

WIDE RANGE OSCILLATOR
SG67A

INSTRUCTION MANUAL



ADVANCE
INSTRUMENTS

Hainault Essex England

Telephone 01-500 1000

Telegrams Attenuate Ilford

Telex 263785

Division of ADVANCE ELECTRONICS LIMITED

ERRATA SHEET
FOR
SG67A

Page 21

Fig.4. Should read "Wiring Details for Internal Battery and BE1 operation".

Note that the + and - sockets on Top R.H. Corner of board are not used.

170off. 9.4.70.
JR/JB.

2 CONTENTS

| | | |
|-----------|-------------------------------------|----|
| SECTION 1 | INTRODUCTION | 3 |
| SECTION 2 | SPECIFICATION | 4 |
| SECTION 3 | OPERATION | 6 |
| 3.1 | General | 6 |
| 3.2 | Power Unit Type BE1 | 6 |
| 3.3 | Frequency | 7 |
| 3.4 | Output | 7 |
| SECTION 4 | CIRCUIT DESCRIPTION | 8 |
| 4.1 | Wien Bridge Oscillator | 8 |
| 4.2 | Sinewave Output | 8 |
| 4.3 | Squarewave Output | 8 |
| SECTION 5 | MAINTENANCE | 9 |
| 5.1 | General | 9 |
| 5.2 | Battery Check | 9 |
| 5.3 | Recalibration Procedure | 9 |
| 5.3(a) | Initial Setting-up Instructions | 9 |
| 5.3(b) | Frequency Calibration | 10 |
| 5.3(c) | Squarewave Setting up Instructions | 11 |
| 5.4 | Restranging Information | 11 |
| SECTION 6 | COMPONENTS LIST AND CIRCUIT DIAGRAM | 13 |
| SECTION 7 | GUARANTEE AND SERVICE FACILITIES | 24 |

ILLUSTRATIONS

| | | |
|--------|-----------------------------------------|----|
| Fig. 1 | Restranging Diagram | 12 |
| Fig. 2 | Circuit Diagram | 17 |
| Fig. 3 | Circuit Diagram Power Unit Type BE1 | 19 |
| Fig. 4 | Wiring Details – Rear Connector Board | 21 |
| Fig. 5 | Component Layout Underside Chassis View | 22 |
| Fig. 6 | Component Layout Above Chassis View | 23 |

The Wide Range Oscillator SG67A has a frequency range that is continuously variable in six switched ranges covering 1Hz to 1MHz. Two outputs are available, either sinewave or squarewave and are selected by a switch. Amplitude control is achieved by means of a variable level control in conjunction with a four position push-button attenuator giving an output of between 0 and 2.5VR.M.S. A fifth push-button provides a means of checking the internal batteries.

The instrument is completely portable and takes up the minimum of bench space. Two internal batteries provide the power. If operation from the local supply is preferred, a mains power unit is available as an optional accessory, alternatively 16 to 18VD.C. may be supplied to the instrument via the rear sockets provided.

FREQUENCY

1Hz to 1MHz continuously variable in 6 ranges.

ACCURACY

$\pm 3\%$ of reading.

WAVEFORM

Sine or Square. Squarewave rise-time not greater than 100nS (typically 50nS).

OUTPUT AMPLITUDE

Up to 2.5V R.M.S. Continuously variable in 4 ranges.

OUTPUT STABILITY

At constant temperature, the output level remains constant within ± 1 dB up to 200 kHz.

OUTPUT IMPEDANCE

600 Ω on all ranges except 2.5V range. 100 Ω on 2.5V range at maximum output setting, increasing to a maximum of 250 Ω at approximately half maximum output.

SINEWAVE DISTORTION

Not greater than 0.5% for frequencies 20Hz to 20kHz. Typically 0.25% at 18V battery voltage.

POWER SUPPLY

Two internal 9V batteries, Ever-Ready type PP9 or equivalent.
Minimum supply voltage to meet the foregoing specification 16V DC.
Consumption 23mA at 18V. A power supply unit, Type BE1, is available as an optional accessory.

TEMPERATURE RANGE

0°C to + 40°C.

DIMENSIONS

11.3/8" (29 cm) wide. 5.3/4" (15 cm) deep, 9.7/8" (25 cm) high.

WEIGHT

9lb.

FINISH

Case constructed from aluminium extrusions with off white front panel and graphite grey trim panels.

TYPICAL FIGURES**SHORT TERM FREQUENCY STABILITY (Approx 2hr period)**

Frequency change typically $\pm 0.05\%$ for frequencies up to 100kHz.

Frequency change typically $\pm 0.2\%$ for frequencies above 100kHz.

FREQUENCY/TEMPERATURE VARIATION

Typically less than $\pm 0.05\%$ per $^{\circ}\text{C}$ at $+20^{\circ}\text{C}$.

FREQUENCY/SUPPLY VARIATION

For 10% reduction in battery voltage from 18V.

Less than $\pm 0.1\%$ change in frequency at scale setting 1.

Typically $\pm 1\%$ change in frequency at scale setting 10.

3.1 GENERAL

The instrument is normally supplied complete with internal batteries. To check that the batteries are functioning, set the function switch to 'Sine' or 'Square' and press the push-button marked 'Batt. Test', whilst measuring the battery voltage appearing on the rear sockets. During periods of non-use switch off the instrument to conserve battery power. If required the instrument may be powered from an external source of 16-18V DC. Ref. should be made to Fig. 4 which indicates the appropriate internal connection required.

3.2 POWER UNIT TYPE BE1

This unit is available as an optional accessory to replace the internal batteries.

NOTE The power unit is normally supplied to operate from a nominal 240V AC supply. To operate from a 110 to 125V refer to Fig. 3 and proceed as follows:

- (1) Disconnect the unit from the local supply.
- (2) Remove the power unit cover.
- (3) On the printed circuit board remove the link between transformer tags 3 and 4
- (4) Link tags 2 and 4
- (5) Link tags 3 and 5
- (6) Do not make any other alteration. Replace the cover.

To install the unit proceed as follows:

- (1) Switch off the instrument.
- (2) Remove the cover by unscrewing the screw at the rear of the cover and sliding it free.
- (3) Remove the batteries.
- (4) Feed the power lead through the slot provided in the rear panel and place the power unit in the position previously occupied by the batteries.
- (5) Connect the flying leads to the unit (red to positive, black to negative and green/black (normally connected to earth stowage) to ground on the B.E.1.
- (6) Replace the cover.

All that remains is to connect the power lead to the local supply and switch on i.e. to 'Sine' or 'Square' as required.

To operate the instrument from an external supply (14–19 volts D.C.) proceed as follows:—

- (1) Refer to Fig. 4
- (2) Remove the positive and negative flying leads from the batteries inside the instrument and stow in the Battery Stowage points on the connector panel.
- (3) Remove the yellow lead from EXT. and connect it to the stowage point.
- (4) Remove the black flying lead from –INT. and connect it to EXT–.

WARNING. Switching off the instrument does not isolate the power unit from the AC supply. Therefore, be sure to remove the plug from the A.C. supply before removing the instrument cover.

3.3 FREQUENCY

A signal of any frequency between 1Hz and 1MHz is set by using the 'Frequency Range' switch and variable 'Frequency' control in conjunction with the calibrated scale.

3.4 OUTPUT

The sinewave or squarewave output is selected by part of the function switch. Variation of the output level is accomplished by means of the 'Level' control and the push-button attenuator. For example if an output of 200mV is required, set the 'Level' control to 2 press the push-button marked 'X0.1V'.

The selected output is available at the 'Output' terminals, black is common and red is the high side. It should be noted that an excessive capacity load across the output will cause the HF response to fall off.

4.1 WIEN BRIDGE OSCILLATOR

Transistors VT1, VT2, VT3 form a conventional Wien bridge variable frequency oscillator. The series arm of the bridge is formed by RV3B, RV4 or RV5 (depending on the range) and capacitors C1 to C8; the parallel arm being formed by RV3A, RV1/2 and capacitors C9 to C15. R1 and MR1, 2, 3 set the DC operating conditions of the bridge. Negative feedback is taken from VT3 emitter and applied to VT1 via C17, R8 and thermistor TH1, to stabilise the output amplitude.

4.2 SINEWAVE OUTPUT

With the function switch to sinewave the output of the oscillator is applied to the base of voltage amplifier VT6. The amplified sinewave output is then fed to the base of VT8. VT7 and VT8 are connected as a complementary emitter follower stage providing the required output level via RV10 the level control. The output attenuator consists of a 'ladder attenuator' comprising resistors R30 to R35.

4.3 SQUAREWAVE OUTPUT

With the function switch set to squarewave the output of the oscillator is applied to a Schmitt trigger circuit consisting of VT4 and VT5. The squarewave output is then applied to the base of VT8 and thence to the output via the attenuator circuit.

5.1 GENERAL

Maintenance of this instrument is normally limited to replacing the batteries or the indicator lamp. Should the accuracy of the instrument be suspect the calibration procedure in paragraph 5.3 should be strictly adhered to. It may be necessary to lubricate the pulley bearings with a little light oil if the frequency control knob appears stiff to turn.

5.2 BATTERY CHECK

An indication of the battery condition is provided by measuring the voltage at the test terminals on the rear of the instrument whilst depressing the 'Batt. Test' button. The batteries should be replaced when the battery terminal voltage falls below 16V measured in situ with the 'Batt. Test' button operated and with the function switch set at sine or square. The batteries are mounted inside the instrument on the left hand side panel.

NOTE For normal use the battery voltage should not be less than 16V but for alignment purposes it must be $17V \pm 0.4V$.

5.3 RECALIBRATION PROCEDURE

After a long period in service the instrument may need some small internal adjustments to regain specified frequency or voltage calibration accuracy. The entire recalibration procedure is listed below. Should this procedure be beyond the skill of the user, reference should be made to Section 7. Before attempting to recalibrate the instrument check that the battery voltage is correct (see paragraph 5.2).

- (a) Initial setting-up instructions
- (1) Remove the instrument cover.

- (2) Set all preset controls to their mid-positions.
- (3) Connect battery terminations to a $-17V \pm 0.4V$ power unit and switch to 'Sine'.
- (4) Set RV9 so that voltage between negative terminal of C24 and chassis is $9V \pm 5\%$.
- (5) Set output controls for 2.5V R.M.S. output.
- (6) Measuring at unloaded 'Output' terminals set RV7 for a reading of 2.5V R.M.S. at 1kHz (1 to 10k Hz range).

(b) Frequency calibration

- (1) Set RV2, RV4 and RV5 to their mid-positions.
- (2) Set the drum to the anticlockwise stop.
- (3) Set the pointer to LH edge of the window keeping the drum at the end stop.
- (4) With a valve voltmeter (VM77C or VM78) and a timer counter (e.g. TC11) connected across the output terminals, set RV3A and RV3B for a frequency of 1kHz and note the output level.
- (5) Rotate drum by hand so that pointer is over '1' on the scale.
- (6) Tighten one drum screw.
- (7) Rotate the 'Frequency' control so that the pointer is at '10'.
- (8) Adjust RV1 and RV4 together to obtain an output frequency of 10kHz and in opposite senses to obtain a level within 6% of that obtained in (4).
- (9) Rotate the 'Frequency' control so that the pointer is at '1'. If the output frequency is incorrect slacken the drum screw and repeat the steps from (3) onwards. Finally check the frequency alignment and output level between 1Hz and 100kHz.
- (10) Switch to range 5 (100kHz – 1 MHz) and set the pointer to '1'.
- (11) Set the two trimmer capacitors C8 and C15 to approximately half maximum capacitance. If necessary adjust the trimmer capacitors together in order to obtain the correct output frequency of 100kHz.
- (12) If the output level differs by more than 6% from that obtained at 1kHz adjust the trimmer capacitors simultaneously but in opposing senses so as to maintain an output frequency of 100kHz.
- (13) Rotate the 'Frequency' control so that the pointer is at '10'.
- (14) Adjust RV2 and RV5 together to obtain an output frequency of 1MHz, and in opposite senses to obtain an output level within 6% of that obtained in (4).
- (15) Rotate the pointer back to '1' and recheck the frequency and level,

repeating the steps from (11) onwards.

(16) Finally check the complete frequency alignment and tighten the second screw on the drum.

(c) Square wave setting-up instructions

(1) Switch to 'Square'.

(2) Measuring at unloaded 'Output' terminals (at 1kHz output frequency), rotate RV6 from a fully anti-clockwise position until an equal mark-space ratio is obtained.

(3) Rotate RV8 for an output level of 2.5V R.M.S. (5V peak/peak).

5.4 RESTRINGING INFORMATION

The following procedure should be adopted when restringing the instrument.

(1) Remove all the front panel knobs.

(2) Remove the perspex front panel after extracting the screws.

(3) Slacken the coupling between the shaft of the drum and the printed board.

(4) Remove the printed board after extracting the screws.

(5) Referring to Fig. 1, tie one end of the *string to the drum spring at position 1 and thread the other end through the hole in the drum.

(6) Wind one anti-clockwise turn around the drum and continue to 2.

(7) Pivot clockwise around 2 and continue to 3.

(8) Pivot ~~anti~~ clockwise around 3 and continue to 4.

(9) Pivot ~~anti~~ clockwise around 4 and continue to 5.

(10) Pivot anti-clockwise around 5 and then pass over the top of the drum and make approximately one anti-clockwise turn.

(11) Finally thread the string back through the hole in the drum and tie it to the spring at the same time taking up any slack.

(12) Fit the indicator to the string running between positions 3 and 4 as illustrated in Fig. 1.

Turn the drum to and fro between its stops and check for ease of movement. All that remains is to re-assemble the instrument which is the reverse of steps (1) to (4).

* String: Suflex 3148, 7ft, Advance Part No 3586.

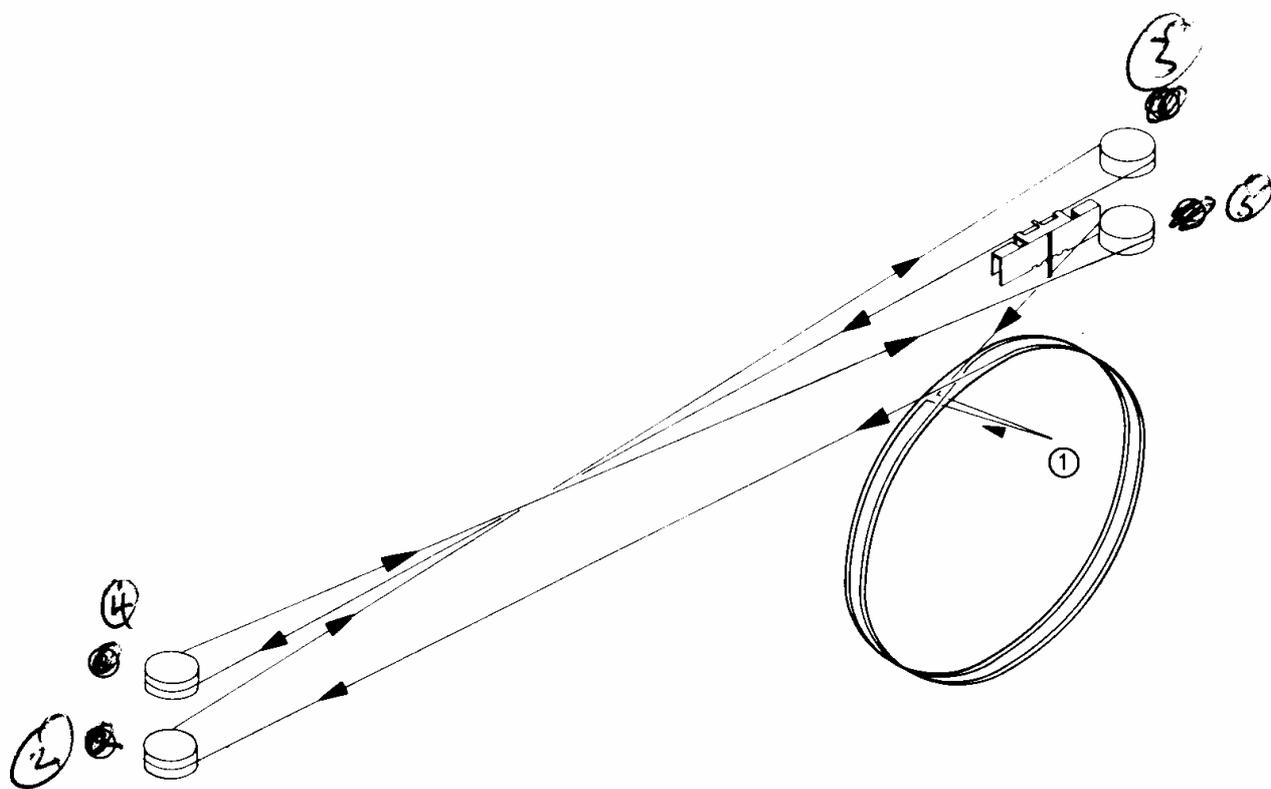


Fig. 1 Restringing Diagram

COMPONENT LIST AND CIRCUIT DIAGRAM

SECTION 6

| Ref. | Value | Description | Part No |
|------------------------------------------------------|-------|----------------------------------|---------|
| RESISTORS (5% 1/8W cracked carbon, unless specified) | | | |
| R1 | 3.9K | | 312 |
| R2 | 330 | | 1894 |
| R3 | 390 | | 2410 |
| R4 | 3.3K | | 1638 |
| R5 | 1.5K | | 385 |
| R6 | 150 | | 301 |
| R7 | 6.8K | | 313 |
| R8 | 150 | | 301 |
| R9 | 100 | | 11504 |
| R10 | 1K | | 384 |
| R11 | 8.2K | | 314 |
| R12 | 3.3K | | 1638 |
| R13 | 68 | | 1640 |
| R14 | 1.8K | | 310 |
| R15 | 27 | | 724 |
| R16 | 1K | | 384 |
| R17 | 1.5K | | 385 |
| R18 | 3.3K | | 1638 |
| R19 | 3.3K | | 1638 |
| R20 | 820 | | 1637 |
| R21 | 2.7K | | 311 |
| R22 | 1.5K | | 385 |
| R23 | 27 | | 724 |
| R24 | 27 | | 724 |
| R25 | 27 | | 724 |
| R26 | 27 | | 724 |
| R27 | 4.7K | | 386 |
| R28 | 27 | | 724 |
| R29 | 56 | | 2411 |
| R30 | 5.6K | 2% Electrosil TR5 ½W | 22483 |
| R31 | 680 | 2% Electrosil TR5 ½W | 22484 |
| R32 | 5.6K | 2% Electrosil TR5 ½W | 22483 |
| R33 | 680 | 2% Electrosil TR5 ½W | 22484 |
| R34 | 5.6K | 2% Electrosil TR5 ½W | 22483 |
| R35 | 620 | | 22485 |
| R36 | 56 | | 2411 |
| RV1 | 1K | Plessey CP161687/102/A Linear | 1054 |

| Ref | Value | Description | Part No |
|--------|---------|--------------------------------------|---------|
| RV2 | 1K | Plessey CP161687/102/A Linear | 1054 |
| RV3A/B | 10K+10K | Colvern(gang) CLR4049/13 Semi-log | 27045 |
| RV4 | 1K | Plessey CP161687/102/A Linear | 1054 |
| RV5 | 1K | Plessey CP161687/102/A Linear | 1054 |
| RV6 | 2.2K | Davall 80 | 25227 |
| RV7 | 2.2K | Davall 80 | 25227 |
| RV8 | 6.8K | Plessey MPD | 24559 |
| RV9 | 47K | Davall 80 | 26860 |
| RV10 | 1K | Colvern CLR 1106/24 Linear | 27044 |

CAPACITORS

| | | | |
|-----|--------------|----------------------------|-------|
| C1 | 15 μ F | 1% Film cap TF1 | 27050 |
| C2 | 1.5 μ F | 1% Film cap TF1 | 27051 |
| C3 | 0.15 | 1% 160V Wima trop. M | 22490 |
| C4 | 0.015 | 1% 160V Wima trop. M | 22491 |
| C5 | 1500p | 1% Lemco 2515 insul. | 22492 |
| C6 | 10pf | Erie Ceramic | 22364 |
| C7 | 120pf | 5% Lemo 1510 insul. | 27049 |
| C8 | 4/20p | Trico 004a/10B | 11580 |
| C9 | 15 μ F | 1% Film cap TF1 | 27050 |
| C10 | 1.5 μ F | 1% Film cap TF1 | 27051 |
| C11 | 0.15 | 1% 160V Wima trop. M | 22490 |
| C12 | 0.015 | 1% 160V Wima trop. M | 22491 |
| C13 | 1500p | 1% Lemco 2515 insul. | 22492 |
| C14 | 120pf | 5% Lemco 1510 insul. | 27049 |
| C15 | 4/20p | Trico 004a/10B | 11580 |
| C16 | 33p | 5% Lemco 1106B insul. | 4779 |
| C17 | 3200 | 10V Mullard C431 BR/D3200 | 17047 |
| C18 | 2000 | 16V Mullard C431 BR/E2000 | 2800 |
| C19 | 27p | 10% Erie disc | 22369 |
| C20 | 0.1 | +80-20% Lemlac | 19647 |
| C21 | 400 | 25V Mullard C437 AR/F400 | 20784 |
| C22 | 1000 μ F | 6.4V Mullard C437 AR/C1000 | 24797 |
| C23 | 1600 | 10V Mullard C437 AR/D1600 | 21153 |
| C24 | 1000 | 16V Mullard C437 AR/E1000 | 21152 |
| C25 | 10000 | 16V Mullard C431 BR/E1000 | 27048 |

| Ref | Value | Description | Part No |
|---------------|-------------------------|------------------|---------|
| TRANSISTORS | | | |
| VT1 | 2N3905 | Mullard | 20818 |
| VT2 | 2N3393 | General Electric | 19818 |
| VT3 | 2N3905 | Mullard | 20818 |
| VT4 | 2N711 | (Beta over 100) | 20253 |
| VT5 | 2N711 | (Beta over 100) | 20253 |
| VT6 | 2N3905 | Mullard | 20818 |
| VT7 | 2N3905 | Mullard | 20818 |
| VT8 | 2N706 | Texas | 3146 |
| DIODES | | | |
| MR1 | HG1087 | Hughes | 17956 |
| MR2 | HG1087 | Hughes | 17956 |
| MR3 | HG1087 | Hughes | 17956 |
| MR4 | MS1H | A E I | 18806 |
| MR5 | ZF9 | S T C | 4667 |
| MR6 | MS1H | A E I | 18806 |
| MR7 | MS1H | A E I | 18806 |
| MR8 | ZF4.7 | S T C | 4073 |
| MESCELLANEOUS | | | |
| S1 | Frequency range switch | | 27041 |
| S2 | Function switch | | 27037 |
| S3/4 | Attenuator switch assy. | | 27042 |
| TH1 | Thermistor S T C R23 | | 22495 |

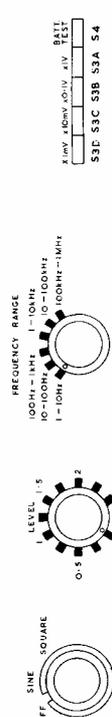
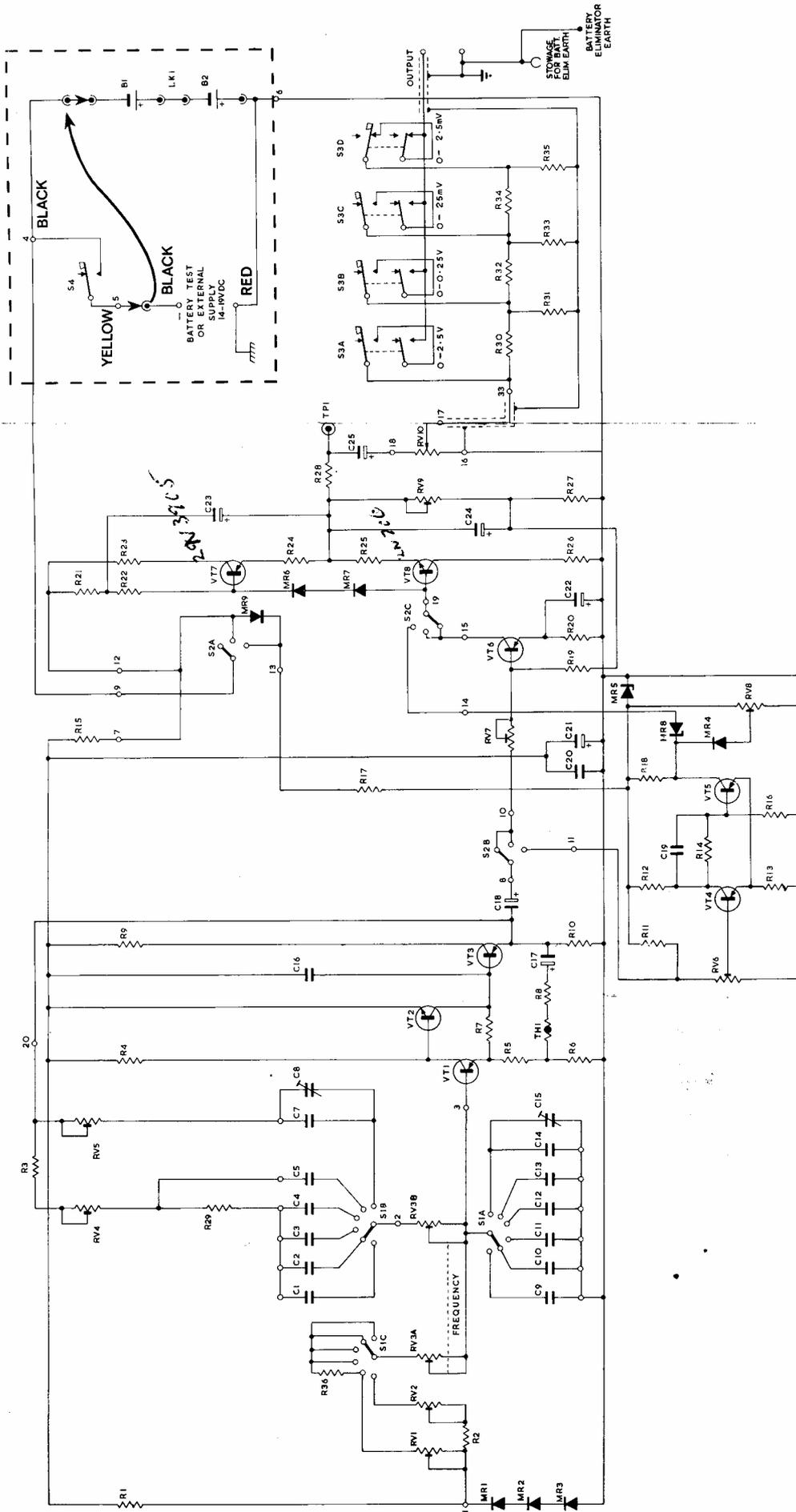


Fig. 2 Circuit Diagram

| Ref | Description | Part No |
|--------|-------------------------------------|---------|
| R1 | 270 10% RWV4J wirewound | 19641 |
| C1 | 500 F 64V Mullard C431 | 18780 |
| C2 | 400 F 40V Mullard C437 AR/G400 | 20788 |
| F1, F2 | Fuse 250mA Belling-Lee L562 | 19815 |
| MR1 | Bridge rectifier Raytheon 200V 0.5A | 21160 |
| MR2 | Zener diode 8V VR8F A E I | 3308 |
| MR3 | Zener diode 9V VR8F A E I | 20558 |
| LP1 | 5mm tubular (flying leads) 12V 1.5W | 22610 |
| T1 | Supply transformer | MT526 |

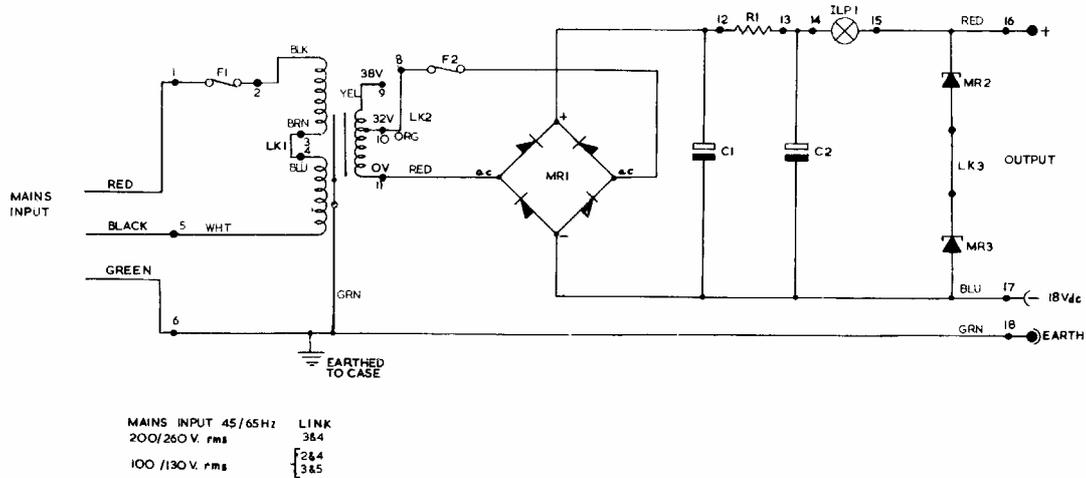


Fig. 3 Circuit Diagram Power Unit Type BE1

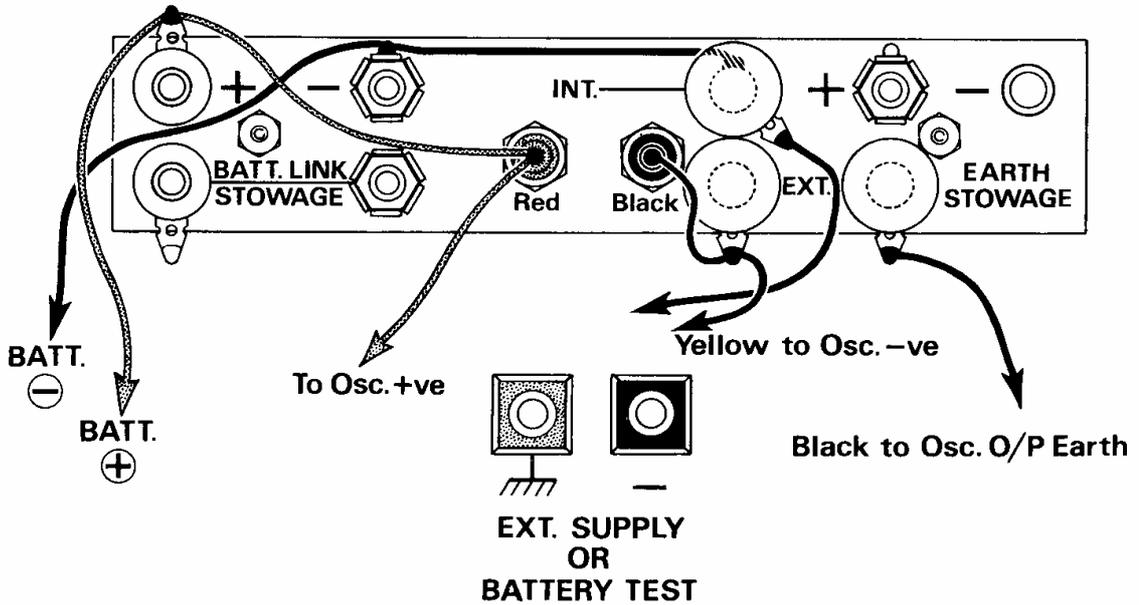


Fig. 4 Wiring Details - Rear Connector Board

FOR INTERNAL BATTERY & BEI OPERATION
 NOTE: That the + and - sockets on Top R.H. Corner of Board are not used

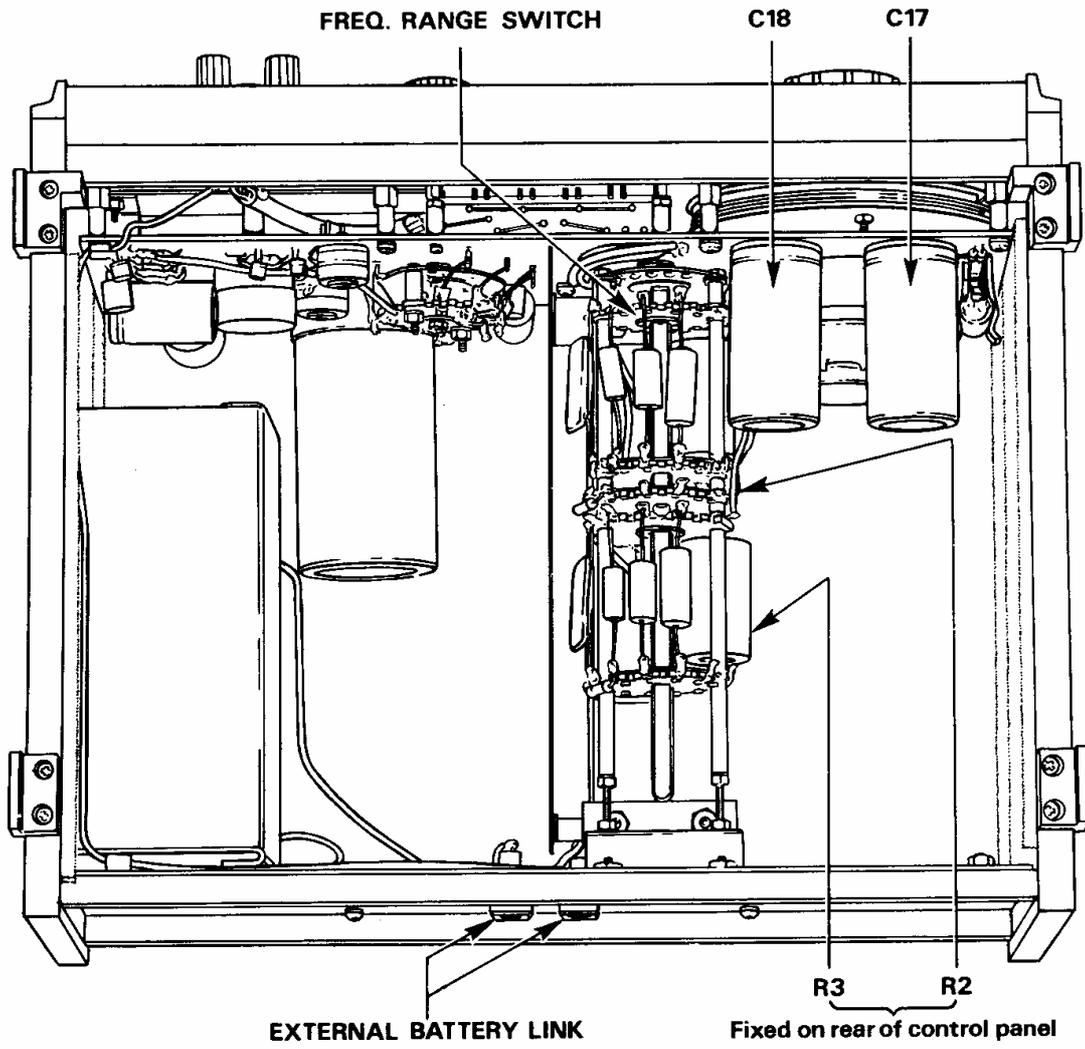


Fig. 5 Component Layout Underside Chassis View

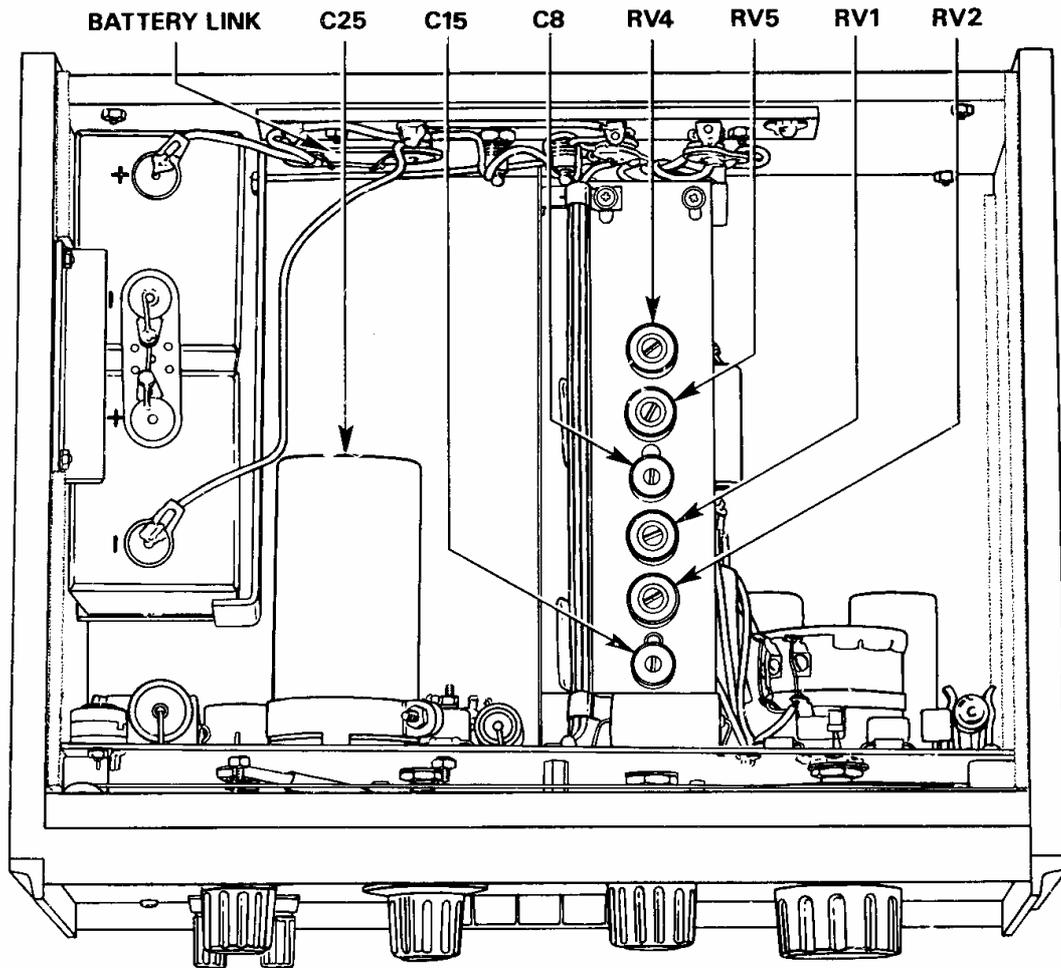


Fig. 6 Component Layout Above Chassis View

This instrument is guaranteed for a period of one year from its delivery to the purchaser, covering the replacement of defective parts other than valves, semiconductors and fuses. Valves and semiconductors are subject to the manufacturers' guarantee.

We maintain comprehensive after sales facilities and the instrument can, if necessary, be returned to our factory for servicing. The type and serial number of the instrument should always be quoted, together with full details of any fault and the service required. The Service Department can also provide maintenance and repair information by telephone or letter.

Equipment returned to us for servicing must be adequately packed, preferably in the special box supplied, and shipped with transportation charged prepaid. We can accept no responsibility for instruments arriving damaged. Should the cause of failure during the guarantee period be due to misuse or abuse of the instrument, or if the guarantee has expired, the repair will be put in hand without delay and charged unless other instructions are received.

OUR SALES, SERVICE AND ENGINEERING DEPARTMENTS ARE
READY TO ASSIST YOU AT ALL TIMES.

ERRATA SHEET
FOR
SG67A

Page 12

Fig.1 Restringing Diagram.

| | | |
|---|-------------|---|
| 5 | should read | 2 |
| 4 | should read | 3 |
| 3 | should read | 4 |
| 2 | should read | 5 |



Page 11

5.4 Restringing Information

Line

(8) Read clockwise not anticlockwise
(9) Read clockwise not anticlockwise



200 copies
+30 copies
JR/JB
18.2.70.