SAYROSA

Automatic Modulation Meter 252

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ILLUSTRATIONS

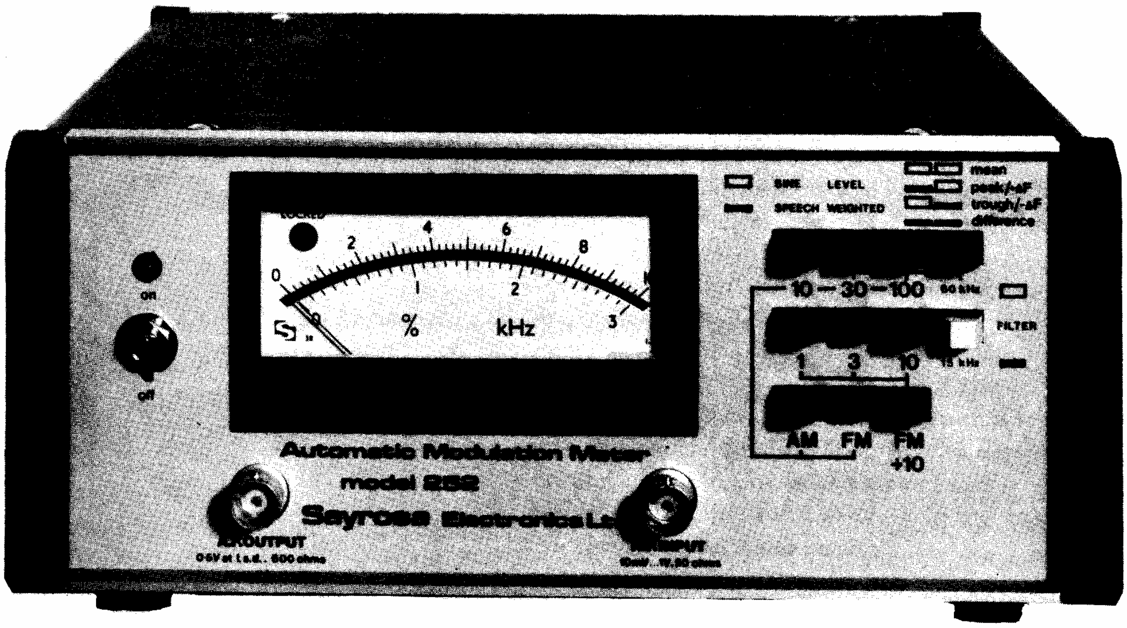


FIG. 1.1 AUTOMATIC MODULATION METER MODEL 252

1 INTRODUCTION

The Sayrosa Model 252 modulation meter is a fully automatic instrument for the comprehensive analysis of amplitude and frequency modulated signals in the range 1.5MHz to 2GHz.

The Model 252 is a very easy-to-use lightweight instrument with a wide ranging specification. For field use a battery version is available which enables operation from an internal battery as well as from the a.c. power.

2 SPECIFICATION

2.1 GENERAL

Frequency Range	1.5MHz to 2.0GHz continuous coverage. Useful response to at least 4GHz.
Tuning	Automatic tuning selects the largest available signal within the frequency range specified. Correct operation requires spurious signals to be greater than 10dB down on the wanted carrier.
Acquisition Time	Typically less than 100ms to locate and lock to carrier signal. Settling time for the demodulation and a.f. circuits is additional and is typically 1 second for a reading in the top two thirds of the meter scale.
Lock and Level Indicator	An LED, when illuminated, indicates that the instrument is locked to frequency and that the level is within range.
Input Impedance	50 ohms nominal.
Input Level	The unit will lock and perform a measurement function over the carrier level range 2mV to 1V. The full specification for noise, accuracy, etc., only applies over the range 10mV to 1V.
Maximum Input Level	Intermittent overload up to 1 Watt (7V) will not cause damage.
Local Oscillator Feed-Out	Typically -60dBm.
Display	Taut band meter with 70mm mirror scale. Ranges 0-3 and 0-10. Notation % and kHz.
Display Overload	The meter is fully protected against overload and cannot be damaged by overranging.

2.2 F.M. MEASUREMENT (Full Frequency Range)

F.M. Ranges and Measurement Bandwidth	Low Ranges:	
	F.S. Peak Deviation	Modulation Rate
	±1kHz	25Hz to 3.5kHz
	±3kHz	25Hz to 3.5kHz
	±10kHz	25Hz to 3.5kHz
	High Ranges:	
	±10kHz	25Hz to 15kHz
	±30kHz	25Hz to 15kHz or 60kHz
	±100kHz	25Hz to 15kHz or 60kHz

A.F. Characteristics	For the specified modulation rate limits given, the response is within 0.5dB of the indication at 1kHz.
Accuracy (+5° to +45°C)	±2% of scale max. ±1% of reading at 1kHz rate. There is an additional deviation error of approximately ±20Hz at carrier frequencies up to 100MHz and thereafter increasing at 6dB per octave.
Residual F.M.	Less than 100Hz at 500MHz.
Distortion	1% or less for 100kHz deviation at a 1kHz rate.
Measurement Modes	Peak positive deviation. Peak negative deviation. Mean of positive and negative measurements. Difference between positive and negative measurements. Speech average to indicate relative loudness of audio. Selection of psophometric filter (C.C.I.T.T.). The difference measurement always appears as a positive indication on the display meter.

2.3 A.M. MEASUREMENT (Full Frequency Range)

A.M. Ranges and Measurement Bandwidth	F.S. Range	Modulation Frequency
	10%	25Hz to 15kHz
	30%	25Hz to 15kHz or 60kHz
	100%	25Hz to 15kHz or 60kHz

A.M. Characteristics	For the specified modulation frequency limits given, the response is within 0.5dB of the indication at 1kHz.
Accuracy (+5° to +45°C)	±2% of scale max. ±2% of reading at 1kHz modulation frequency. Residual a.m. is additional.

Residual A.M.	Less than 0.5% with a 15kHz bandwidth selected.
Distortion	1% or less for 80% a.m. at 1kHz modulation frequency.
Measurement Modes	Peak Trough Mean between peak and trough. Difference between peak and trough. Speech average to indicate relative loudness of audio. Selection of psophometric filter (C.C.I.T.T.). The difference measurement always appears as a positive indication on the meter.

2.4 SIGNAL OUTPUTS

I.F. Output	100mV nominal from 50 ohms at approximately 420kHz. BNC connector is mounted on rear panel.
A.F. Output	Demodulated a.f. at front panel BNC connector. Level is proportional meter reading where 0.5V corresponds to full scale on any range. Impedance is 600 ohms.

2.5 BATTERY OPERATION - 252B

The battery pack consists of a sealed lead-acid 6V battery with associated electronic circuits. The instrument must be ordered in this form and cannot be updated from a.c. only to a.c. and battery at a later date.

Battery Discharge Time	4 hours. Typically 5 hours.
Re-charge Time	14 hours.
Voltage Check	Battery test pushbutton enables the battery voltage to be displayed on the meter.
Battery Usage Indication	Front panel power indicator LED glows green.
Battery Protection	1A cartridge fuse located inside the unit.
Inadvertent Battery Usage Protection	The unit will not automatically switch to battery operation when a.c. power is removed. The unit must be switched to OFF and then back to ON to obtain battery power. The unit will revert to a.c. power operation immediately this is applied.

2.6 POWER REQUIREMENTS - AC

Voltage	230V or 115V $\pm$ 15%
Frequency	48Hz to 60Hz
Consumption	Approximately 5VA
Indication	Red LED illuminates when A.C. power is present.

2.7 PHYSICAL DATA

Dimensions	Height	102mm (4 in.)
	Width	216mm (8.5 in.)
	Depth	271mm (10.65 in.)
Weight	252:	2.5kg (5.5 lb)
	252B:	3.25kg (7 lb)
Operating Temperature Range	0°C to $+55^{\circ}$C. Full specification over the range $+5^{\circ}$ to $+45^{\circ}$C.	
Storage Temperature Range	-20°C to $+55^{\circ}$C.	
Humidity	95% relative humidity at 30°C.	

3 OPERATING INSTRUCTIONS

3.1 POWER INPUT

Two nominal a.c. power ranges are available, 230V ± 15% or 115V ± 15%. Select the appropriate range on the rear panel slide switch.

WARNING

INCORRECT SUPPLY RANGE SELECTION COULD CAUSE SERIOUS DAMAGE TO THE INSTRUMENT.

Connect the power lead to the local a.c. supply socket.

3.2 MANUAL OPERATION - MAINS

Set the ON/OFF switch to ON and check that the adjacent indicator illuminates. The instrument is immediately ready for use; no warm-up time is required. If the indicator does not illuminate, check the a.c. power input and the fuse.

3.2.1 LOCK Indicator

Connect the signal source to the INPUT socket (BNC); the LOCK indicator should immediately illuminate if the signal source is within the instrument range. The illuminated LOCK indicator shows that the instrument is correctly tuned to the incoming signal and that the signal level is within range. The measuring circuits are inhibited when the LOCK indicator is extinguished.

3.2.2 A.M. Measurements

Proceed as follows:

(1) Press the AM pushbutton.

(2) Select 10, 30 or 100, which refer to a percentage of modulation. The a.m. demodulator is highly linear and allows accurate a.m. readings up to 100%.

(3) Select the appropriate filter but note that the 10 range is always limited to 15kHz. With the pushbutton out the range is 25Hz to 60kHz and with it in, the range is limited to 15kHz. It is preferable to use the narrower bandwidth when high modulation rates are not being used.

(4) Press the WEIGHTED button if the CCITT weighted psophometric filter is required (the 15kHz filter is also automatically selected).

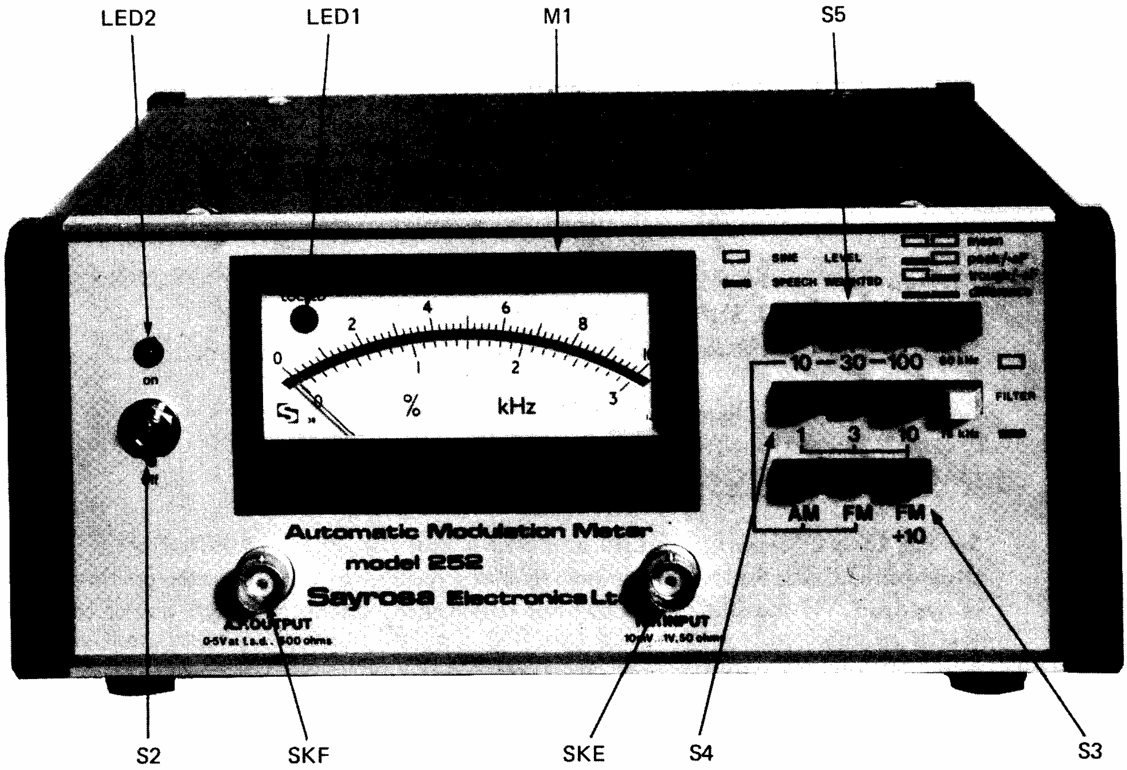


FIG. 3.1 FRONT PANEL VIEW

(5) Select the measurement required as given in Table 3.1

TABLE 3.1

Measurement Modes

Measurement	PEAK Pushbutton	TROUGH Pushbutton	SPEECH Pushbutton
Peak	in	out	out
Trough	out	in	out
Mean	out	out	out
Difference	in	in	out
Speech	in/out	in/out	in

Use 'Mean' to obtain more accurate measurements in the presence of modulation distortion. Use 'Difference' to measure any modulation distortion present. Use 'Speech' on speech waveforms to obtain a useful indication of relative loudness, see 3.2.4(5).

3.2.3 F.M. Measurements

The procedure is similar to that for a.m., as follows:

(1) Press the FM pushbutton.

(2) Select 10, 30 or 100, which refer to full scale peak deviation in kHz. If desired, the FM ÷10 pushbutton can be pressed instead of FM; this reduces the peak deviation selection to 1, 3 or 10kHz and also limits the bandwidth (25Hz to 3.5kHz). Note that at 10kHz a choice for the upper limit of the modulation band is available (15kHz or 3.5kHz).

(3) As for a.m.

(4) As for a.m.

(5) As for a.m., except that in the table, Peak and Trough refer to peak positive or peak negative deviation.

3.2.4 Measurement Notes

(1) Meter Overrange: No damage will be caused by overranging the meter indication.

(2) AM on FM, FM on AM: The instrument has low inherent generation of AM on FM and FM on AM, and may be used to perform these measurements.

(3) Automatic Tuning: The instrument locks to the highest level signal applied to the input. The instrument will not lock to a harmonic or other spurious signal provided that the intended carrier has the highest level signal and that it is within the specified frequency range. The tuning mechanism provides a continuous dynamic frequency lock that permits accurate modulation measurements to be taken even on a slowly sweeping carrier.

(4) Interference Rejection: In general, the instrument provides good selectivity against interference from spurious signals. However, the broadband nature of the input circuits implies that the possibility of such interference cannot be completely eliminated. If it is suspected that a reading is being affected by high level interfering signals make a check by disconnecting and reconnecting the signal source several times; any change in the modulation reading implies interference. Normal harmonic levels, even in the worst case, are very unlikely to have any effect on measurements.

(5) Speech Average Mode: The speech averaging facility provides an output proportional to the time average of its input. The averaging time is longer than the lowest audio frequencies but shorter than the length of a typical speech syllable. The output is 'slugged' to ensure a readable meter display.

This facility is particularly useful when setting up the audio gain of transmitters. With the peak deviation correctly set, a speech average reading of 25% to 35% of peak will give clear and distinct results. If the reading is above 60% the signal will sound distorted and if it is below 10% it will sound weak.

3.3 MANUAL OPERATION - BATTERY OPTION

The operation of the instrument on a.c. power is exactly the same as that given in para.3.2.

3.3.1 Switching On (Battery)

If the instrument has been operating from a.c. power and this is removed, the instrument will go off even though it contains batteries and is still switched on, to prevent inadvertent battery operation. The instrument must be switched OFF and then ON again to operate it from the battery.

When the OFF/CHARGE/ON switch is set to ON, the adjacent power indicator will glow green. A fully charged battery pack will now give at least 4 hours continuous usage.

3.3.2 Battery Charging

The battery can be tested by pressing the BATT TEST pushbutton. The meter then indicates the battery voltage on a scale of 0 to 10V; it should read approx. 6.5V when fully charged. If there is no voltage, check the 1A fuse on the battery board inside the instrument.

To charge the battery, connect the instrument to the a.c. power supply and set the ON/CHARGE/OFF switch to CHARGE. A fully discharged battery will take up to 14 hours to re-charge.

Note that whenever the instrument is operating from a.c. power the battery is trickle charged.

4 TECHNICAL DESCRIPTION

4.1 INTRODUCTION

The 252 technical description comprises a system description followed by a circuit description of each sub-assembly. The circuit description shows how the particular system functions are achieved.

4.2 SYSTEM DESCRIPTION

The system is described in conjunction with the block diagram (fig.4.1). Component references for major items in each block enable rapid cross-referencing to the circuit diagrams.

4.2.1 RF System

The r.f. input is applied to a sampling mixer. This mixer allows a wide range of r.f. carrier frequencies to be covered with a single local oscillator of modest tuning range. The mixer is tolerant to overloading and is very linear. The lowest r.f. carrier frequency is determined by the fundamental frequency range of the local oscillator (L.O.). The highest r.f. carrier frequency is determined by the harmonics in the very narrow (250 picoseconds) sampling pulse. An incoming signal causes the L.O. frequency to change until the mixer output is at i.f. (420kHz), when the L.O. is locked.

The mixer output is fed via a buffer, a 1.5MHz low pass filter (to remove L.O. and r.f. carrier frequencies), and an a.g.c. stage to the i.f. amplifier.

The L.O. is controlled by a broadband phase sensitive detector which locks the oscillator to the highest amplitude signal in the i.f. passband via an integrator system.

4.2.1.1 AM Demodulation

The i.f. output is fed via a band pass filter (allows all relevant modulation sidebands to pass) to the a.m. demodulator.

The a.m. demodulator is an active mean detector and is highly linear. The demodulated a.f. signal is fed to the AF Board and is also used to control the a.g.c. system.

4.2.1.2 FM Demodulation

The f.m. demodulator is of the pulse integrating type and is highly linear. The output consists of twin current sources of opposite polarity.

The effective L.O. frequency (particular L.O. harmonic) may be above or below the r.f. carrier frequency, and this affects the sense of the i.f. deviations. A phase switch selects the output from the demodulator which is appropriate for the particular L.O. frequency.

4.2.1.3 Frequency Locking System

An output from the i.f. amplifier is limited to remove any a.m. Normal and inverted outputs from the limiter are applied to a phase shifting network. An output from the centre of the network plus one of the inputs is fed to a phase sensitive detector. The detector is balanced when the two inputs are in quadrature, i.e. when the phase shifting network is at resonance (420kHz).

When the i.f. deviates from 420kHz, the phase sensitive detector is driven off balance, in a direction determined by the state of the phase switch. This causes the integrator voltage to rise or fall, as appropriate to adjust the L.O. frequency to bring back the i.f. to 420kHz.

To prevent the integrator saturating, a comparator circuit detects when the oscillator tuning voltage has exceeded the desired range. The comparator output triggers a monostable which resets the integrator to within the control range.

If the phase of the feedback frequency is incorrect, the local oscillator will be moved away from the required frequency. The comparator will then operate and the monostable will clock a bistable; this reverses the phase of the reference signal into the phase discriminator, and also selects the appropriate f.m. demodulator output.

4.2.1.4 Lock Indication

A comparator inhibits the lock action if the a.g.c. voltage goes out of the proper operating range. A detector and comparator combination measures the signal level at the phase shifting network and inhibits the lock indication if an i.f. signal at 420kHz is not present. Besides controlling the lock indicator, the lock signal also inhibits the input to the a.f. system and disables the peak and trough detectors.

4.2.2 AF System

The required a.m. or f.m. audio signal is selected by a switch and applied via the first part of a 60kHz filter (to remove noise and i.f. components) to a switched gain stage. The gain is reduced by a factor of 10 when FM ÷10 is not selected, and the following 3.5kHz low pass filter is bypassed.

The psophometric filter is switch selected as required, and the output fed to an amplifier with three switched gains (x1, x10/3, x10).

The switched gain stage output is fed either through the final section of the 60kHz filter or through a 15kHz low pass filter, as selected. The signal is then fed through a 25Hz high pass filter (to remove any sub-audio components) to the audio detectors.

The peak and trough of the a.f. signal are separately detected. Switches at the output select the required measurement mode: peak, trough, the mean between peak and trough, and peak minus trough. Finally, a full-wave average detector provides another mode and drives the meter.

4.3 CIRCUIT DESCRIPTION

The following descriptions should be read in conjunction with the circuit diagrams which are located at the rear of this manual.

4.3.1 RF Circuit (252-202) - Figure 4.2

The sampling mixer D4 to D7 is fed from the L.O. T63, L7, D1, D2 via the driver amplifier T64 to T68, and the pulse generator using step recovery diode D3 and L9.

The FET buffer stage T1 prevents loading of the mixer. Inductor L2 with C5 to C7 forms the 1.5MHz low pass filter and T2 is the gain control stage.

The i.f. amplifier comprises the FET input stage T3, emitter-coupled pairs T4, T5 and T6, T7 and tuned stage T10 driven by T8. The output to the limiter of the L.O. control system is provided by T9.

The filter (L3, C18, L4, L5 and C19) feeds the detectors and the driver (T11) for the i.f. socket. VR5 adjusts the filter shape for minimum AM on FM.

The a.m. demodulation is performed by transistors T12 and T14, with bias control provided by T13. The demodulator outputs appear as currents of opposite polarity. One is converted to a voltage by VR3 with T15 and is fed to the A.F. Board; VR3 sets the AM output amplitude. The other output is applied to C22, which is backed off by the a.g.c. reference current source (TR7 to TR9); VR6 sets the a.g.c. threshold. The potential on C22 is applied to the a.g.c. control FET T2. If the level of the i.f. signal applied to the demodulator is not correct, the current into C22 will be greater or less than the back off current, and the signal level into the i.f. amplifier will be controlled accordingly.

The signal at T13 collector is a clipped version of the i.f. and feeds the limiting amplifier T25 to T27. C25, T28, T29 form a monostable with emitter current controlled by T32. VR4 controls the clipping level, which thus sets the f.m. demodulator output amplitude.

The pulse outputs at the collectors of T28, T29 are of opposite phase. When T31 is on, the output is fed via D19 and when T31 is off, the output is fed via D20.

Transistor T41 with associated diodes clips the i.f. signal to remove any a.m. and the clipped signal is applied to C33 of the series tuned circuit C33, L6. T42 provides an anti-phase signal which is applied to the other end of the tuned circuit (L6). Bistable IC1 via T43 selects at TP3 either the in-phase or the anti-phase signal (at D27, D28) to be applied to the phase detector, with the quadrature signal at TP4 from the centre of the tuned circuit (C33/L6).

The phase detector consists of two series current switches, T44 controlled by T56 and T57 controlled by T55. The output current feeds the 'current mirror' circuit T51 and T52. Preset controls VR1 and VR2 set the gain and offset respectively. The current output is fed through the composite amplifier T58, T60, T61, T62, to the integrator capacitor C45 and via L12, L8, L7 to the varicap diodes D1, D2, causing the L.O. frequency to change.

The tuning voltage is monitored at the dual comparator T59, T54, T53. When the voltage is outside the normal range monostable T47, T46 is triggered which, in turn, clocks the bistable IC1. Also, the reset circuit T48 to T50 operates to reset the integrator at T58 base.

Transistors T20, T21 act as a dual comparator to detect if the a.g.c. voltage is within the working voltage range. Diodes D14, D21 detect the presence of a 420kHz i.f. signal at the tuned circuit C33/L6. This is combined with the a.g.c. detector output through D13, and converted to a logic signal by T22, T23 to switch the Lock line and Lock LED.

4.3.2 A.F. Board (252-212) - Figure 4.3

The a.m. and f.m. audio current inputs are applied across resistors R53, R51 to provide a voltage. Attenuation of i.f. components is provided by C8, C6 respectively. Analogue switch IC1a selects either a.m. or f.m. as required; the switch is inhibited at pin 6 when the L.O. is not locked.

The first section of the 60kHz low pass filter comprises R55 to R57, C9, C10, IC5a, plus either R51, C6 or R53, C8.

When FM ÷10 is selected, the stage IC5b provides a gain of 50, set by VR1. When FM ÷10 is not selected, R59, VR1 are bypassed by R63 and IC1b to provide a gain of 5, i.e. a 10:1 reduction.

The 3.5kHz low pass filter comprises R60 to R62, C11 to C15, IC5c, R64, R65, IC5d. The output is fed to one input of switch IC2a and to the psophometric filter (C16 to C21, R82, R83, R48, R69 to R73, VR2, IC6c, IC6d). R83 provides a steeper rate of roll off and VR2 is used to set the filter output level. Switch IC2b selects either the normal filtering or the psophometric filter.

Buffer IC6a drives the switched gain stage IC6b. With both IC2c and IC3b switches connected to 0V, a gain of 1 is provided (R76, R81). When IC2c is selected, the gain is set to 10/3 (R74, VR3 in parallel with R76). When IC3b is selected, the gain is set to ten (VR4, R75 in parallel with R76).

The second section of the 60kHz low pass filter (R77, R78, C31, C32, VC1, IC7d) gives boost at higher frequencies; trimmer capacitor VC1 adjusts the h.f. response. The 15kHz low pass filter comprises R66 to R68, C33 to C35, IC7a. The appropriate filter output is selected by IC1c.

High pass filter (25Hz) C36, C37, R79, R80, IC7c feeds the a.f. output stage IC7b and the detectors.

In the peak detector (IC8c, IC8d) capacitor C2 charges to the peak of the input voltage, and this is fed back via IC8d to the second input of IC8c. If the peak input falls IC8c will not operate and the voltage on C2 will be held. If the peak input rises, the charge on C2 will rise. Hence C2, and IC8d pin 14, faithfully follows the peak value of the input. D1 limits the voltage swing at IC8c pin 8 allowing faster switching times.

The trough detector (IC8a, IC8b) operates in the same way as the peak detector but C3 is charged negatively.

Switch IC3a short circuits the two capacitor voltages when the L.O. goes out of lock, so that the display quickly reduces to zero and the capacitors are ready when lock is again achieved.

The detector outputs are selected as given in Table 4.1.

TABLE 4.1

Output Selection

Function	IC3c pins	IC4b pins	IC4a pins	IC4c pins	Output
Peak	5-4	1-15	13-14	3-4	$\frac{1}{2}$ of V (TP1) via R45, R44
Trough	3-4	2-15	13-14	3-4	$\frac{1}{2}$ of V (TP2) via R42, R43
Mean	3-4	1-15	13-14	5-4	Voltage across R44
Difference	3-4	1-15	13-14	3-4	Peak minus trough, to 0V
Speech	-	-	12-14	-	From atten. R36 to R38 ($\frac{1}{2}$)

Note that the peak and trough outputs are interchanged to give the correct sense readings on the meter.

IC9c is a buffer to minimise loading of summing resistors. Trimmer control VR5 can be adjusted to minimise the d.c. offsets in the operational amplifiers and any imbalance in the peak and trough readings. IC9d pin 12 is high impedance so only one buffer is required.

IC9d pin 14 drives a bridge rectifier D5 to D8 which has the front panel meter connected across two corners. Because of feedback, the current which flows into IC9d via R46 is the same current that flows through the meter. Capacitor C4 slightly slugs the meter so that readings can be taken from speech signals when in the speech averaging mode.

The peak and trough switches are controlled by gates IC11a to IC11c in conjunction with inverters IC10b, IC10c.

Referring to fig. 4.3, the analogue switch control lines are held high by R1 to R9 and are taken low when the appropriate front panel pushbutton is pressed.

4.3.2.1 Power Supply

The a.c. from the secondaries of the power transformer is fed to bridge rectifiers D9, D10. A +12V output is obtained from REG2 via L1, and a -12V output is obtained from REG3 via the other half of L1. Regulator REG1 gives a +5V supply from the +12V output.

When the 252 is powered from a battery, the outputs from the inverter are taken directly to REG2 and REG3. Also, the earth link (LINK 1) from REG3 output is deleted.

4.3.3 Battery Supply PCB (252-213) - Figure 4.4

The circuit can be divided into three main areas: a main charging circuit (T1 - T3, T5, T6), a trickle charging circuit (R14, C8, D17), and an inverter (T16, L1, L2).

When the instrument is connected to a.c. power and CHARGE is selected, the power transformer secondary voltages are rectified by D1, D3, D5, D8 and fed to the charging circuit. The charging current is supplied by T1, T2 via R2. The voltage is monitored by R3, R5 and compared with the reference D10 by T5. The control signal is fed via T3. SK5 pin 9 is at 0V and hence T6 is switched off.

When the instrument is connected to a.c. power and ON is selected, R15 is taken down to -12V and T6 is turned on; this inhibits the main charging circuit. Also, rectifiers D2, D7 provide a negative voltage via R14 to trickle charge the battery. C8 provides smoothing and D17 prevents damage from reverse voltages.

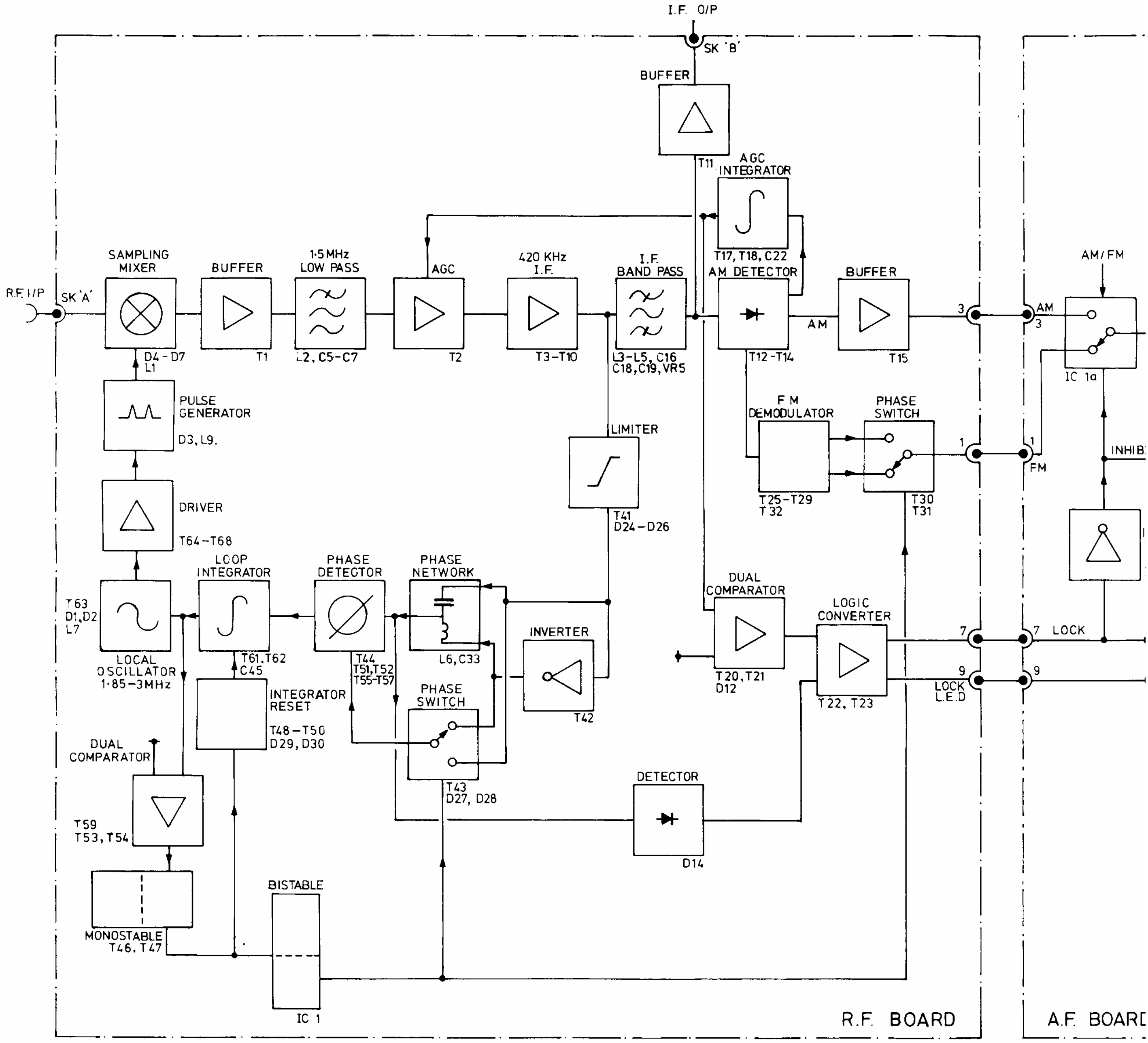
When ON is selected with the instrument not connected to a.c. power, the battery is effectively connected between SK5 pins 2 (-ve) and 3.

The inverter start transistor T12 switches on and the current through L2 starts the inverter T16, L1, L2 oscillating. A negative output is taken via D16, R22 to T14 base, and a positive output is taken via D15 and R17, T11 and R23 also to T14 base. This negative feedback controls T14 and hence the voltage stored on C7. Transistors T13 and T15 provide the bias control for T16. As the battery voltage falls, the mark-space ratio of the inverter is automatically adjusted to maintain the output voltage.

When the battery is operating, T4 is driven on, and hence SK5 pin 8 is low. Also, SK5 pin 5 is high due to D15, R16. Hence the green LED illuminates. When the a.c. power is present T4 is driven off by rectifiers D4, D6 and pin 8 is high due to rectifiers D1, D3, D5, D8. Also, SK5 pin 5 is low via R16, R17, R19. Hence, the red LED illuminates.

4.3.4 Chassis Wiring (252-214, 252-215) - Figures 4.5, 4.6

There are two versions of the chassis wiring, the battery version having a three-position a.c. power switch and including the Battery Supply PCB. The battery version also has a battery test switch which connects the battery through the fuse to the meter via R2.


I.F. O/P
SK 'B'
BUFFER
T11
AGC INTEGRATOR
T17, T18, C22
R.F. I/P
SK 'A'
SAMPLING MIXER
D4 - D7 L1
BUFFER
T1
1·5 MHz LOW PASS
L2, C5-C7
AGC
T2
420 KHz I.F.
T3-T10
I.F. BAND PASS
L3-L5, C16 C18, C19, VR5
AM DETECTOR
T12-T14
AM
BUFFER
T15
PULSE GENERATOR
D3, L9.
DRIVER
T64-T68
LIMITER
T41 D24-D26
F M DEMODULATOR
T25-T29 T32
PHASE SWITCH
T30 T31
T63 D1, D2 L7
LOCAL OSCILLATOR 1·85-3MHz
LOOP INTEGRATOR
T61, T62 C45
PHASE DETECTOR
T44 T51, T52 T55-T57
PHASE NETWORK
L6, C33
INVERTER
T42
DUAL COMPARATOR
T20, T21 D12
LOGIC CONVERTER
T22, T23
INTEGRATOR RESET
T48-T50 D29, D30
PHASE SWITCH
T43 D27, D28
DUAL COMPARATOR
T59 T53, T54
MONOSTABLE T46, T47
BISTABLE
IC 1
DETECTOR
D14
R.F. BOARD
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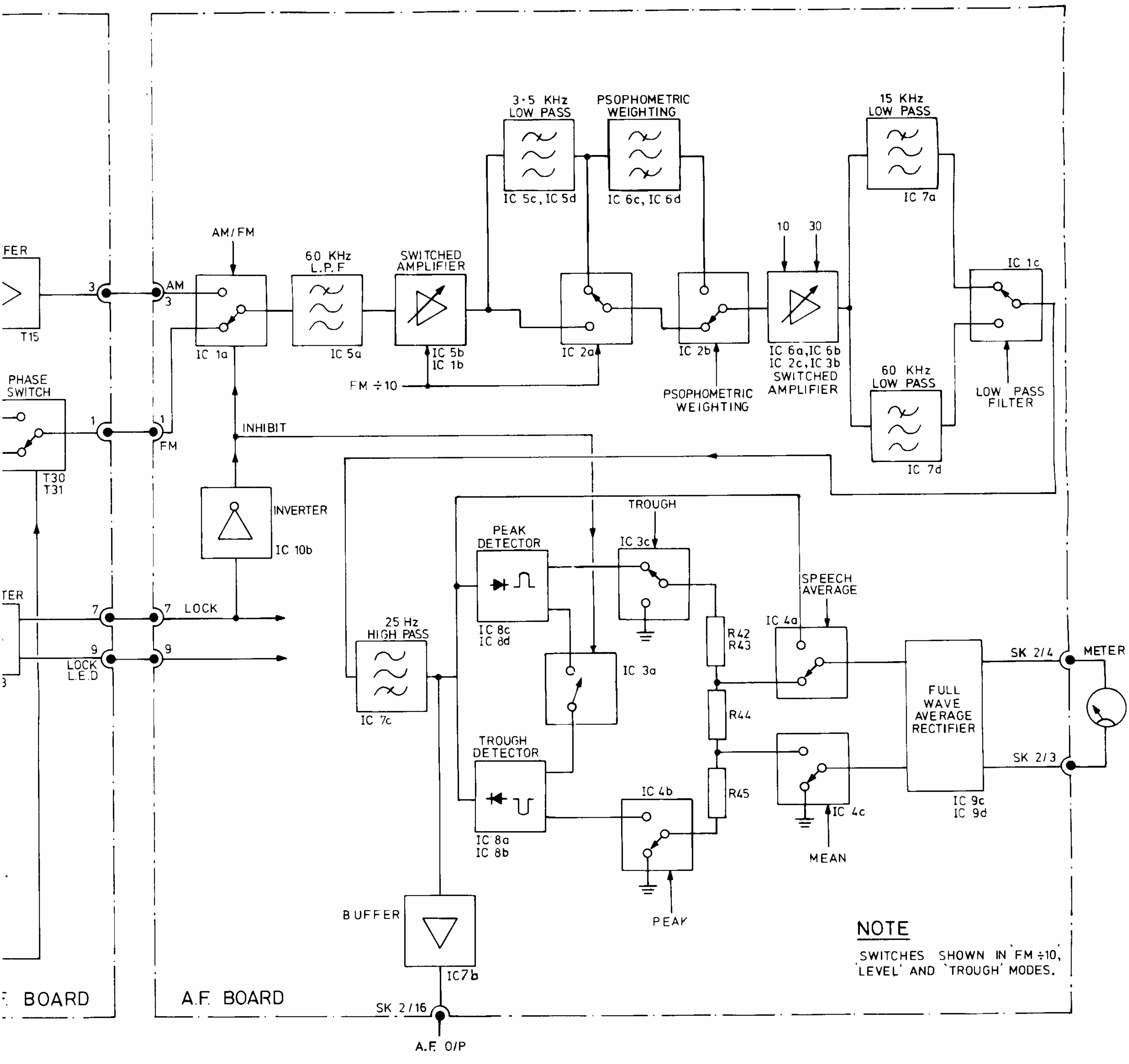
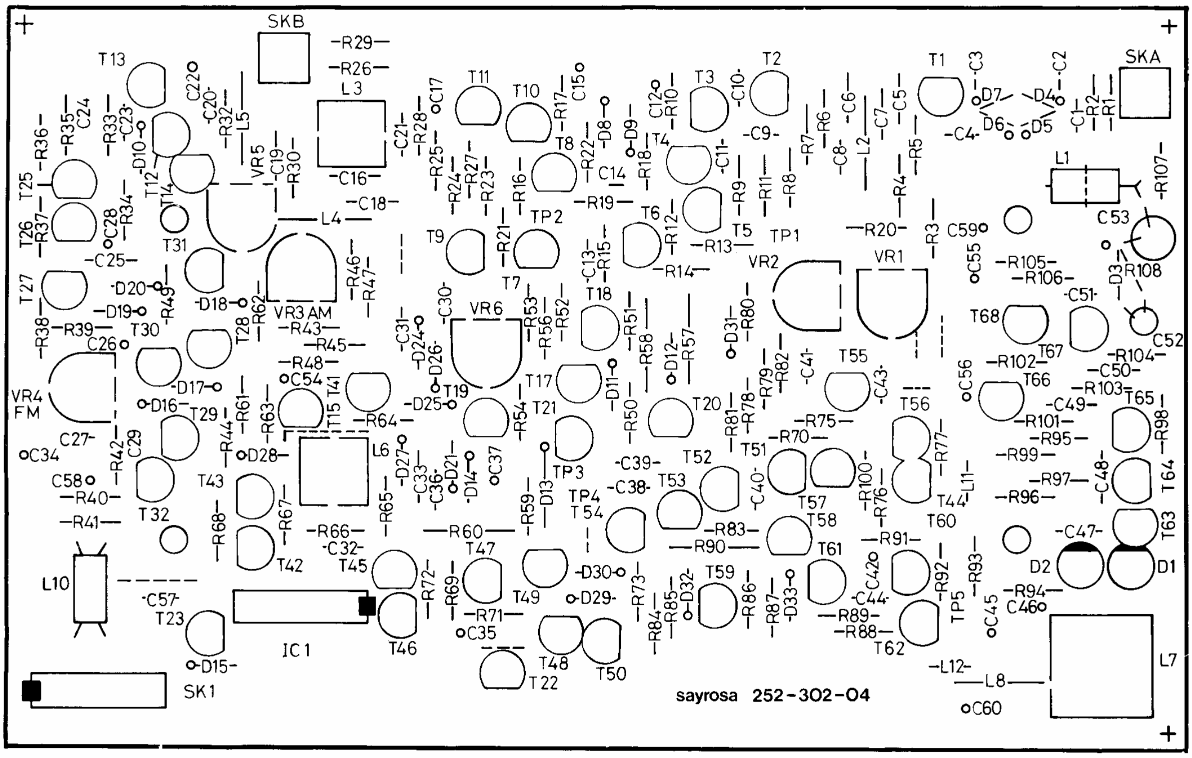
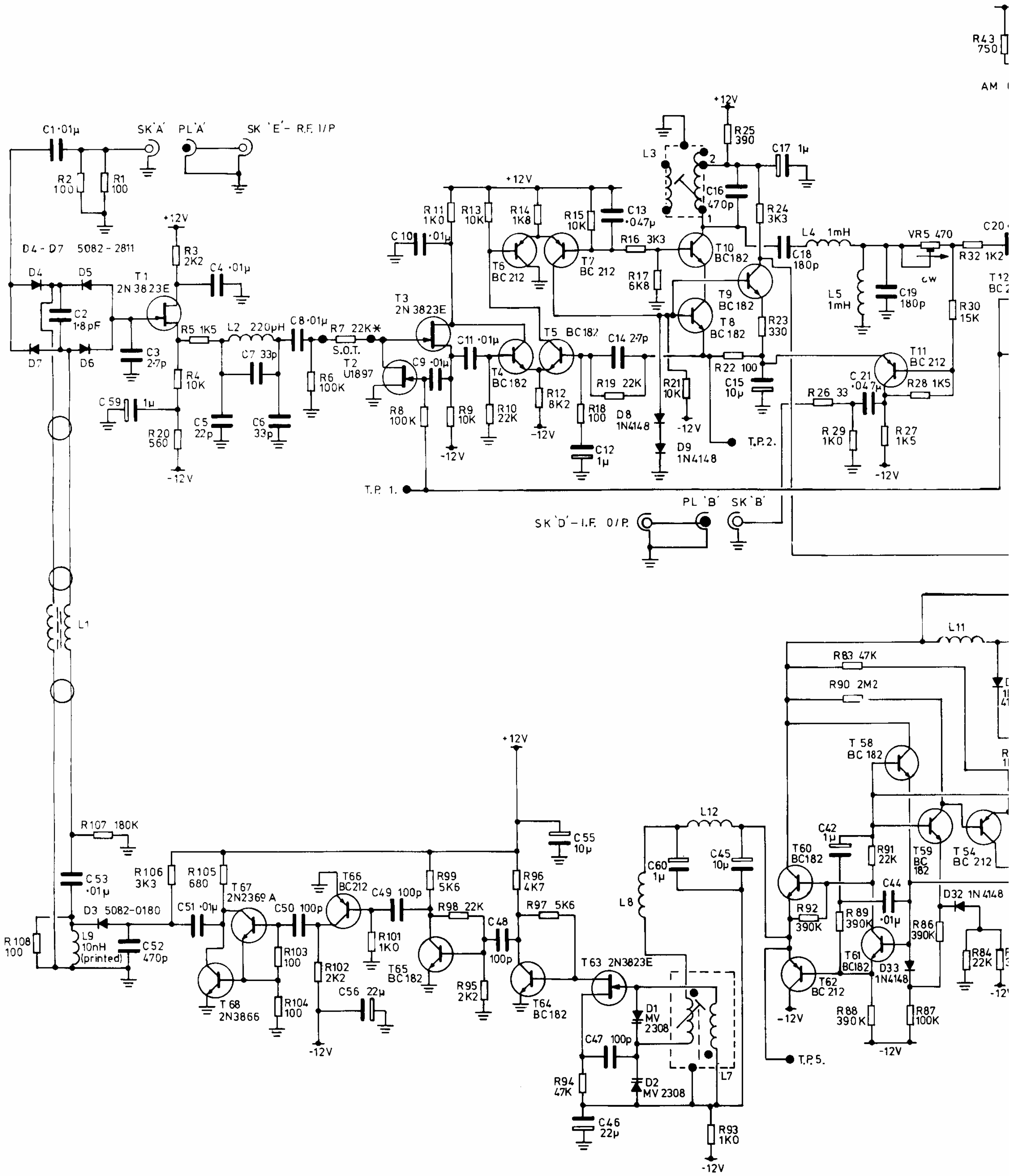
INHIB
A.F. BOARD

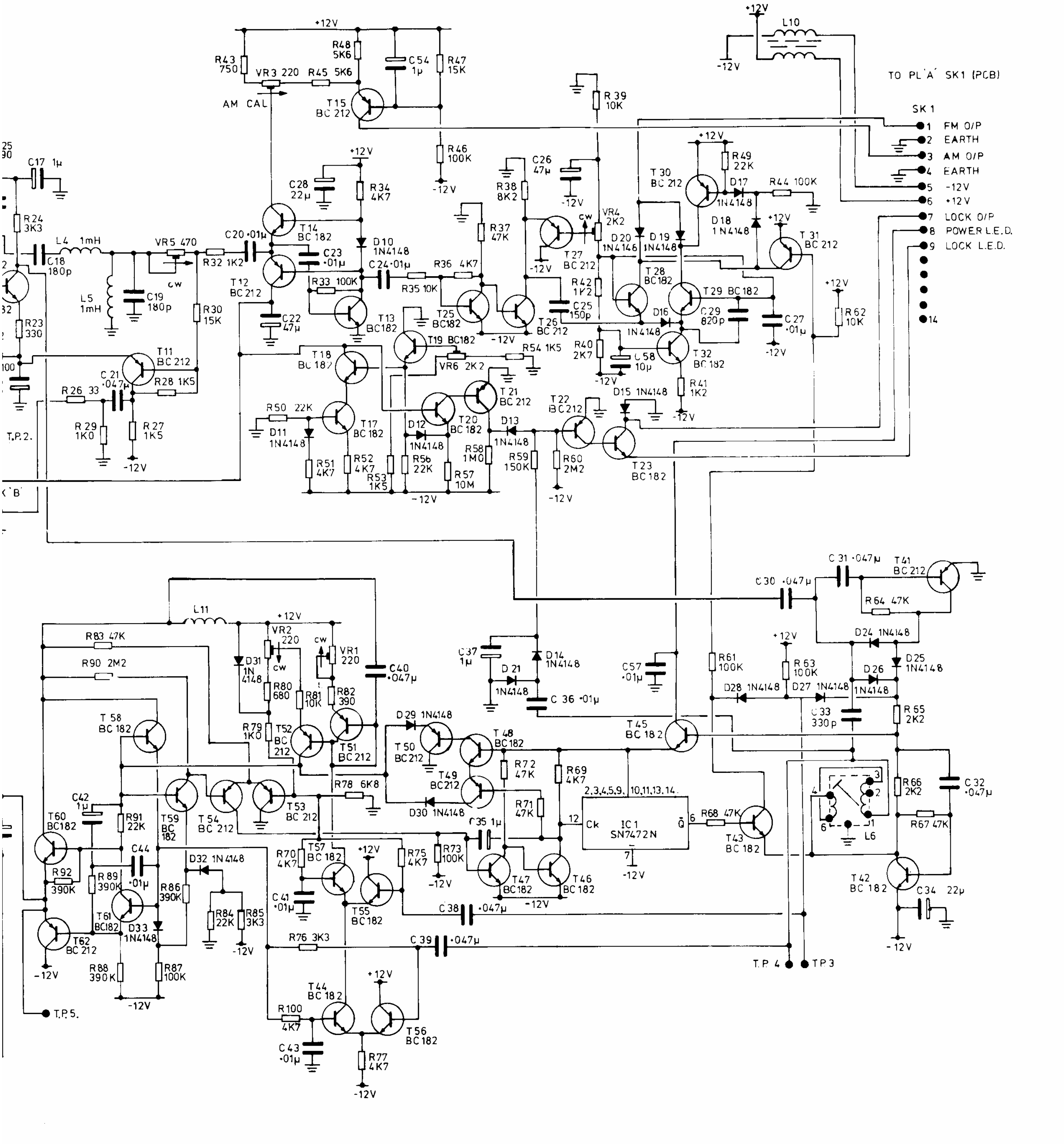


BLOCK DIAGRAM FIG. 4.1

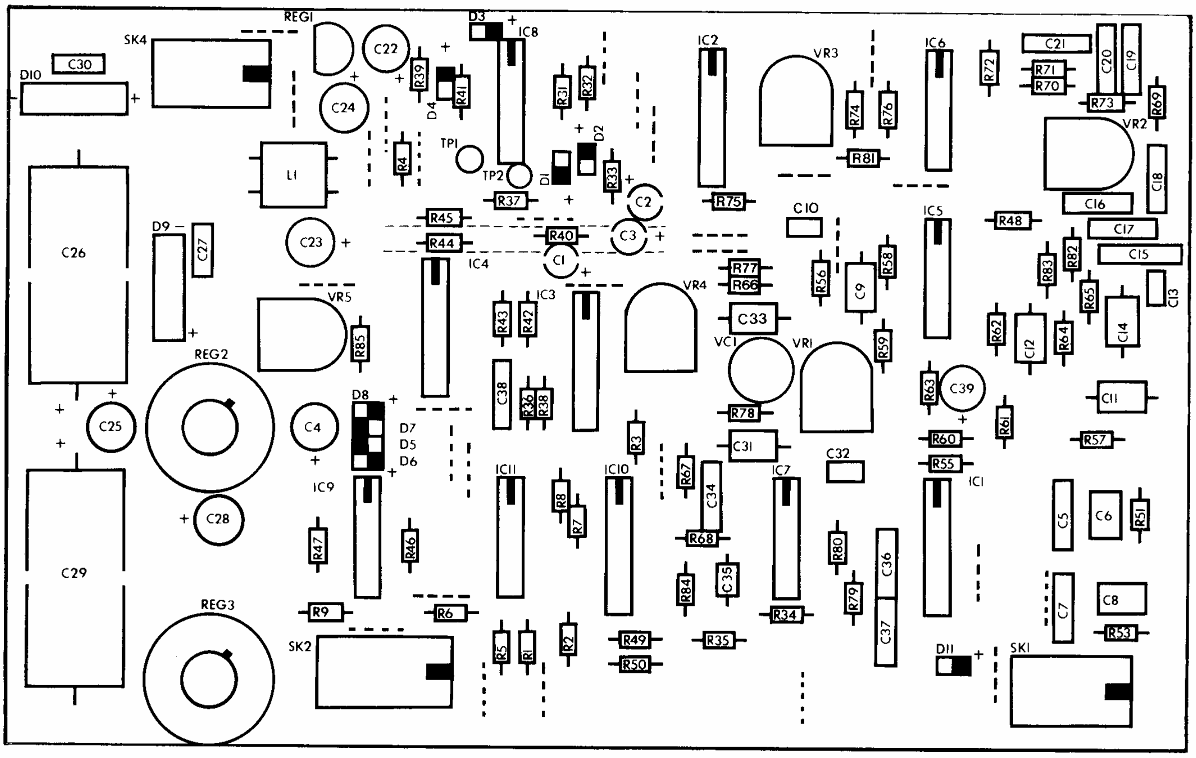

SKB
SKA
L3
L4
VR1
VR2
VR3 AM
VR4 FM
VR5
VR6
TP1
TP2
TP3
TP4
TP5
L1
L7
L8
L10
L12
IC 1
SK1
sayrosa 252-302-04

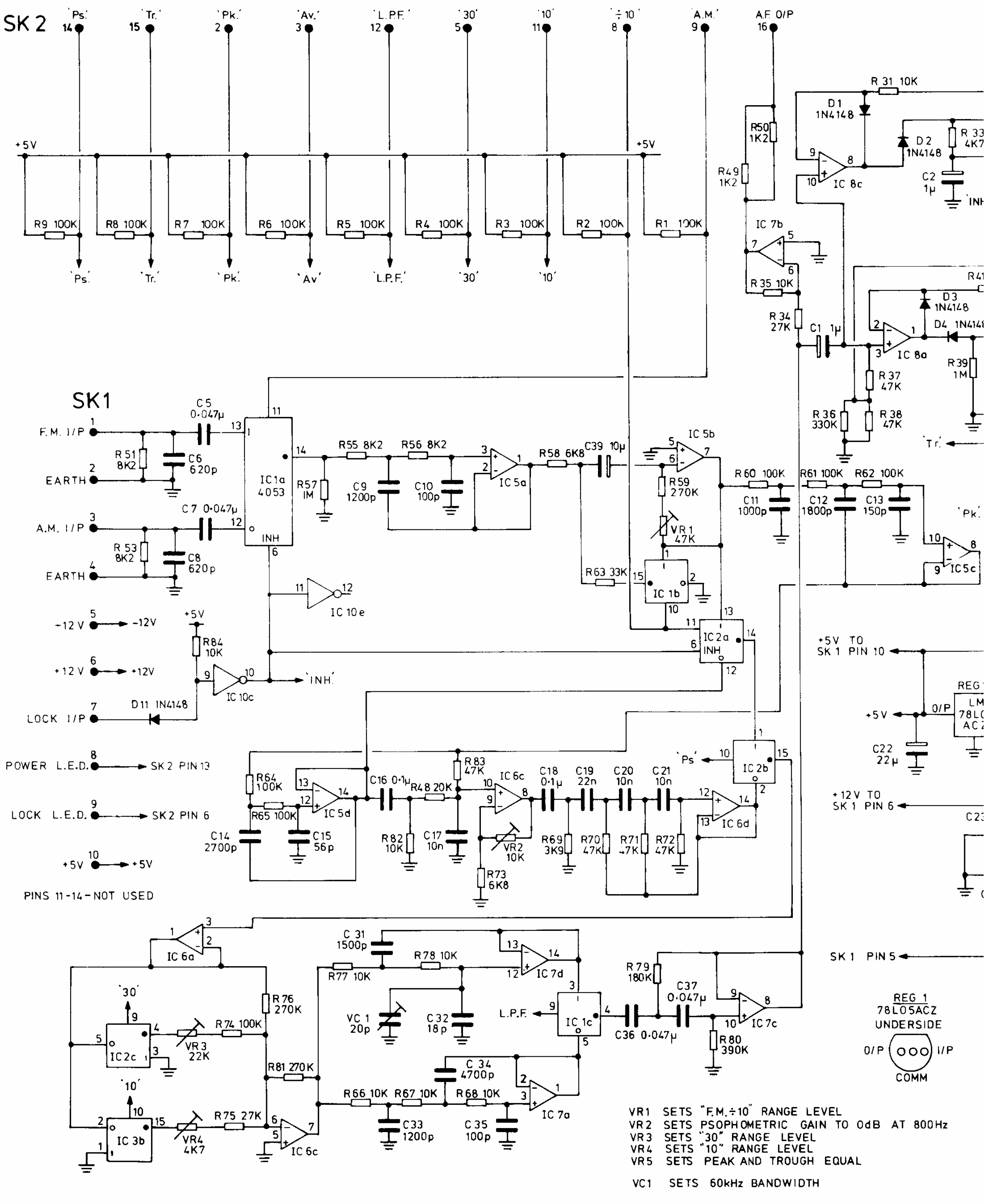


R43 750
AM
+12V
R25 390
C17 1µ
L3
2
C16 470p
1
C1 ·01µ
SK'A'
PL'A'
SK 'E'- R.F. I/P
R2 100
R1 100
D4-D7 5082-2811
+12V
R3 2K2
C4 ·01µ
D4
D5
T1 2N3823E
C2 1·8pF
D7
D6
C3 2·7p
R5 1K5
L2 220µH
C8 ·01µ
R7 22K*
S.O.T.
T2 U1897
C7 33p
R6 100K
R4 10K
C59 1µ
R20 560
C5 22p
C6 33p
-12V
+12V
R11 1K0
R13 10K
R14 1K8
R15 10K
C13 ·047µ
C10 ·01µ
T6 BC212
T7 BC 212
R16 3K3
T10 BC182
R24 3K3
C18 180p
L4 1mH
VR5 470
C20
R32 1K2
R17 6K8
T9 BC182
T8 BC 182
R23 330
L5 1mH
C19 180p
cw
R30 15K
T12 BC2
T3 2N 3823E
C11 ·01µ
T5 BC182
C14 2·7p
R22 100
C15 10µ
T11 BC 212
C9 ·01µ
T4 BC 182
R19 22K
R21 10K
C21 ·047µ
R26 33
R28 1K5
R8 100K
R9 10K
R10 22K
R12 8K2
R18 100
D8 1N4148
-12V
T.P.2.
R29 1K0
R27 1K5
C12 1µ
D9 1N4148
T.P. 1.
SK 'D'- I.F. O/P.
PL 'B'
SK 'B'
L1
L11
R83 47K
R90 2M2
T 58 BC 182
+12V
L12
C42 1µ
R107 180K
C55 10µ
C60 1µ
C45 10µ
T60 BC182
R91 22K
T59 BC 182
T 54 BC 212
C53 ·01µ
R106 3K3
R105 680
R99 5K6
R96 4K7
L8
C44 ·01µ
D32 1N4148
T 67 2N2369 A
T66 BC212
C49 100p
D3 5082-0180
C51 ·01µ
C50 100p
R98 22K
R97 5K6
R92 390K
R 89 390K
R86 390K
R 108 100
L9 10nH (printed)
C52 470p
R101 1K0
C48 100p
T61 BC182
D33 1N4148
R84 22K
R103 100
T65 BC182
T63 2N3823E
T62 BC 212
R102 2K2
R95 2K2
T64 BC182
D1 MV 2308
R88 390K
R87 100K
T 68 2N3866
R104 100
C56 22µ
C47 100p
L7
T.P.5.
-12V
R94 47K
D2 MV 2308
C46 22µ
R93 1K0
-12V

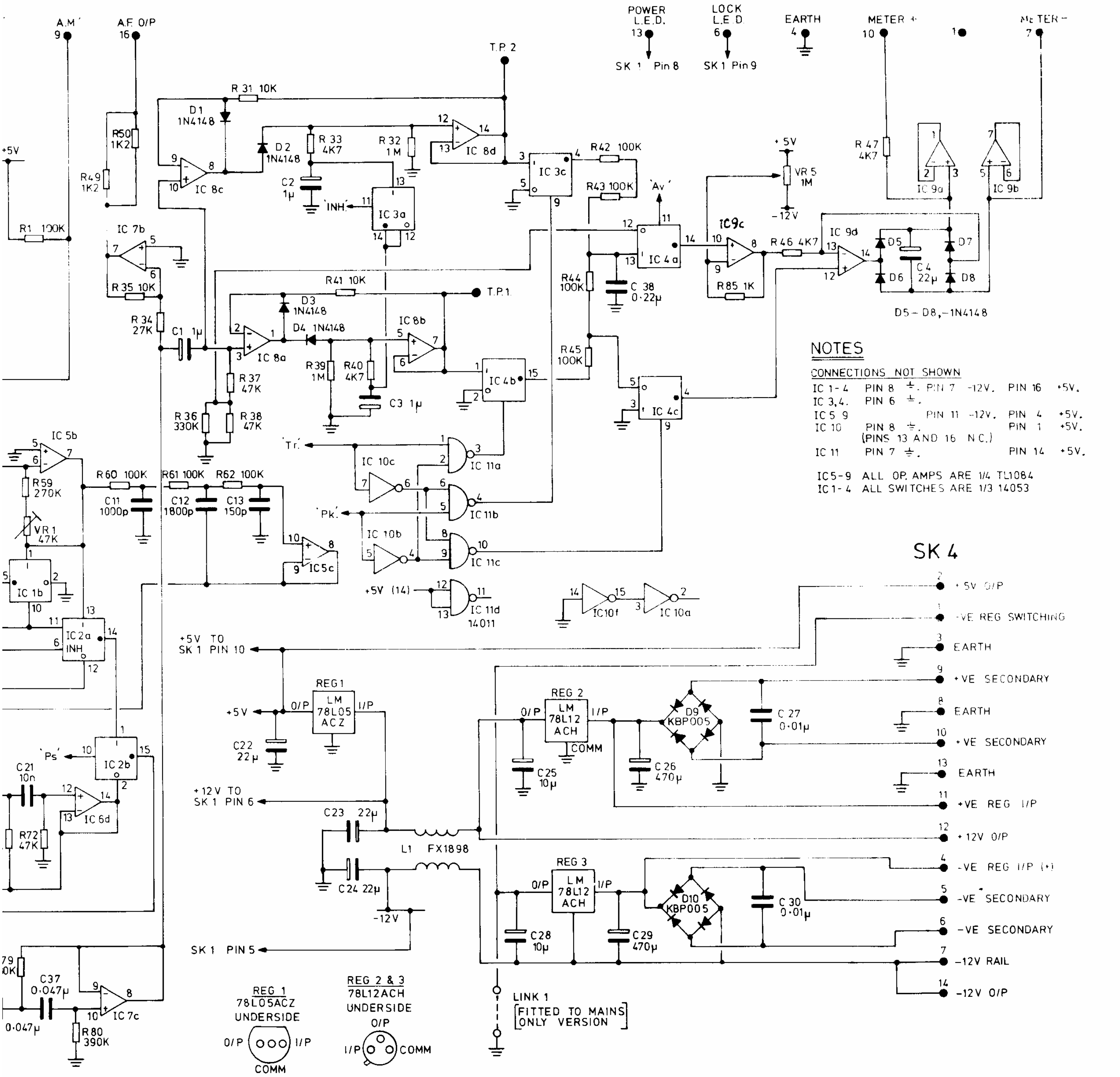


R.F. BOARD – CIRCUIT FIG. 4.2


REG1
D3
IC8
SK4
C30
D10
C22
C24
R39
D4
R41
R31
R32
D2
D1
TP1
TP2
R33
R37
C2
C3
C1
R40
R45
R44
IC4
L1
C26
D9
C27
C23
VR5
R85
REG2
C25
C4
D8
D7
D5
D6
IC9
C28
C29
REG3
R47
R46
R9
R6
SK2
IC2
VR3
IC6
R72
C21
C20
C19
R71
R70
R73
R69
VR2
R74
R76
R81
R75
C10
IC5
R48
C16
C18
C17
C15
R77
R66
R56
C9
R58
R83
R82
R65
C13
C14
C33
VR4
VC1
VR1
R59
R62
C12
R64
IC3
R43
R42
C38
R36
R38
R3
R63
C39
C11
R78
R61
R60
R57
C31
C32
R55
IC1
IC11
IC10
IC7
R67
C34
R8
R7
R68
R80
C36
C5
C6
R51
R84
C35
R79
C37
C7
C8
R34
R53
R5
R1
R2
R49
R50
R35
D11
SK1



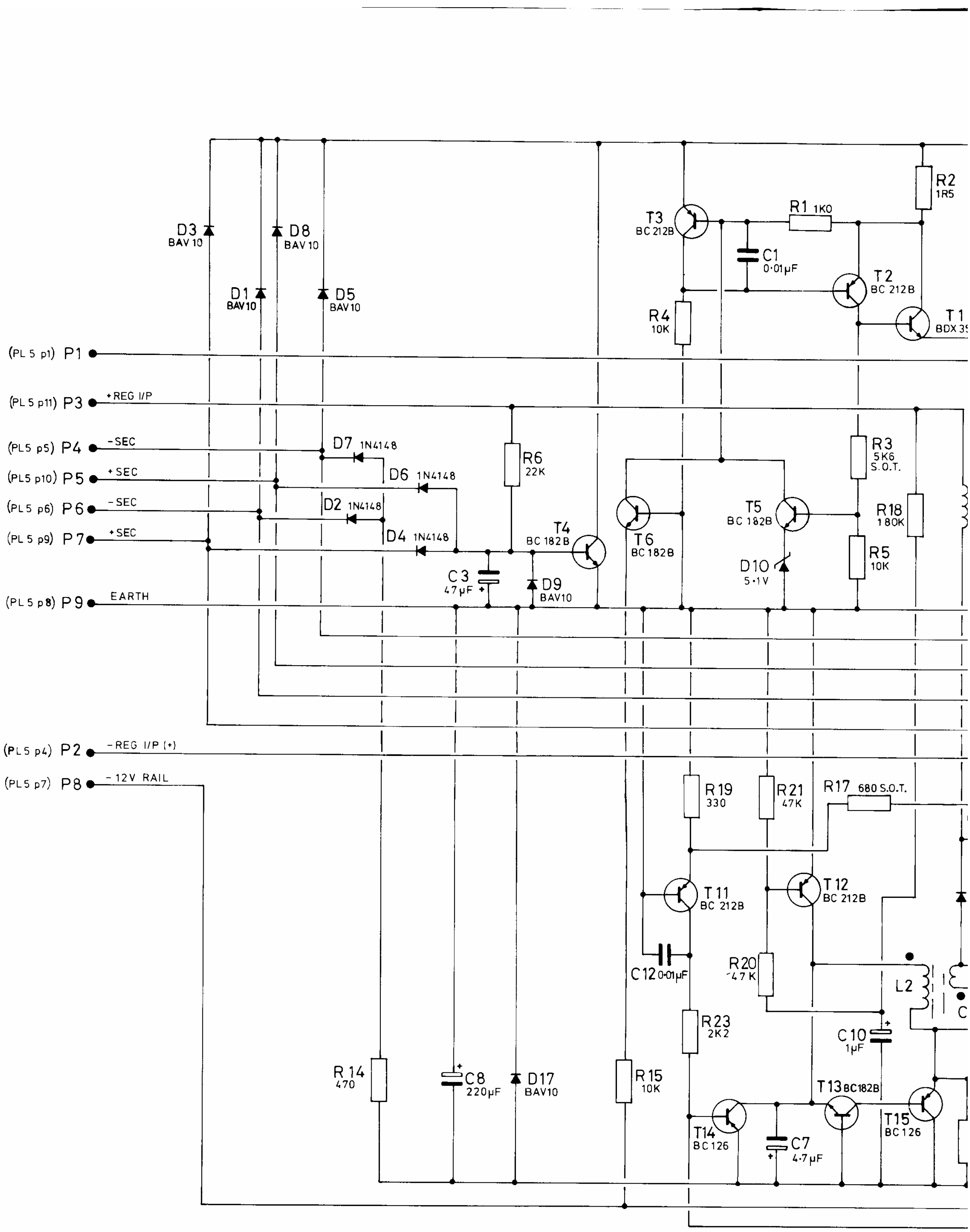
SK 2
'Ps.' 14
'Tr.' 15
'Pk.' 2
'Av.' 3
'L.P.F.' 12
'30' 5
'10' 11
'÷10' 8
'A.M.' 9
A.F. O/P 16
+5V
R9 100K
R8 100K
R7 100K
R6 100K
R5 100K
R4 100K
R3 100K
R2 100K
R1 100K
'Ps.' 'Tr.' 'Pk.' 'Av' 'L.P.F.' '30' '10'
SK1
F.M. I/P 1
EARTH 2
A.M. I/P 3
EARTH 4
-12V 5 -12V
+12V 6 +12V
LOCK I/P 7
POWER L.E.D. 8 SK2 PIN 13
LOCK L.E.D. 9 SK2 PIN 6
+5V 10 +5V
PINS 11-14-NOT USED
C5 0·047μ
R51 8K2
C6 620p
C7 0·047μ
R53 8K2
C8 620p
IC1a 4053
INH
R55 8K2
R56 8K2
R57 1M
C9 1200p
C10 100p
IC 5a
R58 6K8
C39 10μ
IC 5b
R59 270K
VR1 47K
R63 33K
IC 1b
IC 2a
INH
IC 10e
R84 10K
IC 10c
'INH'
D11 1N4148
R60 100K
C11 1000p
R61 100K
R62 100K
C12 1800p
C13 150p
'Pk.'
IC5c
R50 1K2
R49 1K2
R 31 10K
D1 1N4148
D2 1N4148
R 33 4K7
IC 8c
C2 1μ
'INH'
IC 7b
R 35 10K
R 34 27K
C1 1μ
R41
D3 1N4148
D4 1N4148
IC 8a
R39 1M
R 37 47K
R 36 330K
R 38 47K
'Tr.'
+5V TO SK 1 PIN 10
REG 1 LM 78L05 ACZ
O/P
+5V
C22 22μ
+12V TO SK 1 PIN 6
C23
SK 1 PIN 5
R64 100K
R65 100K
C14 2700p
C15 56p
IC 5d
C16 0·1μ
R48 20K
R83 47K
IC 6c
R82 10K
C17 10n
VR2 10K
R73 6K8
C18 0·1μ
C19 22n
C20 10n
C21 10n
R69 3K9
R70 47K
R71 47K
R72 47K
IC 6d
'Ps'
IC 2b
IC 6a
'30'
IC2c
VR3 22K
R74 100K
R76 270K
'10'
IC 3b
VR4 4K7
R75 27K
R81 270K
IC 6c
C 31 1500p
R77 10K
R78 10K
IC 7d
VC 1 20p
C32 18p
L.P.F.
IC 1c
C 34 4700p
R66 10K
R67 10K
R68 10K
C33 1200p
C 35 100p
IC 7a
R79 180K
C37 0·047μ
C36 0·047μ
R80 390K
IC 7c
REG 1 78L05ACZ UNDERSIDE
O/P I/P
COMM
VR1 SETS "F.M.÷10" RANGE LEVEL
VR2 SETS PSOPHOMETRIC GAIN TO 0dB AT 800Hz
VR3 SETS "30" RANGE LEVEL
VR4 SETS "10" RANGE LEVEL
VR5 SETS PEAK AND TROUGH EQUAL
VC1 SETS 60kHz BANDWIDTH



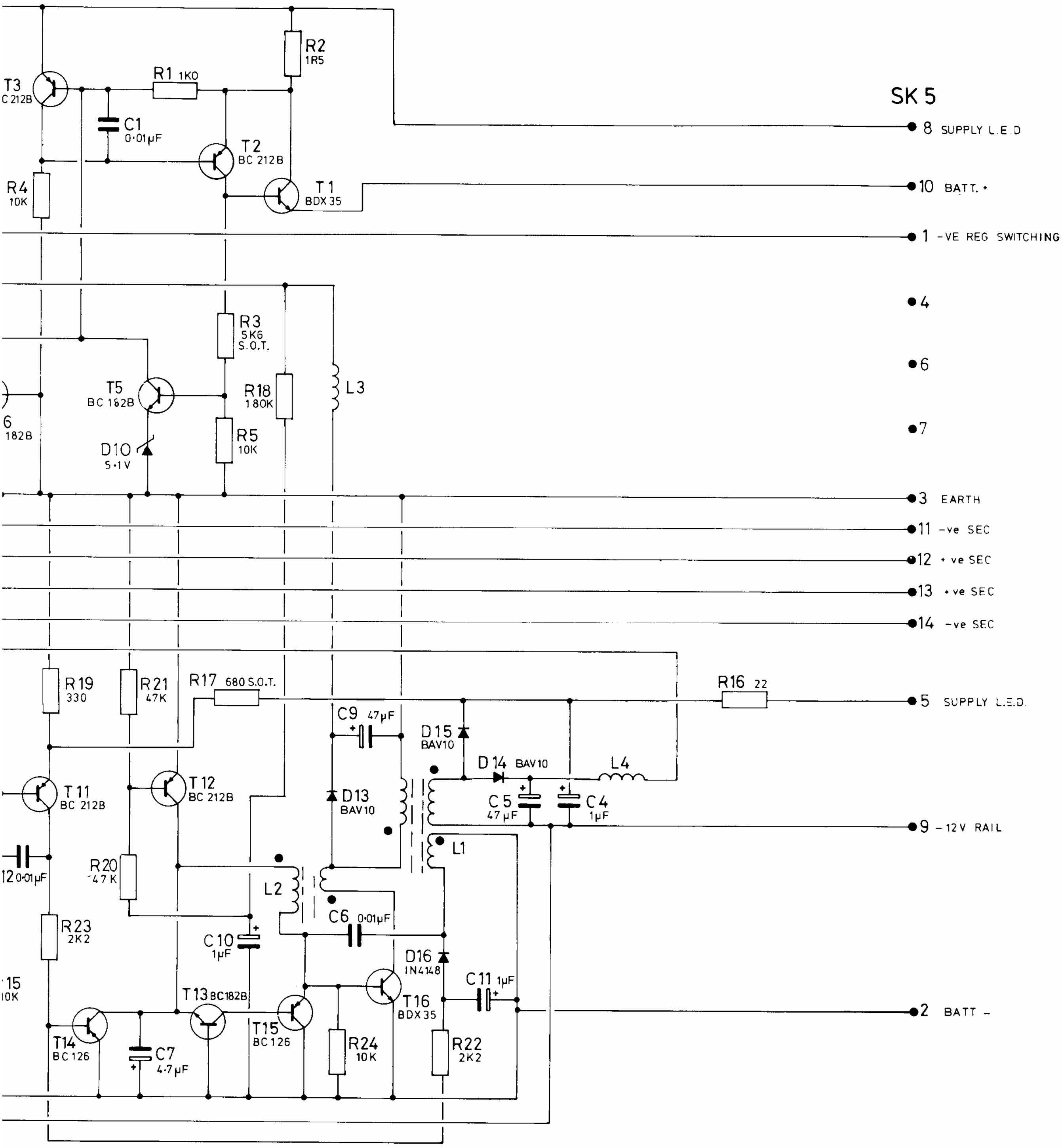
R1 SETS "F.M.÷10" RANGE LEVEL
R2 SETS PSOPHOMETRIC GAIN TO 0dB AT 800Hz
R3 SETS "30" RANGE LEVEL
R4 SETS "10" RANGE LEVEL
R5 SETS PEAK AND TROUGH EQUAL

'C1 SETS 60kHz BANDWIDTH

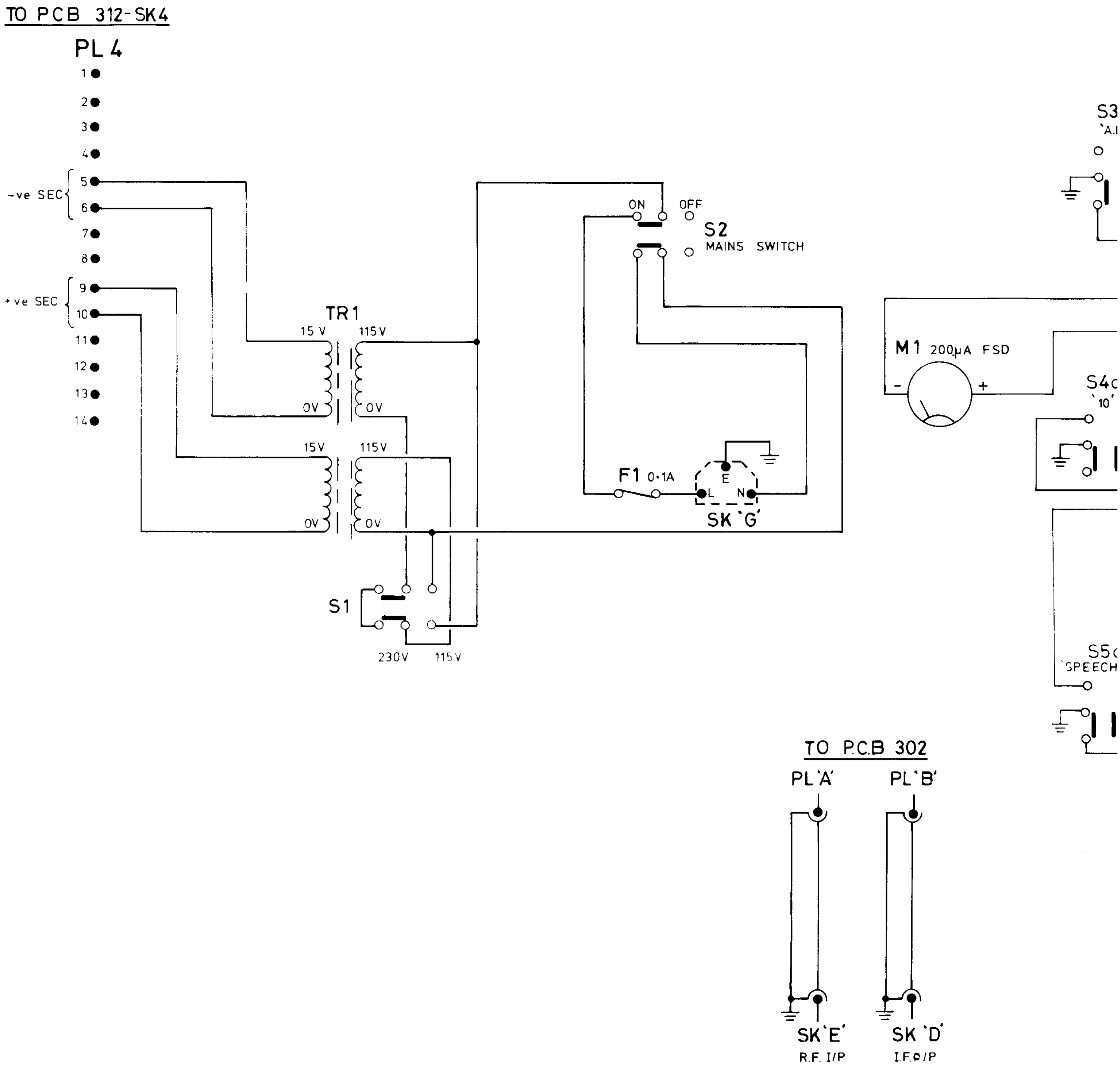
A.F. BOARD – CIRCUIT FIG. 4.3



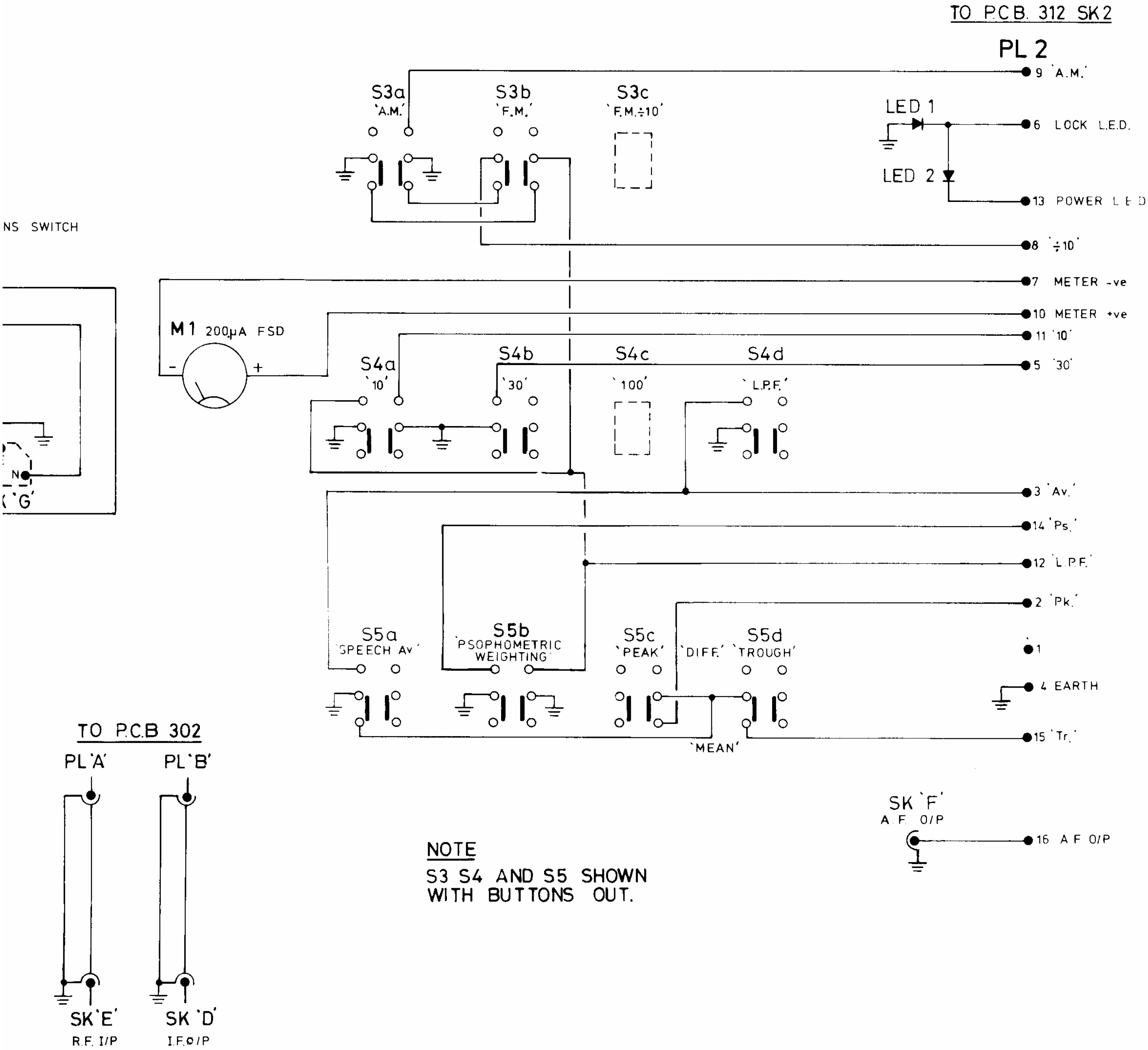
(PL 5 p1) P1
(PL 5 p11) P3
+REG I/P
(PL5 p5) P4
-SEC
(PL5 p10) P5
+SEC
(PL5 p6) P6
-SEC
(PL 5 p9) P7
+SEC
(PL 5 p8) P9
EARTH
(PL5 p4) P2
-REG I/P (+)
(PL5 p7) P8
-12V RAIL
D3 BAV 10
D8 BAV 10
D1 BAV10
D5 BAV 10
D7 1N4148
D6 1N4148
D2 1N4148
D4 1N4148
R6 22K
T4 BC 182B
C3 47µF
D9 BAV10
T3 BC 212B
R4 10K
C1 0·01µF
R1 1K0
T2 BC 212B
R2 1R5
T1 BDX 3
T6 BC 182B
T5 BC 182B
D10 5·1V
R3 5K6 S.O.T.
R5 10K
R18 180K
R19 330
R21 47K
R17 680 S.O.T.
T11 BC 212B
T12 BC 212B
C12 0·01µF
R20 47K
L2
C10 1µF
R23 2K2
R14 470
C8 220µF
D17 BAV10
R15 10K
T14 BC 126
C7 4·7µF
T13 BC182B
T15 BC 126



BATTERY BOARD – CIRCUIT FIG. 4.4

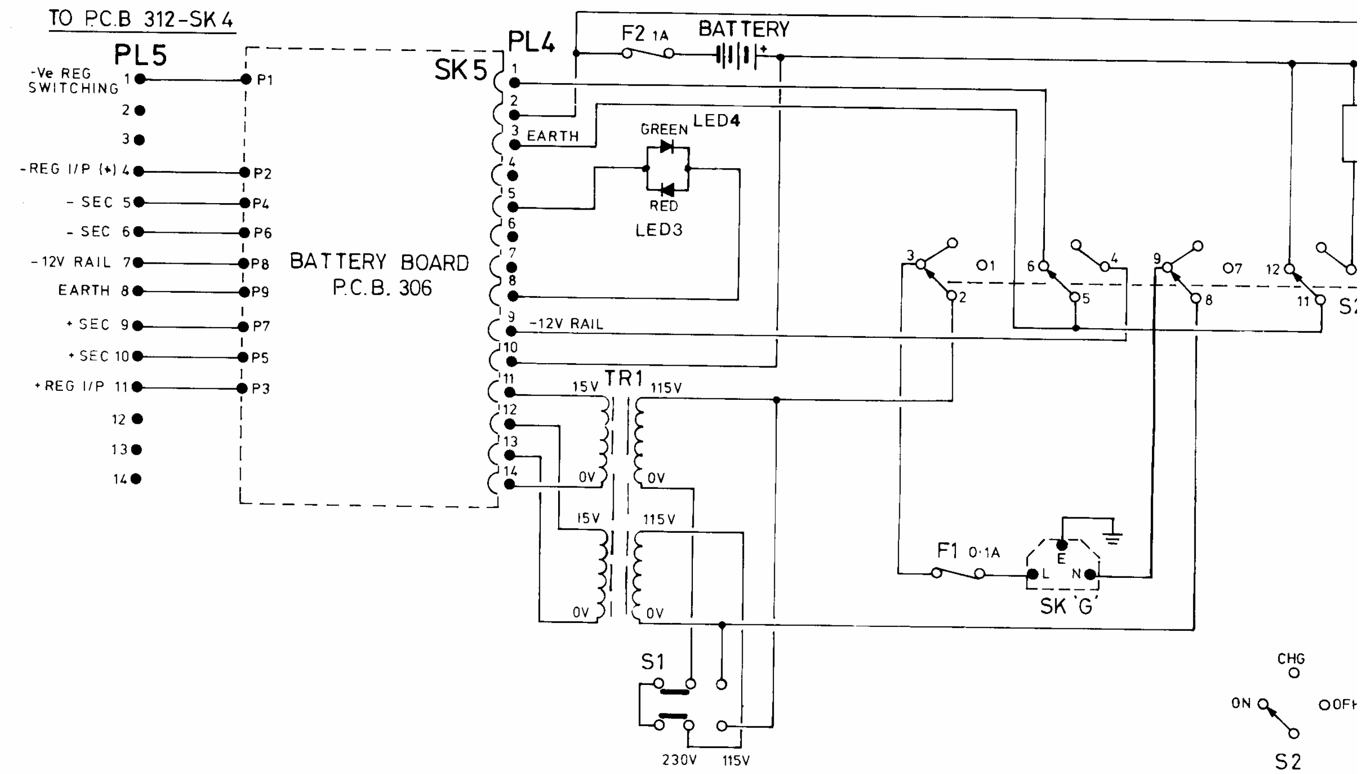


TO P.C.B 312-SK4
PL 4
-ve SEC
+ve SEC
1
2
3
4
5
6
7
8
9
10
11
12
13
14
TR1
15 V
115 V
0V
0V
15V
115V
0V
0V
S1
230V
115V
ON
OFF
S2
MAINS SWITCH
F1 0·1A
E
L
N
SK 'G'
M1 200μA FSD
-
+
S3
S4
'10'
S5
SPEECH
TO P.C.B 302
PL 'A'
PL 'B'
SK 'E'
R.F. I/P
SK 'D'
I.F. O/P

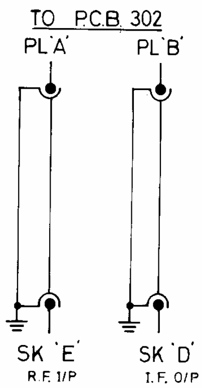


NOTE
S3 S4 AND S5 SHOWN WITH BUTTONS OUT.

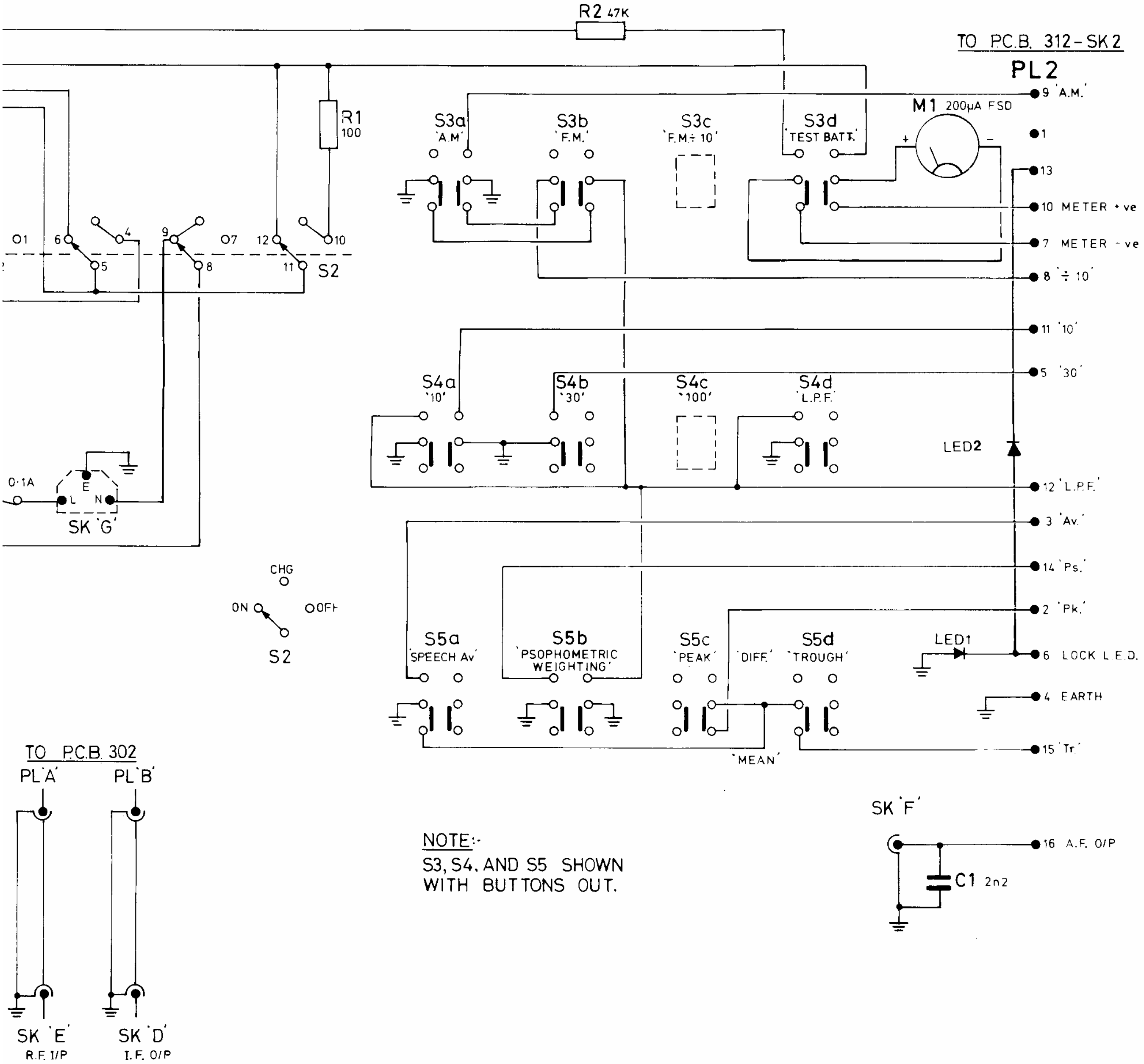
CHASSIS (A.C. ONLY VERSION) – CIRCUIT FIG. 4.5



TO P.C.B 312-SK 4
PL5
-Ve REG SWITCHING 1
2
3
-REG I/P (+) 4
- SEC 5
- SEC 6
-12V RAIL 7
EARTH 8
+ SEC 9
+ SEC 10
+REG I/P 11
12
13
14
P1
P2
P4
P6
P8
P9
P7
P5
P3
BATTERY BOARD
P.C.B. 306
SK5
PL4
EARTH
-12V RAIL
F2 1A
BATTERY
GREEN
LED4
RED
LED3
TR1
15V
115V
0V
S1
230V
115V
F1 0·1A
L
E
N
SK 'G'
CHG
ON
OFF
S2



TO P.C.B. 302
PL'A'
PL'B'
SK 'E'
R.F. I/P
SK 'D'
I.F. O/P



CHASSIS – CIRCUIT **FIG. 4.6**
(A.C./BATTERY VERSION)

5 CALIBRATION

5.1 TEST EQUIPMENT REQUIRED

1. Digital Voltmeter (DVM); at least 10MΩ input impedance.
2. 30MHz Oscilloscope with x10 probe.
3. 10MHz Counter.
4. Generator, 1 - 2GHz (AM/CW)
5. Signal Generator, 1 - 100MHz, AM/FM. Variable modulation frequency, 10Hz - 100kHz. Deviation 0 - 100kHz peak. AM modulation 0 - 100%.
6. AF Level Meter and distortion analyser.
7. Frequency Difference Meter and reference oscillator (Frequency Difference Method) or:
8. Spectrum Analyser (Bessel Zero Method).
9. Ammeter, 0 to 500mA (Battery version only).

5.2 PROCEDURE

NOTE

All meter readings or adjustments must be performed with the instrument in its normal operating attitude (near horizontal and the right way up).

5.2.1 With the instrument not powered, zero the meter (on front of meter). Switch on. Check that the +12V rail on SK4 pin 12 and the -12V rail on SK4 pin 14 are within $\pm$5% and remain stabilised down to 95 or 195V a.c. input.

5.2.2 Select pushbuttons as follows:

FM	in	
100	in	
Peak	out	Mean
Trough	out	
Weighted	out	
Speech	out	
15kHz Filter	in	

Use the signal generator (item 5) to inject a 0dBm r.f. signal (INPUT socket) deviated by 90kHz at a 1kHz rate. Adjust VR4 (RF Board) for a meter reading of 9 on the upper scale.

5.2.3 Press the 30 pushbutton and reduce the test signal deviation to 30kHz. Adjust VR3 (AF Board) for a meter reading of 3 on the lower scale. Switch between "peak" and "trough" modes, if there is a difference, adjust VR5 (AF board) to make the readings equal. Reselect "mean" mode.

5.2.4 Press the 10 pushbutton and reduce the test signal deviation to 10kHz. Adjust VR4 (AF Board) for a meter reading of 10 on the upper scale.

5.2.5 Press the 100 and FM ÷10 pushbuttons. Adjust VR1 (AF Board) for a meter reading of 10 on the upper scale.

5.2.6 Repeat 5.2.2 to 5.2.5 until no further adjustment is necessary.

5.2.7 Filter Checks. Select pushbuttons as follows:

FM	in	
30	in	
Peak	out	Mean
Trough	out	
Weighted	out	
Speech	out	
15kHz Filter	out (60kHz)	

Use the signal generator (item 5) to inject an r.f. signal deviated by 24kHz at a 1kHz rate. Swing the a.f. from 25Hz to 60kHz and check that the reading remains within ±0.5dB e.g. ±2.5 divisions on the upper meter scale (i.e. between 75 and 85). If the reading is out of limit at the upper end, adjust VC1 (AF Board).

5.2.8 Press the 15kHz Filter pushbutton. Swing the a.f. from 25Hz to 15kHz and check that the reading remains within ±2.5 divisions at 1kHz. Reading must fall by more than 2.5 divisions at 20kHz.

5.2.9 Press the 100 and FM ÷10 pushbuttons and inject a test signal deviated by 8kHz at a 1kHz rate. Swing the a.f. from 25Hz to 3.5kHz and check that the reading remains within ±2.5 divisions.

5.2.10 Set the modulation frequency to 800Hz and note the meter reading. With the Weighted button in, check the reading again. Adjust VR2 (AF Board) with Weighted selected so that there is no difference between the two readings.

5.2.11 Connect the AF Level Meter (item 6) to the A.F. OUTPUT socket. Press the Weighted pushbutton and check that the response is within the limits given in Table 5.1.

TABLE 5.1

Psophometric Filter Checks
(C.C.I.T.T. Volume V Recommendation P53)

Frequency (Hz)	Level (dB) Maximum	Nominal	Minimum
50	-61	-63	-65
100	-39	-41	-43
150	-27	-29	-31
200	-19	-21	-23
300	-8.6	-10.6	-12.6
400	-5.3	-6.3	-7.3
500	-2.6	-3.6	-4.6
600	-1.0	-2.0	-3.0
800	+0.1 (+1%)	0	-0.1 (-1%)
1000	+2.0	+1.0	0.0
1200	+1.0	0.0	-1.0
1500	-0.3	-1.3	-2.3
2000	-2.0	-3.0	-4.0
2500	-3.1	-4.1	-5.1
3000	-3.6	-5.6	-7.6
3500	-5.5	-8.5	-11.5
4000	-12	-15	-18
5000	-32	-36	-39

5.2.12 Speech Average. Adjust the modulation for f.s.d. and press the Speech pushbutton. Check that the meter reads between 62 and 66 (64 nominal).

5.2.13 Discriminator. Connect the signal generator, set to 1.5MHz at 0dBm level, to the INPUT socket. Connect the oscilloscope (item 2) using the x10 probe to TP5 (RF Board). Set the oscilloscope to 5V/cm d.c. and increase the signal generator frequency to obtain the first lowest d.c. level on the CRT (2.3MHz approx.).

Remove the oscilloscope probe. Connect counter (item 3) to I.F. OUTPUT socket and record the frequency.

5.2.14 Replace the x10 probe and increase the signal generator frequency until a second low is found (3.2MHz approx.). Again remove the probe and record the frequency at the I.F. output using the counter.

5.2.15 Subtract the counter readings obtained in 5.2.13 and 5.2.14 and divide the difference by 2. Adjust VR2 (RF Board) to alter the i.f. by the amount just calculated so that both the low points produce the same i.f..

5.2.16 Reduce the signal generator frequency to 2MHz, reconnect the oscilloscope to TP5, and then adjust the frequency to find the first highest d.c. level (2.3MHz approx.). Disconnect probe and measure i.f. with counter. Reconnect probe and then look for the second highest d.c. level (3.2MHz approx.).

5.2.17 Calculate the difference between the high readings and divide by 2. Adjust VR1 (RF Board) to alter the i.f. by the amount just calculated so that both the high points produce the same i.f.

5.2.18 If necessary, repeat the settings of 5.2.13 to 5.2.17 four or five times until both upper points are the same and both lower points are the same. The i.f. should then be between 400 and 440kHz with a maximum of 1kHz difference between the two upper points, and between the two lower points; and a maximum of 10kHz between the upper and lower points.

5.2.19 Lock Indicator. Connect the oscilloscope to TP1 (RF Board). Connect the signal generator, set to give 50mV at 3MHz, to the INPUT socket. Reduce output of signal generator until the a.g.c. at TP1 falls. Increase the level slightly until the voltage just rises; this should occur between 1mV and 2mV. Adjust VR6 (RF Board) until the Lock indicator extinguishes and then bring it back slightly so that the indicator just glows. Note that the Lock indicator should come on as the a.g.c. rises.

5.2.20 Set the signal generator to 1MHz and then increase the frequency until the Lock indicator is fully illuminated; this should occur at a frequency of less than 1.5MHz.

5.2.21 Connect the oscilloscope to the junction of R1, R2 (input). Set the signal generator to 3MHz and then increase the signal level until the Lock indicator extinguishes; this should not occur until 2.8V p-p is reached on the oscilloscope. If 2.8V p-p is not reached increase the value of R7 and recheck.

5.2.22 AM Demodulator. Connect the calibrated signal generator* to the INPUT socket and set it to give 90% a.m. at a 1kHz rate. Adjust VR3 (RF Board) for a meter reading of 9 on the upper scale (mean mode still selected).

5.2.23 Tuned Circuit Adjustments. Fit the test lid on the RF Board and connect the signal generator to the INPUT socket, set to give 100kHz deviation at a 1kHz rate. Connect the oscilloscope to the AF OUTPUT socket and set it to 0.1V/cm. Press the AM and 10 pushbuttons. Adjust VR5, L3 and L6 for a minimum reading on the oscilloscope or on the meter. Remove the lid.

5.2.24 Re-check 5.2.22 and 5.2.2 (use accurate 90kHz deviation*), readjust VR4, (RF Board) if necessary. Note that if the RF board was far out of calibration, re-check 5.2.3 to 5.2.12 as well.

5.2.25 Additional Checks. Check according to Table 5.2.

TABLE 5.2

Additional Checks

Monitor Point	Test Item	Input	Notes
TP3	Oscilloscope	1GHz, 70% a.m.	Reading not to differ by more than 0.5 division at both lock points.
A.F. OUTPUT	Distortion Analyser	40MHz, 80% a.m. at 1kHz	Lids fitted to both trays. Check distortion is less than 1%.
A.F. OUTPUT	Distortion Analyser	40MHz, 80kHz f.m. deviation at 1kHz	Check distortion is less than 1%.
A.F. OUTPUT	AC Voltmeter	40MHz, 100% a.m. at 1kHz	Switch off modulation and note that reading drops by approx. 50dB.
A.F. OUTPUT	AC Voltmeter	40MHz, 100kHz deviation at 1kHz	Switch off modulation and note that reading drops by approx. 50dB.
-	-	2GHz c.w.	Increase input level until Lock indicator illuminates. Input level should be 2mV.
-	-	1GHz, c.w.	Press 10 and FM ÷10. Meter reading (residual f.m.) should be less than 200Hz.

* If a calibrated signal generator is not available, refer to Appendix A.

5.3 BATTERY OPTION CHECK

With the unit switched off, remove the fuse (F2) and connect a meter across the fuseholder to measure current. Use the oscilloscope to monitor SK5 pin 8.

5.3.1 Connect the instrument to the a.c. power supply and switch to CHARGE. The oscilloscope waveform should be as shown in fig. 5.1, and the charging current should be approximately 200mA.

5.3.2 Press the BATT TEST pushbutton and check that the meter indicates the battery voltage $\pm 5\%$.

5.3.3 Switch to ON. Check that there is a trickle charge of approx. 4mA.

5.3.4 Remove a.c. power connector and check that unit switches off completely. Switch to OFF and then back to ON again. The instrument should now be operating with the green indicator illuminating on the front panel.

5.3.5 Connect the oscilloscope to the collector of T16 and check that the waveform is as shown in fig. 5.2.

5.3.6 Use the DVM to measure the voltage at P2 (Battery Supply PCB); it should be +3V(-0.25V +1V). Measure the voltage at P3; it should be +15V(-0.25V +1V).

5.3.7 Switch off and refit the battery fuse (F2).

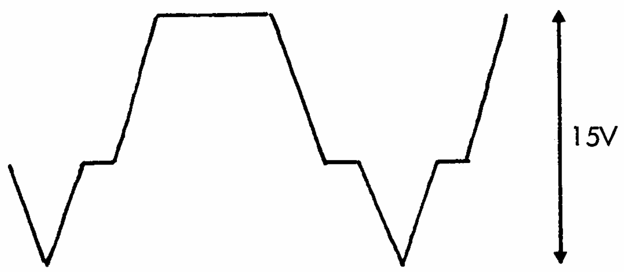


FIG. 5.1 CHARGE WAVEFORM

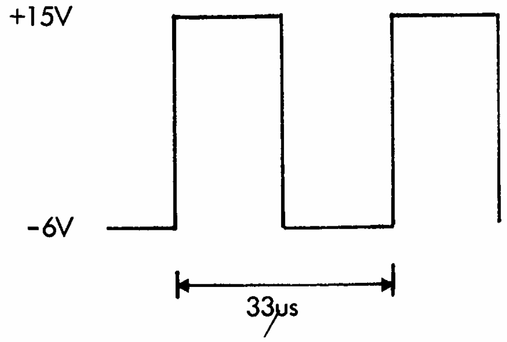


FIG. 5.2 INVERTER WAVEFORM

6 PARTS LIST

6.1 R.F. BOARD 252-202

Ref.	Value	Description	Tol.	Rat.	Manufacturer
Resistors					
R1	100	Carbon film	5	0.33w	Mullard CR25
R2	100	Carbon film	5	0.33w	Mullard CR25
R3	2k2	Carbon film	5	0.33w	Mullard CR25
R4	10k	Carbon film	5	0.33w	Mullard CR25
R5	1k5	Carbon film	5	0.33w	Mullard CR25
R6	100k	Carbon film	5	0.33w	Mullard CR25
R7	22k nom	Carbon film	5	0.33w	Mullard CR25
R8	100k	Carbon film	5	0.33w	Mullard CR25
R9	10k	Carbon film	5	0.33w	Mullard CR25
R10	22k	Carbon film	5	0.33w	Mullard CR25
R11	1k0	Carbon film	5	0.33w	Mullard CR25
R12	8k2	Carbon film	5	0.33w	Mullard CR25
R13	10k	Carbon film	5	0.33w	Mullard CR25
R14	1k8	Carbon film	5	0.33w	Mullard CR25
R15	10k	Carbon film	5	0.33w	Mullard CR25
R16	3k3	Carbon film	5	0.33w	Mullard CR25
R17	6k8	Carbon film	5	0.33w	Mullard CR25
R18	100	Carbon film	5	0.33w	Mullard CR25
R19	22k	Carbon film	5	0.33w	Mullard CR25
R20	560	Carbon film	5	0.33w	Mullard CR25
R21	10k	Carbon film	5	0.33w	Mullard CR25
R22	100	Carbon film	5	0.33w	Mullard CR25
R23	330	Carbon film	5	0.33w	Mullard CR25
R24	3k3	Carbon film	5	0.33w	Mullard CR25
R25	390	Carbon film	5	0.33w	Mullard CR25
R26	33	Carbon film	5	0.33w	Mullard CR25
R27	1k5	Carbon film	5	0.33w	Mullard CR25
R28	1k5	Carbon film	5	0.33w	Mullard CR25
R29	1k0	Carbon film	5	0.33w	Mullard CR25
R30	15k	Carbon film	5	0.33w	Mullard CR25
R32	1k2	Carbon film	5	0.33w	Mullard CR25
R33	100k	Carbon film	5	0.33w	Mullard CR25
R34	4k7	Carbon film	5	0.33w	Mullard CR25
R35	10k	Carbon film	5	0.33w	Mullard CR25
R36	4k7	Carbon film	5	0.33w	Mullard CR25
R37	47k	Carbon film	5	0.33w	Mullard CR25
R38	8k2	Carbon film	5	0.33w	Mullard CR25
R39	10k	Metal film	2	0.4w	Mullard MR25
R40	2k7	Metal film	2	0.4w	Mullard MR25
R41	1k2	Carbon film	5	0.33w	Mullard CR25

6.1 R.F. BOARD 252-202 (Contd.)

Ref.	Value	Description	Tol.	Rat.	Manufacturer
Resistors (Contd.)					
R42	1k2	Metal film	2	0.4w	Mullard MR25
R43	750	Metal film	2	0.4w	Mullard MR25
R44	100k	Carbon film	5	0.33w	Mullard CR25
R45	5k6	Metal film	2	0.4w	Mullard MR25
R46	100k	Carbon film	5	0.33w	Mullard CR25
R47	15k	Carbon film	5	0.33w	Mullard CR25
R48	5k6	Carbon film	5	0.33w	Mullard CR25
R49	22k	Carbon film	5	0.33w	Mullard CR25
R50	22k	Carbon film	5	0.33w	Mullard CR25
R51	4k7	Carbon film	5	0.33w	Mullard CR25
R52	4k7	Carbon film	5	0.33w	Mullard CR25
R53	1k5	Carbon film	5	0.33w	Mullard CR25
R54	1k5	Carbon film	5	0.33w	Mullard CR25
R56	22k	Carbon film	5	0.33w	Mullard CR25
R57	10M	Carbon film	10	0.33w	Mullard CR25
R58	1M0	Carbon film	10	0.33w	Mullard CR25
R59	150k	Carbon film	5	0.33w	Mullard CR25
R60	2M2	Carbon film	10	0.33w	Mullard CR25
R61	100k	Carbon film	5	0.33w	Mullard CR25
R62	10k	Carbon film	5	0.33w	Mullard CR25
R63	100k	Carbon film	5	0.33w	Mullard CR25
R64	47k	Carbon film	5	0.33w	Mullard CR25
R65	2k2	Carbon film	5	0.33w	Mullard CR25
R66	2k2	Carbon film	5	0.33w	Mullard CR25
R67	47k	Carbon film	5	0.33w	Mullard CR25
R68	47k	Carbon film	5	0.33w	Mullard CR25
R69	4k7	Carbon film	5	0.33w	Mullard CR25
R70	4k7	Carbon film	5	0.33w	Mullard CR25
R71	47k	Carbon film	5	0.33w	Mullard CR25
R72	47k	Carbon film	5	0.33w	Mullard CR25
R73	100k	Carbon film	5	0.33w	Mullard CR25
R75	4k7	Carbon film	5	0.33w	Mullard CR25
R76	3k3	Carbon film	5	0.33w	Mullard CR25
R77	4k7	Carbon film	5	0.33w	Mullard CR25
R78	6k8	Carbon film	5	0.33w	Mullard CR25
R79	1k0	Carbon film	5	0.33w	Mullard CR25
R80	680	Carbon film	2	0.33w	Mullard CR25
R81	10k	Carbon film	5	0.33w	Mullard CR25
R82	390	Carbon film	5	0.33w	Mullard CR25
R83	47k	Carbon film	5	0.33w	Mullard CR25
R84	22k	Carbon film	5	0.33w	Mullard CR25
R85	3k3	Carbon film	5	0.33w	Mullard CR25
R86	390	Carbon film	5	0.33w	Mullard CR25

6.1 R.F. BOARD 252-202 (Contd.)

Ref.	Value	Description	Tol.	Rat.	Manufacturer
Resistors (Contd.)					
R87	100k	Carbon film	5	0.33w	Mullard CR25
R88	390k	Carbon film	5	0.33w	Mullard CR25
R89	390k	Carbon film	5	0.33w	Mullard CR25
R90	2M2	Carbon film	10	0.33w	Mullard CR25
R91	22k	Carbon film	5	0.33w	Mullard CR25
R92	390k	Carbon film	5	0.33w	Mullard CR25
R93	1k0	Carbon film	5	0.33w	Mullard CR25
R94	47k	Carbon film	5	0.33w	Mullard CR25
R95	2k2	Carbon film	5	0.33w	Mullard CR25
R96	4k7	Carbon film	5	0.33w	Mullard CR25
R97	5k6	Carbon film	5	0.33w	Mullard CR25
R98	22k	Carbon film	5	0.33w	Mullard CR25
R99	5k6	Carbon film	5	0.33w	Mullard CR25
R100	4k7	Carbon film	5	0.33w	Mullard CR25
R101	1k0	Carbon film	5	0.33w	Mullard CR25
R102	2k2	Carbon film	5	0.33w	Mullard CR25
R103	100	Carbon film	5	0.33w	Mullard CR25
R104	100	Carbon film	5	0.33w	Mullard CR25
R105	680	Carbon film	2	0.33w	Mullard CR25
R106	3k2	Carbon film	5	0.33w	Mullard CR25
R107	180k	Carbon film	5	0.33w	Mullard CR25
R108	100	Carbon film	5	0.33w	Mullard CR25
VR1	220	Preset	20	0.5w	Bourns VA05H
VR2	220	Preset	20	0.5w	Bourns VA05H
VR3	220	Preset	20	0.5w	Bourns VA05H
VR4	2k2	Preset	20	0.5w	Bourns VA05H
VR5	470	Preset	20	0.5w	Bourns VA05H
VR6	2k2	Preset	20	0.5w	Bourns VA05H
Capacitors					
C1	0.01	Disc	20	50V	
C2	1p8	Plate	0.25p	100V	Mullard 632
C3	2p7	Plate	0.25p	100V	Mullard 632
C4	0.01	Disc	20	50V	
C5	22p	Polystyrene	5	160V	Siemens B31110
C6	33p	Polystyrene	5	160V	Siemens B31110
C7	33p	Polystyrene	5	160V	Siemens B31110
C8	0.01	Disc	20	50V	
C9	0.01	Disc	20	50V	
C10	0.01	Disc	20	50V	
C11	0.01	Disc	20	50V	

6.1 R.F. BOARD 252-202 (Contd.)

Ref.	Value	Description	Tol.	Rat.	Manufacturer
Capacitors (Contd.)					
C12	1.0	Tantalum	20	35V	
C13	0.047	Polyester	5	250V	Siemens B32560
C14	2p7	Plate	0.25p	100V	Mullard 632
C15	10	Tantalum	20	25V	
C16	470p	Polystyrene	2	160V	Siemens B31110
C17	1.0	Tantalum	20	35V	
C18	180p	Polystyrene	2	160V	Siemens B31110
C19	180p	Polystyrene	2	160V	Siemens B31110
C20	0.01	Disc	20	50V	
C21	0.047	Polyester	5	250V	Siemens B32560
C22	47	Tantalum	20	10V	
C23	0.01	Disc	20	50V	
C24	0.01	Disc	20	50V	
C25	150p	Polystyrene	2	160V	Siemens B31110
C26	47	Tantalum	20	6.3V	
C27	0.01	Ceramic Disc	20	50V	
C28	22	Tantalum	20	16V	
C29	820p	Plate	10	100V	Mullard 630
C30	0.047	Polyester	5	250V	Siemens B32560
C31	0.047	Polyester	5	250V	Siemens B32560
C32	0.047	Polyester	5	250V	Siemens B32560
C33	330p	Polystyrene	2	160V	Siemens B31110
C34	22	Tantalum	20	16V	
C35	1.0	Tantalum	20	35V	
C36	0.01	Cer. Disc	20	50V	
C37	1	Tantalum	20	35V	
C38	0.047	Polyester	5	250V	Siemens B32560
C39	0.047	Polyester	5	250V	Siemens B32560
C40	0.047	Polyester	5	250V	Siemens B32560
C41	0.01	Disc	20	50V	
C42	1	Tantalum	20	35V	
C43	0.01	Disc	20	50V	
C44	0.01	Disc	20	50V	
C45	10	Tantalum	20	25V	
C46	22	Tantalum	2	16V	
C47	100p	Polystyrene	2	160V	Siemens B31110
C48	100p	Polystyrene	2	160V	Siemens B31110
C49	100p	Polystyrene	2	160V	Siemens B31110
C50	100p	Polystyrene	2	160V	Siemens B31110
C51	0.01	Disc	20	50V	
C52	470p	Plate	10	100V	Mullard 630
C53	0.01	Disc	20	50V	
C54	1	Tantalum	20	35V	

6.1 R.F. BOARD 252-202 (Contd.)

Ref.	Value	Description	Tol.	Rat.	Manufacturer
Capacitors (Contd.)					
C55	10	Tantalum	20	25V	
C56	22	Tantalum	20	16V	
C57	0.01	Disc	20	50V	
C58	10	Tantalum	20	25V	
C59	1	Tantalum	20	35V	
C60	1	Tantalum	20	35V	
Diodes					
D1	100p	Varactor diode			Motorola MV2308
D2	100p	Varactor diode			Motorola MV2308
D3		Step. Rec. diode			H.P.5082-0180
D4		Schottky diode			H.P.5082-2811
D5		Schottky diode			H.P.5082-2811
D6		Schottky diode			H.P.5082-2811
D7		Schottky diode			H.P.5082-2811
D8		1N4148			I.T.T.
D9		1N4148			I.T.T.
D10		1N4148			I.T.T.
D11		1N4148			I.T.T.
D12		1N4148			I.T.T.
D13		1N4148			I.T.T.
D14		1N4148			I.T.T.
D15		1N4148			I.T.T.
D16		1N4148			I.T.T.
D17		1N4148			I.T.T.
D18		1N4148			I.T.T.
D19		1N4148			I.T.T.
D20		1N4148			I.T.T.
D21		1N4148			I.T.T.
D24		1N4148			I.T.T.
D25		1N4148			I.T.T.
D26		1N4148			I.T.T.
D27		1N4148			I.T.T.
D28		1N4148			I.T.T.
D29		1N4148			I.T.T.
D30		1N4148			I.T.T.
D31		1N4148			I.T.T.
D32		1N4148			I.T.T.
D33		1N4148			I.T.T.

6.1 R.F. BOARD 252-202 (Contd.)

Ref.	Value	Description	Tol.	Rat.	Manufacturer
Transistors					
T1		2N3823E F.E.T.			
T2		U1897 F.E.T.			
T3		2N3823E F.E.T.			
T4		BC182B			
T5		BC182B			
T6		BC212B			
T7		BC212B			
T8		BC182B			
T9		BC182B			
T10		BC182B			
T11		BC212B			
T12		BC212B			
T13		BC182B			
T14		BC182B			
T15		BC212B			
T17		BC182B			
T18		BC182B			
T19		BC182B			
T20		BC182B			
T21		BC212B			
T22		BC212B			
T23		BC212B			
T25		BC182B			
T26		BC182B			
T27		BC212B			
T28		BC182B			
T29		BC182B			
T30		BC212B			
T31		BC182B			
T32		BC182B			
T41		BC212B			
T42		BC182B			
T43		BC182B			
T44		BC182B			
T45		BC182B			
T46		BC182B			
T47		BC182B			
T48		BC182B			
T49		BC212B			
T50		BC182B			
T51		BC182B			
T52		BC182B			
T53		BC182B			
T54		BC182B			

6.1 R.F. BOARD 252-202 (Contd.)

Ref.	Value	Description	Tol.	Rat.	Manufacturer
Transistors (Contd.)					
T55		BC182B			
T56		BC182B			
T57		BC182B			
T58		BC182B			
T59		BC182B			
T60		BC182B			
T61		BC182B			
T62		BC212B			
T63		2N3823E F.E.T.			
T64		BC182B			
T65		BC182B			
T66		BC212B			
T67		2N2369A			
T68		2N3866			
Miscellaneous					
L1		Balun			Sayrosa 252-606
L2	220µH	Choke. R.F.	10		Plessey C12
L3		Transformer, I.F.			Sayrosa 252-607
L4	1000µH	Choke. R.F.	10		Plessey C12
L5	1000µH	Choke. R.F.	10		Plessey C12
L6		Transformer, I.F.			Sayrosa 252-607
L7		Coil, OSC			Sayrosa 252-608
L8		Choke. R.F.			Sayrosa 252-609
L9	10nH	Coil, printed			On P.C.B.
L10		Choke, bifilar			Sayrosa 252-601
L11		Choke. R.F.			Sayrosa 252-610
L12		Choke. R.F.			Sayrosa 252-611
IC1		Int. Circuit			T.I. SN7472N
SKA		Socket, S.M.B.			Suhner 82-SMB-50-0-1
SKB		Socket, S.M.B.			Suhner 82-SMB-50-0-1
SK1		Socket, 14 D.I.L.			Symec A14TGK

6.2 A.F. BOARD (252-212)

Ref.	Value	Description	Tol.	Rating	Manufacturer Type No.
Resistors					
R1	100k	Carbon film	5	0.33	Mullard CR25
R2	100k	Carbon film	5	0.33	Mullard CR25
R3	100k	Carbon film	5	0.33	Mullard CR25
R4	100k	Carbon film	5	0.33	Mullard CR25
R5	100k	Carbon film	5	0.33	Mullard CR25
R6	100k	Carbon film	5	0.33	Mullard CR25
R7	100k	Carbon film	5	0.33	Mullard CR25
R8	100k	Carbon film	5	0.33	Mullard CR25
R9	100k	Carbon film	5	0.33	Mullard CR25
R10	100k	Carbon film	5	0.33	Mullard CR25
R11	100k	Carbon film	5	0.33	Mullard CR25
R12	100k	Carbon film	5	0.33	Mullard CR25
R13	100k	Carbon film	5	0.33	Mullard CR25
R14	100k	Carbon film	5	0.33	Mullard CR25
R31	10k	Carbon film	5	0.33	Mullard CR25
R32	1M	Carbon film	5	0.33	Mullard CR25
R33	4k7	Carbon film	5	0.33	Mullard CR25
R34	27k	Carbon film	5	0.33	Mullard CR25
R35	10k	Carbon film	5	0.33	Mullard CR25
R36	330k	Carbon film	5	0.33	Mullard CR25
R37	47k	Metal film	2	0.4	Mullard MR25
R38	47k	Metal film	2	0.4	Mullard MR25
R39	1M	Carbon film	5	0.33	Mullard CR25
R40	4k7	Carbon film	5	0.33	Mullard CR25
R41	10k	Carbon film	5	0.33	Mullard CR25
R42	100k		1	0.25	NEOHM RGP027
R43	100k		1	0.25	NEOHM RGP027
R44	100k		1	0.25	NEOHM RGP027
R45	100k		1	0.25	NEOHM RGP027
R46	4k7	Carbon film	5	0.33	Mullard CR25
R47	4k7	Carbon film	5	0.33	Mullard CR25
R48	20k	Metal film	2	0.4	Mullard MR25
R49	1k2	Carbon film	5	0.33	Mullard CR25
R50	1k2	Carbon film	5	0.33	Mullard CR25
R51	8k2	Metal film	2	0.4	Mullard MR25
R53	8k2	Metal film	2	0.4	Mullard MR25
R55	8k2	Metal film	2	0.4	Mullard MR25
R56	8k2	Metal film	2	0.4	Mullard MR25
R57	1M	Carbon film	5	0.33	Mullard CR25
R58	6k8	Carbon film	5	0.33	Mullard CR25
R59	270k	Carbon film	5	0.33	Mullard CR25
R60	100k	Carbon film	5	0.33	Mullard CR25
R61	100k	Metal film	2	0.4	Mullard MR25
R62	100k	Metal film	2	0.4	Mullard MR25

6.2 A.F. BOARD (252-212) (Contd.)

Ref.	Value	Description	Tol.	Rating	Manufacturer Type No.
Resistors (Contd.)					
R63	33k	Metal film	2	0.4	Mullard MR25
R64	100k				
R65	100k	Metal film	2	0.4	Mullard MR25
R66	10k	Metal film	2	0.4	Mullard MR25
R67	10k	Metal film	2	0.4	Mullard MR25
R68	10k	Metal film	2	0.4	Mullard MR25
R69	3k9	Metal film	2	0.4	Mullard MR25
R70	47k	Metal film	2	0.4	Mullard MR25
R71	47k	Metal film	2	0.4	Mullard MR25
R72	47k	Metal film	2	0.4	Mullard MR25
R73	6k8	Carbon film	5	0.33	Mullard CR25
R74	100k	Carbon film	5	0.33	Mullard CR25
R75	27k	Carbon film	5	0.33	Mullard CR25
R76	270k	Carbon film	5	0.33	Mullard CR25
R77	10k	Metal film	2	0.4	Mullard MR25
R78	10k	Metal film	2	0.4	Mullard MR25
R79	180k	Metal film	5	0.4	Mullard MR25
R80	390k	Carbon film	5	0.33	Mullard CR25
R81	270k	Carbon film	5	0.33	Mullard CR25
R82	10k	Metal film	2	0.4	Mullard MR25
R83	47k	Metal film	2	0.4	Mullard MR25
R84	10k	Carbon film	5	0.33	Mullard CR25
R85	1k	Carbon film	5	0.33	Mullard CR25
VR1	47k	Preset			Bourns VA05H
VR2	10k	Preset			Bourns VA05H
VR3	22k	Preset			Bourns VA05H
VR4	4k7	Preset			Bourns VA05H
VR5	1M	Preset			Bourns VA05H
Capacitors					
C1	1	Tantalum		35V	
C2	1	Tantalum		35V	
C3	1	Tantalum		35V	
C4	22	Tantalum		16V	
C5	0.047	Polyester	5	250V	Siemens B32560
C6	620p		2.5	160V	Siemens B31110
C7	0.047	Polyester		250V	Siemens B32560
C8	620p		2.5	160V or 25V	Siemens B31110
C9	1200p		2.5	160V	Siemens B31310
C10	100p	Plate	2	100V	Mullard 632

6.2 A.F. BOARD (252-212) (Contd.)

Ref.	Value	Description	Tol.	Rating	Manufacturer Type No.
Capacitors (Contd.)					
C11	1000p	Polystyrene	2.5	160V or 25V	Siemens B31310
C12	1800p	Polystyrene	2.5	160V	Siemens B31310
C13	150p	Plate	2	100V	Mullard 632
C14	2700p	Polystyrene	2.5	160V	Siemens B31310
C15	56p	Plate	2	100V	Mullard 632
C16	0.1	Polyester	5	100V	Siemens B32560
C17					
C18	0.1	Polyester	5	250V	Siemens B32560
C19					
C20					
C21					
C22	22	Tantalum		16V	
C23	22	Tantalum		16V	
C24	22	Tantalum		16V	
C25	10	Tantalum		25V	
C26	470	Electrolytic		40V	Siemens B41010
C27	0.01	Disc		50V	
C28	10	Tantalum		25V	
C29	470	Electrolytic		40V	Siemens
C30	0.01	Disc		50V	
C31	1500p	Polystyrene	2.5	160V	Siemens B31310
C32	18p	Plate	2	100V	Mullard 632
C33	1200p	Polystyrene	2.5	160V	Siemens B31310
C34	4700p	Polyester	10	250V	Siemens B32560
C35	100p	Plate	2	100V	Mullard 632
C36	0.047	Polyester	5	250V	Siemens B32560
C37	0.047	Polyester	5	250V	Siemens B32560
C38	0.22	Polyester	5	250V	Siemens B32560
C39	10	Tantalum		25V	
Diodes					
D1		1N4148			I.T.T.
D2		1N4148			I.T.T.
D3		1N4148			I.T.T.
D4		1N4148			I.T.T.
D5		1N4148			I.T.T.
D6		1N4148			I.T.T.
D7		1N4148			I.T.T.

6.2 A.F. BOARD (252-212)(Contd.)

Ref.	Value	Description	Tol.	Rating	Manufacturer Type No.
Diodes (Contd.)					
D8		1N4148			I.T.T.
D9		Rectifier Bridge		1.5A @ 50V	G.I. KBP005
D10		Rectifier Bridge		1.5A @ 50V	G.I. KBP005
D11		1N4148			I.T.T.
Integrated Circuits					
IC1		Analogue Switch			Motorola MC14053
IC2		Analogue Switch			Motorola MC14053
IC3		Analogue Switch			Motorola MC14053
IC4		Analogue Switch			Motorola MC14053
IC5		Quad. Op. Amp.			Texas TL084CN
IC6		Quad. Op. Amp.			Texas TL084CN
IC7		Quad. Op. Amp.			Texas TL084CN
IC8		Quad. Op. Amp.			Texas TL084CN
IC9		Quad. Op. Amp.			Texas TL084CN
IC10		Hex Inverter			Motorola MC14049
IC11		Quad NAND Gates			Motorola MC14011
Miscellaneous					
REG1		Voltage Regulator			National LM78L05ACZ
REG2		Voltage Regulator			National LM78L12ACH
REG3		Voltage Regulator			National LM78L12ACH
VC1	2-22p	Trimmer Capacitor		100V	Mullard 808-11229
L1		Choke			
SK1		D.I.L. Socket, 14pin			SYMEC A14 TGK
SK2		D.I.L. Socket, 16pin			SYMEC A16 TGK
SK4		D.I.L. Socket, 14pin			SYMEC A14 TGK

6.3 BATTERY BOARD 252-213

Ref.	Value	Description	Tol.	Rating	Manufacturer
Resistors					
R1	1k0	Carbon film	5	0.33w	Mullard CR25
R2	1R5	Carbon film	5	0.5w	Mullard CR37
R3	5k6 nom	Carbon film	5	0.33w	Mullard CR25
R4	10k	Carbon film	5	0.33w	Mullard CR25
R5	10k	Carbon film	5	0.33w	Mullard CR25
R6	22k	Carbon film	5	0.33w	Mullard CR25
R14	470	Carbon film	5	0.33w	Mullard CR25
R15	10k	Carbon film	5	0.33w	Mullard CR25
R16	22	Carbon film	5	0.33w	Mullard CR25
R17	680 nom	Carbon film	5	0.33w	Mullard CR25 S.O.T.
R18	180k	Carbon film	5	0.33w	Mullard CR25
R19	330	Carbon film	5	0.33w	Mullard CR25
R20	47k	Carbon film	5	0.33w	Mullard CR25
R21	47k	Carbon film	5	0.33w	Mullard CR25
R22	2k2	Carbon film	5	0.33w	Mullard CR25
R23	2k2	Carbon film	5	0.33w	Mullard CR25
R24	10k	Carbon film	5	0.33	Mullard CR25
Capacitors					
C1	0.01	Disc		50V	
C3	47	Electrolytic		40V	
C4	1	Tantalum		35V	
C5	47	Electrolytic		40V	
C6	0.01	Disc		50V	
C7	4.7	Tantalum		16V	
C8	220	Electrolytic		16V	
C9	47	Electrolytic		40V	
C10	1	Tantalum		35V	
C11	1	Tantalum		35V	
C12	0.01	Disc		50V	
Diodes					
D1		BAV10			Mullard
D2		1N4148			Mullard
D3		BAV10			Mullard
D4		1N4148			Mullard
D5		BAV10			Mullard
D6		1N4148			Mullard
D7		1N4148			Mullard
D8		BAV10			Mullard
D9		1N4148			Mullard
D10		Zener BZY88-C5V1		5.1V	Mullard

6.3 BATTERY BOARD 252-213 (Contd.)

Ref.	Value	Description	Tol.	Rating	Manufacturer
Diodes (Contd.)					
D13		BAV10			Mullard
D14		BAV10			Mullard
D15		BAV10			Mullard
D16		1N4148			Mullard
D17		BAV10			Mullard
Transistors					
T1		BDX35			
T2		BC212B			
T3		BC212B			
T4		BC182B			
T5		BC182B			
T6		BC182B			
T11		BC212B			
T12		BC212B			
T13		BC182B			
T14		BC126			
T15		BC126			
T16		BDX35			
Miscellaneous					
L1		Transformer			Sayrosa 252-602
L2		Transformer			Sayrosa 252-603
L3		R.F. Choke			Sayrosa 252-604
L4		R.F. Choke			Sayrosa 252-604
SK5		Socket, 14p. D.I.L.			Symec
PL5		Plug, 14p. D.I.L.			Symec

6.4 CHASSIS CIRCUIT 252-214 (AC Only)

Ref.	Value	Description	Tol.	Rating	Manufacturer
LED1		LED red			Monsanto MV5023
LED2		LED red			Monsanto MV5023
TR1		Transformer			Sayrosa 252-605
M1	200µA	Meter			Sifam 38
S1		Switch, 115V/230			Switchcraft 46206
S2		Switch, power			Sifam MTA206N
S3		Switch, mode			ALPS
S4		Switch, range			ALPS
S5		Switch, function			ALPS
F1	0.1A	Fuse, a.c.			
		Fuseholder for F1			Bulgin F296/1
PLA		Plug			Radiall 114186
PLB		Plug			Radiall 114186
PL2		Plug, 16p D.I.L.			Symec A16P
PL4		Plug, 14p D.I.L.			Symec A14P
SKD		Socket, BNC, IF OUTPUT			Suhner 22BNC
SKE		Socket, BNC, INPUT			Suhner 25BNC
SKF		Socket, BNC, AF OUTPUT			Suhner 25BNC
SKG		Socket, I.E.C., power			Bulgin P580

6.5 CHASSIS CIRCUIT 252-215 (AC/Battery)

Ref.		Description	Tol.	Rating	Manufacturer
R1	100	Resistor, carbon film	5	0.33w	Mullard CR25
R2	47k	Resistor, carbon film	5	0.33w	Mullard CR25
LED1		LED Red			Monsanto MV5023
LED2		LED Red			Monsanto MV5023
LED3		LED Red			Monsanto
LED4		LED Green			Monsanto
TR1		Transformer			Ripley 252-605
M1	200μA	Meter			Sifam 38
S1		Switch, 115/230V			Switchcraft 46206
S2		Switch, power, 4 pole double-throw			APEM 5664A
S3		Switch, mode			ALPS
S4		Switch, range			ALPS
S5		Switch, function			ALPS
		Fuseholder, mains			Bulgin F296/1
F1		0.1A Fuse, a.c.			
		Fuseholder, battery			RS412-661
F2	1A	Fuse, battery			
BT1	6V @2.6AH	Battery			YUASA MPA 6-6
PLA		Plug, 90SMB			Radiall 114186
PLB		Plug, 90SMB			Radiall 114186
PL2		Plug, 16p DIL			Symec A16p
PL4		Plug, 14p DIL			Symec A14p
SKD		Socket, BNC			Suhner 22BNC
SKE		Socket, BNC			Suhner 25BNC
SKF		Socket, BNC			Suhner 25BNC
SKG		Socket, I.E.C. Power			Bulgin P580

APPENDIX A

If an accurately calibrated standard signal generator is not available, the following procedures should be used.

AM CALIBRATION

The most accurate method of AM calibration is to set up 100% AM at 1kHz rate on the RF source by using the oscilloscope to set the AM trough to exactly zero. This setting is not dependent on the 'scope linearity. Note that it is valid to perform this setting operation by observing the IF output (420kHz). Set the AM Cal. Pot. (VR3 on RF Board 252-302) for 100% AM reading (Mean). If the modulation on the RF source is linear there will be no significant difference between Peak and Trough (less than .5%).

Modulation depths of less than 100% may be used for calibration, but achieving an accurately known depth of AM is more prone to error.

FM CALIBRATION

Setting up a known FM deviation on the RF source may be achieved in several ways. Two convenient methods are as follows:

'Bessel Zero' Method. This method involves the use of a selective receiver (preferably a spectrum analyser) to observe the nulling of the carrier or sidebands that occurs at known ratios of Peak deviation to Modulation rate.

Suggested conditions are: Set the mod. rate to exactly 1kHz (± 1Hz). Observe the level of the carrier frequency with the deviation at zero; Increase deviation until the third null of the carrier is reached, and set the deviation to achieve a carrier null of 50dB or better. This setting corresponds to a deviation of 8.65kHz. Set the FM Cal. Pot. (VR4 on RF Board 252-302) to this reading on the 10kHz range, with Mean selected.

Note that it is valid to observe the I.F. spectrum as well as the RF spectrum.

Frequency Difference Method. Connect the RF source and a reference oscillator of the same nominal carrier frequency to the inputs of the Frequency Difference Meter. With the deviation at zero, tune the reference oscillator for minimum reading on the meter (no greater than a few kHz). With a 1kHz mod. rate, increase deviation, which will cause the difference reading to rise. The difference reading corresponds to the average frequency deviation, and for sinusoidal modulation is related to the peak deviation by a factor of $\pi/2 = 1/.636$. Hence a frequency difference of 63.6kHz corresponds to a peak deviation of 100kHz. The calibrated RF source is now applied to the 252 and the FM Cal. Pot. adjusted for correct reading on the appropriate range.

Note: An FDM may be substituted by a frequency counter driven from the (filtered) output of a mixer, the RF source and reference being connected to the mixer inputs.