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DY MME 031

TECHNICAL HANDBOOK

A. M. - F. M.

MODULATION METER

TYPE 1785

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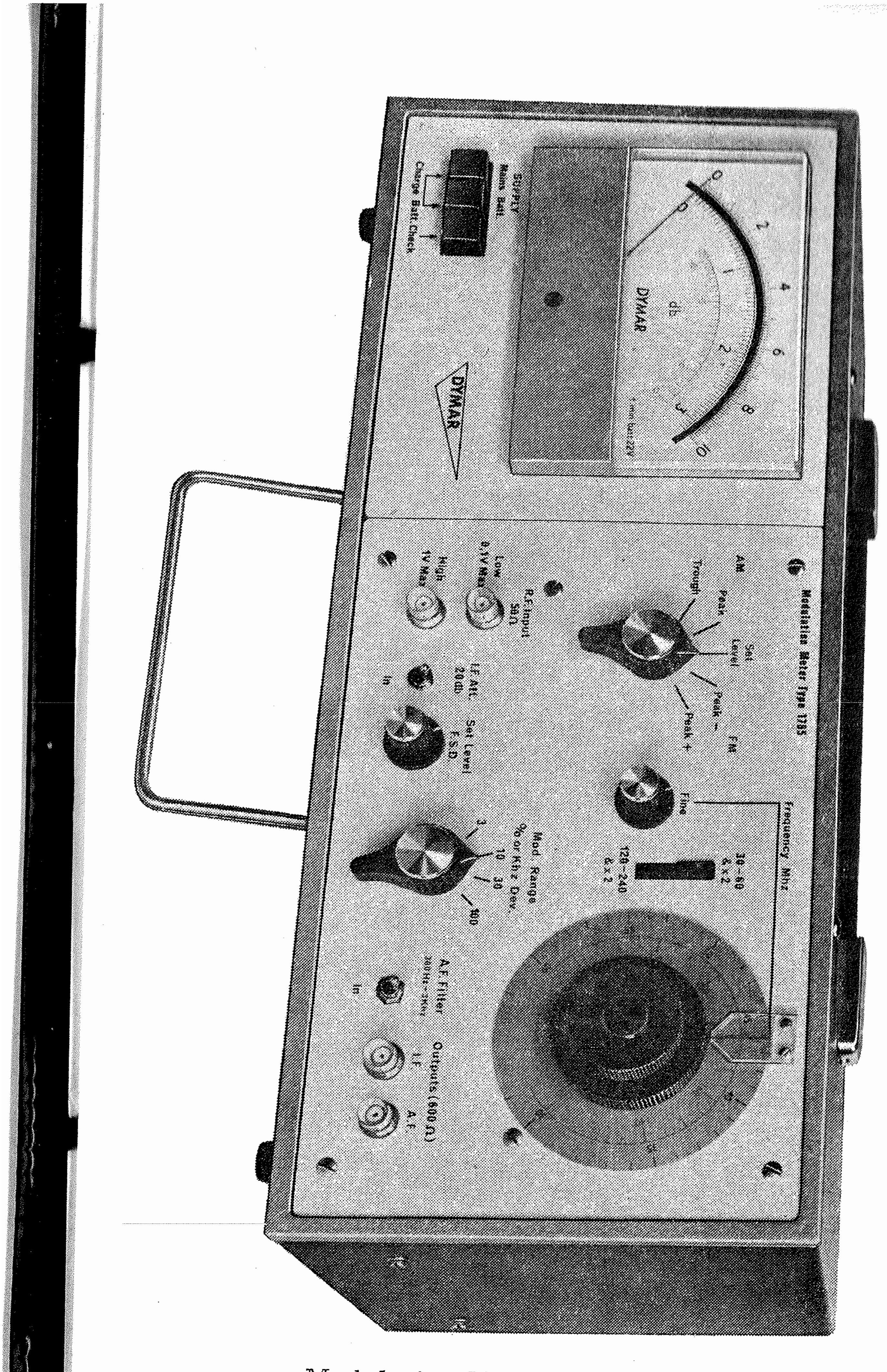


Modulation Meter Type 1785

1. GENERAL DESCRIPTION.

The Dymar AM/FM Modulation Meter Type 1785 is an all solid state instrument for the measurement of depth of modulation or frequency deviation of transmitters. It is operated either from A.C. Mains or from its own rechargeable battery and as much is equally suitable as a laboratory instrument or as a portable field servicing equipment.

The frequency range covered is the whole of the V.H.F. band and extends into the U.H.F. band to include the mobile band of 470 MHz. The sensitivity over the whole of this range is better than 2.5 mV in 50 ohm (-40 dm) which permits loose coupling to the transmitter under test.

The instrument is specifically designed for measurement of narrow deviation transmitters in todays mobile and portable radiotelephones, the most sensitive deviation being 3 kHz. The local oscillator has low residual F.M. noise of typically 44 db below 3 kHz.

Auxiliary outputs are provided both at the Intermediate Frequency (500 kHz) for viewing the modulation envelope and at Audio Frequency for measurement of distortion.

2. SPECIFICATION

Frequency Range:	30 MHz to 480 MHz in Range 1 - 30 MHz to 60 MHz fundamental mixing 60 MHz to 120 MHz 2nd harmonic mixing. Range 2 - 120 MHz to 240 MHz fundamental mixing 240 MHz to 480 MHz 2nd harmonic mixing.
R.F. Sensitivity:	2.5 mV to 1 Volt into 50 ohm.
A.M. Depth:	4 ranges of both peak or trough percentage modulation from 3% fsd to 100%.
F.M. Deviation:	4 ranges of both positive and negative deviation from 3 kHz fsd to 100 kHz.
Modulation Accuracy:	5% for modulating frequencies between 100 Hz and 10 kHz.
A.F. Bandwidth:	30 Hz to 100 Hz and 10 kHz to 15 kHz within 0.5 db relative to 1 kHz.
A.F. Filter:	Switchable A.F. Filter giving 3 db bandwidth of 300 Hz to 3 kHz for low noise measurements.

Residual F.M. Noise:	32 db below 3 kHz for full A.F. bandwidth. 44 db below 3 kHz with A.F. Filter in.
External Power Supply:	190 - 260 Volts 95 - 130 Volts 50 - 60 Hz or 22 - 32 Volts DC at 75 mA.
Internal Battery:	24 Volt nominal Nickel Cadmium rechargeable battery of 400 mAh capacity giving a typical operating time of 5 hours between recharging. Batteries are recharged, in situ, by means of an internal charging circuit, in 14 hours from a fully discharged condition (22 Volts).
Meter:	Precision 5 inch movement with mirror backed scale calibrated 0 - 10, 0 - 3 and a db scale of -12 to +2db for relative measurements. A "Check Battery" push button connects meter across battery to read voltage directly.
Dimensions and Weight:	see below

Width	Height	Depth	Weight
$16\frac{1}{2}$"	$6\frac{1}{2}$"	8"	15 lbs.
42 cm	16.5cm	20 cm	6.7kg

Accessories:	Rack Mounting Adaptor Kit Type 1801. Protective Front Panel Cover Type 1802.

3. OPERATION.

3.1 Power Supply

The instrument as despatched from the factory is normally set for 230 V operation and no further tap changes or adjustments are necessary provided the mains voltage is between 190 and 260 Volts A.C. If the mains voltage is in the range 95 to 130 Volts A.C. then the primary windings on the transformer have to be connected in parallel and not in series. In order to do this remove the cover from the instrument and make the following adjustments on the power supply board which is situated behind the meter. Remove the link which connects the two pins marked 230 V and substitute it with two links across pins marked 115 V. Also replace the 150 mA fuse with an equivalent type but rated for 300 mA.

To operate the instrument from the mains supply push the red button marked "Mains" which will then light up.

To operate the instrument from its own internal battery, first check the battery voltage by depressing the green button when a reading of not less than 22 Volt on the 30 Volt scale should be obtained, and then push in the blue button only. This button does not light up in the interest of conserving battery drain but the instrument is nevertheless operational. If the battery voltage is less than 22 Volts the batteries need recharging. This is done by depressing both red and blue buttons, when the instrument is operational from the mains and charging its own batteries simultaneously. A discharged battery of 22 Volts or less will take 14 hours of charging to obtain its full charge.

To operate the instrument from an external battery connect it to the two sockets at the back and push the slider switch to "External battery" and then proceed as before. The battery should have a nominal voltage of 24 Volts and the instrument will operate satisfactorily between 22 and 32 Volts D.C.

3.2 Tuning Procedure

Set the function switch to "Set Level" and connect the R.F. signal to Input Socket marked "High". Warning: An input level of more than 1 Volt will give inaccurate readings, and since the impedance is 50 ohm, input levels of more than 5 Volts (0.5 Watts) will permanently damage the instrument. D.C. voltages in excess of 5 Volts should also not be applied to the input.

Select the appropriate oscillator range. Range 1 covers 30 - 60 MHz by second harmonic mixing. Therefore if the signal to be measured is 88 MHz the oscillator should be set to 44 MHz. Similarly Range 2 covers 120 to 240 MHz directly and 240 to 480 MHz through harmonic mixing.

Set the sensitivity of the instrument to maximum by switching out the 20 db I.F. Attenuator and turning the "Set Level" control clockwise. Adjust the main tuning control for a dial setting of input signal frequency ± 500 kHz.

NOTE: The dial is calibrated for the local oscillator frequency and a response can be obtained by setting it 500 kHz above or 500 kHz below the input frequency. However the sense of the deviation in F.M. as indicated by the positions "Peak +" and "Peak -" is only correct when the oscillator is tuned 500 kHz below the signal frequency.

Adjust the tuning controls to get a peaked reading and using the "I.F. Attenuator" and "Set Level" controls set the reading for full scale deflection (F.S.D.) If F.S.D. cannot be obtained connect the signal through the "Low - 0.1 Max." input socket.

When tuning on Range 2 the "Fine" tuning control can be used to get accurate peaking and level setting.

3.3 Modulation Measurements

Tune the instrument as indicated in para. 3.2.

For A.M. measurements set the "Mod. Range" switch to 100% and the main function switch to either "Peak" or "Trough" to get the % of modulation. If this is less than $\frac{1}{3}$ of full scale, a more sensitive range, e.g. 30% f.s.d. can be selected.

For F.M. measurements set the function switch to "Peak -" or "Peak +" as required and again use the modulation range switch which now shows the peak deviation in kHz to get optimum reading.

NOTE: A large deflection on the meter occurs when the function control is set to the F.M. peak positions but the instrument is off tune or no carrier is applied. This is normal, it will not damage the meter, and its cause is the lack of "F.M. quieting".

3.4 Audio Frequency Filter.

This filter, when switched in, restricts the Audio Bandwidth to 300 Hz - 3 kHz measured at its 3 db points. It is effective in removing any residual hum modulation and other wide-band noise and is particularly useful when measuring small deviations on narrow band F.M. systems.

3.5 Monitoring Facilities

The socket marked I.F. gives an output of the applied signal after its translation to the intermediate frequency of 500 kHz. It is approximately 150 mV from an impedance of 600 ohm and enables the viewing of amplitude modulated waveforms on a low frequency oscilloscope.

The final demodulated waveform is available at the A.F. output socket at a level of approximately 1 Volt from 600 ohm. This can also be viewed on an oscilloscope or applied to distortion analysers (e.g. Dymar Type 1765) for further measurements.

4. TECHNICAL DESCRIPTION

The circuit description should be read with reference to the attached circuit diagrams.

The R.F. input signal is fed to the mixer VT1, whose other signal is derived from the local oscillators.

The mixer provides an I.F. output at a frequency of 500 kHz which is applied, via a low-pass filter, 20 db "I.F. attenuator" S3 and "Set level" potentiometer RVI, to the integrated circuit amplifier VT2. The amplified I.F. frequency is now taken to the A.M. detector via C15 and to the F.M. discriminator via C16.

With the "Function" Switch S1 in the "Set Level" position, the I.F. signal passes to the A.M. diode detector D1 arranged to measure the mean carrier level and the rectified output drives the meter directly. In the condition the input level of the I.F. is set by means of the "I.F. attenuator" S3 and the "Set level" control RV1 to give full scale deflection on the meter.

When the "Function" switch is turned to the "AM Peak" or "AM Trough" positions, the I.F. signal passes to the diode detector D1. The demodulated audio frequency is then amplified, passed through the low-pass filter L4, C43, C44 and applied to the "Mod. Range" attenuator, having four full scale deflection ranges of 3, 10, 30 and 100% of modulation.

From the "Mod. Range" attenuator the audio signal is fed into the integrated circuit A.F. amplifier VT16 whose amplification band is 10 Hz - 50 kHz (3 db points).

Upon operating the "A.F. Filter" switch, the band of the amplifier VT16 is restricted to 300 Hz - 3 kHz (3 db points) by switching in capacitor C50. The signal is now applied, via emitter follower VT17 to the peak detecting amplifier VT19 and VT20. The feature of the peak detecting amplifier is its non-Linear gain characteristic provided by the diodes D3 and D4 in the feed-back path. The purpose of the amplifier is to correct the non-linear characteristic of the peak detecting diode D5 and render it linear. The A.F. output available on the front panel is taken via the emitter follower VT18.

When the "Function" switch S1 is turned to the "FM+" or "FM-" positions, the I.F. signal is applied, via the amplifier stage VT7, to the limiters VT8 and VT9 to reduce the effect of amplitude modulation of the R.F. input signal. The output from the limiters is fed via the emitter follower VT10 into the Schmitt trigger circuit to provide the final limiting to a constant amplitude square wave. The output from VT12 is a square wave at I.F. frequency and is fed to the frequency discriminator VT13. The capacitor C35 is charged and discharged between defined limits and the resultant current pulses in VT13 are integrated to give an audio frequency output proportional to frequency deviation.

The modulation signal appearing at the output of the I.F. filter C36, R65 and C39 is fed, via emitter follower VT14, to the amplifier VT15 and applied to the "Mod. Range" attenuator having full scale deflection ranges of 3, 10, 30 100 kHz. The I.F. output available on the front panel is taken via the emitter follower VT6.

The R.F. frequency range of the instrument, 30 - 480 MHz, is covered by two local oscillators.

The fundamental of the first oscillator covers the range 30-60 MHz and the second harmonic is used for the 60 - 120 MHz. The oscillator consists of VT21 in a grounded base circuit with C65 as the variable element of the tank circuit. VT22 is a buffer emitter follower.

The fundamental of the second oscillator covers the range 120 - 240 MHz and the second harmonic is used to cover the 240 - 480 MHz.

The oscillator consists of the transistor VT23. Tuning is effected by the main tuning capacitor C74 and "Fine" tuning adjustments, made by means of the potentiometer RV5 varying the d.c. bias applied to the variable capacitance diode D6. The oscillator is isolated from the rest of the circuitry by the emitter follower VT22. The supply lines to the oscillators are stabilised by the Zener diode D7 and D8.

The push-button switch S5 activates the required oscillator by connecting the dc supply to it, and also connects its output to the input mixer VT1.

Power Supply

The design of the power supply is conventional and consists of transformer T_1 and rectifying diodes D_3 and D_4 giving "raw" D.C. across capacitor C_7. This voltage is an unregulated 24 volts and is applied to the regulator which gives a highly stable voltage of 12.6 V at pin 1 of S.K.1. The reference voltage is the

Zener Diode D1 and the difference amplifier is VT_3 and VT_4. RV1 adjust the voltage to 12. 6 Volts precisely. The series element of the regulator is VT1 driven by the emitter follower VT2. The collector load of VT4 is returned to a stabilised voltage of about 18V (5. 6V relative to 12. 6V) from across Zener Diode D2, and this voltage is applied to series transistor VT5 giving a partially stabilised voltage of 18 Volts at pin 2.

The same regulator is used to stabilise the voltage of the internal (or external) battery of 24 Volts is used.

The internal battery is re-charged by the voltage doubling circuit of D5, D6, C_5 and C_6 through resistor R9.

5. ALIGNMENT PROCEDURE

5.1 If re-alignment of the instrument is required withdraw the right-hand or "Plug-In" part of it, by releasing the two Phillips type screws on the back panel. All test points and pre-set controls are now accessible for adjustment. Do not adjust or tamper with these controls unless adequate test gear is available for the proper calibration of the instrument.

5.2 The following test gear are required.

1) A.M. Signal Generator with frequency range 30 - 240 Mhz having symmetrical modulation envelope and calibrated for a depth of 31.6% at 1 kHz. This is best done using a spectrum analyzer and a precision 16 db attenuator, this being the difference in level between carrier and sidebands at 31.6% mod.

2) F.M. Signal Generator calibrated for a known deviation of 10 kHz.

This is best done by setting the modulation frequency to 4.15 kHz when carrier drop-out will be observed on the spectrum analyzer when the deviation is 10 kHz.

3) Audio Signal Generator with calibrated output attenuator.

5.3 Mod. Range Attenuator.

Apply a signal of 1 kHz at the input to the Audio Board, i.e. across capacitor C43. With the "Mod. Range" switch set to 3, full scale deflection should be about 30 mV. Check that by increasing the signal in 10 db steps and reducing the sensitivity of the Range Switch the range attenuator is within 1% on all ranges.

5.4 Linearity of Peak Detector.

Set the 1 kHz signal to read f.s.d. on range 3 (i.e. 3.16) as in 5.3. With the same input switch to range 10. The reading should now be 3.16 on scale 10. If not adjust RV4 slightly and as this will alter the absolute sensitivity repeat the whole procedure.

5.5 Calibration of A.M.

Apply a calibrated signal of 31.6% depth at approx. 45 MHz and tune the instrument as described in paragraph 3.2. Check that the instrument reads f.s.d. on Mod. Range 30. If not, adjust controls RV_2 and RV_6 until this is obtained.

5.6 Calibration of F.M.

Apply a calibrated signal of 10 kHz deviation at say, 45 MHz, and tune the instrument. Set the Mod. Range switch to 10 and by setting the function switch to FM+ or FM- check that the reading is f.s.d. If not adjust RV3.

5.7 To check the calibration of the local oscillators.

First check that the frequency dial in its anti-clockwise position is set to read 29 MHz. Set the "Fine" frequency control to mid position.

Using calibrated signal generator check the reading of the dial, taking into account the I.F. frequency, by applying the signal to the input of the Modulation Meter and peaking the meter with the "Function" switch set to the "Set Level" position. Accuracy ± 3% of dial reading.

If the oscillators need re-tracking, ensure that proper trimming tools are available.

The tracking points for the 30 - 60 MHz oscillator are 34 MHz and 54 MHz which should be tracked by L6 and C66 respectively.

The tracking points for the 120 - 240 MHz oscillator are 140 MHz and 225 MHz and should be tracked by L8 and C75 respectively.

6. COMPONENT LIST

Circuit Ref.	Description	Value	Tol.%	Rating
6.1 Resistors				
R1	Carbon Film	510Ω	5%	$\frac{1}{2}$W
R2	Carbon Film	56 Ω	5%	$\frac{1}{2}$W
R3	Solid Carbon	560Ω	5%	$\frac{1}{4}$W
R4	Solid Carbon	2. 2KΩ	5%	$\frac{1}{4}$W
R5	Solid Carbon	56Ω	5%	$\frac{1}{4}$W
R6	Solid Carbon	3. 3KΩ	5%	$\frac{1}{4}$W
R7	Solid Carbon	15KΩ	5%	$\frac{1}{4}$W
R8	Solid Carbon	10KΩ	5%	$\frac{1}{4}$W
R9	Solid Carbon	56 Ω	5%	$\frac{1}{4}$W
R10	Metal Film	1. 8KΩ	1%	$\frac{1}{4}$W
R11	Metal Film	1. 8KΩ	1%	$\frac{1}{4}$W
R12	Metal Film	470Ω	1%	$\frac{1}{4}$W
R13	Carbon Film	33Ω	5%	$\frac{1}{2}$W
R14	Carbon Film	220Ω	5%	$\frac{1}{2}$W
R15	Carbon Film	100KΩ	5%	$\frac{1}{2}$W
R16	Carbon Film	100KΩ	5%	$\frac{1}{2}$W
R17	Metal Film	150Ω	1%	$\frac{1}{4}$W
R18	Metal Film	15KΩ	1%	$\frac{1}{4}$W
R19	Metal Film	47KΩ	1%	$\frac{1}{4}$W
R20	Carbon Film	5. 6KΩ	5%	$\frac{1}{2}$W
R21	Carbon Film	15KΩ	5%	$\frac{1}{2}$W
R22	Carbon Film	4. 7KΩ	5%	$\frac{1}{2}$W

Circuit Ref.	Description	Value	Tol. %	Rating
R23	Carbon Film	220Ω	5%	$\frac{1}{2}$W
R24	Carbon Film	4.7KΩ	5%	$\frac{1}{2}$W
R25	Carbon Film	330Ω	5%	$\frac{1}{2}$W
R26	Carbon Film	330Ω	5%	$\frac{1}{2}$W
R27	Metal Film	3.16KΩ	1%	$\frac{1}{4}$W
R28	Metal Film	18KΩ	1%	$\frac{1}{4}$W
R29	Carbon Film	470KΩ	5%	$\frac{1}{2}$W
R30	Carbon Film	220KΩ	5%	$\frac{1}{2}$W
R31	Carbon Film	220KΩ	5%	$\frac{1}{2}$W
R32	Carbon Film	220 Ω	5%	$\frac{1}{2}$W
R33	Carbon Film	1.2KΩ	5%	$\frac{1}{2}$W
R34	Carbon Film	1.8KΩ	5%	$\frac{1}{2}$W
R35	Carbon Film	56Ω	5%	$\frac{1}{2}$W
R36				
R37	Carbon Film	22KΩ	5%	$\frac{1}{2}$W
R38	Carbon Film	33KΩ	5%	$\frac{1}{2}$W
R39	Carbon Film	560Ω	5%	$\frac{1}{2}$W
R40	Carbon Film	6.8KΩ	5%	$\frac{1}{2}$W
R41	Carbon Film	100KΩ	5%	$\frac{1}{2}$W
R42	Carbon Film	560Ω	5%	$\frac{1}{2}$W
R43	Carbon Film	33KΩ	5%	$\frac{1}{2}$W
R44	Carbon Film	10KΩ	5%	$\frac{1}{2}$W
R45	Carbon Film	3.9KΩ	5%	$\frac{1}{2}$W
R46	Carbon Film	1KΩ	5%	$\frac{1}{2}$W
R47	Carbon Film	22KΩ	5%	$\frac{1}{2}$W

Circuit Ref.	Description	Value	Tol. %	Rating
R48	Carbon Film	10KΩ	5%	½W
R49	Carbon Film	1KΩ	5%	½W
R50	Carbon Film	4.7KΩ	5%	½W
R51	Carbon Film	1KΩ	5%	½W
R52	Carbon Film	1KΩ	5%	½W
R53	Carbon Film	22KΩ	5%	½W
R54	Carbon Film	22KΩ	5%	½W
R55	Carbon Film	1KΩ	5%	½W
R56	Carbon Film	12KΩ	5%	½W
R57	Carbon Film	10KΩ	5%	½W
R58	Carbon Film	1KΩ	5%	½W
R59	Carbon Film	33Ω	5%	½W
R60	Carbon Film	2.2KΩ	5%	½W
R61	Carbon Film	68KΩ	5%	½W
R62	Carbon Film	39KΩ	5%	½W
R63	Carbon Film	220Ω	5%	½W
R64	Metal Film	6.8KΩ	1%	¼W
R65	Carbon Film	10KΩ	5%	½W
R66	Carbon Film	220Ω	5%	½W
R67	Carbon Film	33KΩ	5%	½W
R68	Carbon Film	22KΩ	5%	½W
R69	Carbon Film	1.2KΩ	5%	½W
R70	Carbon Film	1.8KΩ	5%	½W
R71	Carbon Film	180Ω	5%	½W
R72	Carbon Film	680Ω	5%	½W

Circuit Ref.	Description	Value	Tol. %	Rating
R73	Metal Film	1.23KΩ	½%	¼W
R74	Metal Film	390Ω	1%	¼W
R75	Metal Film	123Ω	½%	¼W
R76	Metal Film	39Ω	1%	¼W
R77	Metal Film	18Ω	1%	¼W
R78	Carbon Film	220Ω	5%	½W
R79	Carbon Film	100KΩ	5%	½W
R80	Carbon Film	100KΩ	5%	½W
R81	Metal Film	330Ω	1%	¼W
R82	Metal Film	10KΩ	1%	¼W
R83	Metal Film	68KΩ	1%	¼W
R84	Carbon Film	22KΩ	5%	½W
R85	Carbon Film	220Ω	5%	½W
R86	Carbon Film	22KΩ	5%	½W
R87	Carbon Film	3.3KΩ	5%	½W
R88	Carbon Film	22KΩ	5%	½W
R89	Carbon Film	3.3KΩ	5%	½W
R90	Carbon Film	100KΩ	5%	½W
R91	Carbon Film	560Ω	5%	½W
R92	Carbon Film	3.3KΩ	5%	½W
R93	Carbon Film	22KΩ	5%	½W
R94	Carbon Film	3.3KΩ	5%	½W
R95	Carbon Film	3.3KΩ	5%	½W
R96	Carbon Film	220Ω	5%	½W
R97	Carbon Film	2.2KΩ	5%	½W

Circuit Ref.	Description	Value	Tol. %	Rating
R98	Carbon Film	330Ω	5%	$\frac{1}{2}$W
R99	Carbon Film	680Ω	5%	$\frac{1}{2}$W
R100	Metal Film	7.5KΩ	1%	$\frac{1}{4}$W
R101	Solid Carbon	10KΩ	5%	$\frac{1}{4}$W
R102	Carbon Film	1.2KΩ	5%	$\frac{1}{2}$W
R103	Solid Carbon	47KΩ	5%	$\frac{1}{4}$W
R104	Solid Carbon	10KΩ	5%	$\frac{1}{4}$W
R105	Solid Carbon	3.3KΩ	5%	$\frac{1}{4}$W
R106	Solid Carbon	560Ω	5%	$\frac{1}{4}$W
R107	Solid Carbon	1KΩ	5%	$\frac{1}{4}$W
R108	Solid Carbon	12KΩ	5%	$\frac{1}{4}$W
R109	Solid Carbon	1.2KΩ	5%	$\frac{1}{4}$W
R110	Solid Carbon	150Ω	5%	$\frac{1}{4}$W
R111	Solid Carbon	10KΩ	5%	$\frac{1}{4}$W
R112	Solid Carbon	3.3KΩ	5%	$\frac{1}{4}$W
R113	Solid Carbon	470Ω	5%	$\frac{1}{4}$W
R114	Solid Carbon	1KΩ	5%	$\frac{1}{4}$W
R115	Solid Carbon	12KΩ	5%	$\frac{1}{4}$W
R116	Solid Carbon	1.2KΩ	5%	$\frac{1}{4}$W
R117	Solid Carbon	68Ω	5%	$\frac{1}{4}$W
R118	Solid Carbon	220Ω	5%	$\frac{1}{4}$W
R119	Metal Film	1.8KΩ	1%	$\frac{1}{4}$W

6.2 Capacitors

C1	Ceramic	.003μF		150V
C2	Metal. Foil	0.1μF	20%	250V

Circuit Ref.	Description	Value	Tol. %	Rating
C3	Ceramic	.001μF		150V
C4	Ceramic	.003μF		150V
C5	Ceramic	.003μF		150V
C6	Ceramic	.001μF		150V
C7	Ceramic	68pF	5%	150V
C8	Polystyrene	140pF	2½%	125V
C9	Polystyrene	68pF	2½%	125V
C10	Ceramic	.001μF		150V
C11	Polycarbonate	1μF	10%	100V
C12	Polycarbonate	1μF	10%	100V
C13	Polystyrene	200pF	2½%	125V
C14	Polystyrene	50pF	2½%	125V
C15	Ceramic	.001μF		150V
C16	Ceramic	.001μF		150V
C17	Electrolytic	125μF		16V
C18	Polystyrene	100pF	2½%	125V
C19	Polyester	.01μF	10%	400V
C20	Polystyrene	680pF	2½%	125V
C21	Polystyrene	20pF	2½%	125V
C22	Polycarbonate	2.2μF	10%	100V
C23	Electrolytic	125μF		16V
C24	Electrolytic	10μF		16V
C25	Electrolytic	125μF		16V
C26	Polycarbonate	.1μF	10%	100V
C27	Polystyrene	100pF	2½%	125V

Circuit Ref.	Description	Value	Tol. %	Rating
C28	Polycarbonate	.1μF	10%	100V
C29	Ceramic	.003μF		150V
C30	Polyester	.033μF	10%	400V
C31	Ceramic	.003μF		150V
C32	Polycarbonate	.1μF	10%	100V
C33	Polycarbonate	.1μF	10%	100V
C34	Polystyrene	100pF	2½%	125V
C35	Polystyrene	68pF	2½%	125V
C36	Polystyrene	200pF	2½%	125V
C37	Electrolytic	125μF		16V
C38	Polycarbonate	2.2μF	10%	100V
C39	Polystyrene	200pF	2½%	125V
C40	Electrolytic	125μF		16V
C41	Electrolytic	10μF		16V
C42	Electrolytic	125μF		16V
C43	Polystyrene	6300pF	2½%	125V
C44	Polystyrene	6300pF	2½%	125V
C45	Electrolytic	125μF		16V
C46	Electrolytic	10μF		16V
C47	Polycarbonate	1.5μF	10%	100V
C48	Polystyrene	30pF	2½%	125V
C49	Electrolytic	50μF		25V
C50	Polystyrene	.001μF	2½%	125V
C51	Polystyrene	68pF	2½%	125V
C52	Electrolytic	16μF		10V

Circuit Ref.	Description	Value	Tol. %	Rating
C53	Electrolytic	125μF		16V
C54	Electrolytic	16μF		10V
C55	Electrolytic	16μF		10V
C56	Electrolytic	125μF		16V
C57	Electrolytic	16μF		10V
C58	Electrolytic	125μF		16V
C59a	Polycarbonate	6.8μF	10%	100V
C59b	Polycarbonate	6.8μF	10%	100V
C60	Ceramic	.003μF		150V
C61	Ceramic	.001μF		500V
C62	Ceramic	.001μF		150V
C63	Ceramic	.003μF		150V
C64	Ceramic	.001μF		150V
C65	Variable	56pF		
C66	Variable	5pF		
C67	Ceramic	47pF	5%	150V
C68	Ceramic	.003μF		150V
C69	Ceramic	.003μF		150V
C70	Ceramic	.003μF		150V
C71	Ceramic	4.7pF	5%	150V
C72	Ceramic	.001μF		150V
C73	Ceramic	33pF	5%	150V
C74	Variable	56pF		
C75	Variable	7.3pF		
C76	Ceramic	15pF	5%	150V

Circuit Ref.	Description	Value	Tol. %	Rating
C77	Ceramic	.003μF		150V
C78	Ceramic	.001μF		150V
C79	Ceramic	.001μF		500V
C80	Ceramic	100pF	5%	150V
C81	Ceramic	15pF	5%	150V
C82	Polystyrene	4700pF	2½%	125V

6.3 Coils

L1	680μH	10%
L2	680μH	10%
L3	BA 1704	
L4	BA 1705	
L5	6.8μH	10%
L6	AA 1675	
L7	1.5μH	10%
L8	AA 1674	

6.4 Semiconductors

Circuit Ref.	Maker	Type
VT1	RCA	2N5180
VT2	Gen. El.	PA 230
VT3	Texas	BC183LA
VT4	Texas	BC183LA
VT5	Texas	BC183LA
VT6	Texas	BC183LA

Circuit Ref.	Maker	Type
VT7	Texas	BC183LA
VT8	Texas	BC183LA
VT9	Texas	BC183LA
VT10	Texas	BC183LA
VT11	Texas	BC183LA
VT12	Texas	BC183LA
VT13	Texas	BC183LA
VT14	Texas	BC183LA
VT15	Texas	BC183LA
VT16	Gen. El.	PA230
VT17	Texas	BC183LA
VT18	Texas	BC183LA
VT19	Texas	BC183LA
VT20	Texas	BC183LA
VT21	RCA	2N5180
VT22	RCA	2N5180
VT23	RCA	2N5180
VT24	RCA	2N5180
D1	Mullard	OA91
D2	Mullard	AAY42
D3	Mullard	OA91
D4	Mullard	OA91
D5	Mullard	AAY42
D6	STC	BA110
D7	Mullard	BZY88-C6V2

Circuit Ref.	Maker	Type
D8	Mullard	BZY88-C6V2

6.5 Miscellaneous

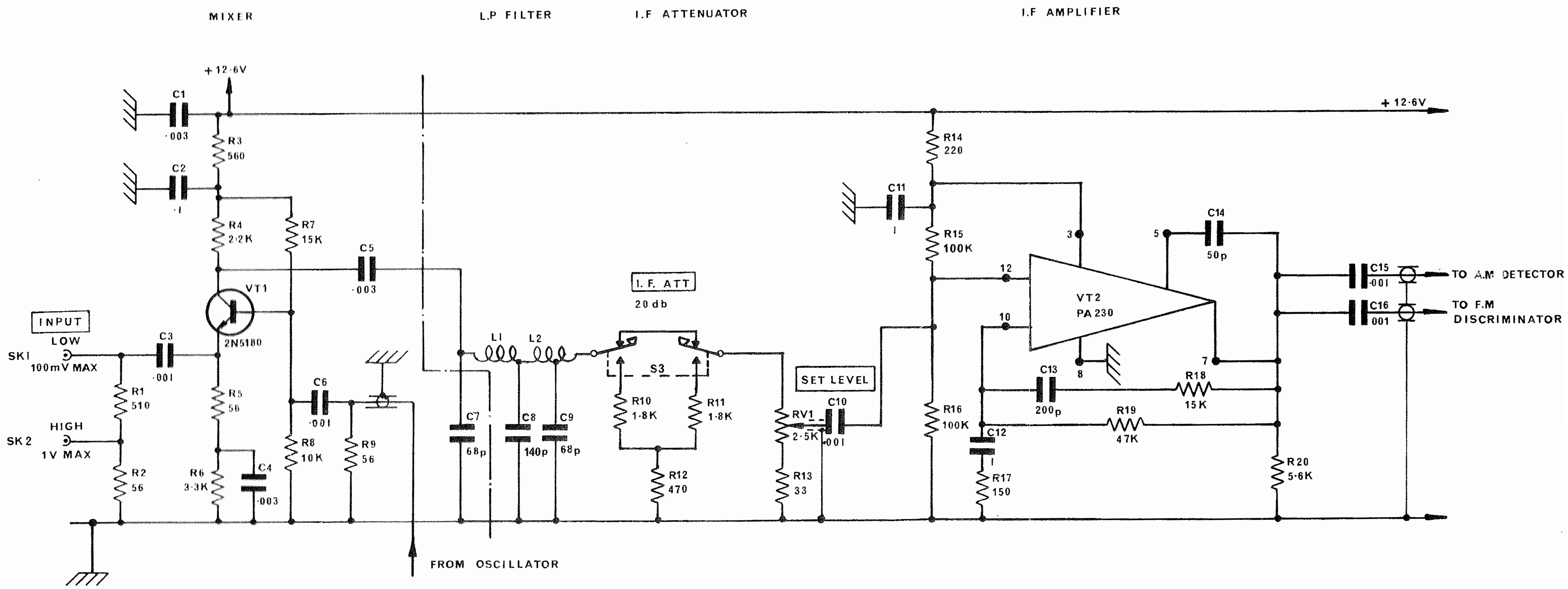
Circuit Ref.	Description	Value	Type
RV1	Carbon Pot.	2.5KΩ	log.
RV2	Preset	5KΩ	lin.
RV3	Preset	5KΩ	lin.
RV4	Preset	10KΩ	lin.
RV5	W.W. Pot	1KΩ	lin.
RV6	Preset	1KΩ	lin.
S1	Switch		BD 1670
S2	Switch		BD 1671
S3	Toggle Switch		D.P.D.T.
S4	Toggle Switch		D.P.D.T.
S5	Push Button Special		
SK1	Socket		BNC
SK2	Socket		BNC
SK3	Socket		BNC
SK4	Socket		BNC
SK7	Socket Microdot		
PL7	Plug Microdot		
PL1	Plug McMurdo		PP6

Circuit Ref.	Description	Value	Tol. %	Rating

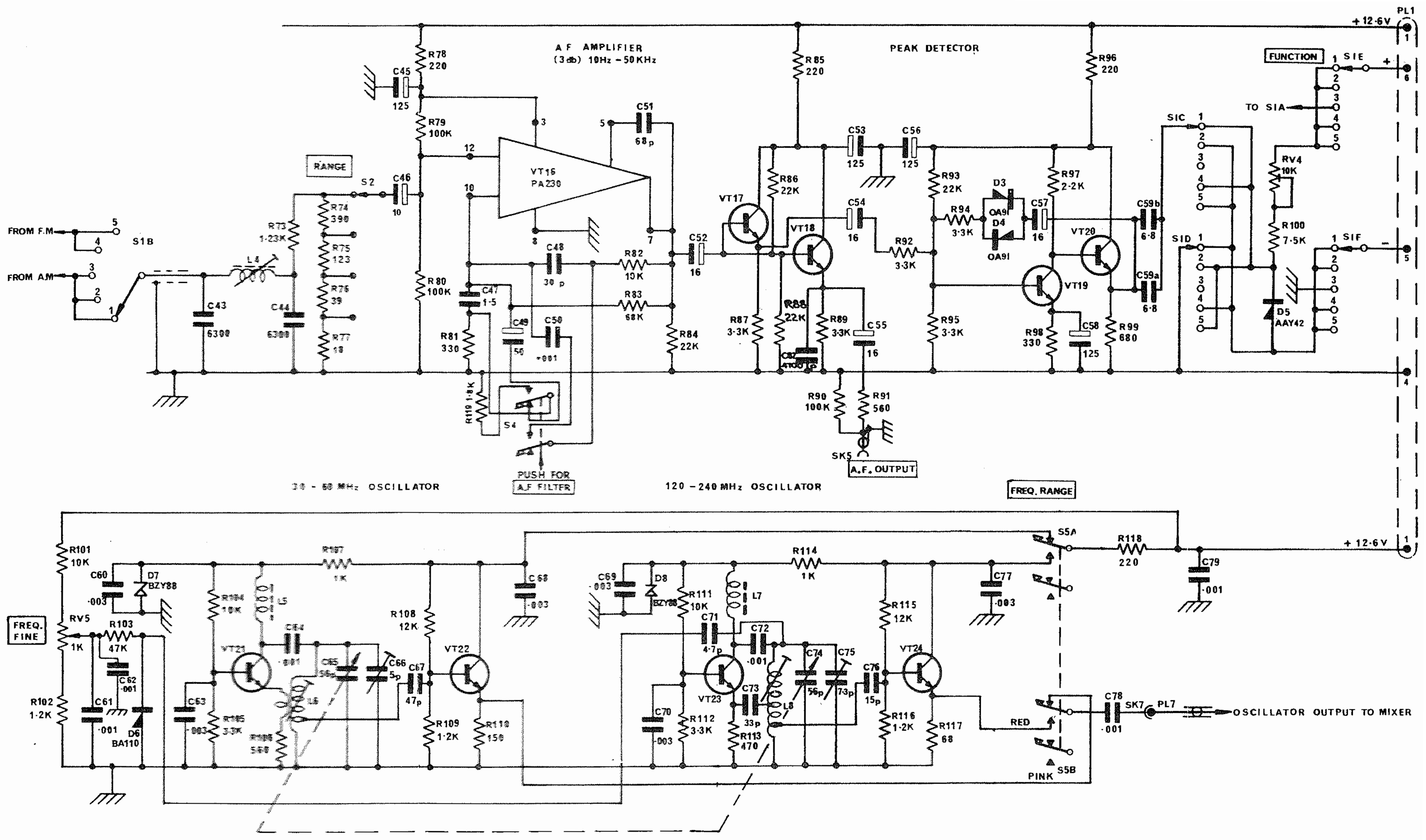
6. 6. Power Supply Components

R1	Metal Oxide	316KΩ	1%	½W
R2	Carbon	2. 2KΩ	10%	½W
R3	Carbon	22KΩ	10%	½W
R4	Carbon	4. 7KΩ	10%	½W
R5	Carbon	2. 2KΩ	10%	½W
R6	Carbon	10KΩ	10%	½W
R7	Carbon	10KΩ	10%	½W
R8	Carbon	10KΩ	10%	½W
R9	Metal Oxide	820Ω	5%	10W
RV1	Preset	2. 5KΩ		
C1	Carbon	.033μ F		25V
C2	Electrolytic	10μ F		16V
C3	Electrolytic	10μ F		16V
C4	Electrolytic	100μ F		40V
C5	Electrolytic	150μ F		100V
C6	Electrolytic	150μ F		100V
C7	Electrolytic	1000μF		40V
VT1	RCA	2N 5296		
VT2	Texas	BC 183LA		
VT3	Texas	BC 183LA		
VT4	Texas	BC 183LA		
VT5	RCA	BSY 90		

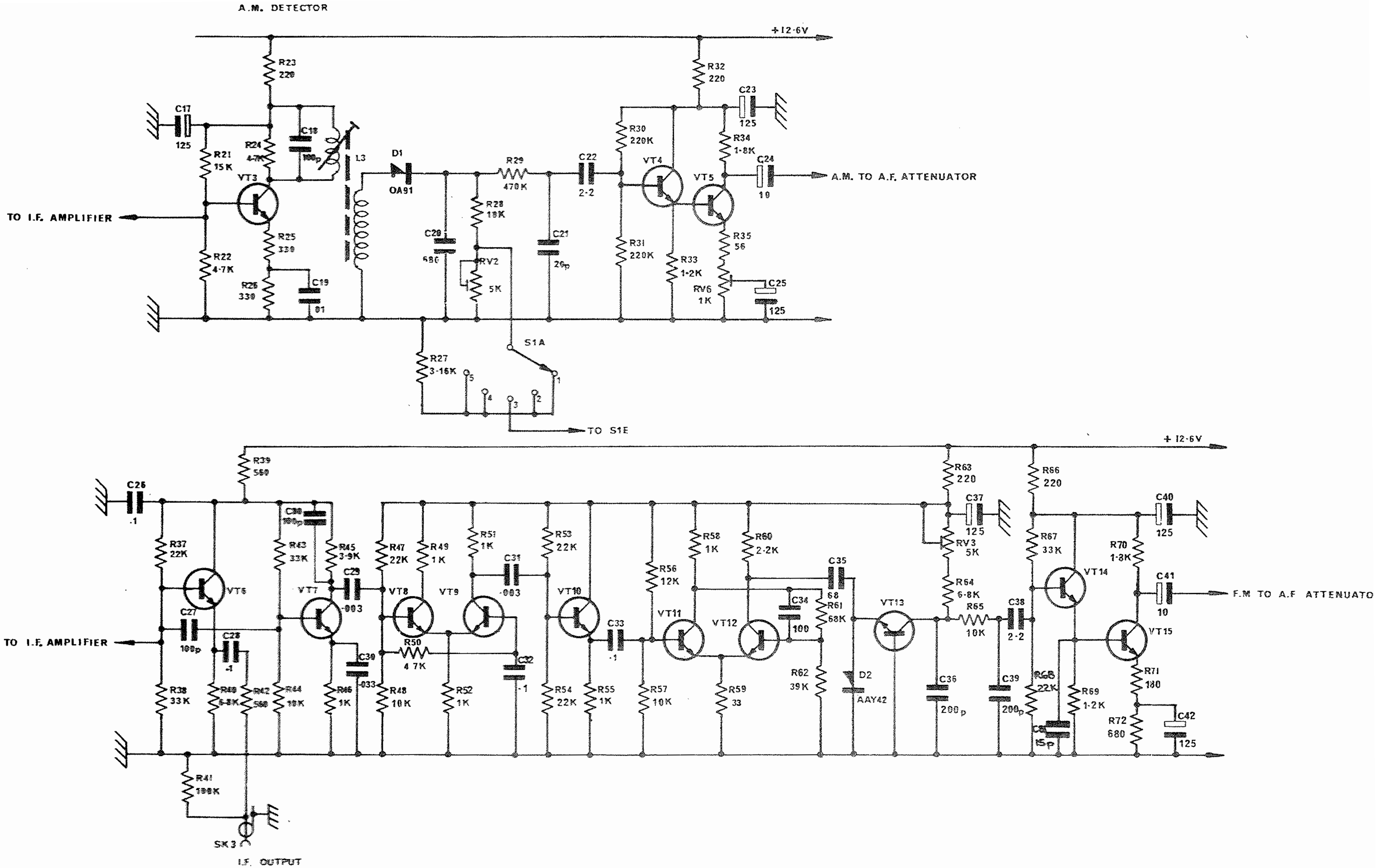
Circuit Ref.	Description	Value	Tol. %	Rating
D1	Mullard	BZY88-C6V2		
D2	Mullard	BZY88-C6V2		
D3	Westinghouse	SIMI		
D4	Westinghouse	SIMI		
D5	Westinghouse	SIMI		
D6	Westinghouse	SIMI		
T1	Transformer	40/1024		
F1	Fuse	Type F286 150mA		
S1	Combined Push-Button Switch	Special		
S2	Combined Push-Button Switch	Special		
S3	Combined Push-Button Switch	Special		
S4	Slider Switch Diamond H	D.P.D.T. Type 278		
SK1	Socket McMurdo	PS6		



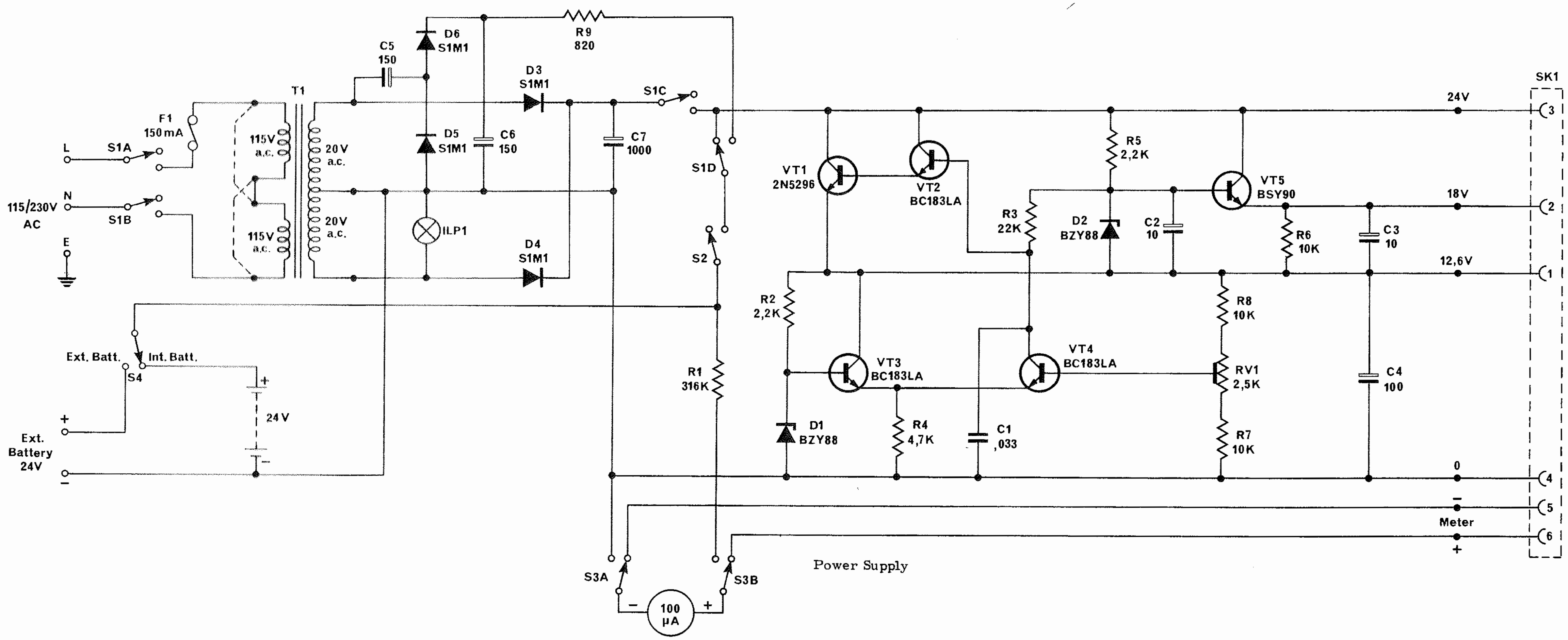
MIXER
L.P FILTER
I.F ATTENUATOR
I.F AMPLIFIER
+12·6V
C1
·003
R3
560
C2
·1
R4
2·2K
R7
15K
C5
·003
VT1
2N5180
INPUT
LOW
SK1
100mV MAX
C3
·001
R1
510
HIGH
SK2
1V MAX
R2
56
R5
56
R6
3·3K
C4
·003
C6
·001
R8
10K
R9
56
FROM OSCILLATOR
L1
L2
C7
68p
C8
140p
C9
68p
I.F. ATT
20db
S3
R10
1·8K
R11
1·8K
R12
470
SET LEVEL
RV1
2·5K
C10
·001
R13
33
R14
220
C11
1
R15
100K
R16
100K
VT2
PA 230
C12
1
R17
150
C13
200p
R18
15K
R19
47K
C14
50p
R20
5·6K
C15
·001
C16
·001
TO A.M DETECTOR
TO F.M DISCRIMINATOR



NOTE:- VT17 TO VT20 TYPE BC183LA
VT21 TO VT24 TYPE 2N5180



NOTE :— VT3 TO VT15 TYPE BC 183 LA



Power Supply