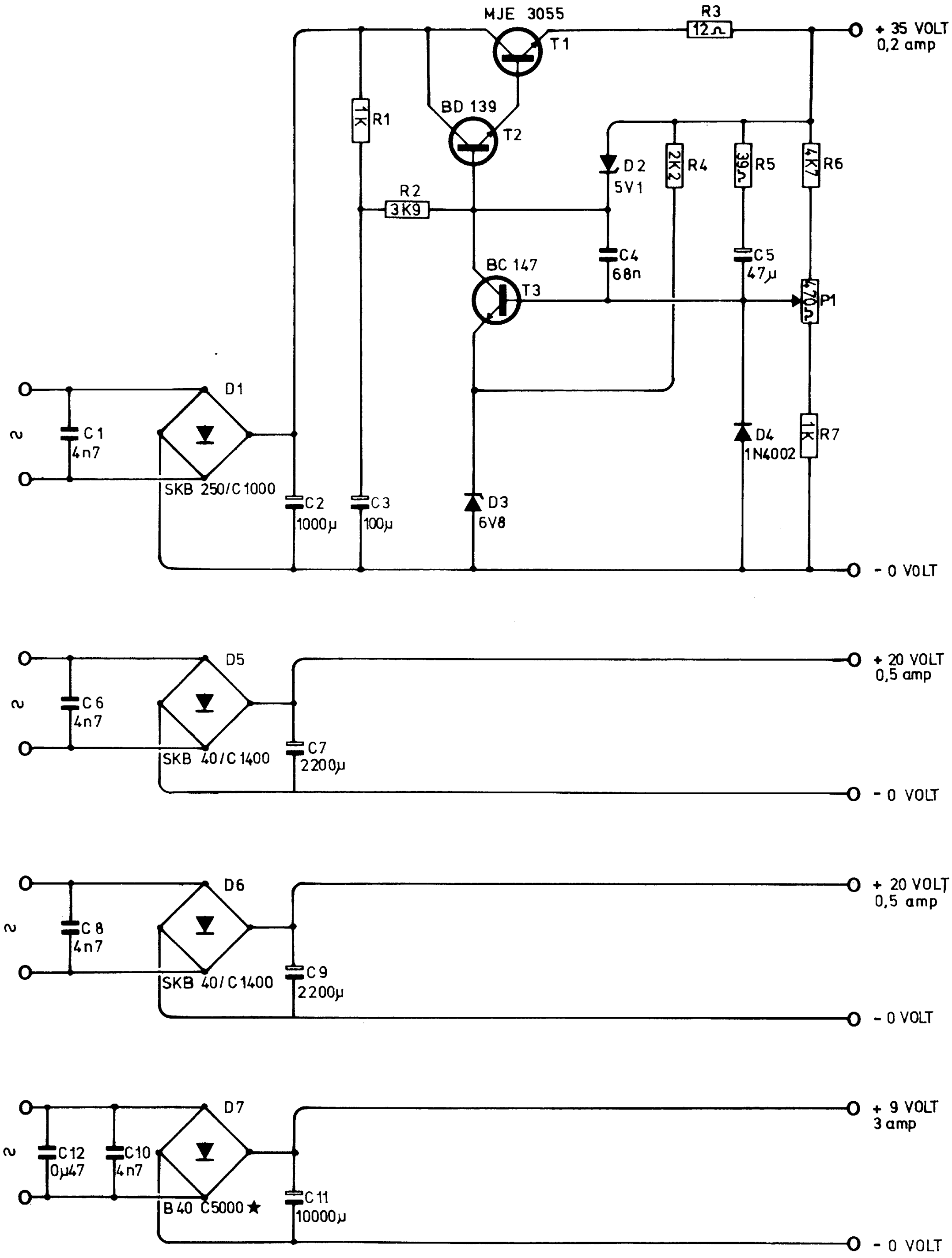
CLARIFIER LOOP 02 0229
FOR RECEIVER R 201-203
DRAWING NO. 10 0259



WIRING DIAGRAM FOR REAR PANEL
FOR RECEIVER R 201-203



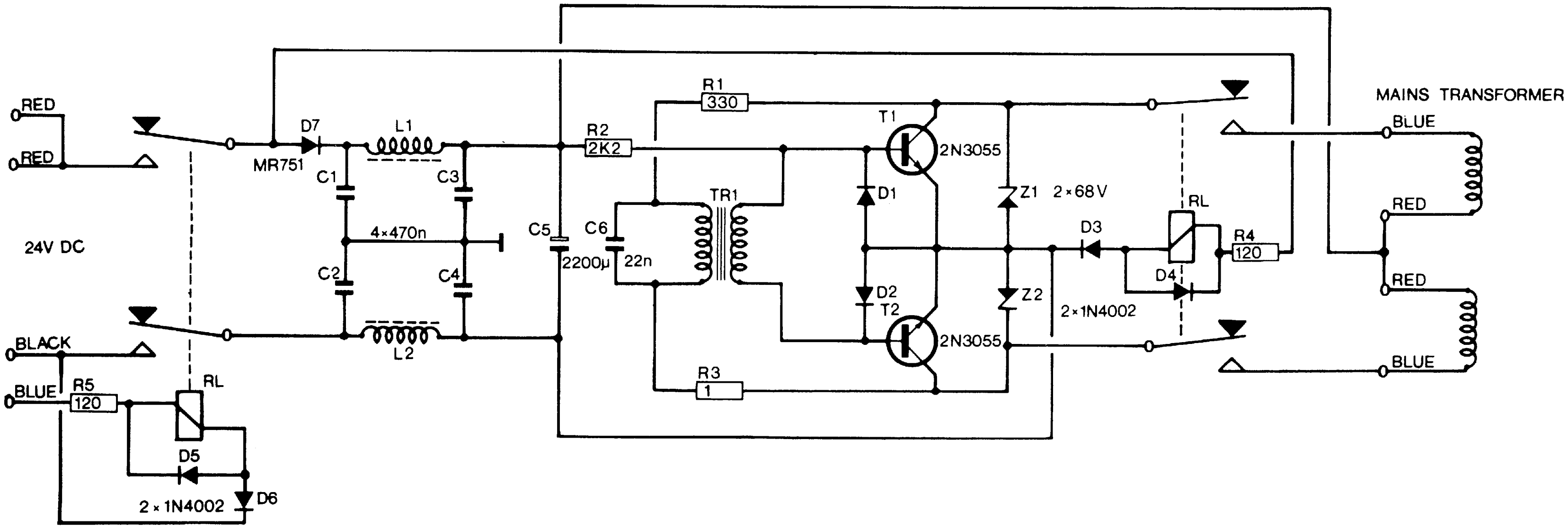
AF-AMPLIFIER MODULE 202



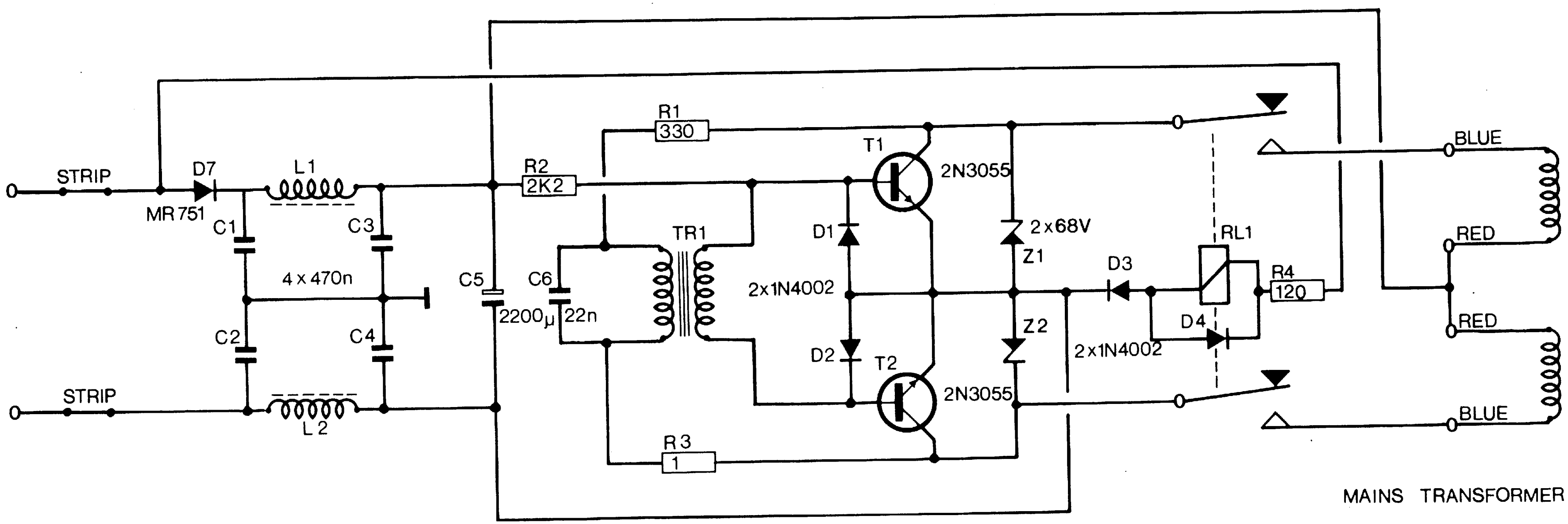
★ NOT PLACED AT CIRCUIT BOARD

RECTIFIER 35 VOLT
REGULATOR

MODULE 210



DC-CONVERTER
MODULE 280



DC - CONVERTER

MODULE 201