

**Signal Generators
SG63E and SG63F**

Contents SG63E and SG63F

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The Advance Signal Generators SG63E and SG63F provide AM, FM or CW signals in the frequency range of 4 to 230MHz. These two instruments are electrically similar but differ in the type of mechanical coupling between the tuning control and tuning components. Although the instruments have been designed primarily for use in servicing radio receivers, operating up to VHF, and television receivers operating in bands 1 to 3, the comprehensive specification makes them suitable for various laboratory applications.

The basic tuning accuracy of the instruments is obtained by means of a directly calibrated frequency scale and a slow-motion drive. This accuracy may be improved by utilizing the 5MHz calibration markers provided by the internal crystal oscillator to an accuracy of $\pm 0.03\%$.

The X-sweep facility and phasing control permits the user to examine the response of a tuned circuit or discriminator on an oscilloscope.

FREQUENCY RANGES

4 to 7.5 MHz	25 to 50 MHz
7.5 to 13 MHz	50 to 100 MHz
13 to 25 MHz	100 to 230 MHz

SCALE ACCURACY

+ 1%. Logging scale and cursor adjustment provided.

CRYSTAL CHECK

At 5 MHz intervals, accurate to $\pm 0.03\%$. Detector output available on front panel.

RF OUTPUT

Monitored at 100mV. Accuracy ± 1.0 dB at SET level up to 180 MHz when accurately terminated.

ATTENUATOR

100dB in four 20dB steps with a continuously variable control of 20dB. Step attenuator accuracy: ± 2 dB overall.

OUTPUT IMPEDANCE

Nominal 75 Ω unterminated. 50 Ω available to special order

LEAKAGE

Less than 3 μ V in a single-loop coil positioned close to instrument.

FUNCTIONS

- (1) Continuous wave.
- (2) AM 30% nominal at 1000 Hz $\pm 10\%$.

(3) 0 to 400kHz total internal FM sweep at supply frequency up to 180MHz.

(4) External FM 20Hz to 20kHz. Total sweep approximately 6kHz/V of applied signal. Maximum total sweep 400kHz up to 180MHz.

(5) Fixed internal FM 150kHz ± 30 kHz total sweep. Modulation frequency 1000Hz $\pm 10\%$.

(6) Fixed internal FM total sweep 45kHz ± 10 kHz up to 180MHz. Modulation frequency 1000Hz $\pm 10\%$.

PHASE CONTROL

An output at supply frequency, with variable phase, is available for use with internal frequency modulation.

POWER SUPPLY REQUIREMENTS

100 to 120V, 200 to 240V, 40 to 60Hz, 25W approx.

ACCESSORIES SUPPLIED

One 75 Ω RF lead type PL5B (PL43 for 50 Ω version).

One 75 Ω Termination Unit Type TP2A (TP2D for 50 Ω version).

One Jack plug, Part No. 10806.

One Tuning knob with handle, Part No. 13568.

One Instruction Manual, Part No. 18506.

WEIGHT

27lb (12.2kg)

FINISH

Dark blue metal case complete with leather carrying handle. Light grey front panel with medium grey surround. Knobs medium grey.

Operation

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Section 3 ⁵

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3.1 SUPPLY VOLTAGE CHECK

Before using the instrument, ensure that it is correctly adjusted to operate from the local supply voltage. In the case of the SG63E the voltage tapping panel should be removed and the position of the tapping plug checked; in the SG63F the case must be removed from the instrument to check the supply tapings on the printed circuit board. Check that the supply lead is connected to the supply plug with the black lead to NEUTRAL, the red lead to LIVE and the green lead to GROUND.

3.2 FREQUENCY COVERAGE

An RF signal between 4 and 230 MHz can be selected by use of the range switch and slow-motion tuning control. A linear scale is provided with 180 sub-divisions. This enables the instrument to be reset, and to be adjusted to frequencies that fall between the principal sub-divisions on the main scale.

3.3 CRYSTAL CHECK

A built-in crystal calibrator operates on a fundamental of 5 MHz and, using harmonics, provides calibration checks at 5 MHz intervals, over the entire frequency range. The accuracy is $\pm 0.03\%$ compared with the normal calibration accuracy of $\pm 1\%$. To check any frequency which is a multiple of 5 MHz, proceed as follows.

- (1) Connect a pair of high resistance headphones to the jack plug, Part No. 10806.
- (2) Set FUNCTION switch to XTAL CHECK.
- (3) Insert the jack plug firmly into the PHONES socket. Tune the instrument dial to the appropriate multiple frequency. When the oscillator frequency is almost an exact multiple of 5 MHz, a beat note will be heard.
- (4) Use the FREQUENCY control to obtain a zero beat condition.

3.4 CALIBRATION ACCURACY

To obtain a signal of high accuracy follow the procedure detailed in para. 4.4. Any calibration error, shown by inspection of the main scale, can be corrected by using the cursor adjuster situated at the base of the pointer. Insert a screwdriver into the aperture at the base of the pointer and make adjustments until the cursor line and the required scale reading coincide. If the cursor is not adjusted note the logging scale setting to facilitate resetting the instrument to the same frequency.

3.5 SPURIOUS MODULATION

Incidental AM modulation of a FM signal is typically no greater than 30%. Incidental FM modulation with an AM signal is typically no greater than 30 kHz.

3.6 FUNCTION SWITCH

This five position switch provides the following facilities:

- (1) 30% AM - the output signal is amplitude modulated at 1000 Hz to a nominal depth of 30%, up to 180 MHz.
- (2) 1000 Hz INT. FM 45 kHz - this position provides an FM signal using a 1000 Hz modulation frequency with a total deviation of 45 kHz ± 10 kHz, up to 180 MHz RF.
- (3) 1000 Hz INT. FM 150 kHz - this position also provides an FM signal using a 1000 Hz modulation frequency but with a total deviation of 150 kHz ± 30 kHz, up to 180 MHz RF.
- (4) LINE FM, EXT. FM or CW
 - i) With LINE FM switch OFF, and with no signal injected into the EXT. FM IN socket, the output is unmodulated (continuous wave) at the selected carrier frequency.
 - ii) With the LINE FM control on, the carrier is frequency modulated at the supply frequency with deviation as indicated. The LINE FM scale is calibrated to 300 kHz. A total deviation of 400 kHz can be obtained at the maximum setting of the control up to 180 MHz RF. When using modulation at the supply frequency the X-SWEEP OUT socket and the SWEEP PHASING control can be used to obtain IF or discriminator characteristics on an oscilloscope. The X-SWEEP signal is used as the timebase for the oscilloscope. It consists of a 30V to 50V signal from an approximate 100 k Ω source at the supply frequency with variable phase control.
 - iii) With the LINE FM control OFF an external signal can be injected into the EXT FM socket for external frequency modulation. Acceptable modulating frequencies are in the range 20 Hz to 20 kHz and deviation is approximately 6 kHz per volt. Maximum total deviation is 400 kHz up to 180 MHz RF.
- (5) XTAL CHECK - The 5 MHz crystal oscillator is switched into circuit for frequency checking.

3.7 RF OUTPUT TERMINATION

The output signal can be fed directly from the RF OUTPUT socket into a 75 Ω load.

When feeding into a high impedance load, the output should be terminated with the TP2A termination unit supplied with the instrument. The leads from the TP2A, or from the RF OUTPUT socket, must be kept as short as possible.

The open circuit voltage at the RF OUTPUT socket is nominally twice the level indicated by the fine and coarse attenuators.

3.8 OUTPUT ISOLATING CAPACITORS

There is a risk of a large potential difference existing between the signal generator and a receiver under test if the receiver is of the AC/DC type. It is essential to fit isolating capacitors to both output and ground leads. Suitable capacitors will be 0.1 μ F, 500V working, providing that the high potential points do not exceed 500V peak.

It is recommended that the output of the signal generator is always fed to the equipment under test via a suitable capacitor. This will avoid damage to the instruments output attenuators from high DC voltage points, such as valve anode circuits.

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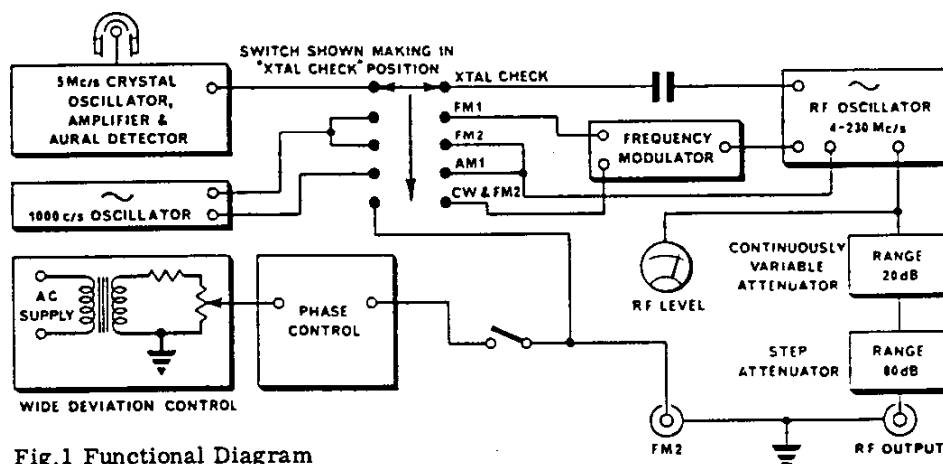


Fig. 1 Functional Diagram

4.1 GENERAL

The block diagram of the instruments is shown in Fig. 1, and the circuit diagram is illustrated in Fig. 3, Section 6. As shown in Fig. 1 the RF signal is generated by a variable frequency Colpitts type oscillator. The signal is then used directly as a CW output, amplitude or frequency modulated, or fed to a crystal oscillator circuit for calibration purposes.

4.2 FREQUENCY MODULATION

Frequency modulation is provided via a circuit consisting of two diodes MR2 and MR3, in series with a capacitive circuit which is associated with the RF oscillator V1A. Voltage applied to the diodes will cause a change in their admittance and capacitance characteristics and, therefore, cause a change in the resonant frequency of the network. Since the effect of this circuit will vary widely with frequency of the oscillator the variable resistor networks comprising RV3 to RV8 and RV11 to RV14 are used to provide a constant deviation for a given input.

With the FUNCTION switch set to position 'b' (Fig. 3), no external input and the LINE FM control set to OFF, an unmodulated CW output is available. When the LINE FM control is set to any position other than OFF a signal at the supply frequency is fed to the modulation circuit and by selecting the amplitude of this signal the modulating frequency can be set as indicated by the calibration marks associated with the control. With the LINE FM control set to OFF an external signal in the range 20Hz to 20kHz may be applied to the modulation circuit via the EXT FM IN Socket. The sensitivity of this input is approximately 6kHz per volt.

When the FUNCTION switch is set to position 'c' and 'd' (Fig. 3), the modulation frequency is controlled by the output of V4B. In this condition V1B is operating as a Hartley type oscillator at a frequency of 1000 Hz and is coupled to the RF circuit via the modulating transformer T1. Since the amplitude of the AF waveform again determines the modulating frequency, different loads are provided for V4B to enable the calibrated frequencies to be obtained.

4.3 AMPLITUDE MODULATION

This mode of operation is similar to the fixed internal frequency modulation described above. However, in this case, the full output from T1 is applied to the grid of V1A. The amplitude of this signal is sufficient to control the grid bias conditions of V1B and thus control the amplitude of the RF signal.

4.4 CRYSTAL CHECK

When the FUNCTION switch is set to position 'a' (Fig. 3) the output from V1A is fed to the cathode circuit of V1B. The switch position causes V1B to operate again as a Hartley type oscillator but this time at the crystal controlled frequency of 5 MHz. Thus the RF output signal is heterodyned with the 5 MHz oscillator signal and the output is amplified by VT1 which provides an AF output at the PHONES socket. The RF output can, therefore, be calibrated to the nearest 5 MHz using earphones and a zero beat technique.

4.5 POWER SUPPLY

The H. T. and heater supplies for the instrument are derived from the supply via the power transformer T2 and conventional rectifying and suppression circuits. A further secondary winding on the transformer provides the necessary supplies for the X SWEEP OUTPUT and the LINE FM circuits.

- (3) Tune the instrument to 230MHz CW and adjust C12 until the indicated output is 230MHz.
- (4) Repeat the operations detailed in para. 5.3 (d) (1) to (3) until optimum settings are obtained, then check the calibration at each main point in this frequency band.
- (5) Carry out the procedures detailed in para. 5.3 (d) (1) to (4) in the other frequency bands of the instrument as detailed in Table 5.2.
- (6) Carry out the RF output level check procedure detailed in para. 5.3 (c).
- (e) 5MHz Oscillator accuracy
 - (1) Set the FUNCTION switch to XTAL CHECK and using a timer counter (e.g. Advance TC4A) terminated with a loop, examine the frequency at coil L7.
 - (2) If the frequency is not within the range 4.999 MHz to 5.001MHz replace the crystal XL1.

Table 5.2 RF Calibration Adjustments

Band	Tuned Frequency	Adjust
A	100MHz	L6
	230MHz	C12
B	50MHz	L1
	100MHz	C2
C	25MHz	L2
	50MHz	C6
D	13MHz	L3
	25MHz	C7
E	7.5MHz	L4
	13MHz	C8
F	4MHz	L5
	7.5MHz	C9

- (f) Amplitude modulation
 - (1) Set the FUNCTION switch to 30% AM and connect a timer counter across C24.
 - (2) The output indicated on the counter should be 1000Hz $\pm$ 80Hz. If necessary adjust the setting of C24 to obtain this frequency.
 - (3) Disconnect the counter and connect a modulation depth meter to the output.
 - (4) Tune the instrument to a suitable frequency and check that the modulation depth is between 20% and 50%. If necessary adjust the setting of RV20 to obtain this level.

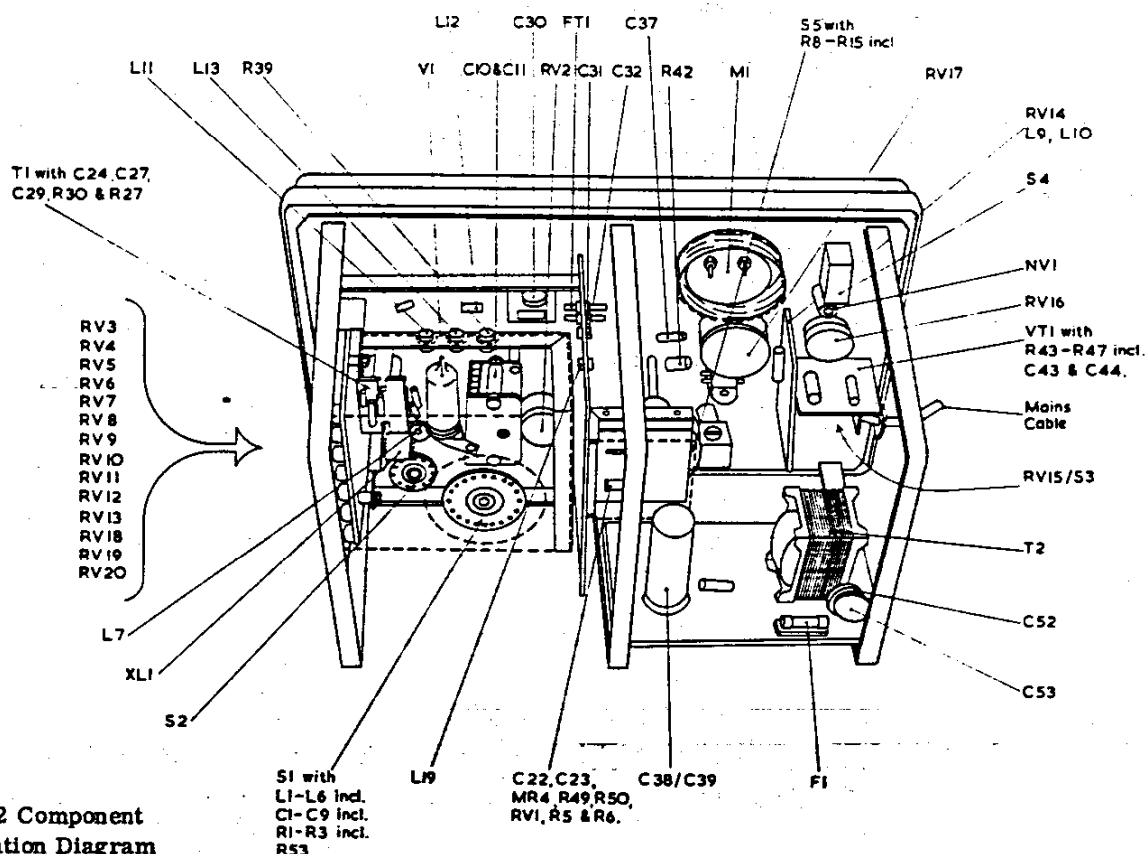


Fig. 2 Component Location Diagram

5.1 ACCESS TO COMPONENTS

(a) Removal of Case (Fig. 2)

Access to the internal components is obtained by placing the instrument face downwards and by removing the four securing screws at the rear and removing the case rearwards. Replacing the case is the reverse of the procedure detailed above.

(b) Removal of RF Screening Cans (Fig. 2)

To gain access to the components associated with the RF oscillatory circuits two screening cans must be removed. Extract the self-tapping screws and detach the appropriate plates.

NOTE: When the oscillator screens are removed a shift in frequency calibration of the order of 1% will occur. To ensure efficient screening, ALL screws must be used to refit the screening cans in place.

5.2 INTRODUCTION OF RECALIBRATION PROCEDURE

After a considerable period of service the instrument may require recalibration to meet the requirements of the specification detailed in Section 2. The recalibration procedure is detailed in para. 5.3.

5.3 RECALIBRATION PROCEDURE

(a) Preliminary procedure

Before proceeding with the recalibration procedure the instrument should be checked to ensure that it is suitable for operating from the AC supply available. The instrument should then be removed from its case (para. 5.1(a)) and connected to the AC supply ready for operation. Switch the instrument on and check that the power ON indicator is illuminated.

(b) DC Voltage checks

- (1) Set the FREQUENCY RANGE switch to position C, the FREQUENCY control for 35 MHz and the LINE FM control to 200 kHz.
- (2) Adjust the setting of the SET OUTPUT control until the meter indicates 'SET'.
- (3) Using an Avometer model 8, or similar instrument, check that the voltages at the test points indicated on the circuit diagram, Fig. 3, for the various settings of the FUNCTION switch, are within $\pm 7\%$ of the readings detailed in Table 1.

Table 5.1 DC Voltage Levels

Test Point	FUNCTION Switch Position				
	XTAL CHECK	FM/CW	150kHz	45MHz	30%AM
A	300V under all conditions				
B	230V under all conditions				
C	5.2V	5.2V	5.2V	5.4V	5.0V
D	4.5V	4.5V	12.5V	7.0V	13.0V
E	3.0V	3.0V	2.1V	2.7V	2.1V
F	125.0V	115.0V	117.0V	46.0V	130.0V
K	140V to 145V as set by SET OUTPUT control				
L	145V $\pm$ 2V under all conditions				
M	115V $\pm$ 2V under all conditions				

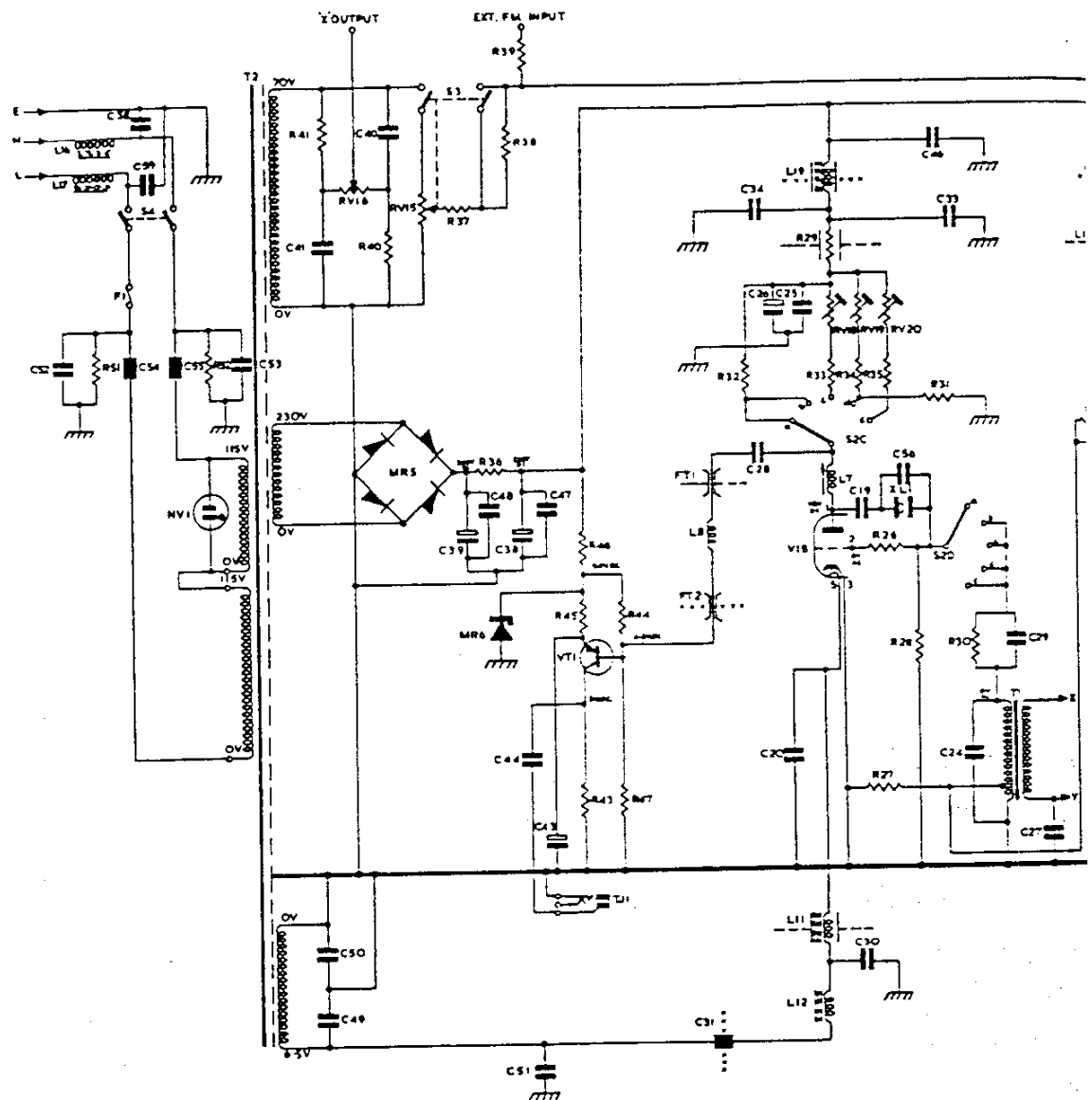
(c) RF Output level

- (1) Set the FUNCTION switch to CW, the frequency controls to 40MHz and the attenuators to 0dB.
- (2) Connect the RF OUTPUT socket to an RF millivoltmeter (e.g. Advance Type VM79) via the appropriate termination unit. (TP2A for 75 Ω model).
- (3) Adjust the SET OUTPUT control to obtain a reading of 100mV on the millivoltmeter. Adjust the preset potentiometer RV14 until the internal meter indication is 'SET'.
- (4) Check that the outputs corresponding to +1dB and -1dB internal meter indications are 112mV and 89mV respectively.
- (5) With the SET OUTPUT control set fully clockwise, sweep through the entire frequency range of the instrument. If necessary, adjust the coupling of the appropriate oscillator coils so that the minimum output on each range is not greater than 130mV.
- (6) Tune the instrument to 180MHz CW i.e. set frequency controls to 180MHz, set the FUNCTION switch to CW, and adjust the SET OUTPUT control until the internal meter indication is 'SET'.
- (7) Check that the millivoltmeter indication is within the range 89mV to 112mV. If necessary, readjust the setting of RV14 to obtain this reading.

NOTE: In the following procedures the RF OUTPUT socket must remain correctly terminated. The instruction 'Tune' shall be interpreted as defined in para. 5.3 (c) (6).

(d) RF Calibration

- (1) Tune the instrument to 100MHz CW and connect the output to a suitable frequency calibrator.
- (2) Adjust the core of L6A until the indicated output is 100MHz.

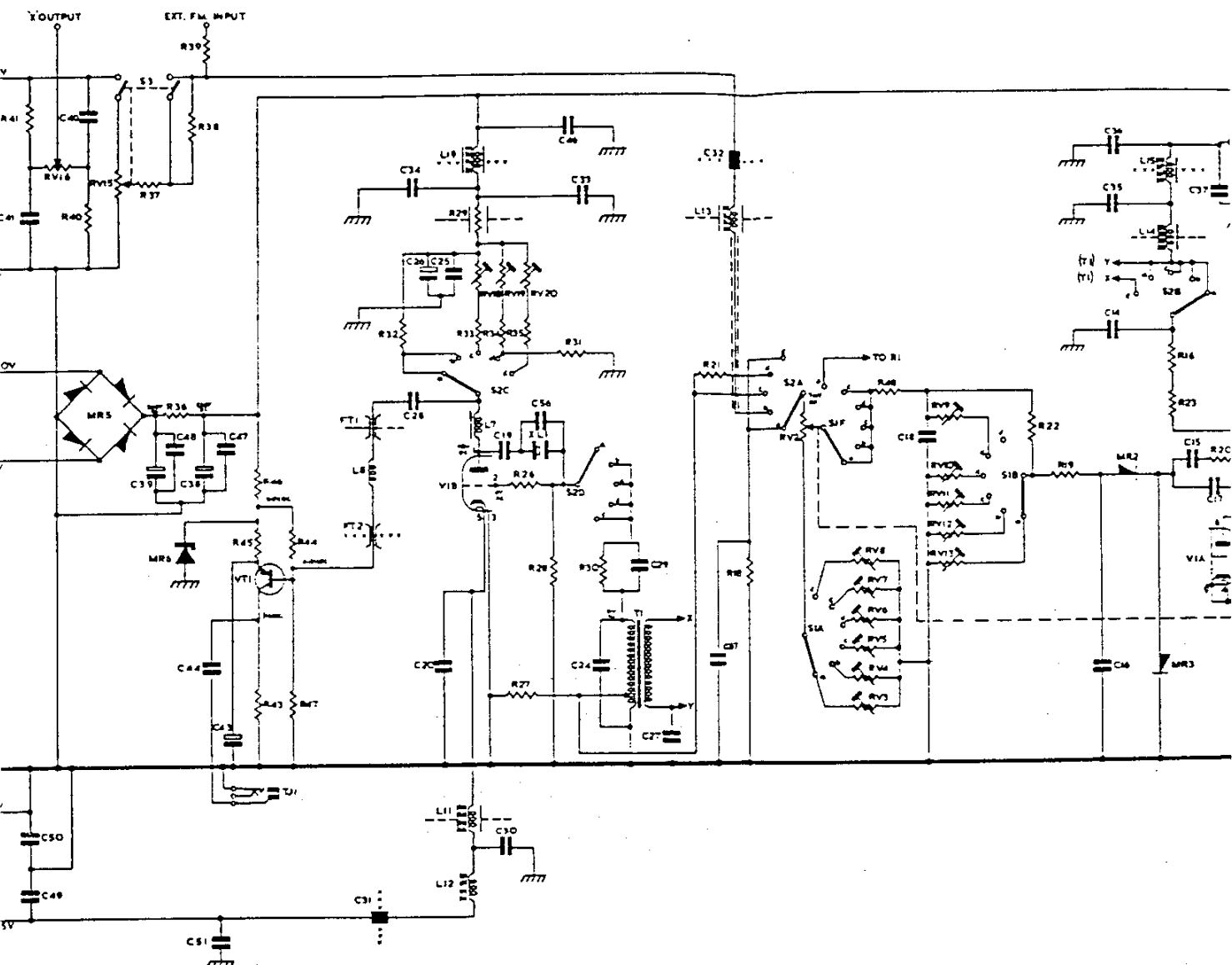


NOTES
 S2 FUNCTION SWITCH SHOWN IN
 CRYSTAL CHECK POSITION.
 S1 RANGE SWITCH SHOWN IN
 RANGE X POSITION
 --- DEMOTES INNER SCREEN
 . . . DEMOTES OUTER SCREEN
 VOLTAGES SHOWN ARE WITH "BT" WIPER
 IN POSITION "B", WHICH IS THE LINE PAUSE POSITION
 VOLTAGE PHILIPS TUNING ON
 "C" BAND POINTS AT 20 kHz
 "LAE FM" ANT TO 500 kHz
 OVP METER AT "BT" LEVEL
 D.C. VOLTAGES READ ON 100V
 A.C. VOLTAGES READ ON 10V/77
 E.F. VOLTAGES READ ON 10/79 WITH 75.6 LOUD

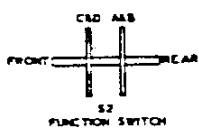
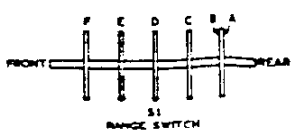
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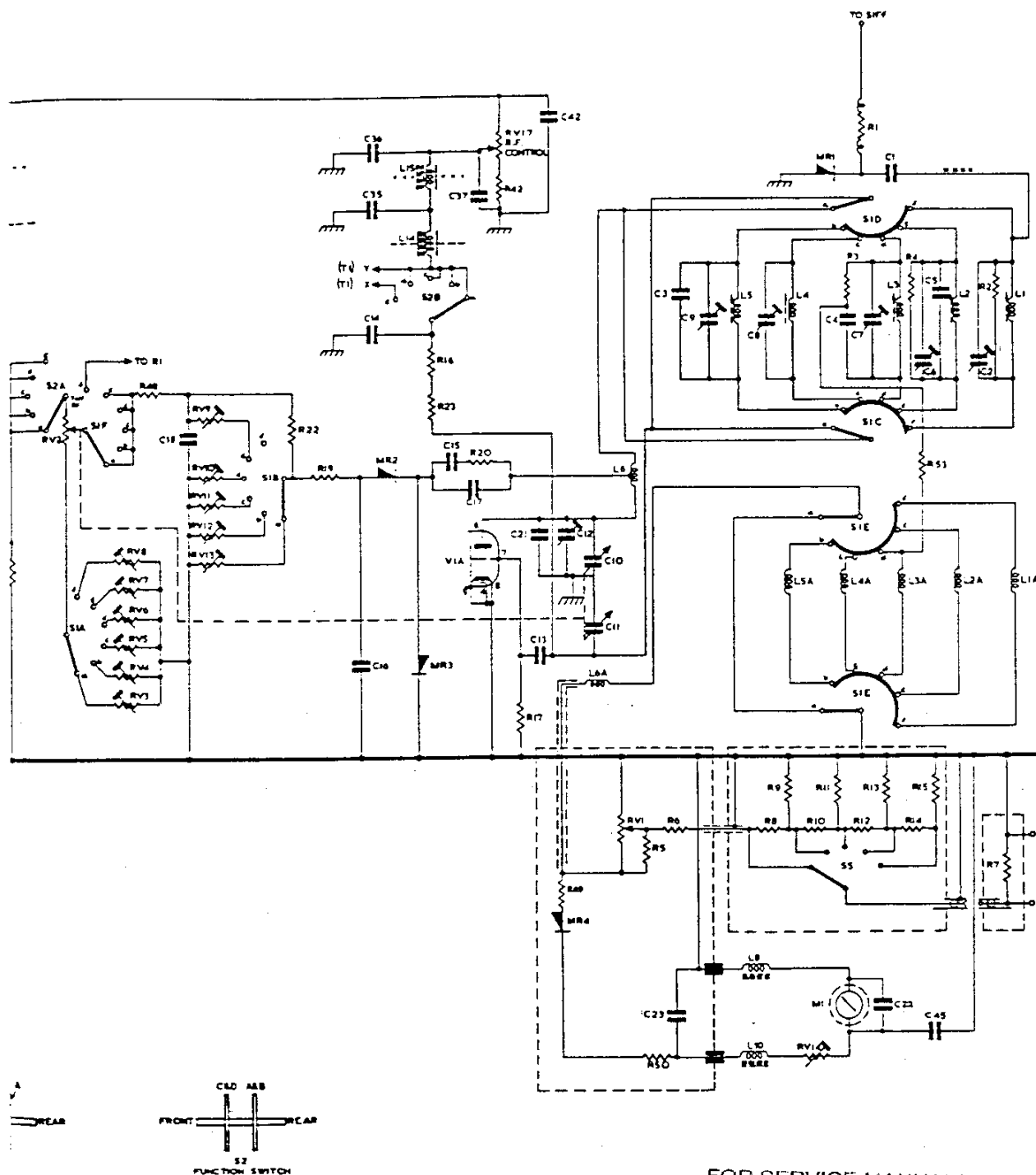


Fig.3 Circuit Diagram



SHOWN IN
ON
WKN IN
1 SCREEN
1 SCREEN
5" WIRE
JMS. PUNCH POSITION





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Ref	Value	Description	Part No
RESISTORS (RC7K 10% unless specified)			
R1	22K Ω		3433
R2	22K		3433
R3	12K		3429
R4	10K		1069
R5	220		3418
R6	82		3414
R7	75		3439
R8	743	1%	6249
R9	92	1%	6250
R10	743	1%	6249
R11	92	1%	6250
R12	743	1%	6249
R13	92	1%	6250
R14	743	1%	6249
R15	82.5	1%	6251
R16	1.5K	10%	591
R17	10K		1069
R18	3.3K		3425
R19	120		3417
R20	68		3415
R21	1.8K		3420
R22	5.6K		3428
R23	1.5K	10%	591
R24, R25	Not used		
R26	100		3416
R27	220		1272
R28	207K		3437
R29	1K		3424
R30, R31	56K		3435
R32	18K		3432
R33, R34			
R35	10K		1069
R36	2.2K	5%	599
R37, R38	3.3K	10%	7704
R39	2.2K	10%	6781
R40, R41	12K		3429
R42	1.8K	5%	3394
R43	3.3K		3425
R44	4.7K		3427
R45	470		3419
R46	150K		3436
R47	33K		3434
R48	3.9K		3426
R49	120	5%	735
R50	820	5%	1637
R51, R52	1M	10%	1171
R53	270K		3437

POTENTIOMETERS (Weins P345, unless specified)

RV1	100		10374
RV2	16.5K		A15680
RV3			
RV4	10K	Preset	3447
RV5			
RV6			
RV7	25K	Preset	3446
RV8			
RV9	5K	Preset	3444
RV10	10K	Preset	3447
RV11			
RV12	5K	Preset	3444
RV13			
RV14	10K	Preset	3447
RV15	5K		10766
RV16	250K		11078
RV17	10K		1213
RV18	100K	Preset	3445
RV19	250K	Preset	3443
RV20	100K	Preset	3445

Ref.	Value	Description	Part No
CAPACITORS (Wima M 400V unless specified)			
C1	27pF		18454
C2	1-5p		8770
C3	2.2p		815
C4	10p		4504
C5	2.2p		815
C6/C9	1-5p		8770
C10, C11	70 x 70p		8807
C12	1-5p		8770
C13	30p		3448
C14	.0047 μ		3778
C15/C17	10p		4504
C18	40p		3395
C19	1000p		3397
C20, C21	50p		3699
C22	0.05 μ F	20% 12V	19657
C23	.05 μ		2793
C24	.047 μ		3779
C25	3300p		3396
C26	8 μ		10760
C27	0.1 μ		2385
C28	0.022 μ		4243
C29	0.047 μ		3398
C30	0.01 μ		3399
C31, C32	300p		7099
C33, C34	4700p		4212
C35, C36	0.01 μ		3399
C37	0.1 μ		2385
C38	100 μ	(60-100 μ 350V. Elect. Plessey)	2072
C39	60 μ		2072
C40, C41	0.22 μ		2601
C42	4700p		4212
C43	50 μ		1746
C44	0.1 μ		2385
C45	0.05 μ F	20% 12V	19657
C46/C50	4700p		4212
C51	0.01 μ		3399
C52, C53	5070p		1514
C54, C55			18146
C56	10p		4504
C57	0.047 μ		3779
C58	5000pF		1514
C59	5000pF		1514

MISCELLANEOUS

FS1	Fuse 1A	4732
FT1, FT2	Feed thro' Cambion	3412
L1	Osc coil 4-7.5MHz	RF641
L2	Osc coil 7.5-13MHz	RF633
L3	Osc coil 13-25MHz	RF632
L4	Osc coil 25-50MHz	RF631
L5	Osc coil 50-100MHz	RF630
L6	Osc coil 100-230MHz	10377
L7	Xtal Calibration Coil	RF619
L8	1mH choke Cambion 3635/37	3404
L9 to L15, L19	Choke Ferroxcube	C 173
L16, L17	Choke	11212
L18	Not used	
M1	Meter 20 μ A	18182
MR1	Diode MS4H	20422
MR2, MR3		5871
MR4		7110
MR5		12783
MR6		4225
NV1	Neon Indicator	1165
S1	Frequency Range switch	A12349
S2	Function Switch	
S3	DPST switch (part of RV15)	A10606
S4	Supply ON/OFF switch	539
S5		
T1	Modulation transformer	MT356
T2	Supply transformer	MT415
TJ1	Jack Igranic P72	10805
V1	Tube 6BQ7A	12339
VT1	OC71	340
XL1	Crystal Quartz 5MHz	12343

This instrument is guaranteed for a period of one year from its delivery to the purchaser, covering the replacement of defective parts other than tubes, semiconductors and fuses. Tubes 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 charges 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.

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ADVANCE INFORMATION



AMENDMENT SHEET

FOR

INSTRUCTION MANUAL SG63F

(Part No. 18506)

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Page 12, Components List

R1 now 22k Ω , Part No. 3433.
C1 now 27pF, Part No. 18454.
C22, C45 now 0.05 μ F Murata 20% 12V, Part No. 19657.

Add the following:

C58, C59 5000pF Erie K35011/CD8, Part No. 1514.

Page 13, Components List

L16, L17 choke, Part No. 11212.
M1 meter now 20 μ A, Part No. 18182.
MR1 now Diode MBI MS4H, Part No. 20422.

Page 13, Circuit Diagram

In series with the Neutral path to S4 insert L16.

In series with the Line path to S4 insert L17.

Add C58 between Earth and the S4 end of L16.

Add C59 between Earth and the S4 end of L17.

R40 and R41 are now interchanged (12k Ω each).

C40 and C41 are now interchanged (0.22 μ F each).

Delete the connection from the bottom of MR5 to C39.

Insert an h.t. connection from the junction of R36 and R46 (point B) to the top of L19 (junction of L19 and C46).

Add C57 across R18.

The junction of R23 and C13 should be joined to the bottom plate of C11 (at the junction of the two lines that cross).

R49 is now positioned on the opposite side of MR4 adjacent to RV1 and R5.

Insert C45 between RV14 side of meter M1 and chassis.

Insert C22 directly across meter M1.

KHE/DL/22. 11. 67.



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