TRANSMITTER AND RECEIVER OUTPUT

TEST SET

TYPES TF 1065 AND TF 1065/1

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SCHEDULE OF PARTS SUPPLIED

1. One Test Set Type TF 1065 or TF 1065/1, complete with items as under:-

Semiconductors:	Two:	Type OC202, Junction Transistors.
	Two:	Type CV291 (CS2-A), Silicon Diodes.
	Two:	Type CV425 (CG1-E), Germanium Diodes.
Battery:	One:	Mallory Type SKB 639 Mercury Battery.

2. One Coaxial Free Plug, Type N, for use with r.f. power input socket; 50-ohm plug for TF 1065; 75-ohm plug for TF 1065/1.

3. One Coaxial Free Plug, Type BNC, 50-ohm; for use with local oscillator input socket.

4. One Operating and Maintenance Handbook No. OM 1065 -/1.

The following items are optional accessores, supplied only if specially ordered:-

5. 7-dB Attenuator, Type TM 5280 - for use with TF 1065 only.

6. Probe Unit, Type TM 5302.

1 DESCRIPTION

1.1 GENERAL

Transmitter and Receiver Output Test Set Type TF 1065 or TF 1065/1 forms a companion instrument to the V.H.F. Signal Generator Type TF 1064 (Series). Together, Test Set and Generator provide full facilities for testing a.m. and f.m. transmitters and receivers.

Considered as a separate instrument, the Test Set performs four main functions. It can be switched to act as (1) an a.f. power meter, (2) an r.f. power meter, (3) a deviation indicator, and (4) a 7-range d.c. voltmeter/ammeter.

The a.f. power meter has ten ranges: five 3-ohm ranges to cater for receivers designed to operate a loudspeaker, and five ranges for use with standard 600-ohm line outputs. Full-scale deflections ranging from 300 µW to 3 W are obtainable, at both impedances, within the frequency range 250 c/s to 10 kc/s. Connection to the a.f. power meter is made via screw terminals.

The r.f. power meter section may be used at any frequency between 50 c/s and 500 Mc/s, the impedance depending upon the model of the Test Set being used. The TF 1065 has an impedance of 50 ohms, and the TF 1065/1 an impedance of 75 ohms. In both cases a Type N coaxial socket is provided for connection of the r.f. feeder from the transmitter.

For 50-ohm power measurements in the frequency range 150 to 185 Mc/s, the coverage of the r.f. power meter in the TF 1065 can be extended to 125 watts by the use of an external attenuator type TM 5280. For further details see Section 1.2.6. This facility is not available with Test Set Type TF 1065/1.

With an f.m. transmitter coupled to the r.f. power input socket, the degree of modulation can be checked by switching the Test Set to DEVIATION. The actual deviation monitor operates at 130 kc/s, frequency translation being performed in the preceding crystal mixer. To avoid circuit complexity, no local oscillator is incorporated in the Test Set; instead a separate BNC inlet is provided so that an externally-derived c.w. signal can be fed into the mixer. For deviation measurements, the panel meter has a scale marked with 5-, 10-, and 15-kc/s points.

1.1 (continued)

The panel meter has a full-scale deflection of 50 μA. It can be switched direct to a pair of panel terminals for external use. At six other switch settings it is associated with either shunts or multipliers so that full-scale values of 10 mA, 100 mA, 1 ampere, 10 volts, 100volts an 1,000 volts are obtained.

Supplied as an optional accessory, Probe Unit Type TM 5302 enables the Test Set to be used as a signal tracer. The unit may be used at any frequency between 50 kc/s and 500 Mc/s. (See Section 1.2.6.)

1.2 DESIGN DETAILS

It is suggested that the following sections be read in conjunction with the Block Schematic and Circuit Diagrams included at the end of this handbook.

1.2.1 A.F. Power Meter

The Test Set provides a.f. power ranges of 300 μW, 3 mW, 30 mW 300 mW and 3 W, full-scale, at both 3- and 600-ohms impedance. The smallest calibrated meter indication at either impedance is 10 μW. Red spots at intervals of 2 dB are marked on the a.f. power meter scale, enabling comparative measurements to be made over a range of 50 dB.

The basic load element in the a.f. power meter section of the instrument is a heavy-duty wire-wound resistor, R12. The secondary winding of transformer T1 is connected in parallel with this resistor. When the A.F. POWER switch is set to any of its 600-ohm positions, the primary winding of T1 is not in circuit, the secondary winding, which is tapped at five points, serving as an autotransformer; the ratio of this autotransformer is dependent upon the full-scale value selected by the A.F. POWER switch. For the 3-watt range, the secondary of T1 provides a substantial "step-down" between the voltage developed across the main load resistor and that supplied to the meter rectifier, MR3; at the other extreme, for the 300-μW range, the winding is used to provide a "step-up".

With the A.F. POWER switch set to any of its 3-ohm positions, transformer T1 performs an additional role. Its primary winding is

1.2.1 (continued)

brought into use and the load resistor is now transformer-coupled to the A.F. INPUT terminals, the ratio between primary and secondary being such that the effective input impedance of the a.f. power meter section is changed to 3 ohms.

To compensate for the slight shunting effect of the meter, and also the inevitable losses associated with the transformer, the effective load resistance is varied by a small amount on certain ranges; this is done by means of padding resistors which are automatically switched into circuit as required.

1.2.2 R.F. Power Meter

The r.f. power meter section employs a heavy-duty, high-stability resistor as the dissipative element. This resistor has a tubular ceramic former with a conductive outer coating of cracked carbon and it is mounted so that it forms the central conductor of a slab or parallel-plate line.

Connection of the power source is made to a type N coaxial socket on the side of the Test Set, the input being fed to the "live" end of the resistor by an outward-tapering section which preserves a constant impedance between the connector and the relatively large-diameter resistor. From "live" to "earthy" end of the resistor, the broad metal plates which form the outer conductor have an inward taper so that continuous matching is maintained along the whole length of the resistor.

Indication up to a maximum of 25 watts is by means of the panel meter and a silicon-diode rectifier circuit. The diode, MR4, is shunt-connected and fed via a resistor from a tapping point on the load resistor. The d.c. output from the diode is taken to the meter through a series resistor R5 and variable potentiometer RV3.

Capacitor C5 is incorporated to balance out the unwanted effects of stray capacitance across R4; the correct setting for C5 - a preset component - is determined during manufacture. (See also Sect. 4.6 and 4.8.5.)

1.2.3 Deviation Indicator

The deviation indicator uses the superheterodyne principle. A portion of the frequency-modulated signal is obtained from a tapping point on the r.f. load resistor. This signal is applied together with an externally-derived signal, to a silicon-diode mixer, MR1. The i.f. output from this mixer is applied to a 130-kc/s tuned circuit (L1 - C2) via a low-pass filter consisting of C1, C6 and R3. A germanium diode, MR2, rectifies the signal developed across the tuned circuit and feeds a load having a long time constant compared to 130 kc/s, but short compared to the modulating frequencies. Dependent upon the amount of carrier deviation, the instantaneous i.f. deviates from the resonant frequency of the tuned circuit during part of the modulation cycle; thus the mean voltage across the tuned circuit is less than if there were no modulation present. Output from MR2 therefore varies inversely with deviation.

The output available from the germanium diode is too low for reasonable meter deflection, so the sensitivity is increased by means of a d.c. transistor amplifier. This uses two [illegible] transistors in a push-pull grounded-emitter circuit. This basic circuit is modified to suit an unbalanced input, resulting in both the emitters and battery "floating" above earth potential. Potentiometer RV1 functions as a SET ZERO control and serves to balance the collector voltages of the two transistors.

The SET CARRIER control operates a ganged potentiometer RV2A-B. Meter sensitivity is varied by this control, while the restricted impedance change in the collector load is designed to produce the minimum variation in loading across the 130-kc/s tuned circuit.

1.2.4 7-Range Test Meter

A separate pair of terminals is provided for making connection to the d.c. voltmeter/ammeter section of the instrument. Basically, this section comprises the 50-μA panel meter and R28, its permanently connected series resistor. R28 is individually selected during manufacture to give an effective meter resistance of exactly 1,000 ohms. When switched to one of the three voltage ranges, an additional resistor, R6, R7 or R8, is switched in series with the meter. For current measurement, except on the 50-μA range where the meter is used at full sensitivity, shunt resistors R9, R10 or R11 are switched across the meter.

1.2.4 (continued)

The panel terminals are completely isolated from the case and chassis of the instrument so that measurements can be taken with either polarity at earth potential.

1.2.5 Power Supplies

No external power supplies are required for the Test Set. The internal supply for the transistor amplifier takes the form of a Mallory Type SKB 639 mercury battery of five cells. This battery, which has been specially produced for use with the Test Set, delivers 6.75 volts, tapped at 5.4 volts, with a common negative connection. A feature of this mercury cell is its extremely long shelf-life coupled with leak-proof construction.

Total current consumption is about 800 µA when the selector switch is set to DEVIATION. At all other switch settings the collector current is interrupted, the drain being due to emitter current only. Since this latter is of the order of 20 µA, the 3,400-mAH battery should only require replacement after a very considerable period of service.

1.2.6 Optional Accessories

The following accessories are not supplied with the instrument, but can be ordered separately:

Probe Unit, Type TM 5302. Used in conjunction with the 50-µA range of a TF 1065 or TF 1065/1, this probe enables either instrument to be used as a signal tracer at frequencies from 50 kc/s to 500 Mc/s. Within these frequency limits the overall sensitivity varies between 1 volt and 100 mV for full-scale deflection. The dimensions of the probe have been kept to a minimum to facilitate use in a confined space. Connection to the point under test is made by means of the tip of the probe and an earthing clip; the rectified output is fed via a 4-ft cable to the voltmeter/ammeter terminals on the Test Set.

7-dB Attenuator, Type TM 5280. When using the TF 1065 to test transmitters requiring a 50-ohm load, this accessory extends the r.f. power measurement range to 125 watts over the band 150 to 185 Mc/s. The unit is fitted with Type N 50-ohm coaxial connectors to allow insertion between the transmitter under test and the R.F. inlet on the TF 1065.

2 OPERATION

2.1 INSTALLATION

Unless otherwise specified, the Test Set is normally despatched with its internal battery in position, and is ready for immediate use.

2.2 SWITCHING ON AND WARMING UP

No separate on/off switch is provided on the Test Set, the action of switching to DEVIATION automatically energizing the transistor amplifier. Neglecting the emitter current, power is only drawn from the internal supply in this position of the selector switch. When the switch is turned to OFF, a short circuit is applied across the meter to reduce the likelihood of mechanical damage during transit.

In view of the above, it is recommended that the selector switch be returned to the OFF position at the end of each test.

Before using the Test Set, check that the mechanical zero of the meter is correctly set. After switching to DEVIATION, a period of about five minutes should elapse before the instrument is used; this will permit the transistors to reach their normal operating temperature. No warming-up period is required at any other setting of the selector switch and the instrument may be used immediately the correct range has been selected.

2.3 A.F. POWER MEASUREMENT

The Test Set can be used to measure a.f. power within the frequency range 250 c/s to 10 kc/s, at either 3- or 600-ohms impedance. The following power ranges are provided:-

3 watts, 300 mW, 30 mW, 3 mW and 300 μW.

To measure a.f. power:-

(1) Set the selector switch to A.F. POWER.

(2) Turn the A.F. POWER selector to one of the 3-watt settings - either the 3-ohm or 600-ohm setting as appropriate to the output impedance of the apparatus under test.

2.3 (continued)

(3) Connect the apparatus under test to the A.F. POWER terminals, remembering that the terminal marked E is connected to chassis.

(4) By means of the A.F. POWER switch, increase sensitivity until a suitable meter deflection is obtained.

(5) Note the final range setting and read the a.f. power level on the appropriate scale of the panel meter.

Red spots, at intervals of 2 dB over a range of 10 dB, are marked on the meter scale for a.f. power; (these were not provided on earlier models). Since the A.F. POWER switch alters the sensitivity in 10-dB steps, comparative measurements may be made over a range of 50 dB.

2.4 R.F. POWER MEASUREMENT

The instrument can be used to measure r.f. power outputs up to a maximum of 25 watts mean, at frequencies between 50 c/s and 500 Mc/s, irrespective of the modulating waveform. When using pulse sources, the 500-volt rating of the coaxial input connector imposes a peak power rating of 5 kW for the TF 1065 and 3.3 kW for the TF 1065/1.

The r.f. power input connector is a type N coaxial socket; a selection of suitable mating plugs is given below:

		TF 1065	TF 1065/1
Great Britain:	Films and Equipments Ltd.:	UG-21B/U	UG-94A/U
	Transradio Ltd.:	GEa. 071/50	GE. 071/75
	Air Ministry:	10H/20920	-
	Admiralty Pattern:	-	AP 70768
	Inter-Service No.:	5935-116603	-
United States:	Military No.:	UG-21B/U	UG-94A/U
	Amphenol Electronics Corp.:	82-61	82-84

To measure r.f. power:-

(1) Set the selector switch to R.F. POWER.

(2) Connect the coaxial lead from the transmitter under test to the R.F. socket on the right-hand side of the instrument.

Note: The TF 1065 has an input impedance of 50 ohms; TF 1065/1 has an input impedance of 75 ohms.

2.4 (continued)

(3) The r.f. power will now be indicated on the panel meter.

2.4.1 7-dB Attenuator, Type TM 5280

This optional accessory can be used to extend the r.f. power range of the TF 1065 to 125 watts when making measurements within the range 150 to 185 Mc/s. The attenuator is fitted with 50-ohm coaxial connectors and should be inserted into the coaxial line between the transmitter under test and the R.F. power input socket on the Test Set.

The attenuator has a nominal loss of 7-dB. The actual loss depends upon the operating frequency, however, and may differ from this figure. This frequency variation has been taken into account in the accompanying table and no further correction is necessary.

Measurements using the attenuator are made as follows:-

(1) Set the selector switch to R.F. POWER.

(2) Connect the attenuator between the transmitter under test and the R.F. socket on the side of the Test Set.

(3) Switch on the transmitter and note the power indicated on the panel meter of the Test Set.

(4) Multiply this reading by the factor given in the table below. This gives the correct power in watts.

Frequency (Mc/s)	150	155	160	165	170	175	180	185
Multiplication Factor	3.75	4.0	4.25	4.5	4.75	5.0	5.25	5.5

EXAMPLE:

The attenuator is being used at a frequency of 165 Mc/s and the meter indicates a power of 17 watts. The multiplication factor at this frequency, as shown in the table, is 4.5. The correct power is therefore

$$17 \times 4.5 = 76.5 \text{ watts}$$

2.4.1. (continued)

It should be noted that the attenuator described above is suitable for use with the Transmitter and Receiver Output Test Set Type TF 1065 only.

2.5 DEVIATION MEASUREMENT

The procedure for making deviation measurements can be summarized as follows:-

The r.f. signal, unmodulated, is applied to the R.F. socket. A signal generator, used as the local oscillator and connected to the L.O. socket, is then tuned to produce the required i.f. as shown by a peak in meter deflection. This peak is made to coincide with a mark near f.s.d. on the meter by means of the SET CARRIER control.

If the r.f. carrier now has deviation applied, the meter deflection will be reduced by an amount proportional to the deviation. Points corresponding to sinewave modulation of 5 kc/s, 10 kc/s and 15 kc/s are marked on the meter scale.

A v.h.f. signal generator of the Type TF 1064 series is particularly suited to the role of temporary local oscillator for the deviation meter, as it can also supply the necessary constant-level audio signal for frequency-modulating the transmitter. Other suitable signal generators of the Marconi range are TF 801 (series) or TF 995 (series).

The use of generators employing a simple oscillator with no buffer or multiplier stages is not, in general, recommended. With such generators difficulty may be experienced, particularly at the higher frequencies, due to "pulling" of the oscillator by the transmitter signal.

The detailed procedure for measuring carrier deviation is as follows:-

(1) Connect the coaxial feeder from the transmitter to the R.F. socket on the right-hand side of the Test Set.

(2) Turn the SET CARRIER control to approximately mid-position.

(3) Switch to DEVIATION.

(4) By means of the SET ZERO control, alter the meter indication until the pointer coincides with the SET ZERO mark.

2.5 (continued)

(5) Connect the output of a signal generator to the L. O. socket on the Test Set; this is a type BNC 50-ohm connector. A selection of suitable mating plugs is listed below:

Great Britain:	Films and Equipments Ltd.:	UG-88/U
	Transradio Ltd.:	BN.1/5 or BN.7/5
	Air Ministry:	10H/20935
	Belling-Lee Ltd.:	L.1331/FP or L.1331/RFP
United States:	Military No.:	UG-88/U

(6) Switch on the signal generator and the transmitter and, having allowed sufficient time for both to warm up, tune the signal generator to approximately the same frequency as the transmitter. The transmitter should be unmodulated at this stage.

(7) If the r.f. signal is of the order of 4 watts, adjust the signal generator output to deliver about 100 mV. This signal level may be reduced if more power is available from the transmitter. When using a signal generator of the Type TF 1064 series turn the attenuator clockwise, past the 10 mV mark, so as to make use of the uncalibrated part of the scale.

(8) Tune the signal generator for peak meter deflection on the Test Set. Either one of two frequencies may be selected since a peak deflection will be obtained with the generator tuned to a point 130 kc/s above, or 130 kc/s below, that of the r.f. carrier frequency.

(9) If the peak deflection differs from the SET CARRIER mark by more than about 10% of full scale, alter the level of the generator output and recheck the tuning.

(10) With the signal generator adjusted and accurately tuned, use the SET CARRIER control on the Test Set to bring the pointer of the meter into exact alignment with the SET CARRIER mark.

(11) Finally, modulate the transmitter and, from the reduced meter deflection, note the resulting deviation; the scale is marked at points corresponding to deviations of 5, 10, and 15 kc/s.

2.6 USING THE 7-RANGE TEST METER

D.C. voltage and current measurements may be made on the test-meter section of the instrument, the following ranges being provided:-

D.C. Current	D.C. Voltage
50 μA	10 V
10 mA	100 V
100 mA	1000 V
1 A	

Any of the foregoing ranges may be obtained by turning the selector switch to the required position. Before connecting the instrument to the circuit under test, however, the user should select the highest range available. Then, having ascertained that the meter will not be overloaded, the selector switch may be moved to a more sensitive position if required.

Measurements can be made with either polarity at earth potential since the panel terminals are completely isolated from both case and chassis. The input resistance is approximately 20,000 ohms/volt.

2.6.1 Probe Unit, Type TM 5302

If no output is obtainable from apparatus into which a suitable signal is being injected, the faulty stage may be located in the following manner:-

(1) Connect the probe to the test-meter input terminals by means of the red and black spade connectors provided. Polarity should be observed to avoid reverse meter deflection.

(2) Turn the selector switch to the 50-μA setting.

(3) Connect the alligator clip to the "earthy" side of the circuit under test - normally chassis.

(4) Starting at the input end of the faulty circuit, "follow the signal" through the various stages, working towards the output.

(5) As the probe is advanced towards the output stages, decrease the signal level applied to the input of the faulty equipment.

Note: No attempt should be made to decrease overall probe and meter sensitivity by means of the selector switch.

2.6.1 (continued)

PERMANENT DAMAGE TO THE PROBE RECTIFIER OR METER MAY RESULT IF THE SIGNAL APPLIED TO THE PROBE IS MORE THAN APPROXIMATELY 1 VOLT A.C. OR 300 VOLTS D.C.

(6) Follow the above procedure until a point is discovered where the signal ceases or suffers a sudden incorrect drop in level.

Having isolated the faulty stage, it is normally a simple matter to determine the defective component.

Naturally, the usefulness of the probe is not confined to this one function and it will be found of value for a variety of other test purposes - a typical instance being the location of parasitic oscillations in amplifiers.

3 OPERATIONAL SUMMARY

When the user is familiar with the principles and techniques of operation detailed in Section 2, the following abridged instructions may be found a convenient guide for quick reference.

A.F. Power Meter

Frequency Range:	250 c/s to 10 kc/s.
Measurement Range:	10 μW to 3 watts.
Input Impedance:	3 ohms and 600 ohms.

R.F. Power Meter

Frequency Range:	50 c/s to 500 Mc/s.
Power Range:	Up to 25 watts.
Input Impedance:	50 ohms, TF 1065. 75 ohms, TF 1065/1.

Deviation Monitor

Deviation Range:	0 to 15 kc/s.
Maximum Carrier Frequency:	500 Mc/s.
Input Requirements:	With a carrier power of 4 watts supplied to the R.F. socket, 100 mV c.w. is required at the L.O. socket of the Test Set. For higher carrier powers, the c.w. input can be reduced.

Multi-Range Test Meter

Current Ranges:	50 μA, 10 mA, 100 mA, and 1 ampere d.c. full-scale.
Voltage Ranges:	10, 100, and 1000 volts d.c. full-scale at 20 kΩ/volt.

3 (continued)

MAKING A MEASUREMENT

A.F. Power	Switch to A.F. POWER. Turn A.F. POWER selector to 3-watt setting at desired impedance. Connect apparatus under test to A.F. POWER terminals. Using A.F. POWER selector, increase sensitivity until a.f. power level can be read on appropriate scale of meter.
R.F. Power	Switch to R.F. POWER. Apply transmitter output to R.F. socket and read power level on meter.
Deviation	Switch to DEVIATION. Zero the meter, using SET ZERO control. Apply transmitter and signal generator outputs to R.F. and L.O. sockets respectively. With transmitter unmodulated, tune signal generator for peak meter deflection. Adjust indication to "set carrier" mark by SET CARRIER control. Modulate transmitter and read deviation on meter.
Multi-Range Test Meter	Switch to least sensitive voltage or current range. Increase sensitivity until a readable deflection is obtained on meter.

4 MAINTENANCE

4.1 GENERAL

The following items are included in this handbook to assist in the maintenance of the Transmitter and Receiver Output Test Set, Type TF 1065 (Series):-

Block Schematic Diagram
Complete Circuit Diagram
Component Layout Illustrations
Spares Ordering Schedule with Circuit References.

Section 1, DESCRIPTION, deals with the internal circuits of the Test Set and is intended to be read in conjunction with the Block Schematic and Circuit Diagrams included at the end of this handbook. It is strongly recommended that the user should familiarize himself with this information before commencing the adjustment or replacement of component parts of the instrument.

A description of all the electrical components contained in the instrument - their type, value, rating, etc. - is given in the Spares Ordering Schedule; the Schedule also lists certain selected mechanical components.

The physical location of the electrical components is shown by the Component Layout Illustrations.

4.2 REMOVAL OF CASE

The instrument case is constructed from three basic portions: a front panel, carrying the main chassis and controls; a rear panel; and a cover consisting of top, bottom and sides, formed from one piece of aluminium-alloy sheet. Removal of the case involves the following procedure:-

(1) Place the instrument on its face, knobs downwards.

(2) Remove the four 4-BA screws securing the rear panel - one at each corner - and lift the panel clear of the case.

(3) Lift the sheet-metal cover off the instrument.

4.3 OBTAINING ACCESS TO COMPONENTS

When maintaining or servicing the Test Set, the user may need to obtain access to one or more of the components mounted at the rear of the front panel. For this purpose the complete bulkhead carrying the r.f. load assembly should be removed in the following manner :-

(1) Unsolder the screened lead connecting RV3 to switch SA.

(2) Remove the cable clip securing this lead to the bulkhead.

(3) Unsolder the lead carrying the deviation signal to the 130-kc/s tuned circuit. This should be done at the point where the lead connects to the feed-through capacitor C6.

(4) Unscrew the four 4-BA cheese-head screws along the bottom edge of the bulkhead. The nuts are captive to facilitate reassembly.

(5) At this stage the bulkhead remains attached to the front panel by means of four struts. Remove the six countersunk screws securing the r.f. load assembly and chassis to these struts, taking care not to damage the soldering tags held by two of these screws. The screws, nuts and washers should be set aside until required for reassembly.

(6) With the instrument the correct way up, the complete bulkhead and r.f. load can be lifted away from the struts, leaving the components on the front panel exposed to view.

4.4 WORKING VOLTAGES

The two positive battery leads are marked 6.75 and 5.4 volts; these figures represent the open-circuit voltages with a new battery. When measuring the on-load voltages, the readings obtained should be approximately 6.6 volts and 5.28 volts respectively. When discharged, the battery voltage falls with great rapidity and no doubts will arise regarding the necessity for replacement.

4.4 (continued)

Under conditions of correct operation, the collector current for each transistor should be between 300 and 500 µA. In the unlikely eve of transistor failure, the SET ZERO control will no longer function correctly and the faulty transistor may be located by measuring the collector currents. The faulty transistor will, in most cases, be fou to have a collector current considerably greater than that quoted abov

4.5 REPLACEMENT OF INTERNAL BATTERY

The internal supply for the transistor amplifier consists of a single Mallory Type SKB 639 mercury battery. The life of this 3400-mAH unit is extremely long and the necessity for replacement should not arise until the instrument has seen a considerable amount of servi However, to avoid the inconvenience of battery failure, a routine checl on the voltage should be made every six months. (See also Section 4.4 WORKING VOLTAGES.)

Replacement should be carried out as follows:-

(1) Remove the instrument case as described in Section 4.2. The mercury battery is fitted in a clamp immediately behind the front-panel D.C.+ terminal.

(2) Unsolder the two coloured wires leading to the top of the battery. Both wires are of positive polarity; the blue one is marked "+6.75 V", the yellow one "+5.4 V". Note that the blue wire is connected to the upper soldering tag.

(3) Invert the complete instrument and unsolder the common negative connection at the bottom of the battery.

(4) Slacken the clamping bolt and remove the spent battery. Detach the paxolin disk from the negative terminal and transfer it to the new battery.

(5) Fit the replacement battery and tighten the clamp sufficiently to prevent movement. Over-tightening may tend to crush the battery case and should be avoided.

(6) Solder the two positive leads to their appropriate tags, the blue lead uppermost. Solder the common negative lead to the tag protruding through the hole in the paxolin disk at the bottom of the battery.

4.5 (continued)

Replacement batteries may be obtained from Marconi Instruments Ltd., or direct from the manufacturers:

Mallory Batteries Ltd.,
Rainham Works,
Rainham Road South,
Dagenham, Essex.

4.6 REPLACEMENT OF SEMICONDUCTORS

This section gives details of the replacement of the various semiconductor devices used in the Test Set.

When removing or fitting semiconductors it is recommended that a thermal shunt be used. This can easily be made by soldering copper blocks within the jaws of a small crocodile clip. The thermal shunt should be clipped over the lead-out wire between the component and the hot soldering iron. When fitting diodes, polarity must be carefully observed.

Silicon Diode MR1 is located in a spring holder between the r.f. load and the bulkhead. No dismantling is required, other than removing the instrument from its case as described in Section 4.2. MR1 should be eased out of its holder by means of a small screwdriver and the replacement diode inserted with the finger-tips.

Replacement types: CV291, CS2-A.

Germanium Diode MR2 has wire ends and is mounted on a tag strip about two inches from the mercury battery. In order to replace this component, the instrument must be removed from its case as described in Section 4.2. The bulkhead and r.f. load assembly should then be detached (see Section 4.3) and MR2 unsoldered. Replacement of MR2 necessitates reselection of R27 (see Section 4.8.6).

Replacement types: CV425, CG1-E.

Germanium Diode MR3 is of the same type as MR2 and is mounted on a tag-board above T1. Replacement of MR3 involves the removal of both the instrument case and the bulkhead assembly carrying the r.f. load (see Sections 4.2 and 4.3).

4.6 (continued)

Replacement of MR3 may necessitate reselection of R15 (see Section 4.8.2).

Replacement types: CV425, CG1-E.

Silicon Diode MR4 is located within the small screening box mountec on the r.f. load assembly. In order to replace MR4, the instrumer should be removed from its case (see Section 4.2) and the lid of the screening box removed. MR4 is mounted in a non-reversible holde and may be removed with the aid of a small screwdriver.

Replacement of this diode may affect the accuracy of r.f. power measurements at frequencies above about 400 Mc/s. In the event o replacement becoming necessary, the trimmer capacitor C5 should l readjusted by comparing the instrument with a standard power mete1 (see Section 4.8.5).

Replacement types: CV291, CS2-A.

Junction Transistors VT1 and VT2 are mounted in ametal block, of considerable thermal inertia, attached to the front panel by two scre' Replacement involves the removal of the instrument from its case (Section 4.2) and also the removal of the bulkhead and r.f. load assen (Section 4.3). The employment of a thermal shunt is of the upmost importance when unsoldering the transistor leads.

To remove the transistors, disconnect all six lead-out wires and remove the block containing the transistors. When fitting the new transistors, wrap copper foil (0.001-inch thick) round them so that they form a tight push-fit in the block. Care should be exercised no to damage the transistors during the fitting process and note should b taken of the white identification spots marking thecollector lead-out wires. Refit the block on the front panel and solder the six wires to their appropriate tags; when doing so, avoid bending the leads nearer than 1.5 mm to the seal.

As indicated on the Circuit Diagram, the collector lead-out wire is marked with a white spot. The emitter connection is diametricall opposite the collector lead, with the base connection in the middle. In the unlikely event of the white spot having been rendered indistingui able, the collector lead may still be identified by the position of the base connection which is slightly offset towards the emitter connectior

4.6 (continued)

The actual dimensions between the lead-out wires are:-

emitter to base 0.85 mm
base to collector 1.25 mm

For details of simple tests to enable the user to assess the performance of the individual transistors and select replacements, see Section 4.8.7.

4.7 PRESET AND SPECIALLY SELECTED COMPONENTS

In the manufacturing data for the TF 1065 series, certain of the components are either specified as being of the preset type or designated for individual selection. The setting or selection of these components is carried out during the factory calibration of the instrument; this is necessary since the operating characteristics of the instrument have to conform to a quantitative specification including both maximum and minimum limits.

If in servicing the instrument it becomes necessary to replace a selected or preset component, it will also be necessary to repeat the factory test procedure by which the component was originally adjusted or selected.

Again, in any servicing involving the replacement of a component which is neither preset nor selected, the user should carefully consider the possible effect on the performance of the circuit involved; if the performance has been set previously by means of a preset or specially selected component, it may be necessary to readjust or reselect that component in addition to replacing the faulty one.

Section 4.8 contains, in a series of subsidiary sections, a range of tests whereby the main points of performance of the instrument can be checked; these sections also deal with the adjustment of preset components and with the choice of value for individually selected components. Table 1 lists the circuit reference numbers for both types of component together with the numbers of the section in which their adjustment or selection is described.

Components which are individually selected are distinguished in the Spares Ordering Schedule by a single asterisk.

4.7 (continued)

TABLE 1

Selected Component	Section Describing Selection	Selected Component	Section Describing Selection
R9	4.8.3	VT1)	4.8.7
R10	4.8.3	VT2)	
R11	4.8.3		
R15	4.8.2	**Preset Component**	**Section Describing Adjustment**
R21	4.8.2		
R25	4.8.2		
R26	4.8.2	RV3	4.8.5
R27	4.8.6	C5	4.8.5
R29	4.8.2		

4.8 SCHEDULE OF TESTS

The following information is based on the internal factory test schedule No. TS 1065.

4.8.1 Apparatus Required

(a) Beat Frequency Oscillator capable of delivering 2 watts output at 1 kc/s; 600 ohms impedance; e.g. Marconi Type TF 894A.

(b) Valve Voltmeter with an a.c. accuracy of ±2% of f.s.d. or better; e.g. Marconi Type TF 1041 (Series).

(c) Sensitive Valve Voltmeter, e.g. Marconi Type TF 1100.

(d) Decade Potentiometer (voltage-dividing resistance box).

(e) A.F. Transformer, 10 : 1 ratio, at least 4-watt rating.

(f) Standardized Current Meter for the accurate measurement of 10 mA, 100 mA and 1 ampere.

(g) Dynamometer Wattmeter for the accurate measurement of 50-c/s power in the range 2 to 20 watts.

(h) Source of r.f. power capable of delivering at least 4 watts at frequencies up to 450 Mc/s.

4.8.1 (continued)

(i) Standardized R.F. Power Meter for the accurate measurement of r.f. power at 450 Mc/s, e.g., standardized Marconi Type TF 1152 for TF 1065/1, or TF 1152/1 for TF 1065.

(j) Signal Generator with accurately calibrated output attenuator, covering 120 to 140 kc/s, e.g., Marconi Type TF 885A/1.

(k) Signal Generator to deliver an output of up to 470 Mc/s at 1 volt. The drift after warm-up to be not greater than 0.02% in a ten-minute period, e.g., Marconi Type TF 801C or TF 801D.

(l) Frequency-Modulated Signal Generator to provide outputs from 11 to 470 Mc/s with a frequency stability of the same order as item (k). Deviations of 5, 10 and 15 kc/s required, e.g., Marconi Type TF 1066 (Series).

(m) F.M. Deviation Meter for the accurate measurement of 5, 10, and 15 kc/s deviations at a carrier frequency of approximately 11 Mc/s, e.g., Marconi Type TF 934 (Series).

(n) Crystal-Controlled Transmitter to supply 4 watts at v.h.f. Output impedance 50 ohms when testing TF 1065, or 75 ohms when testing the TF 1065/1.

(p) Variable source of a.c. and d.c. capable of delivering outputs of up to 1 ampere and 500 volts d.c., and 25 watts a.c. (50 c/s).

4.8.2 A.F. Power Meter (Apparatus Required: Items a, b, c, d and e)

This section of the Test Set permits the measurement of a.f. power, at both 3 and 600 ohms impedance, in five ranges: 300 µW, 3 mW, 30 mW, 300 mW and 3 watts. These ranges can be standardized by selection of certain resistors as shown below:-

Selection of R15

(1) Switch to A.F. POWER.

(2) Select the 600-ohm, 3-mW range.

(3) Apply 1.095 volts at 1 kc/s to the A.F. POWER terminals.

4.8.2 (continued)

(4) Select a value for R15, if necessary, until an indication of 2 mW is obtained on the meter.

Selection of R26

(1) Connect the A.F. POWER terminals of the instrument to the tes circuit shown in Drawing No. TLB 28871(a). Resistor R should be a close-tolerance 600-ohm resistor of at least 2 watt rating.

(2) Adjust the B.F.O. output and RV1 until the standardized valve voltmeter (item b) indicates a convenient multiple of 693 mV - sa 6.93 volts.

(3) Using the decade potentiometer, connect the sensitive valve voltmeter (item c) to terminals y-y and calibrate it at 693 mV.

(4) Transfer the sensitive valve voltmeter to terminals x-x and adjust RV2 until the same deflection is obtained.

(5) Note the power level indicated by the TF 1065 and enter the meter reading on a table similar to TABLE 2, together with the percentage error.

(6) Repeat the above sequence with test voltages of 2.19 volts, 6.93 volts, 21.9 volts, and 69.3 volts to determine the error at 2 mW, 20 mW, 200 mW and 2 watts respectively.

(7) The value of R29 should be adjusted on the 300 μW range, and R2 on the other ranges, until the positive and negative errors are equalized.

Selection of R21

(1) Connect the instrument to the test circuit shown in Drawing No. TLB 28871(b). Resistor R should be a close-tolerance 3-oh resistor of at least 2 watts rating.

(2) Using a similar procedure to that already described, check the percentage error on the 3-ohm ranges and enter the results in a table similar to TABLE 3.

(3) The value of R25 should be adjusted on the 300 μW range, and R2 on the other ranges, until the positive and negative errors are equalized.

4.8.2 (continued)

TABLE 2

Range 600 Ω	Ref. Level	Applied Volts	TF 1065 reading	Error %
300 µW	200 µW	693 mV	...... µW	.... %
3 mW	2 mW	2.19 V	...... mW	.... %
30 mW	20 mW	6.93 V	...... mW	.... %
300 mW	200 mW	21.9 V	...... mW	.... %
3 watts*	2 watts	69.3 V	...... watts	.... %
3 watts*	1 watt	49.0 V	...... watts	.... %

TABLE 3

Range 3 Ω	Ref. Level	Applied Volts	TF 1065 reading	Error %
300 µW	200 µW	49.0 mV	...... µW	.... %
3 mW	2 mW	155 mV	...... mW	.... %
30 mW	20 mW	490 mV	...... mW	.... %
300 mW	200 mW	1.55 V	...... mW	.... %
3 watts*	2 watts	4.90 V	...... watts	.... %
3 watts*	1 watt	3.46 V	...... watts	.... %

* Note: In the event of the B.F.O. being unable to supply the required 4 watts the final measurement should be made at a reference level of 1 watt - the B.F.O. delivering an output of 2 watts.

4.8.3 D.C. Current Ranges (Apparatus Required: Items f and p)

Apart from the 50-μA range, for which the basic meter movement is used alone, each current range employs a shunt resistor. These resistors (R9, R10 and R11), of nominal values 0.05, 0.5 and 5 ohms, are selected to give meter readings accurate to within 5% of f.s.d.

Adjustment of R9

(1) Connect a standardized current meter (item f) to one of the D.C. terminals of the Test Set.

(2) Switch both instruments to their 1-ampere ranges.

(3) Connect the other D.C. terminal and the other side of the standardized current meter to a suitable source of d.c., via a variable resistor or rheostat. Adjust the current until the standardized meter reads exactly 1 ampere.

(4) Check that the Test Set is accurate to within 5% of f.s.d. and, if necessary, adjust R9 as follows:-

(5) Switch off the d.c. supply.

(6) Apply a hot soldering iron to the joint at one end of R9 and move the resistance wire relative to the soldering tag, increasing or decreasing the effective length.

(7) Reconnect the d.c. supply and repeat steps (4), (5) and (6) until the Test Set indication lies within the acceptable limits.

Selection of R10 and R11

Using the same method as for adjusting R9, check the accuracy of the Test Set when switched to the 100 mA and 10 mA ranges. If necessary, alter the value of R10 (100 mA) or R11 (10 mA) - remembering to switch off the d.c. supply before disconnecting either of these shunt resistors.

4.8.4 D.C. Voltage Ranges (Apparatus Required: Items b and p)

The three voltage ranges - 10, 100 and 1000 volts - employ resistors R6, R7 and R8, respectively, in series with the meter. The method of selecting these resistors is as follows:-

(1) Connect a variable d.c. voltage source to the D.C. terminals of the Test Set. Connect an accurate voltmeter in parallel with these terminals.

(2) Switch the Test Set to the 1000 V range and set the d.c. source to give an output of 500 volts, as indicated on the monitoring voltmeter.

(3) Check that the reading of the TF 1065 meter is accurate to within 5% of f.s.d. If not, select a new value for R8.

(4) Repeat steps (1) to (3) with a 100-volt supply and the Test Set switched to the 100 V range. Select a value of R7 to give the correct meter reading.

(5) Repeat steps (1) to (3) with a 10-volt source and the Test Set switched to the 10 V range. If necessary, reselect R6.

4.8.5 R.F. Power Meter (Apparatus Required: Items g, h, i and p)

The basic Test Set may be used to measure r.f. power outputs of up to 25 watts. To standardize the meter scale, carry out the following procedure:-

(1) Switch to R.F. POWER and connect a 50-c/s source, via a dynamometer wattmeter, to the R.F. input socket.

(2) Adjust RV3 to give an f.s.d. of 25 watts.

(3) Measure the error at the following power levels:-

2W, 6W, 10W, 14W, 18W and 22W.

(4) If the scale shape error is greatly in excess of 3% f.s.d. at any point, readjust the value of RV3 and repeat step (3) until the positive and negative errors are equalized.

4.8.5 (continued)

Adjustment of C5

Trimmer capacitor C5 is provided to damp out a rise in meter indication which may occur above about 400 Mc/s; the sequence given below describes the correct method of adjusting this component.

(1) Connect a 450-Mc/s r.f. source to a standardized r.f. power meter; the source should have an output impedance of 50 ohms when testing a TF 1065, and 75 ohms when testing a TF 1065/1.

(2) Adjust the level of the power source to give an exact indication of, say, 5 watts.

(3) Taking due precautions to prevent damage to the r.f. source when the load is momentarily disconnected, substitute the TF 1065, switched to R.F. POWER, for the r.f. power meter.

(4) With the lid of the screening box in position, adjust C5 to obtain an identical power indication on the TF 1065; when correctly adjusted, C5 will normally be near its minimum-capacity setting.

4.8.6 Deviation Indicator (Apparatus Required: Items c, j, k, l, m, and n)

I.F. Sensitivity

The following test should be carried out to check that the i.f. sensitivity of the deviation indicator is satisfactory and that the i.f. circuit resonates at the correct frequency.

(1) Switch to DEVIATION; set zero on the meter, and position the SET CARRIER control to mid-travel.

(2) Disconnect R3 and apply about 15 mV from a standard signal generator to the tap on L1. Tune the signal generator for maximum deflection on the TF 1065.

(3) Note the resonant frequency at which maximum meter deflection is obtained; this will normally be between 120 and 140 kc/s.

4.8.6 (continued)

(4) With the SET CARRIER control at maximum, note the output voltage of the signal generator required to give a meter indication of "set carrier" - normally this will be between 10 and 15 mV.

(5) Repeat step (4) with the SET CARRIER control at minimum. An output signal of between 16 and 21 mV will normally be required to give a meter indication of "set carrier".

(6) With the meter at "set carrier", connect a sensitive valve voltmeter across L1. The magnitude of the i.f. voltage developed should be about 300 mV with the SET CARRIER control at minimum. At the maximum setting of the control about 200 mV should be developed.

Selection of R27

The reduced i.f. voltage appearing across L1/C2 for a given deviation is a function of the shape of the response curve. In most cases, the Q of the tuned circuit is such that the voltage falls away too rapidly and, if left uncorrected, exaggerated deviation indications result.

Correction is applied, when necessary, by means of a shunt resistor (R27) connected across the tuned circuit. The correct value for this resistor is determined in the following manner:-

(1) Remove the r.f. load assembly as described in Section 4.3.

(2) Switch to DEVIATION, and set zero on the meter.

(3) Connect the tap on L1 to the circuit given on Drg. No. TLB 28872.

(4) Set the unmodulated r.f. source (item k) to give an output of 1 volt at 11 Mc/s.

(5) With the SET CARRIER control at mid-travel and an unmodulated input of about 100 mV from the f.m. signal generator, tune the latter to obtain a peak on the meter of the TF 1065; this should occur at a frequency of about 130 kc/s above or below 11 Mc/s.

(6) Adjust the input level to give a meter deflection of "set carrier".

4.8.6 (continued)

(7) Apply known deviations of 5, 10 and 15 kc/s (checking the accuracy by means of the deviation meter) and note the indication given on the TF 1065.

(8) If the Test Set indicates a deviation higher than that being applied, reselect R27. Deviation indications should be accurate to within ±15% at 1 kc/s modulation frequency and 15 kc/s deviation.

If the Test Set indicates a deviation lower than that being applied, a fault must be suspected. No provision is made for correcting such low readings, but it is worth noting that a change of MR2 may alter the sensitivity by as much as 20%, and this may well be the cause of such errors.

<u>Tests Using a Transmitter</u>

With the TF 1065 completely assembled, carry out the following tests:-

(1) Using a suitable transmitter, apply a v.h.f. signal of 4 watts to the R.F. input socket of the TF 1065. The transmitter should be crystal-controlled.

(2) Switch to DEVIATION, and set zero on the meter.

(3) Connect an unmodulated f.m. signal generator (item 1) to the L.O. socket and tune to the transmitter frequency ± the i.f. of the Test Set.

(4) With the SET CARRIER control at maximum, obtain "set carrier" indication by adjusting the output level of the signal generator; an output of between 45 and 60 mV will normally be required.

(5) Repeat step (4) with the SET CARRIER control at minimum. A voltage of between 75 and 100 mV is usually required for "set carrier" conditions.

(6) Check that the indication of the TF 1065 is substantially correct at deviations of 5, 10 and 15 kc/s.

4.8.7 Transistor Amplifier (This section applies to earlier models containing (OC71 transistors.

Under normal operating conditions the collector current for each transistor should be approximately 400 μA. In the unlikely event of complete transistor failure, the SET ZERO control will cease to function and the faulty transistor may be located by measuring the separate collector currents. In general, the faulty transistor will probably be found to have a considerably increased collector current, but this may not always be the case.

If it is suspected that one of the transistors is defective, the following test to measure the grounded-emitter collector cut-off current ($I'c(o)$) may be carried out without completely removing the transistor from the circuit.

(1) With the Test Set switched OFF, unsolder the collector and base leads of the suspected transistor, using a thermal shunt.

(2) Leaving the base completely disconnected, introduce a micro-ammeter between the collector lead and the negative (bottom) battery terminal. Under these conditions the meter will indicate the grounded-emitter collector cut-off current which, for the OC71, is quoted by the manufacturers as 150 μA; the reading obtained should therefore be of this order, bearing in mind the accepted (rather wide) variation between individual transistors. If an $I'c(o)$ of more than 325 μA is obtained, the transistor may be definitely regarded as faulty.

Should it become necessary to replace either or both of the transistors, it is advisable first to measure the current gain (α') of the replacement, as described below. Transistors having a gain anywhere within the makers' limits of 30 to 75 will probably be satisfactory; however, to compensate for possible aging effects, it is advisable to use only those having a gain of at least 45. Care should also be taken to ensure that the values for the two transistors do not differ by more than 10.

The Mullard OC71 transistor is equivalent to the U.S. type 2N280.

Measurement of α'

The following information is based on the test procedure recommended by the manufacturers, and is included to enable the user to make a thorough assessment of transistor performance. It should

4.8.7 (continued)

not be regarded as a routine test, however, since it necessitates the complete removal of the transistor so that it can be connected in the circuit shown on Drawing No. TLB 28873.

The base/collector short-circuit current gain of a transistor for small signal inputs is defined as:

$$\alpha' = \frac{\delta Ic}{\delta Ib} Vc$$

where δIc = change in collector current
δIb = change in base current
Vc = collector voltage.

The relationship between Ic and Ib being approximately linear permits finite changes in current to be used for the measurement of α'. Measurement is thus reduced to observing the collector current produced by a known base current, the standing current I'c(o) being backed off by means of a "set zero" control, R1. The test should be carried out as follows:-

(1) With both batteries disconnected, connect the transistor to the test circuit shown in Drawing No. TLB 28873.

(2) Set R1 and R2 to maximum resistance.

(3) Set meter M1 to the 500-μA range.

(4) Open switch S1 (SET ZERO position).

(5) Connect the 4.5-volt battery. Meter M1 will indicate the grounded-emitter collector cut-off current, I'c(o).

(6) Reject the transistor if I'c(o) is more than 325 μA - the normal I'c(o) of an OC71 transistor is of the order of 150 μA.

(7) Connect the 18-volt supply.

(8) Gradually decrease the value of R1 and note the reduced meter deflection (M1); continue this backing-off until zero meter deflection is obtained. Take great care not to exceed the zero-point setting of R1; excessive backing-off voltage could damage the meter, due to a high reverse current through the 4.5-volt battery.

4.8.7 (continued)

(9) Switch meter M1 to the 5-mA range.

(10) Close switch S1 (OPERATE position) and note the base current Ib indicated by the meter M2.

(11) Decrease the value of R2 by a small amount until the base current is a convenient whole number.

(12) Read the collector current, Ic, on meter M1 and determine α' by:-

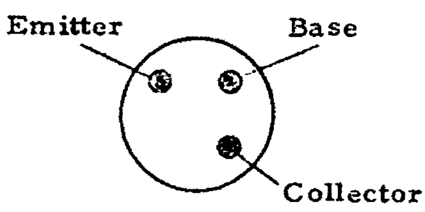
$$\alpha' = \frac{\text{Ic (mA) x 1000}}{\text{Ib }(\mu\text{A})}$$

(13) By measuring the resultant change in Ic for small changes in Ib, determine the value of α' at various levels of Ib. With an Ic of approximately 3 mA, an α' of 47 is typical for the OC71, although with individual specimens α' may range from 30 to as much as 80.

Note: Resistor R3 is included to limit the maximum base current and thus the collector dissipation, to a safe value for the OC71.

4.8.8 <u>Alternative Transistor</u> (This section applies to earlier models (containing OC71 transistors.

Certain instruments are fitted with an alternative type of transistor, AT/AF1, manufactured by Associated Transistors Ltd. The wire connections differ from the OC71 and may be identified from the sketch below:-



AMENDMENT SHEET No. 406/1

Operating and Maintenance Handbook

for

Transmitter and Receiver Output Test Set Types TF 1065 and TF 1065/1

(A) Section 4.8.2., page 23:- If there are excessive errors on the 300 µw ranges the values of R25 and R29 may be adjusted. These resistors apply to the 600 - ohm and 3 - ohm ranges respectively and should be selected before the values of R26 and R21 are adjusted.

(B) On the circuit Diagram, Drawing No. TLC 29521, resistor R24 should be deleted and RV3 inserted in its place.

(C) TRANSISTORS. The Type OC71 transistors (with the Type AT/AF1 as alternative) have been replaced on later instruments by Type OC202 transistors. The lead-out wire positions on the OC202 are the same as those on the OC71.

SPARES ORDERING SCHEDULE No. SOS/1065-/1

WITH CIRCUIT REFERENCES

for

TRANSMITTER AND RECEIVER OUTPUT TEST SET

TYPES TF 1065 AND TF 1065/1

Applicable to Instrument Serial Nos.

JA 184/01 to JA 184/50
JA 273/01 to JA 273/50
JA 324/001 to JA 324/100
JA 274/01 to JA 274/50
JA 406/001 to JA 406/100
JA 535/01 to JA 535/75
JA 634/01 to JA 634/75
JA 912/01 to JA 912/40

When ordering replacement parts, ALWAYS QUOTE THE TYPE NUMBER AND SERIAL NUMBER OF THE INSTRUMENT CONCERNED.

To specify the individual parts required, STATE FOR EACH PART THE QUANTITY AND THE APPROPRIATE SOS ITEM NUMBER.

For example, to order replacements for the 150-kΩ resistor R17, and the 0.0001-μF capacitor C3, quote as follows :-

Spares required for TF 1065 (or TF 1065/1), Serial Number 000000

1 off, SOS Item 18
1 off, SOS Item 33

It is important that the distinguishing code "SOS" preceding each item number should not be omitted.

SOS Item No.	Circuit Ref.	Description	Works Ref.
		FIXED RESISTORS	
1	R1	Carbon, 50 Ω ±10%, complete with inner cone. (TF 1065 only.)	13-TM5286
2	R1	Carbon, 75 Ω ±10%, complete with inner cone. (TF 1065/1 only.)	13-TM5286/1
3	R2	Composition, 180 Ω ±5%, 1/4 W.	PC66604/16
4	R3	Carbon, 47 Ω ±10%, 1/4 W.	15-TM5286
5	R4	Composition, 220 Ω ±5%, 1/4 W.	PC66604/17
6	R5	Composition, 4.7 kΩ ±10%, 1/4 W.	PC66609/27
7	R6*	Wire-Wound, 200 kΩ ±2%, 1/4 W.	40-TF1065
8	R7	Wire-Wound, 2 MΩ ±2%, 1/4 W.	41-TF1065
9	R8	Wire-Wound, 20 MΩ ±2%, 2 W.	3-TM5287
10	R9*	Wire-Wound, 0.05 Ω ±2%.	TB25955/1
11	R10	Wire-Wound, 0.5 Ω ±2%, including former.	TC9638B TB9314
12	R11	Wire-Wound, 5 Ω ±2%, including former.	TC9638B TB9314
13	R12	Wire-Wound, 650 Ω ±5%, 14 W.	7-TM5287
14	R13	Carbon, 270 Ω ±5%, 1/4 W.	13-TM5287
15	R14	Carbon, 330 Ω ±5%, 1/4 W.	14-TM5287
16	R15*	Composition, 680 Ω ±5%, 1/4 W.	PC66602/18
17	R16	Composition, 8.2 kΩ ±5%, 1/4 W.	PC66602/31
18	R17	Composition, 150 kΩ ±10%, 1/4 W.	PC66609/45

* Nominal value: actual value determined during test procedure.

SOS Item No.	Circuit Ref.	Description	Works Ref.
		FIXED RESISTORS (continued)	
19	R18	Composition, 150 kΩ ±10%, 1/4 W.	PC66609/45
20	R19	Composition, 6.8 kΩ ±10%, 1/4 W.	PC66609/29
21	R20	Composition, 6.8 kΩ ±10%, 1/4 W.	PC66609/29
22	R21*	Carbon, 68 Ω ±5%, 1/4 W.	6-TM5287
23	R22	Composition, 680 Ω ±10%, 1/4 W.	PC66609/17
24	R23	Composition, 100 kΩ ±10%, 1/4 W.	PC66609/43
26	R25	Composition, 1 kΩ ±10%, 1/4 W.	PC66609/19
27	R26*	Composition, 10 kΩ ±10%, 1/4 W.	PC66609/31
28	R27*	Composition, 390 kΩ ±10%, 1/4 W.	PC66609/50
29	R28*	Composition, 330 Ω ±10%, 1/2 W.	PC66611/19
30	R29	Composition, 1.5 kΩ ±10%, 1/4 W.	PC66609/21
		CAPACITORS	
31	C1	Paper, 0.001 μF ±20%, 600 V d.c.	21-TM5286
32	C2	Silva Mica, 330 μμF ±5%, 750 V d.c.	54-TF1065
33	C3	Ceramic, 0.0001 μF ±10%, 500 V d.c.; temp. coeff. $-750/10^6$.	55-TF1065
34	C4	Ceramic, Feed-Through, 0.0047 μF, 500 V d.c.	22-TM5286

* Nominal value: actual value determined during test procedure.

SOS Item No.	Circuit Ref.	Description	Works Ref.
		CAPACITORS (continued)	
35	C5	Trimmer, PTFE, 0.7 - 4.0 μμF	23-TM5286
36	C6	Ceramic, Feed-Through, 0.0047 μF, 500 V d.c.	22-TM5286
		POTENTIOMETERS	
37	RV1	Carbon, Linear, 10 kΩ, 750 V d.c.	49-TF1065
38	RV2A-B	Wire-Wound, 600 Ω + 3 kΩ, 2 W, 750 d.c.	50-TF1065
38/1	RV3	Wire-Wound, 10 kΩ ±10%, 1 W.	18-TM5286
		INDUCTOR AND TRANSFORMER	
39	L1	Coil Assembly	TM5142/3
40	T1	Transformer Assembly; includes Items Nos. 9, 10, 13-17, 22, 27 and 45.	TM5308
		TRANSISTORS AND SEMICONDUCTORS	
41	VT1	Junction Transistor, Type OC202	60-TF1065
42	VT2	Junction Transistor, Type OC202	60-TF1065
43	MR1	Silicon Rectifier, Type CV291.	27-TM5286
44	MR2	Germanium Rectifier, Type CG1-E.	61-TF1065
45	MR3	Germanium Rectifier, Type CG1-E.	8-TM5287
46	MR4	Silicon Rectifier, Type CV291.	27-TM5286
47		Mounting Block for VT1 and VT2.	TE25927/5
48		Mount for MR1.	TM4070

SOS Item No.	Circuit Ref.	Description	Works Ref.
		METER	
49	M1	50 μA f.s.d., Moving Coil.	TM3970/67
		BATTERY	
50	BY1	Mercury Battery; Mallory Type SKB 639.	63-TF1065
51		S.R.B.P. Disk, for battery.	TE25927/15
52		Mounting Clip, for battery.	34-TF1065
		PLUGS, SOCKETS AND TERMINALS	
53		Plug, Free, Coaxial, 50 Ω, Type N; to fit Item 56. (TF 1065 only.)	78-TF1065
54		Plug, Free, Coaxial, 75 Ω, Type N; to fit Item 57. (TF 1065/1 only.)	78-TF1065/1
55		Plug, Free, Coaxial, 50 Ω, Type BNC; to fit Item 58.	79-TF1065
56	SKT1	Socket, Fixed, Coaxial, 50 Ω, Type N; for R.F. input. (TF 1065 only.)	28-TM5286
57	SKT1	Socket, Fixed, Coaxial, 75 Ω, Type N; for R.F. input. (TF 1065/1 only.)	28-TM5286/1
58	SKT2	Socket, Fixed, Coaxial, 50 Ω, Type BNC; for L.O. input.	29-TM5286
59		Terminal, D.C.+	TB24330/5
60		Terminal, D.C.-	TB24330/5

SOS Item No.	Circuit Ref.	Description	Works Ref.
		PLUGS, SOCKETS AND TERMINALS (continued)	
61		Terminal, A.F. POWER	TB24330/5
62		Terminal, Earth.	TB24330/5
		SWITCHES	
63	SA	Rotary, 4-pole, 11-position, 4-wafer.	TC4428/433
64	SB	Rotary, 3-pole, 10-position, 3-wafer.	TC4428/434
		KNOBS	
65		Knob, Skirted, for Selector switch.	TB17848/3
66		Knob, Skirted, for A.F. POWER switch.	TB17848/3
67		Knob, Skirted, for SET CARRIER control.	TB17848/4
68		Knob, Plain, for SET ZERO control.	TB23920/2
		MISCELLANEOUS	
69		R.F. Load Assembly; includes Items Nos. 1 - 6, 25, 31, 34 - 36, 43, 46, 48, 56 - 58, and 70 - 74.	
		For TF 1065	TM5286
		For TF 1065/1	TM5286/1
70		Screen, Aluminium Alloy, for Item 69.	TD25930
71		Outer Plate, Right-Hand, for Item 69.	TD25951
72		Outer Plate, Left-Hand, for Item 69.	TD25932

SOS Item No.	Circuit Ref.	Description	Works Ref.
		MISCELLANEOUS (continued)	
73		Mounting Plate, for Items 56 (or 57) and 58; included in Item 69.	TE25927/3
74		Box, Screening; included in Item 69.	TM25927/2
75		Front Panel, for TF 1065.	TE25928/1
76		Front Panel, for TF 1065/1.	TE25928/1A
77		Surround, Aluminium Alloy.	TD24786/1
78		Chassis Rail, Right-Hand, Mild Steel; including Double Anchor Plate.	TE25927/1
79		Chassis Rail, Left-Hand, Mild Steel; including Double Anchor Plate.	TE25927/1A
80		Rear Panel, Aluminium Alloy.	TE25928/2
81		Cover, Aluminium Alloy.	TD25931
82		Feet, Set of Four, Stainless Steel.	TA11420
83		Carrying Handle, Canvas-Backed PVC.	33-TF1065
84		Retainers, for Item 83.	TD25574/6A
85		Hexagonal Wrenches for 2BA, 4BA and 6BA socket set-screws; in linen bag.	81-TF1065
86		Operating and Maintenance Handbook.	OM 1065 (Series)

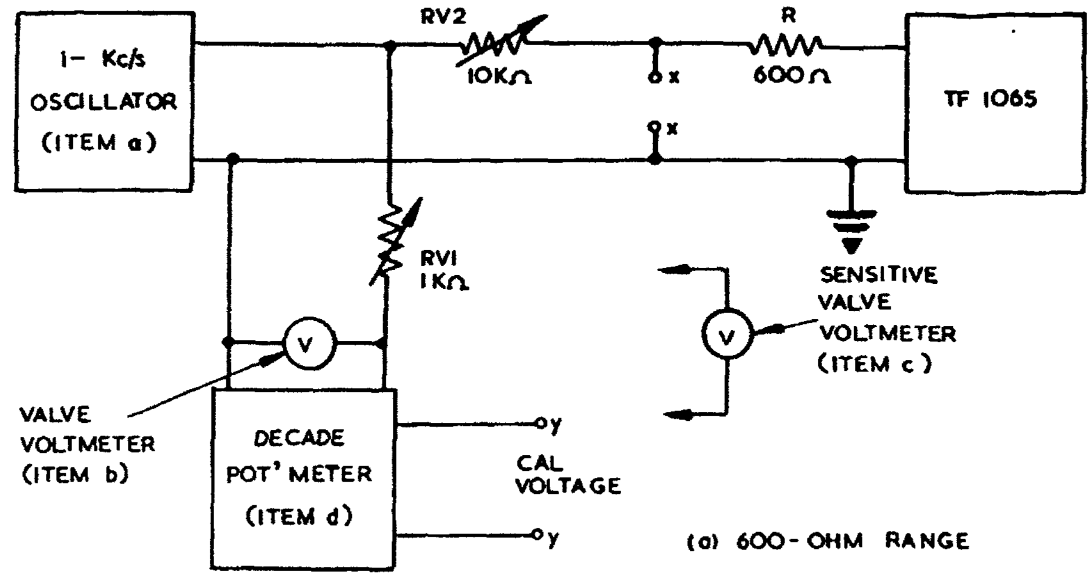
SOS Item No.	Circuit Ref.	Description	Works Ref.
		PROBE UNIT TYPE TM 5302 (Optional accessory)	
87	R	Composition, 4.7 kΩ ±10%, 1/4 W.	PC66609/27
88	C	Paper, 0.001 μF ±20%, 300 V a.c.	6-TM5302
89	MR	Silicon Rectifier, Type CV291.	9-TM5302
90		Spade Terminal, Clix Type TC 415, Black.	14-TM5302
91		Spade Terminal, Clix Type TC 415, Red.	15-TM5302
92		Crocodile Clip, Bulgin Type CR5.	16-TM5302
93		Mounting Plate, for Item 89.	TM4070

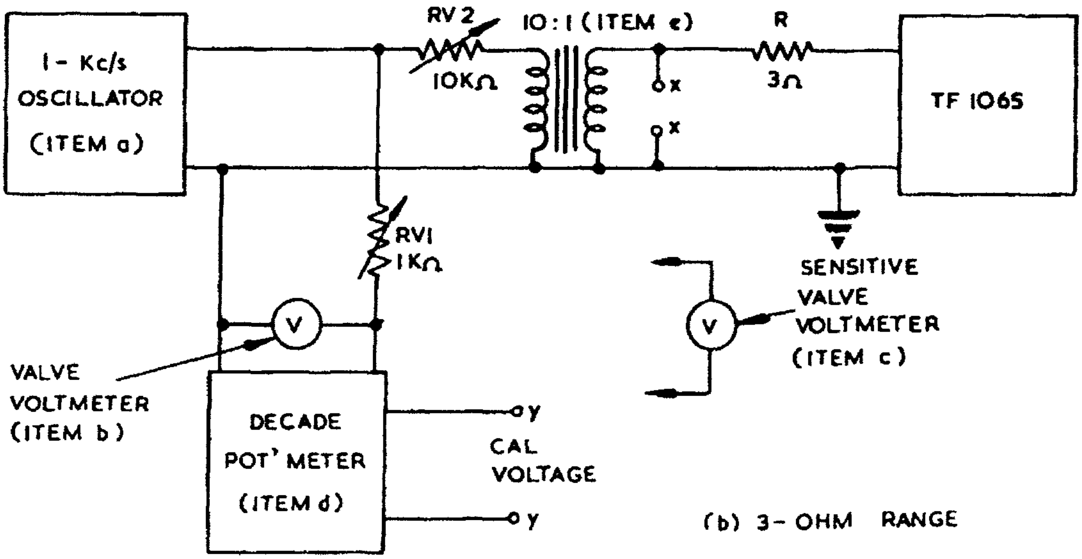
DECIBEL CONVERSION TABLE

Ratio Down			Ratio Up	
VOLTAGE	POWER	DECIBELS	VOLTAGE	POWER
1·0	1·0	0	1·0	1·0
·9886	·9772	·1	1·012	1·023
·9772	·9550	·2	1·023	1·047
·9661	·9333	·3	1·035	1·072
·9550	·9120	·4	1·047	1·096
·9441	·8913	·5	1·059	1·122
·9333	·8710	·6	1·072	1·148
·9226	·8511	·7	1·084	1·175
·9120	·8318	·8	1·096	1·202
·9016	·8128	·9	1·109	1·230
·8913	·7943	1·0	1·122	1·259
·8710	·7586	1·2	1·148	1·318
·8511	·7244	1·4	1·175	1·380
·8318	·6918	1·6	1·202	1·445
·8128	·6607	1·8	1·230	1·514
·7943	·6310	2·0	1·259	1·585
·7762	·6026	2·2	1·288	1·660
·7586	·5754	2·4	1·318	1·738
·7413	·5495	2·6	1·349	1·820
·7244	·5248	2·8	1·380	1·905
·7079	·5012	3·0	1·413	1·995
·6683	·4467	3·5	1·496	2·239
·6310	·3981	4·0	1·585	2·512
·5957	·3548	4·5	1·679	2·818
·5623	·3162	5·0	1·778	3·162
·5309	·2818	5·5	1·884	3·548
·5012	·2512	6	1·995	3·981
·4467	·1995	7	2·239	5·012
·3981	·1585	8	2·512	6·310
·3548	·1259	9	2·818	7·943
·3162	·1000	10	3·162	10·000
·2818	·07943	11	3·548	12·59
·2512	·06310	12	3·981	15·85
·2239	·05012	13	4·467	19·95
·1995	·03981	14	5·012	25·12
·1778	·03162	15	5·623	31·62

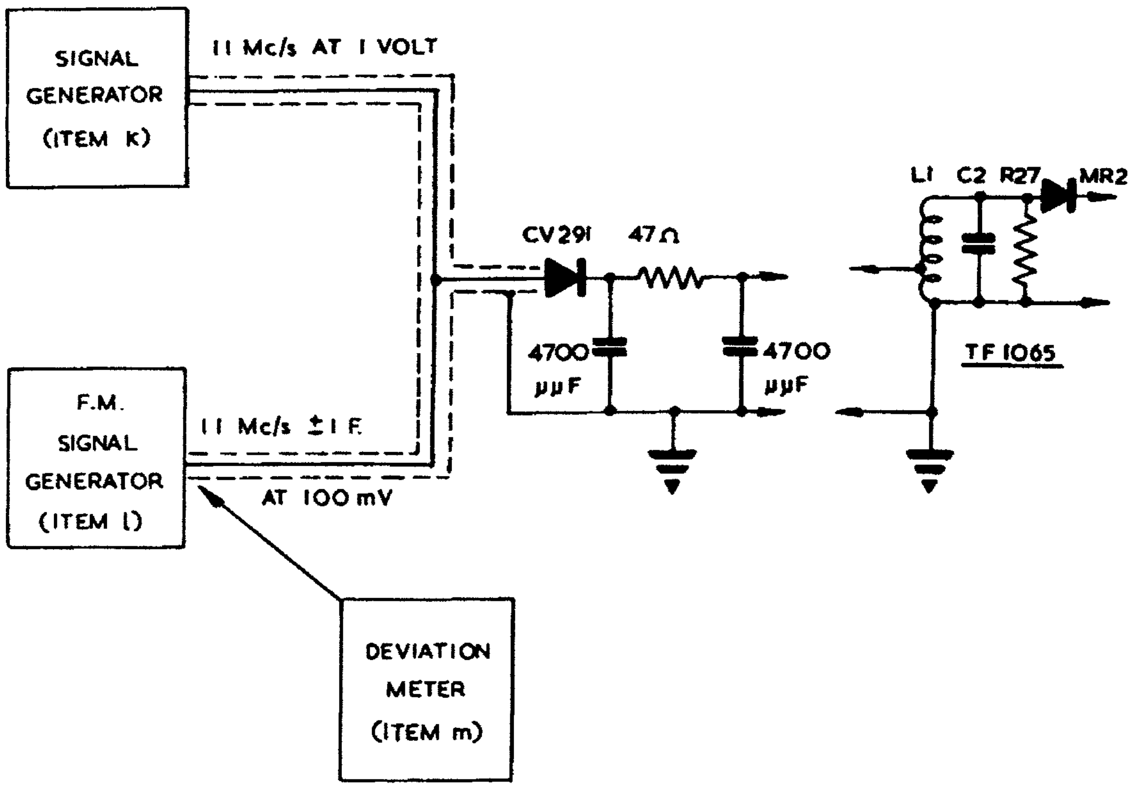
DECIBEL CONVERSION TABLE (continued)

Ratio Down			*Ratio up*	
VOLTAGE	*POWER*	*DECIBELS*	*VOLTAGE*	*POWER*
·1585	·02512	**16**	6·310	39·81
·1413	·01995	**17**	7·079	50·12
·1259	·01585	**18**	7·943	63·10
·1122	·01259	**19**	8·913	79·43
·1000	·01000	**20**	10·000	100·00
·07943	$6{\cdot}310 \times 10^{-3}$	**22**	12·59	158·5
·06310	$3{\cdot}981 \times 10^{-3}$	**24**	15·85	251·2
·05012	$2{\cdot}512 \times 10^{-3}$	**26**	19·95	398·1
·03981	$1{\cdot}585 \times 10^{-3}$	**28**	25·12	631·0
·03162	$1{\cdot}000 \times 10^{-3}$	**30**	31·62	1,000
·02512	$6{\cdot}310 \times 10^{-4}$	**32**	39·81	$1{\cdot}585 \times 10^{3}$
·01995	$3{\cdot}981 \times 10^{-4}$	**34**	50·12	$2{\cdot}512 \times 10^{3}$
01585	$2{\cdot}512 \times 10^{-4}$	**36**	63·10	$3{\cdot}981 \times 10^{3}$
·01259	$1{\cdot}585 \times 10^{-4}$	**38**	79·43	$6{\cdot}310 \times 10^{3}$
·01000	$1{\cdot}000 \times 10^{-4}$	**40**	100·00	$1{\cdot}000 \times 10^{4}$
$7{\cdot}943 \times 10^{-3}$	$6{\cdot}310 \times 10^{-5}$	**42**	125·9	$1{\cdot}585 \times 10^{4}$
$6{\cdot}310 \times 10^{-3}$	$3{\cdot}981 \times 10^{-5}$	**44**	158·5	$2{\cdot}512 \times 10^{4}$
$5{\cdot}012 \times 10^{-3}$	$2{\cdot}512 \times 10^{-5}$	**46**	199·5	$3{\cdot}981 \times 10^{4}$
$3{\cdot}981 \times 10^{-3}$	$1{\cdot}585 \times 10^{-5}$	**48**	251·2	$6{\cdot}310 \times 10^{4}$
$3{\cdot}162 \times 10^{-3}$	$1{\cdot}000 \times 10^{-5}$	**50**	316·2	$1{\cdot}000 \times 10^{5}$
$2{\cdot}512 \times 10^{-3}$	$6{\cdot}310 \times 10^{-6}$	**52**	398·1	$1{\cdot}585 \times 10^{5}$
$1{\cdot}995 \times 10^{-3}$	$3{\cdot}981 \times 10^{-6}$	**54**	501·2	$2{\cdot}512 \times 10^{5}$
$1{\cdot}585 \times 10^{-3}$	$2{\cdot}512 \times 10^{-6}$	**56**	631·0	$3{\cdot}981 \times 10^{5}$
$1{\cdot}259 \times 10^{-3}$	$1{\cdot}585 \times 10^{-6}$	**58**	794·3	$6{\cdot}310 \times 10^{5}$
$1{\cdot}000 \times 10^{-3}$	$1{\cdot}000 \times 10^{-6}$	**60**	1,000	$1{\cdot}000 \times 10^{6}$
$5{\cdot}623 \times 10^{-4}$	$3{\cdot}162 \times 10^{-7}$	**65**	$1{\cdot}778 \times 10^{3}$	$3{\cdot}162 \times 10^{6}$
$3{\cdot}162 \times 10^{-4}$	$1{\cdot}000 \times 10^{-7}$	**70**	$3{\cdot}162 \times 10^{3}$	$1{\cdot}000 \times 10^{7}$
$1{\cdot}778 \times 10^{-4}$	$3{\cdot}162 \times 10^{-8}$	**75**	$5{\cdot}623 \times 10^{3}$	$3{\cdot}162 \times 10^{7}$
$1{\cdot}000 \times 10^{-4}$	$1{\cdot}000 \times 10^{-8}$	**80**	$1{\cdot}000 \times 10^{4}$	$1{\cdot}000 \times 10^{8}$
$5{\cdot}623 \times 10^{-5}$	$3{\cdot}162 \times 10^{-9}$	**85**	$1{\cdot}778 \times 10^{4}$	$3{\cdot}162 \times 10^{8}$
$3{\cdot}162 \times 10^{-5}$	$1{\cdot}000 \times 10^{-9}$	**90**	$3{\cdot}162 \times 10^{4}$	$1{\cdot}000 \times 10^{9}$
$1{\cdot}000 \times 10^{-5}$	$1{\cdot}000 \times 10^{-10}$	**100**	$1{\cdot}000 \times 10^{5}$	$1{\cdot}000 \times 10^{10}$
$3{\cdot}162 \times 10^{-6}$	$1{\cdot}000 \times 10^{-11}$	**110**	$3{\cdot}162 \times 10^{5}$	$1{\cdot}000 \times 10^{11}$
$1{\cdot}000 \times 10^{-6}$	$1{\cdot}000 \times 10^{-12}$	**120**	$1{\cdot}000 \times 10^{6}$	$1{\cdot}000 \times 10^{12}$
$3{\cdot}162 \times 10^{-7}$	$1{\cdot}000 \times 10^{-13}$	**130**	$3{\cdot}162 \times 10^{6}$	$1{\cdot}000 \times 10^{13}$
$1{\cdot}000 \times 10^{-7}$	$1{\cdot}000 \times 10^{-14}$	**140**	$1{\cdot}000 \times 10^{7}$	$1{\cdot}000 \times 10^{14}$





TEST CIRCUIT FOR A.F. POWER METER
(SEE SECTION 4.8.2.)

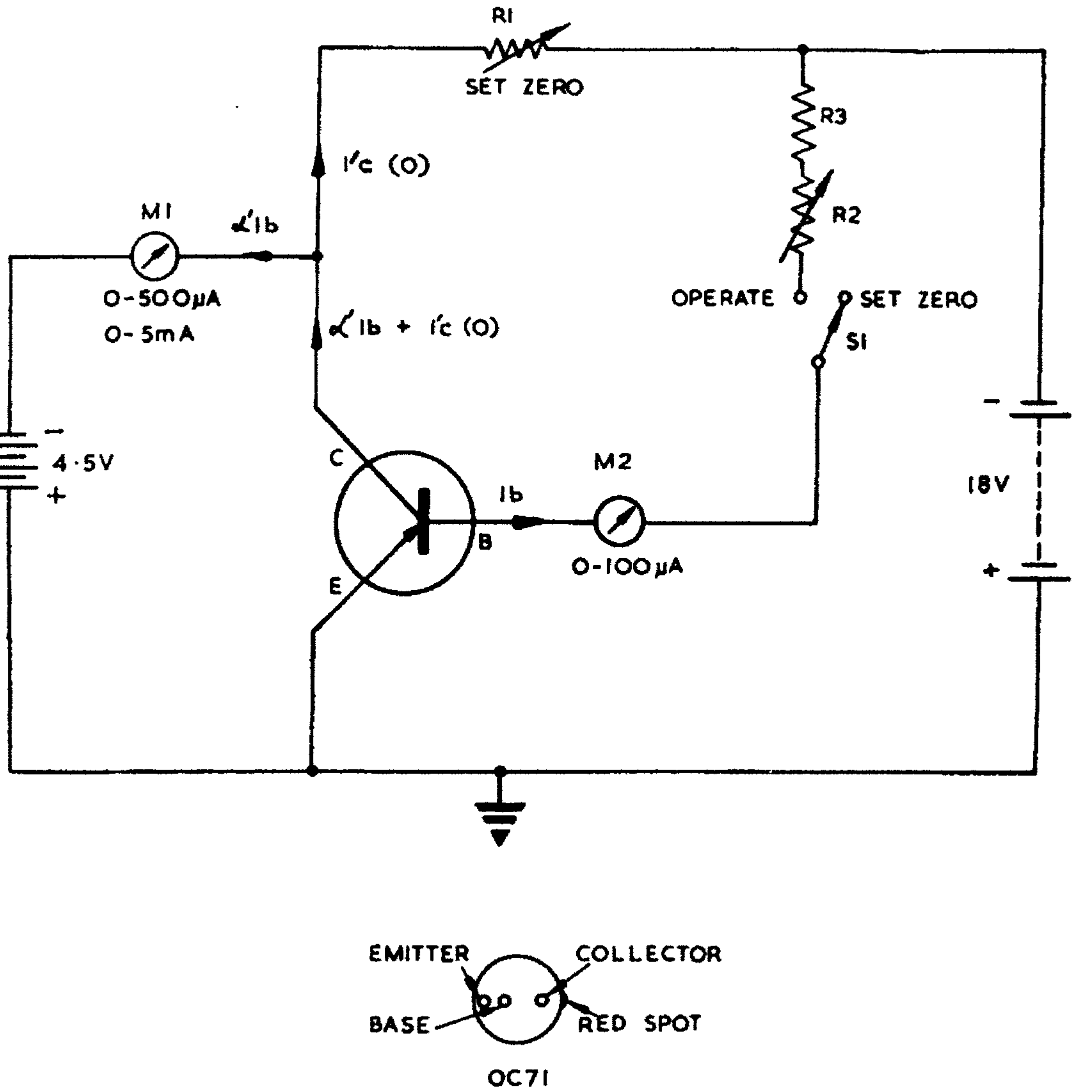


TEST CIRCUIT FOR DEVIATION INDICATOR
(SEE SECTION 4.8.6.)

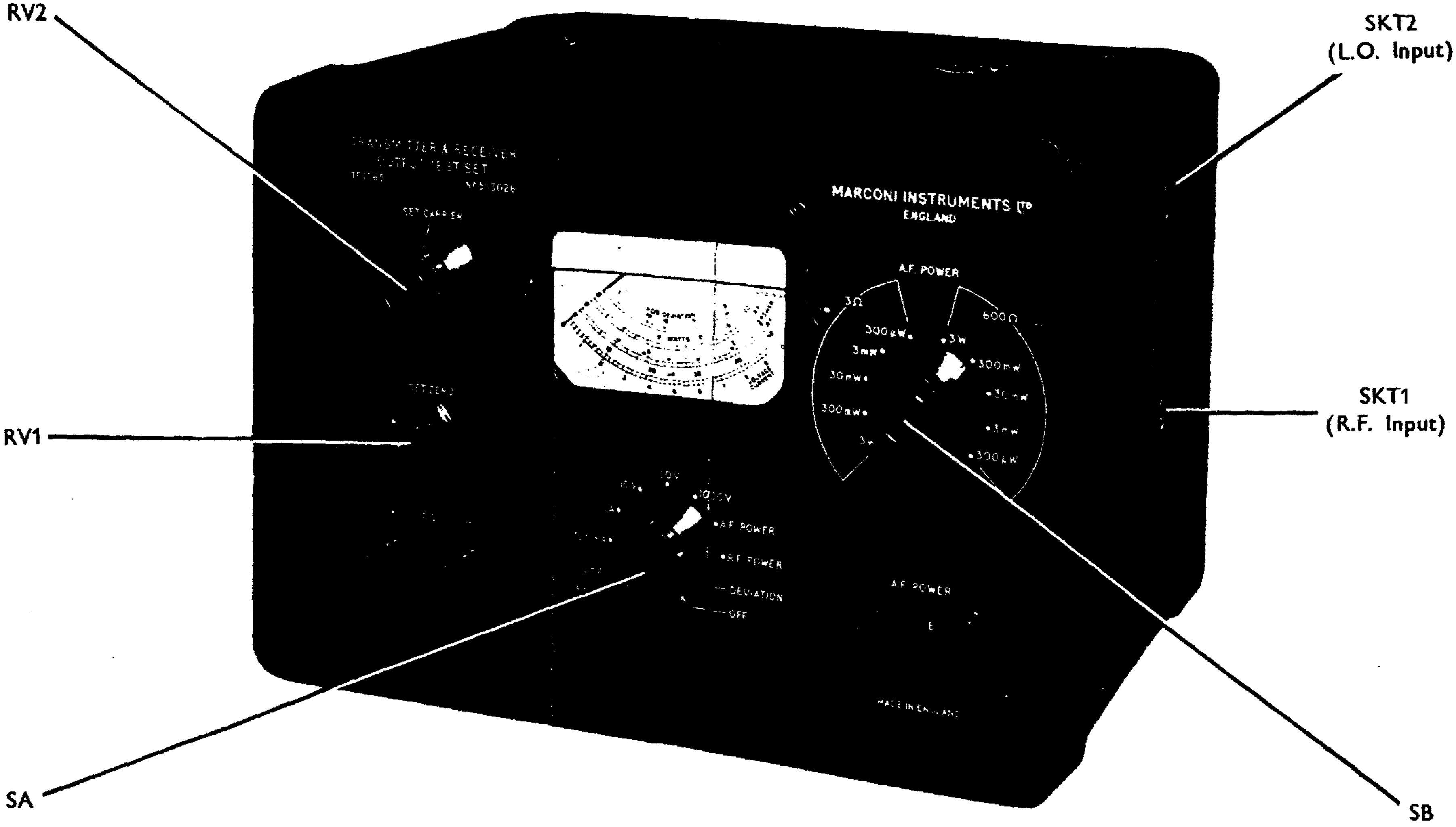
R1 — 250 KΩ

R2 — 2 MΩ

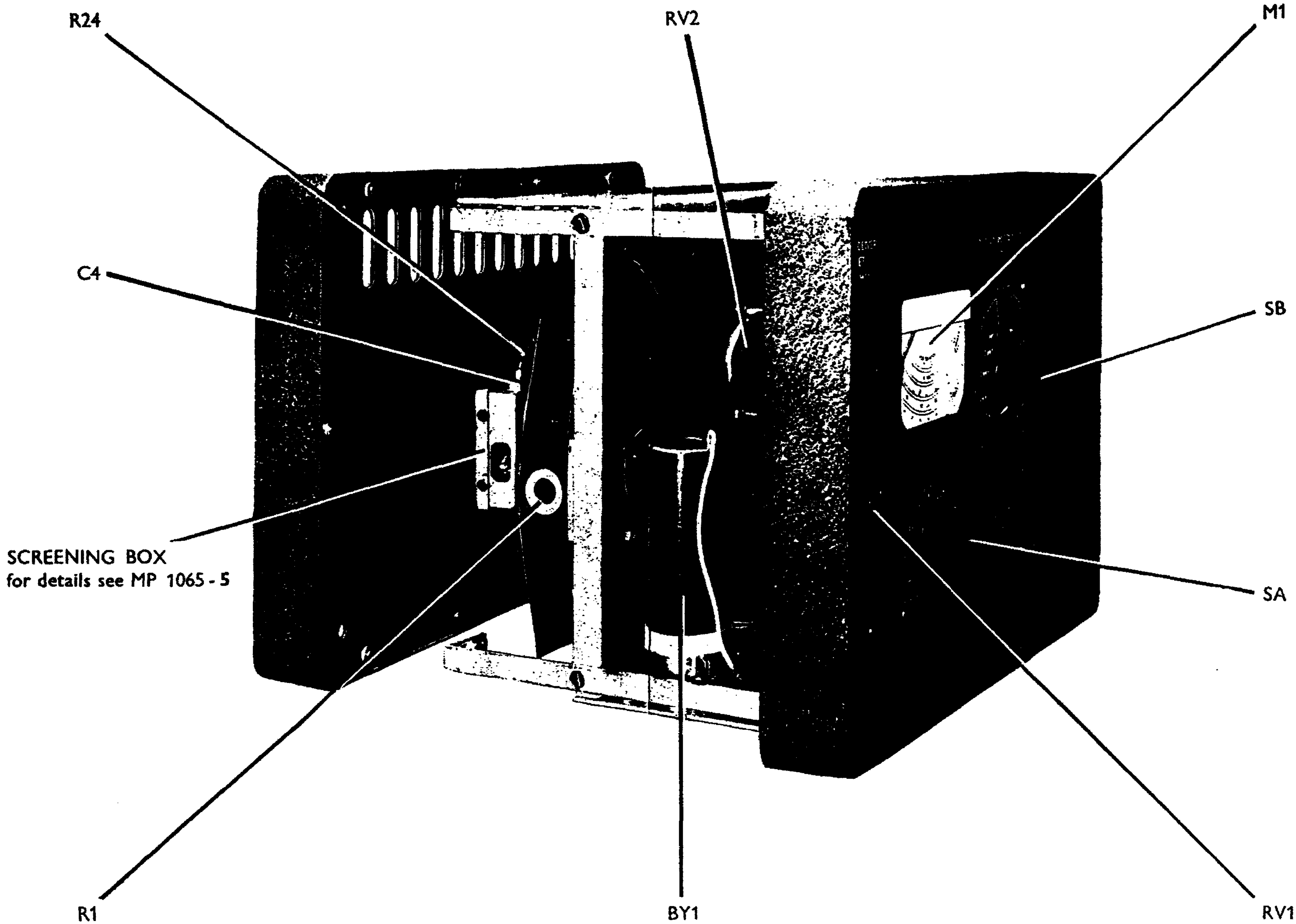
R3 + M2 — 180 KΩ



(SEE SECTION 4.8.7.)

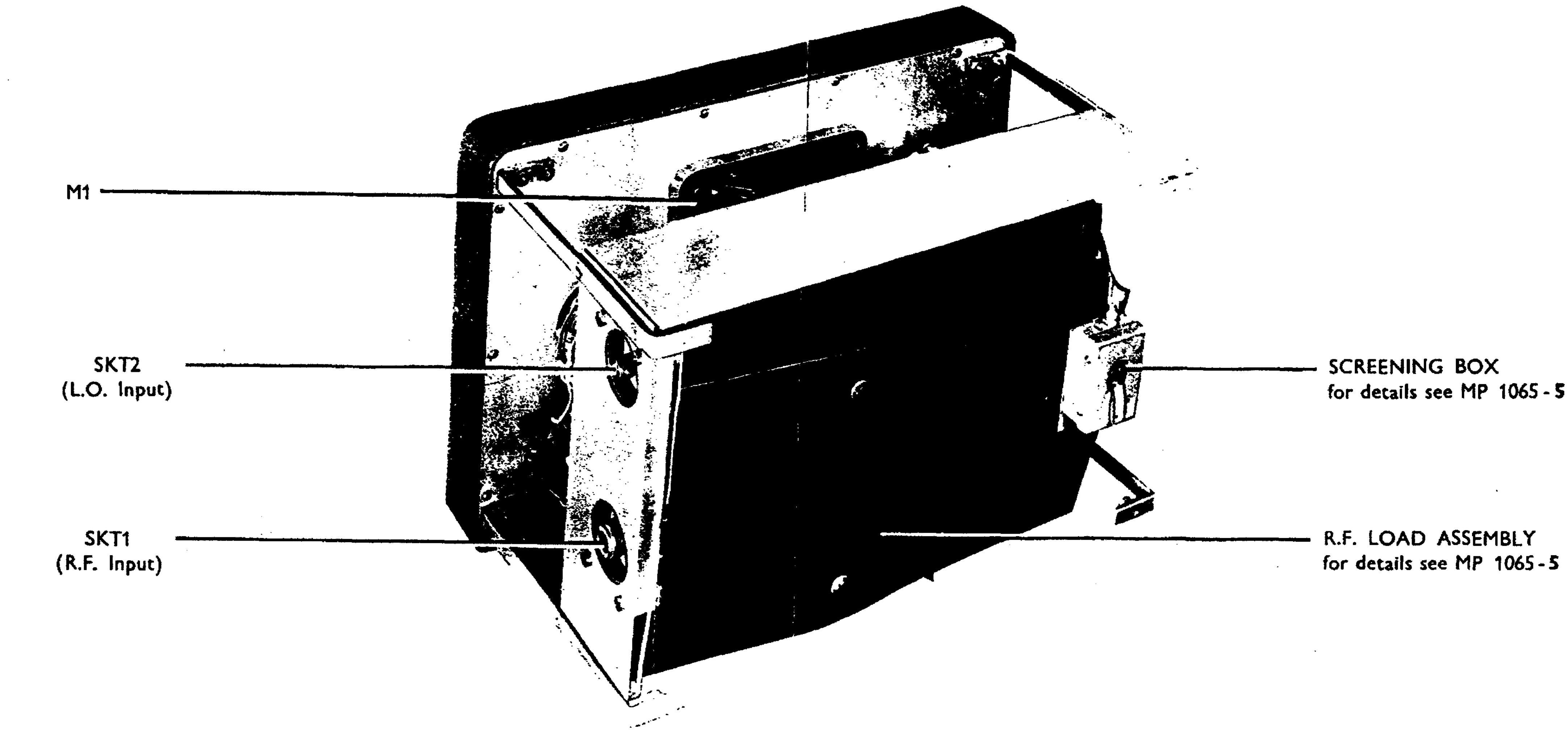

RV2
SKT2
(L.O. Input)
MARCONI INSTRUMENTS LTD
ENGLAND
A.F. POWER
3Ω
600Ω
300μW
3W
3mW
300mW
30mW
300mW
3W
30mW
3mW
300μW
RV1
SKT1
(R.F. Input)
A.F. POWER
R.F. POWER
DEVIATION
OFF
A.F. POWER
SA
SB

FRONT VIEW



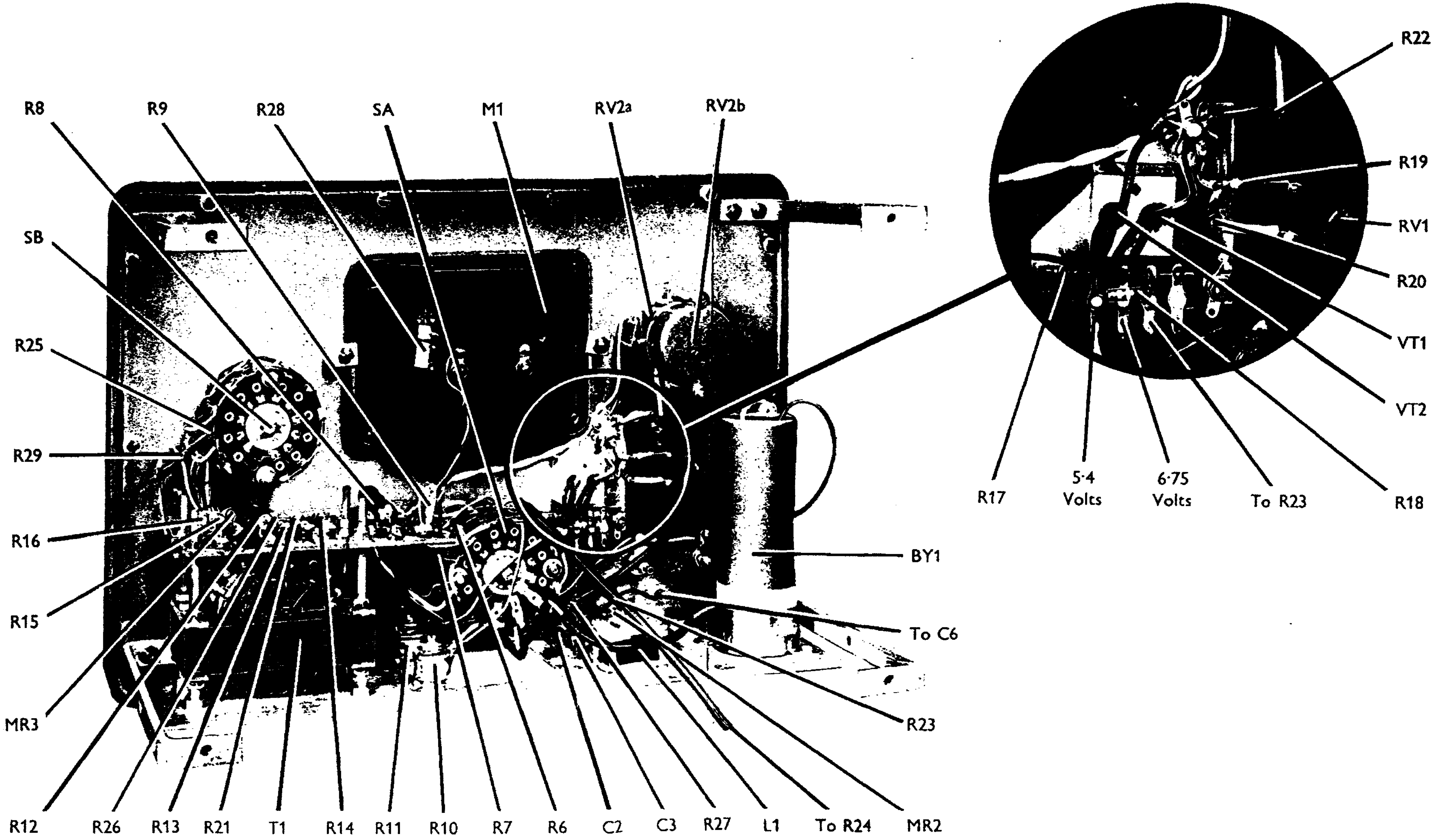
GENERAL VIEW FROM SIDE

MP 1065—2



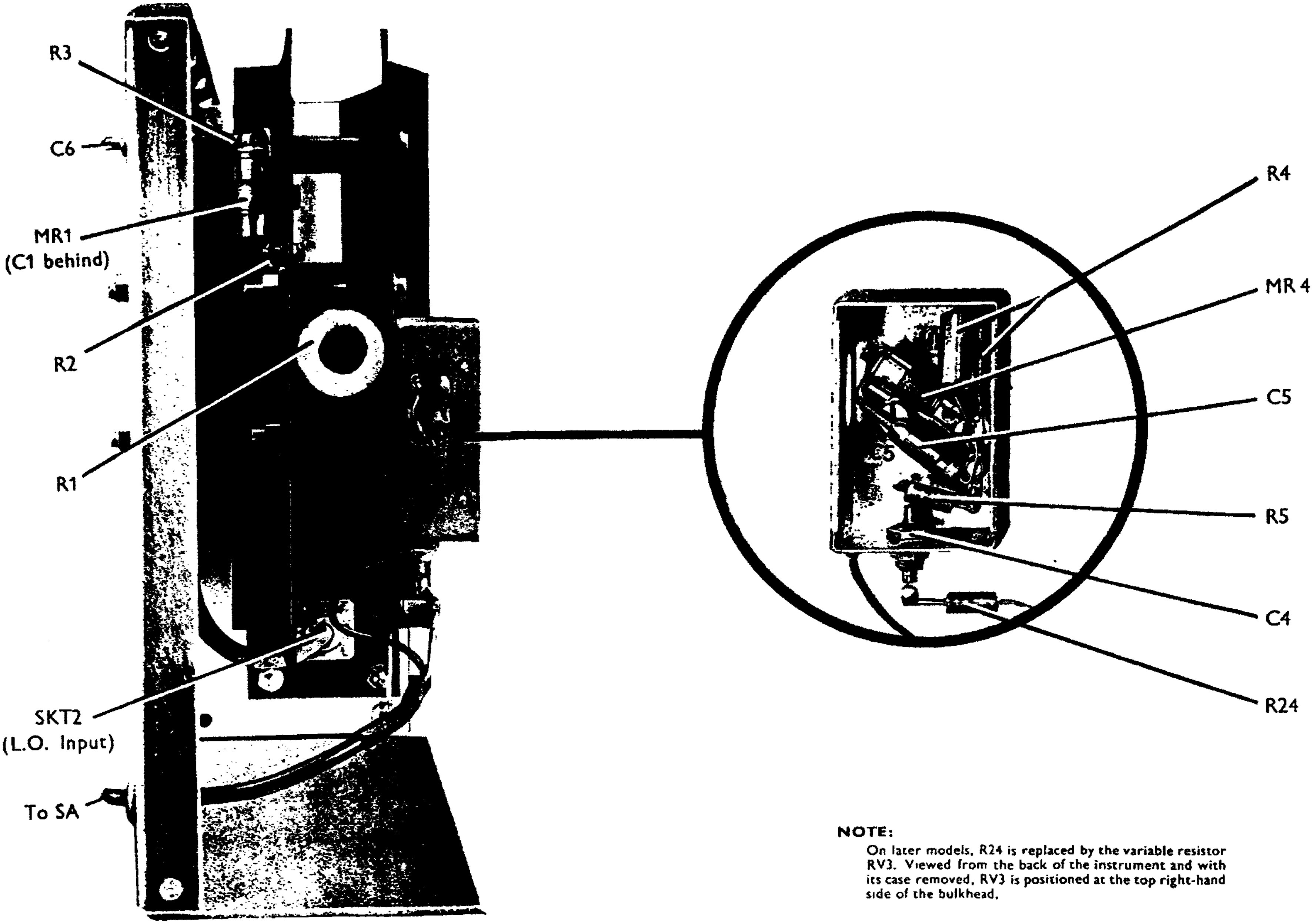
GENERAL VIEW FROM REAR

.TD. 1—9,58
I.Sc. 2,62



INTERNAL VIEW
R.F. LOAD ASSEMBLY REMOVED

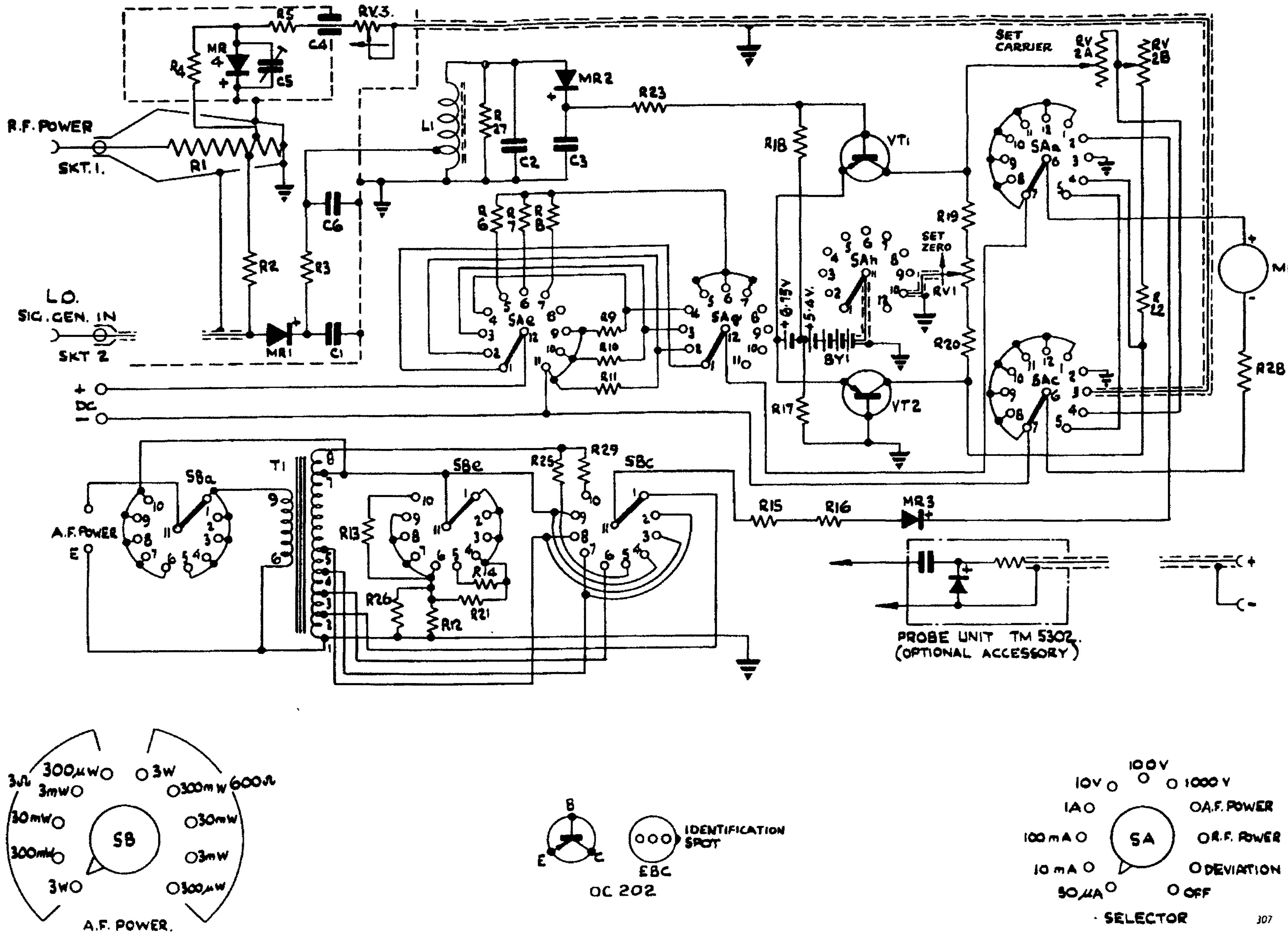
M.I. LTD. 1 - 9,58
C.P. 1.5c. 2,62



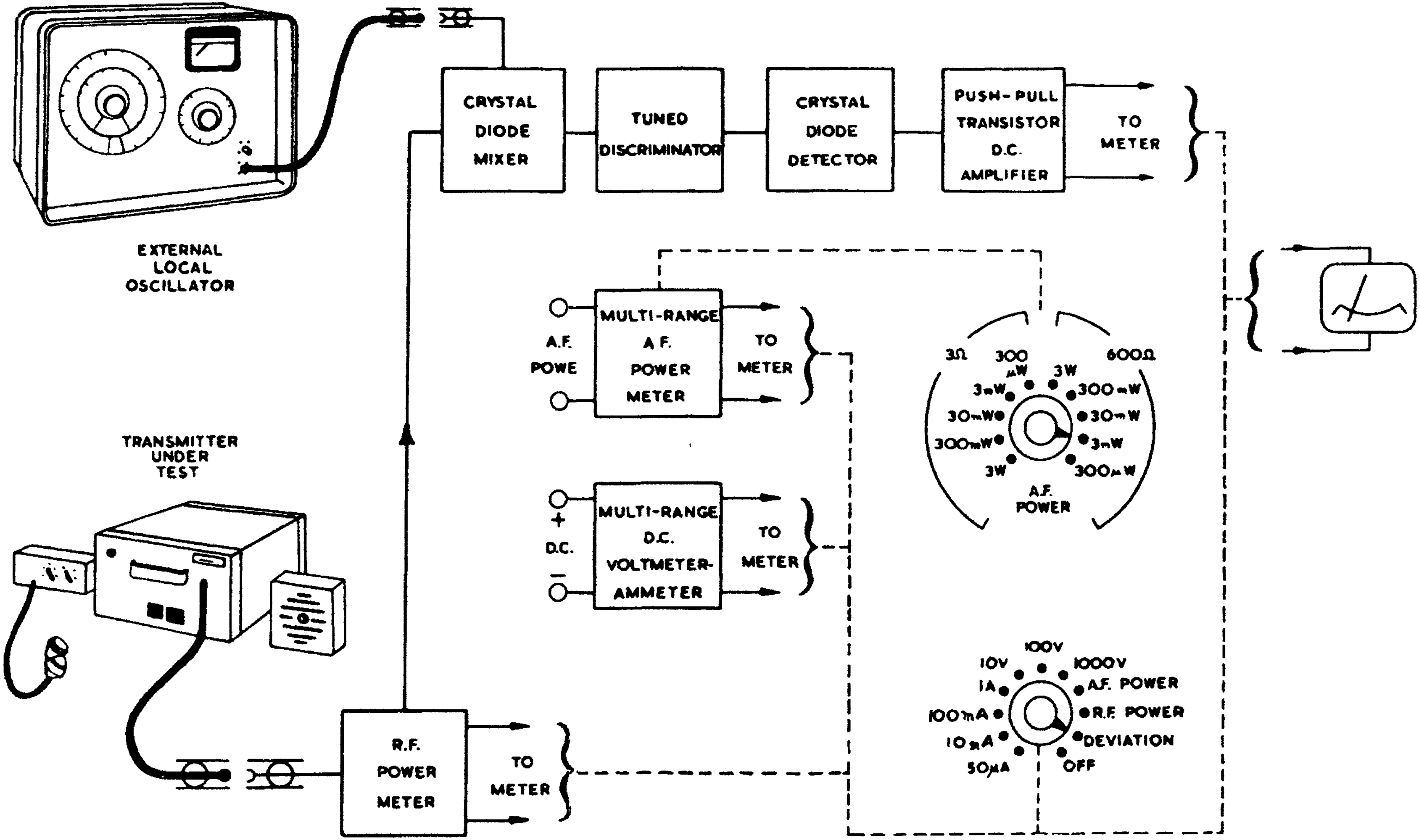
NOTE:

On later models, R24 is replaced by the variable resistor RV3. Viewed from the back of the instrument and with its case removed, RV3 is positioned at the top right-hand side of the bulkhead.

R.F. LOAD ASSEMBLY
END VIEW



CIRCUIT DIAGRAM



TF 1065-1 1-7,56 (EX TBB 26084 IS.2)
2,62

BLOCK SCHEMATIC DIAGRAM

TLC 29523