MND. 20

Instruction Manual

for

MARCONI MARINE

SEAGUIDE
D.F./BROADCAST RECEIVER
Z00-2350-01

Handbook Ref. D.24
1st Edition, December, 1973

COASTAL RADIO LIMITED
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A Marconi Marine Company

Published by
Technical Information Section
THE MARCONI INTERNATIONAL MARINE CO. LTD.
Elettra House, Westway, Chelmsford, Essex.

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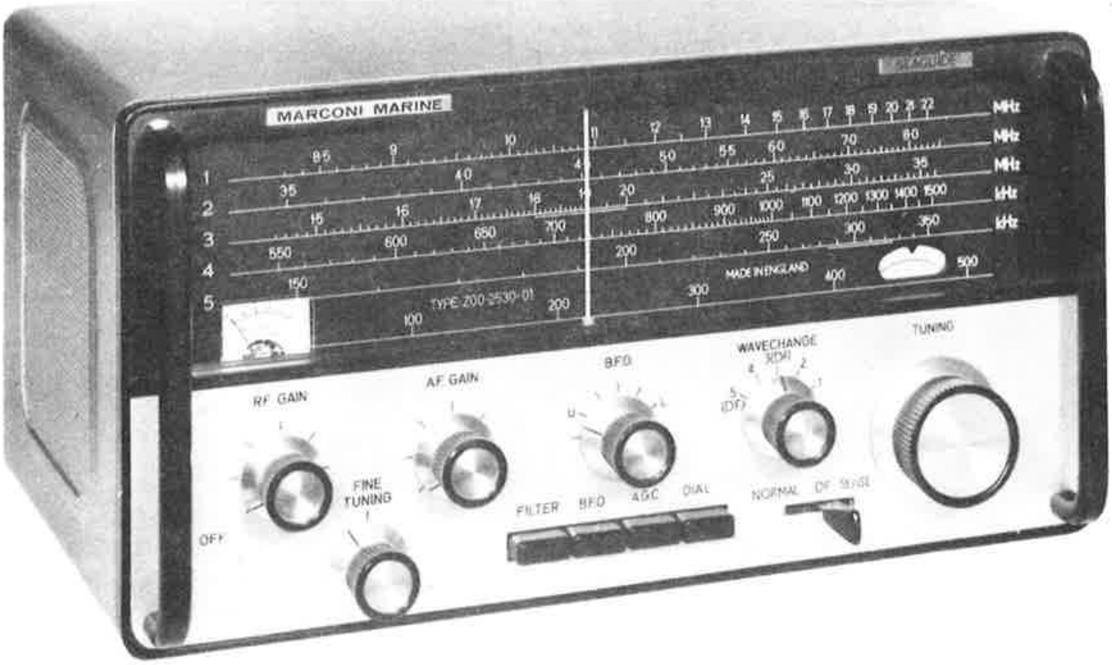

'SEAGUIDE' RECEIVER

HANDBOOK AMENDMENT RECORD

After incorporating an amendment, insert the amendment instruction pages at the rear of the book and record the incorporation of the amendment in the table below.

	Amendment			Amendment	
No.	Incorporated by:	Date	No.	Incorporated by:	Date
1			11		
2			12		
3			13		
4			14		
5			15		
6			16		
7			17		
8			18		
9			19		
10			20		

POST DEVELOPMENT CHANGE RECORD

Post Development Changes to the equipment may necessitate amendments to the information contained in this handbook. Such amendments will be issued with the items required to effect a particular change. After inclusion of the necessary amendments in the handbook the appropriate change number or letter should be struck off the label below.

1	3	5	7	9	11	13	15	17	19	21	23
2	4	6	8	10	12	14	16	18	20	22	24
A	B	C	D	E	F	G	H	J	K	L	M

The Change State of any unit is dependent upon the Serial Number of that unit. Where this handbook is supplied as part of an installation, the Change State of the unit should be ascertained from the label affixed to the unit, and the appropriate numbers and letters struck off the label reproduced above.

INTRODUCTION TO HANDBOOK

1. HANDBOOK LAYOUT

This manual comprises four sections:

Section 1 Installation, commissioning and operating instructions.

Section 2 Technical description.

Section 3 Alignment.

Section 4 Drawings and parts list.

2. PAGE LAYOUT

All the pages are numbered. The page numbers in each section are prefixed by the section number and underlined to prevent confusion with figures used in text or on drawings.

Each page of text carries, in addition to its number:

(a) The instruction manual identity in the form: D.24

(b) The section number

(c) The page issue number and date of issue in the form:

Page Issue 1
(December 1973)

3. HANDBOOK AMENDMENT

Periodically, revised or supplementary information may be issued for the handbook. This information will be issued as either:

(a) Amendment information in the form of new pages and/or instructions for hand-amendment of existing pages. Record the incorporation of such an amendment on the handbook amendment record opposite.

(b) Supplements. These usually cover optional or ancillary items of equipment, and are usually inserted at the end of the book. They may, however, be kept separate, if required.

(c) Handbook amendment information included in Post Development Service Bulletins. These bulletins are issued with sets of parts required to effect changes to the equipment fitted on your ship. Record any such changes made to your equipment on the Post Development Change Record label reproduced opposite. On completion of a change, insert the P.D.S. instruction sheet at the end of the book.

TO ENSURE THAT YOU RECEIVE AMENDMENT INFORMATION, PLEASE ENTER YOUR SHIP AND COMPANY NAME AND ADDRESS ON THE PERFORATED CARD AT THE FRONT OF THIS BOOK AND RETURN IT TO THE ADDRESS ON THE REVERSE OF THE CARD.

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TECHNICAL SUMMARY

1. GENERAL

The Seaguide is a fully transistorised single conversion direction finder/communication receiver, covering the frequency range 150kHz to 22MHz in five ranges. Provision is made for AM and CW reception and the unit can be powered from a self-contained battery pack, mains unit, or +ve 12-24 volt DC supply.

The equipment can be used in conjunction with either a rotating loop, or Bellini-Tosi fixed loop and goniometer system type aerial.

The receiver is provided with a large band spread scale, as well as a vernier/logging scale to permit very quick location of stations. The signal level meter assists in fine tuning.

Range 5 (150kHz to 350kHz) is used for direction finding, in the beacon band 285-315kHz. On Range 3 (1·5MHz to 3·5MHz) the receiver can be used as a directional homing device.

A total of ten transistors is employed together with eight diodes one of which is a zener type which serves to stabilise the supply for the RF section of the receiver. This arrangement helps to maintain a sensibly constant performance with falling battery voltage. Current drain has been kept to a minimum to prolong battery life.

The equipment can be fitted with a rotating loop and pedestal, or a B.T. fixed loop with Goniometer and Quadrantal Error correction coil.

An internal five inch loudspeaker is fitted and arrangements are made for using low impedance telephones where this is more convenient. A push-pull audio output stage is employed and a selective audio filter can be introduced for CW reception under conditions of severe adjacent channel interference.

Independent RF and AF Gain controls are fitted and the other controls include separate BFO and AGC switches and a variable BFO pitch control. The tuning drive is a geared type and is flywheel-loaded for ease of operation. Tuning scales are some nine inches in length and are calibrated directly in terms of frequency. Dial illumination is provided for use when necessary and is controlled by a switch on the panel.

The receiver is light in weight, has contemporary styling with compact dimensions and is housed in a strong metal cabinet. High quality components are used in all parts of the circuit and reliable operation is assured throughout the world.

2. TECHNICAL DATA

2.1 General

A typical system comprises a direction finder loop aerial (fixed or rotating), a goniometer unit with the rotating loop, and the Seaguide receiver which is housed in a "hammer" finished metal cabinet.

2.1.1 Frequency Ranges

The complete frequency coverage is divided into five ranges as follows:-

Range 1	8•5-22•0 MHz. (SW1).
Range 2	3•5- 8•5 MHz. (SW2).
Range 3	1•5- 3•5 MHz. (SW3).
Range 4	550-1500 kHz. (MW).
Range 5	150- 350 kHz. (LW).

2.1.2 Intermediate Frequency

465 kc/s.

2.1.3. IF Selectivity

Typical overall bandwidths at 6dB and 40dB down are 5 kHz and 25 kHz respectively.

2.1.4 IF Breakthrough

Ranges 1-4	greater than 85dB down.
Range 5	greater than 65dB down.

2.1.5. Image Rejection

20dB at 18•0 Mc/s and 50dB at 2•0 Mc/s.

2.1.6 Sensitivity

Better than 5uV for 15dB s/n ratio on Ranges 1-4.
Better than 15uV on Range 5.

2.1.7 Aerial Input Impedance

Ranges 1-4	75Ω (nom) balanced or unbalanced.
Range 5	400Ω (nom) balanced or unbalanced.

2.1.8 Frequency Stability

Drift does not exceed 1 part in 10^4 per $^{\circ}C$ change in ambient temperature.

2.1.9 Calibration Accuracy

1% on all ranges.

2.1.10 AGC Characteristic

An 80dB increase in signal produces less than 12dB change in output. Taken from 6uV at 2•0 Mc/s on Range 4.

2.1.11 Audio Output and Response

The maximum audio output exceeds 1 watt and 800mW is available at 10% distortion.

Frequency response is level within 6dB over the range 300 c/s to 8 kc/s except when using the audio filter. The filter is resonant at approximately 1,000 c/s and can be brought into circuit for selective CW reception. 6dB bandwidth is of the order 180 c/s.

2.1.12 Power Supply

9V from 6 x 1·5V leak-proof dry cells, external supplies of 12V or 24V DC (positive earth) using Voltage Converter Type 945 or standard AC mains supplies using Ac Power Unit Type 8871A

2.1.13 Consumption

36mA quiescent, 77mA at 50mW and 180mA at 500mW output. Dial lamps when in use add 90mA to the normal current drain.

2.2 Dimensions and Weight

Height	$6\frac{3}{8}$" (16·2 cm.).
Width	$12\frac{1}{2}$" (31·7 cm.).
Depth	8" (20·3 cm.).
Weight (less batteries)	$12\frac{3}{4}$ lb. (5·8 kg.).
Weight (with batteries)	14 lb. (6·3 kg.).

2.3 Controls

a) ON/OFF - RF Gain control

b) A.F. Gain control

c) B.F.O. Pitch

d) Wavechange

e) Tuning

f) Four push-button switches control the following functions:-

AF FILTER IN/OUT, BFO ON/OFF, AGC ON/OFF and DIAL LIGHTS ON/OFF.

g) A 3-position NORMAL-D.F.-SENSE switch.

2.4 Back Panel Facilities

a) Earth connection 'E'
Wire aerial connection A1
Loop aerial connections A2 A2.

b) "Sense" balancing potentiometers, ranges 3 and 5.

c) Outputs, headphone socket high impedance output.

d) Power Pack compartment.

2.5 Semiconductors

Semiconductor Complement

TR1	OC171	RF Amplifier.
TR2	OC171	Mixer.
TR3	OC171	Local Oscillator.
TR4	OC171	1st IF Amplifier.
TR5	OC171	2nd IF Amplifier.
TR6	OC171	Beat Oscillator.
TR7	OC71	Audio Amplifier.
TR8	OC83	Audio Driver.
TR9) TR10)	2 x OC83	Audio Output.
D1	OA70	AGC Attenuator.
D2	OA90	Detector/AGC.
D3	OAZ203	Voltage Stabiliser.
D4/5	2xDD006	Aerial Protection Diodes.
D7/8	2xDD006	Aerial Protection Diodes.
D6	BA111	

2.6 Associated Equipment

	A/c. No.
(A.C. Power Pack, 115/230 V.A.C., or,	PWU.243
(D.C. Power Pack, 12/24 V.D.C., or	PWU.296
(Ever-Ready battery, 6 off 1·5 volt U.2 cells	BTY.8
Set of spares for receiver (basic)	SES.328
Set of spares for receiver (optional)	SES.323
Set of spares for 24/12 volt supply pack, or,	SES.322
Set of spares for 115/230 V.A.C. supply pack, or	SES.248
Telephone headset	TEL.117
Goniometer)	GON.8 or 13
Loopaerial)	AEL.19
<u>OR</u>	
Rotating Loop Aerial with pedestal.	AEL.29, 30 or 31

SECTION 1

INSTALLATION & SETTING-UP

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SECTION 1

Chapter 1

INSTALLATION

1. SITING

The layout will vary for each installation depending upon the space available and the equipment to be fitted. In general the equipment should be sited in such a position that the controls are within easy reach of the operator. The installation wiring diagram, if supplied, should be adhered to as far as practicable.

It is emphasised that a properly calibrated direction finder can be regarded as a reliable instrument of navigation and with this object in view, great care is necessary during installation. No installation can be regarded as complete until the equipment has been calibrated and proved.

The site for the loop aerial should be as high as possible on the ship's centre line and be accessible for maintenance purposes. Electrical symmetry must be maintained about the fore and aft line of the ship.

In choosing the position regard must be given to the following points:-

a) Attention must be paid to the length of cable between the loop aerial and the equipment. These cables should be kept to a minimum and should not normally exceed 8 metres in length.

b) The site should be free from aerial leads, rigging and large metal masses.

c) Nearby metal railings and stanchions must be carefully bonded and earthed.

d) Jumper and triatic stays and whistle lanyards in the vicinity should all be broken up by insulators.

2. GENERAL

a) If optional Quadrantal Error Corrector M32-5677-01 is supplied, mount it inside the back of the goniometer unit, type NM01-5010-01 referring to drawing N/S.5607 for method of connection and fitting. Connect the coil across the F/A or P/S connections as appropriate, and adjust the tapping and core setting to achieve the correct value.

b) The cable run between the goniometer and the Seaguide DF receiver must not exceed 2 metres.

c) Coaxial plugs type PC 60201 are used to terminate the loop cables into the goniometer unit.

d) The position of the vertical aerial must be such as to give minimum coupling between it and transmitting aerial. Its length should be between 4·5-6 metres.

3. POWER SUPPLIES

3.1 Mains Power Unit 8871A. 110/240 V.A.C.

i) Remove the battery pack and store for possible use at a later date. The batteries should be removed from the container if prolonged operation from the 8871A unit is envisaged.

ii) Fit the mains power unit in the same way as the battery unit taking care to ensure that the battery plug is inserted correctly (i.e. yellow dots together).

iii) The power unit is despatched with the transformer tap set in the 240V position which is correct for voltage in the range 200/250V. Operation from 100/125V supplies is possible when the tap is moved to the 110V position.

iv) To gain access to the tap adjustment, slacken and remove the two 4BA nuts at the ends of the unit and feed the mains lead through the grommet in the cover plate so that the latter can be removed.

v) The adjustment panel is clearly marked and changeover from one voltage range to the other merely requires that the neutral lead be connected to the appropriate side of the connector. Make sure that the lead is pushed properly into the hole and that the screw is tightened securely.

vi) Mains Leads coded in accordance with:-

LIVE - BROWN NEUTRAL - BLUE EARTH - GREEN/YELLOW

3.2 12/24 V.D.C. Converter type 945.

i) Remove the battery pack and store for possible use at a later date.

ii) Fit the 12/24 volt unit in the same way as the battery unit, taking care to ensure that the polarities of the connections are correct.

iii) Set the 12volt/24 volt link on the unit to suit the supply.

3.3 9 Volt Battery Pack.

To fit the batteries, first unscrew the two knurled screws which retain the battery box at the rear of the receiver. Lift the box clear and free from the receiver by disengaging the four-way connector at the right-hand end. Now remove the inner cover from the box, sort the batteries into two groups of three and slide them into the battery troughs.

Use the diagram printed on the battery container as a guide when fitting the batteries and made absolutely sure that they are in the correct positions before switching on the receiver. Switching on with the batteries connected the wrong way round will damage the transistors. Replace the inner cover, reconnect the four-way plug and then re-fit the battery container in the rear of the set. It should be noted that the plug is a non-reversible type so that there is no chance of the battery polarity being reversed at this point.

4. SEAGUIDE RECEIVER

The receiver requires a bench space of approximately 14" x 16" deep, which allows about 7" at the rear for adjustment of pre-sets and removal/inspection of power supply.

If space is at a premium, the receiver can be mounted on a plate having four fixing holes at centres 9½" x 2". The normal bracket mounting is shown on drawing Z01-2530-50(b) issue 1 sheet 1.

5. GONIOMETER

The goniometer should be sited as near as possible to the receiver to facilitate operation. It is also convenient if the compass repeater is within sight of the goniometer to obtain ship's head from the goniometer position.

It requires a bench space of about 6" x 6", but allow a further 2" at the rear for projections and bends of the coaxial leads.

Slight vertical rotation allows its attitude to be adjusted to suit the operators position. Leads should therefore be run in a manner which will allow this slight rotation.

The QE correction coil is fitted as shown in drawing N/S.5607.

6. WIRING

Installation wiring should be carried out in accordance with the appropriate installation wiring diagram.

7. EARTHING

An earthing bolt should be provided near to the receiver to allow the receiver earthing lead and the loop earthing strip to be earthed at the same point for the DF loops type 2469A or Z00-5510-01.

8. AERIALS

The loop and vertical aerials should be fitted strictly in accordance with the drawings appropriate to the particular fitting. Keep the 'sense' length to 6 metres until setting up (if possible).

9. ADJUSTMENTS

9.1 General

The procedure to be followed in this section ensures that the loop signal and the vertical signal after amplification are equal in amplitude. It is assumed that the equipment has been satisfactorily installed and that the circuits are in working order. Read the whole of this section before proceeding with adjustments.

With the Seaguide switched to DF and on range 3, tune in a fairly strong DF transmitting station, preferably free from interference. Adjust the goniometer to obtain maximum signal strength, then using the RF gain control set the level to give a reading of 6 on the level meter. Note the setting of the goniometer dial.

Switch to "sense". Swing the goniometer (or loop aerial) through ±90°. If the balancing resistors at the rear of the receiver are correctly set, and if the sense aerial is of the correct length, then the level meter will again read 6. This is not likely, so the length of the vertical sense aerial has to be adjusted, and the setting of RV4 (Range 3).

If the sense aerial is of the correct length, then by adjusting RV4 (Range 3) it will be possible to set the meter level to 6. If the sense aerial is too long or too short, the signal level on "sense" will be so high or so low (respectively) as to make it possible to set the meter level to 6 by adjusting RV4. The sense vertical aerial must be shortened or lengthened, whichever is the case.

With RV4 set to its mid position vary the length of the sense aerial to give a level near to 6. Then finely adjust RV4 to obtain a level of 6.

Now go to Range 5. Switch to 'DF', and tune in a fairly strong DF transmitting station. Adjust the goniometer to give maximum signal, note the setting. Adjust RF GAIN to give a meter level of 6. Switch to "sense", swing the goniometer ±90°. Adjust RV5 to give a level of 6.

The balancing resistors are now set.

9.2 Loop and Pointer Alignment Check (Bellini-Tosi Aerials Only)

Tune in a strong signal in the medium frequency band with a bearing near to a mid-quadrant.

Disconnect the calibrating choke in the radiogoniometer unit.

Short circuit terminals P and S inside the radiogoniometer unit with a short bare copper wire, and check the zeros at 000° and 180°

Transfer the shorting wire to terminals F and A and check the zeros at 090° and 270°.

If the zeros are not 180° apart there is direct pick-up owing to faulty earthing of the centre point of the radiogoniometer or of the amplifier, the loop aerials and feeder cables. If the zeros are 180° apart, but are uniformly advanced or retarded, adjust the pointer to indicate 000° or 180° degrees.

9.3 Loop Aerial Alignment

Ensure that the fixed loop aerial is exactly in line, fore-and-aft. Careful line of sight and physical measurement should be sufficiently accurate when the loop is on the ship's centre line. Slotted holes are provided in the base flange of the loop aerial to facilitate the alignment with the F and A line of the ship and the edge of the flange is marked in degrees for this purpose.

The positioning is finally checked by placing a transmitting station dead ahead and comparing the navigators visual bearing with the DF bearing. The loop is then adjusted the correct amount to bring the DF bearing dead ahead.

Chapter 2

CALIBRATION

1. CALIBRATION SEQUENCE

Three important points must receive careful attention:-

i) Check that the aerial loops are correctly placed, the loops being accurately fore and aft and athwartships respectively.

ii) Graphical comparison between DF bearings and visual bearings.

iii) Balancing the pick-up factors of the two loop circuits by means of the quadrantal error correction unit to compensate for the distortion caused by the metal mass of the ship.

2. FREQUENCY OF CALIBRATION

On medium frequencies calibration is generally carried out on 300 or 500 kc/s. If a satisfactory calibration is effected on 300 kc/s and found by careful observation to be accurate for 500 kc/s, it is most unlikely that any additional errors will be found over the M.F. band. However, the same calibration is not necessarily correct for I.F. frequencies.

3. PRELIMINARY TESTS BEFORE CALIBRATION

3.1 Examination of Direction Finder Site

Examine the site of the D.F. loop aerial carefully, and note for future reference any points which are likely to cause errors.

Note particularly whether the loop is on the centre line of the ship and also the disposal of metal objects asymmetrically placed near to the loop. See that the whistle lanyards, triatic stays, etc., have been insulated so that no rigging or structure forms a closed loop arount the frame. Any rails, etc., near the loop aerial should be either bonded or insulated.

Slotted holes are provided in the base flange of the loop aerial to facilitate alignment with the fore and aft line of the ship: the edge of the flange is marked in degrees for this purpose.

Check the precise mechanical alignment of the loops. Confirm that they are at right angles and have not been damaged in transit.

Note the positions of booms and derricks. If these are in their working positions it is useless to calibrate the equipment; they must be in their stowed position before any attempt is made to carry out calibration.

Observe the positions of the wireless aerials and particularly the medium wave transmitter aerial. In some cases this aerial when connected to its transmitter will cause considerable deviation on the direction finder. It is necessary to have the main aerial disconnected for direction finding unless special arrangments have been made to obviate any possible error from this aerial.

See that no reception on or near to the frequency of calibration is taking place in the vicinity of the direction finder.

3.2 Examination of Direction Finder Performance

Check the operation of the Seaguide and its controls and carry out any preliminary adjustments referred to in the appropriate fitting instructions.

Test the continuity and insulation of the loop circuits. With the loop cables disconnected from the goniometer or junction box 799AZ, each loop system should show an insulation resistance of not less than one megohm to earth and to the other loop.

3.3 Checking D.F. Loop Aerial Connections

In order to check that the Bellini-Tosi loop aerial and radiogoniometer unit connections are correct, select any station whose bearing relative to the ship's head is known. If this station has its zeros in the correct quadrants, the connections are correct, but if the zeros are in the wrong quadrants reverse the connections of one pair of loop aerial cables at the radiogoniometer. If the sense is 180° out, reverse the connections of both pairs of loop aerial cables.

If a rotating loop aerial is fitted reversing the loop aerial connections to the receiver will reverse the "sense".

4. CALIBRATION

4.1 Preparation

Because of the expense involved in swinging a large vessel through 360°, it is desirable that calibration be successful first time. To this end certain preliminary checks and adjustments can be carried out whilst the vessel is still berthed. It then requires only minor adjustments to be made during or after the first 360° swing. All preliminary checks (paras 1 to 3.3) should be made.

4.2 Preliminary Quadrantal Error Correction

Using the same station as in 3.3., compare its known or observed bearing with that obtained using the direction finder. If the bearings are different, and the DF bearing tends towards the F/A line, connect the QE coil in the goniometer across the F/A connections in the goniometer. If the DF bearing tends towards the beam, connect the QE coil across the P/S connections in the goniometer.

If, as is generally the case, bearings of a number of reliable stations are known from the ship's berth, then by taking a series of careful bearings, a close idea of the probable quadrantal error can be deduced. It must be clearly realised that the greater quadrantal error on an uncorrected direction finder does not occur at 45° but when the apparent direction of the signal is at 45° - E/2, where E is the maximum quadrantal error. At this point the correct direction of the station is 45° + E/2.

If the difference between the station and the direction finder bearing is large, use taps one and two on the coil. If the difference is small, use taps one and three on the coil.

If, however, the initial calibration produces indifferent or varying Q.E. curves then the cause of these variations must be relentlessly pursued or the installation will always be unreliable. Hence, it cannot be too strongly emphasised that to keep on recalibrating and rejecting the earlier results is just a waste of time because each new calibration will merely produce another curve as unreliable as the previous one.

Calibration is essentially the process of finding the values of the constant errors at all points of the direction finder scale, after all variable errors have been eliminated. It is invariably carried out by comparing the correct bearing with the D.F. bearing at a large number of points in each quadrant. Wherever possible the correct bearings should be obtained by direct visual observations, but it is sometimes possible by the use of a compass to calculate the correct bearing of a distant and invisible station without introducing any appreciable error.

The two standard methods of calibrating a direction finder on a mobile station are either to maintain the station in a fixed position and allow a portable W/T transmitter to be taken round it, or to swing the station round as on a pivot within visible distance of a stationary transmitter.

The distance between the calibrating transmitter and the station should be as great as possible and never less than one mile unless practical conditions prevent such a distance being obtained.

If any reliance is to be placed on the calibration, it must be known that the site is free from error producing factors such as large sheds or other structures in dock areas, or railway lines, fences, etc., also in estuaries and coastal waters one must beware of coastal refraction. In most cases past experience of a particular site will enable an assessment of its reliability to be made but on previously unexplored sites and old sites where new structures, etc., have been erected, a cautionary mental note should be made of the fact that the reliability of the site is not yet proved.

In view of the fact that a ship's aerials may cause large errors in a direction finder by re-radiating the incoming signals, there has been a long-standing rule that all aerials must be isolated whilst calibrating or using the direction finder for navigational purposes.

Recent experience has shown, however, that this ruling causes many unnecessary interruptions to the normal communication services and so the Ministry of Transport Notice No. 402 has been drawn up with a view to minimising these interruptions.

It is not possible to lay down hard and fast rules concerning the safe distance between the down-lead of a particular aerial and the D.F. loops because the magnitude of the errors it may produce will depend on a number of variable factors such as the frequency to which the aerial happens to be tuned. It may be said, however, that if the seperation between the D.F. loop and the down-lead of any aerial exceeds fifty feet, then that particular aerial is unlikely to displace the D.F. bearings even if it be tuned to the same frequency as the direction finder. It should not be necessary, therefore, to isolate any aerial whose down-lead is more than fifty feet from the D.F. loop.

In many instances it may also be possible to ignore aerials whose down-leads are separated from the D.F. loops by more than thirty feet. These instances occur when the down-lead tends to incline away from rather than towards the D.F. loop.

Adjust the core until the DF bearing is the same or almost the same as the known or visual bearing. The scale shows the approximate degrees correction obtained with core adjustment.

Repeat the above for other known stations on other quadrants, adjusting the QE coil core to obtain a compromise.

Final fine adjustment can be made, as the vessel arrives at the position where it will be swung. Make the adjustments to the QE coil with the help of visual bearings by the navigator, with the transmitter bearing approximately 45° on either bow.

5. DETAILED CALIBRATION CHECK

Make arrangements with the navigating staff for accurate visual bearings to be taken simultaneously with the wireless bearings. Also a programme of signals and procedure to suit the circumstances should be arranged beforehand with the Pilot, Navigator, etc.

Steady the ship with the transmitter bearing approximately 45° on either bow.

Progressively adjust the quadrantal error correction choke slug until the D.F. bearing agrees with the visual bearing observed on the pelorus ring of the standard compass, or by any other approved method. This operation can be most quickly carried out by the navigator calling out each change of the visual bearing as the ship moves slowly about her 'steady position' - exactly as he does each day when comparing the steering compass with the standard compass.

This initial adjustment of the calibration choke must be checked from at least one adjacent mid-quadrant angle, preferably on the same side of the ship because this is most likely to expose any extraneous errors.

If after the initial adjustment an error is found in the adjacent quadrant this is most quickly dealt with by re-adjusting the calibrating choke. It will then be found that there is an equal error, but in the opposite direction, on the first bearing.

A full calibration may be carried out by swinging the ship and taking visual and D.F. bearings simultaneously, and tabulating the results.

(A) D.F. Bearing	(B) Visual Bearing	(C) Difference Between (A) & (B)
15°	17°	$+2^{\circ}$
33°	29°	-4°

6. FULL CALIBRATION

The time spent on the initial calibration should never be stinted, for unlike a compass adjustment, once the correct Q.E. adjustment has been made it will generally hold good for the life of the ship - provided, of course, that no material change is made in the rigging or metal structures in the vicinity of the D.F. loop and that the insulation or earthing of the stays, etc., does not vary.

When the separation between the down-lead and the D.F. loop is further reduced the zeros will deteriorate progressively and also become more liable to displacement unless special arrangements are made to isolate the aerial.

It is imperative, therefore, that each down-lead should be sufficiently separated from the D.F. loop to ensure no adverse effect on the accuracy of the bearings on any frequency, but if it is impossible to obtain this separation in any particular instance, then that aerial must be isolated whilst calibrating or using the direction finder and the appropriate information recorded on the calibration chart.

The procedure to be followed for calibrating purposes is as follows:-

a) See that all aerials other than the sense aerial are isolated and that all movable objects near the direction finder are in sea-going trim. In particular, all derricks must be properly stowed.

b) See that no reception on or near to the frequency of calibration is taking place in the vicinity of the direction finder.

c) Make arrangements with the navigating staff for accurate visual bearings to be taken simultaneously with the wireless bearings. In certain cases a difference of ten seconds between visual and W/T bearings may vitiate the calibration.

To ensure the accuracy of bearings from any angle, a full 360° calibration should be carried out. This can be done by swinging the ship within visual range (but at least 1 mile distant) of a suitable radio beacon. Alternatively, another vessel may be made to describe a circule (minimum radius 1 mile) around the ship carrying out calibration.

Whichever system is used the rate of rotation must be slow. Thus it is of little value to try to carry out the calibration in less than one hour. Even this time means a relatively high rate of change of angular bearing (it is in fact 6° change per minute).

If possible the correct visual and W/T relative bearings should be taken every ten degrees and it is usual to arrange for the moving body to change its angular bearing with respect to the fixed body by about ten degrees and then to stop for a minute or so while say three bearings are taken and then to move on again for ten degrees. By this arrangement about thirty-six check points are taken more or less evenly over the 360° of the scale and a good continuous error curve can be drawn relating the observed W/T bearing with the correct visual bearing.

While carrying out the calibration a table should be kept of the comparative bearings under three headings:-

i) The observed W/T bearings.

ii) The correct visual bearings.

iii) The difference between these two readings.

The correct sign must be accorded to (iii) and it is positive if (ii) exceeds (i) and negative if (i) exceeds (ii).

Thus if the W/T bearing is 37° and the visual 45°, the value of the entry under column (iii) is +8°. If, however, the W/T bearing is 325° and the visual is 317° then the entry under column (iii) should read -8°.

It is important to complete column (iii) during the calibration as the corrections shown in this column for each quadrant are more easily compared by inspection than the figures in columns (i) and (ii).

If at the end of the calibration the figures in column (iii) appear to be reasonably consistent as regards symmetry of quadrants, the calibration can be regarded as a good one but if they seem inconsistent and there is reason to doubt their accuracy a second set of calibration figures should be made at once as it is generally much quicker and better to make a second run through the 360° of scale immediately after the first run, than set up the whole system of calibration a second time at a later date. If possible, the frequency should be changed for the second run.

If the second set of figures confirms the first set then a correction curve should be drawn utilising all the available data. This curve should then be carefully analysed and compared with the family of curves opposite. If the data corresponds within, say one degree (Allowing for personal errors) of any of the family curves, then calibration may be considered satisfactory. It is then only necessary to make the necessary adjustment to apply the required correction. On the other hand, if the correction curve obviously includes a semi-circular component (i.e. an error having only one positive and one negative peak in the full 360° scale), then the cause must be traced and removed before any further progress can be made.

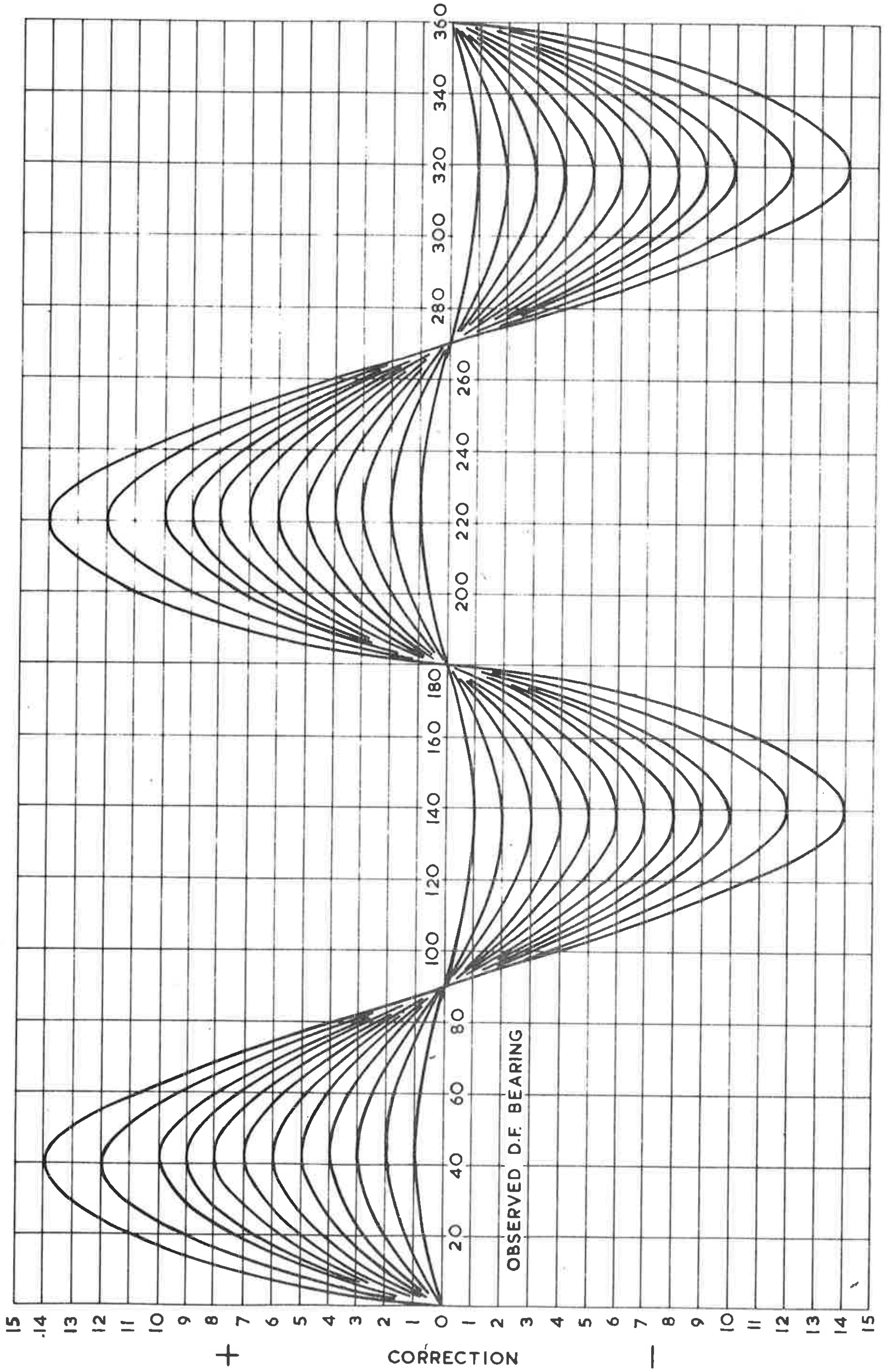
It is frequently impossible to carry out the full procedure for calibration before a ship sails. Under such circumstances every effort should be made to complete all preliminary tests and adjustments before leaving the dock. The earliest opportunity must then be taken to obtain accurate check bearings from at least two adjacent mid-quadrant directions and either estimate the quadrantal error curve from these figures or correct for the error by the system of correction provided. More information on this interim method of calibration is given in the following paragraph.

7. SIMPLIFIED PROCEDURE FOR QUICK CALIBRATION

Mention has been made previously of a simplified method of approximately calibrating a direction finder without employing the full calibration system strongly recommended for all direction finders.

Since time is the controlling factor in this form of calibration it must be decided beforehand just how much to attempt in the time available. To facilitate this decision a list of the operations necessary to complete the full calibration under normal conditions is given together with notes on each particular operation.

i) Preliminary adjustments.
ii) Loop and pointer alignment check.
iii) Q.E. amplitude adjustment.
iv) Q.E. amplitude check.
v) Full scale (360°) accuracy check.


OBSERVED D.F. BEARING
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
+
CORRECTION
-

Note 1...

All the preliminary tests and adjustments detailed in paragraph 3 should be carried out before leaving the dock so that the installation is in first-class working order on arrival at the calibrating site. Additionally a brief programme of signals and procedure to suit the circumstances should be arranged beforehand with the Pilot, Navigator and others concerned so that each person knows precisely what is required of him.

Note 2...

If the time can possibly be spared it is a very definite advantage, first to confirm the absence of the pointer and semi-circular errors by careful checks at 0°, 90° and 270°.

Note 3...

If, however, the available time is very short then one may start with the third operation, namely, that of steadying the ship with the transmitter bearing approximately 45° on either bow. The calibration choke may now be progressively adjusted until the D.F. bearing agrees with the visual bearing observed on the pelorus ring of the standard compass or by any other approved method. This operation may take two or three minutes to complete. It can most quickly be carried out by the navigator calling out each change of the visual bearing as the ship moves slowly about her 'steady' position - exactly as he does each day when comparing the steering compass with the standard compass.

It must not, however, be assumed that the direction finder unit is then fully calibrated because bearings taken in only one quadrant cannot prove the accuracy of the installation.

8. CALIBRATION ON DIFFERENT FREQUENCIES

It is to be noted that when a direction finder has been calibrated on one medium frequency it is not necessarily calibrated on all frequencies. In the medium frequency services calibration is generally carried out on 500 kc/s or on 300 kc/s. If a satisfactory calibration is effected on 300 kc/s and found by careful observations to be accurate for 500 kc/s it is most unlikely that any additional errors will be found over the M.F. band.

The amount of deviation caused by local objects on D.F. bearings is dependent upon the amplitude and phase of the currents produced in these objects by the wireless wave. Since, in general, the inductance capacitance and resistance of these objects is constant, the amplitude and phase of the currents in them varies with the frequency of the wave: the nearer the frequency of the wave is to the resonant frequency of the object the greater will be the current in the object and the greater the rate of change of phase with small variations of frequency.

Hence it is most important that all objects should be far from resonance at the frequency on which D.F. is being used.

In certain cases the current in an object may vary considerably more than two to one when energised by two signals of equal intensity, one on 300 kc/s and the other on 500 kc/s. Under such conditions there will also be considerable phase change in the current and the effect on the direction finder will be much greater on one frequency than on the other; consequently the error curve for 300 kc/s will differ noticeably from that for 500 kc/s.

It is to prove that there are no near-by objects which may be close to resonance that it is so important to take check calibration figures on 300 and 500 kc/s. Any serious variation between the maximum errors on the two frequencies is an invariable sign that some object is dangerously near to resonance on one frequency or the other and owing to the average physical dimensions of the objects in the super-structure of a ship it may generally be assumed that the danger of resonance will occur nearer to 500 kc/s than to 300 kc/s.

Chapter 3

OPERATION

To obtain maximum efficiency from the equipment it is essential that the operator should familiarize himself with the various controls and their function as given below.

Refer to the frontispiece photograph.

1. CONTROLS ON THE FRONT PANEL

ON-OFF/RF. GAIN S6 RV1	The SUPPLY switch is ganged to the RF GAIN control and is moved to the "on" position by rotating the RF GAIN in a clockwise direction. The RF GAIN is a combined RF and IF gain control, and is adjusted to obtain maximum signal to noise strength.
A.F. GAIN RV2	The AF GAIN control adjusts the level of the audio output.
WAVECHANGE SWITCH S.1	This switch selects any one of the five frequency ranges available, with ranges 3 and 5 being for use with D.F.
TUNING CONTROL	Tuning is with the large knob at the right-hand side of the panel, the drive mechanism being a precision unit employing spring-loaded split-gears giving a reduction ratio of the order 110-1. This facilitates accurate tuning on the HF ranges while flywheel-loading allows the control to be "spun" to permit rapid movement from one part of the dial to another. The dial calibration is in MHz on all ranges except Range 5 where the scale is marked in kHz. Range numbering appears at the left-hand end of the dial and is repeated on the WAVECHANGE switch which is located immediately to the left of the TUNING control. The calibrated vernier which appears in the window above the TUNING control is used in conjuction with the bottom logging scale on the main dial. Combining the two readings will give an arbitrary figure which corresponds to the actual frequency to which the receiver is tuned. The readings can be recorded to allow rapid re-setting to specific frequencies.

FINE TUNE R.V.3	This control varies the tuning on each side of the setting of the main tune control by a small percentage. In normal operation, the Fine Tuning control should be maintained at its mid-travel position (index against mark on finger plate), so that adjustment up or down in frequency is available at any setting of the Main Tuning control.
FILTER S.4	This facility is used on C.W. when interference with reception is severe. It narrows the bandwidth to cut out close unwanted stations.
B.F.O. S.3	This switches on the B.F.O. and allows reception of C.W. signals.
B.F.O. PITCH C70	The B.F.O. Pitch control is functional only when receiving CW signals. It allows the B.F.O. to be set to either side of the incoming signal and when using the audio filter it provides a means of setting the beat note to coincide with the resonant frequency of the filter (1,000 c/s).
A.G.C. S.2	This is the A.G.C. on/off control, and is normally switched 'off' when receiving CW signals.
DIAL S.5	The DIAL LIGHT switch is mechanically biased to the "off" position and must be held in the "on" position to obtain scale lighting. Illumination of the dial will not normally be required and since the scale light consumption doubles the average current drawn from the supply, this facility should be used only when absolutely essential. The other switches are of the press-to-operate press-to-release type and lock in the "on" position.
NORMAL-DF-SENSE SWITCH S.7	In the NORMAL position this connects the vertical sense aerial into the RF section as with a normal receiver. The Seaguide can then be operated as a normal receiver. In the "DF" position, the sense aerial is disconnected. The two inputs from the loop aerial are fed to the wavechange switch where they are connected to the RF coils for ranges 3 and 5 when the wavechange switch is at these positions. In this way the signals from the D.F. loop

are fed to the receiver and the equipment can be used for DF with the B.F.O. switched "ON".

In the "sense" position, the vertical sense aerial is again connected to the primaries of the RF coils, where its input is mixed with the loop aerial input. Depending on their relative phases, it will add to the loop aerial signal, or subtract from the loop aerial signal to produce a minimum or zero signal. In this position the switch is spring-loaded and will return to the "DF" position when released.

2. FACILITIES ON THE BACK PANEL

HIGH IMPEDANCE OUTPUT SOCKET	A socket is provided so that an audio output can be fed to an external unit such as an audio amplifier, tape recorder, etc. A plug is provided with the equipment.
HEADPHONE OUTPUT SOCKET	Low impedance headphones can be inserted in this socket. Higher impedance phones could be used but this would reduce the quality of the sound.
"SENSE" BALANCING PRE-SET RESISTORS Range 3, RV4 Range 5, RV5	Adjusted on installation to obtain as clear a zero as possible. On ranges 3 and 5.
AERIAL CONNECTIONS A1; A2 A2; E	The goniometer output on the input from a rotating loop aerial is connected into A2 A2. The vertical sense aerial is connected into A1. The earth is connected to E.
POWER PACK	One of the three power packs can be fitted into the compartment. 9 volt battery pack AC Mains 115/230 V.A.C. DC 12/24 volts supply.

3. D.F. OPERATING PROCEDURE

3.1 Receiver

Isolate all aerials except those associated with the DF installation. A nearby aerial tuned to the same frequency as the DF will produce serious errors in the resulting DF bearing.

To receive CW signals, press the B.F.O. switch. This gives a fixed reading on the meter, unless the signal strength is sufficient to rise above the B.F.O. level. Because of this, audible maxima and minima should be obtained on CW, whereas, audible and meter indication maxima and minima can be used without B.F.O. (MCW).

Select "NORMAL" position on the NORMAL-DF-SENSE switch.

Operate the AGC push switch and rotate RF GAIN control fully clockwise (maximum R.F.).

Adjust AF GAIN for a reasonable audio output.

Switch WAVECHANGE to required DF range; 5 or 3.

Tune in required station or D.F. beacon.

Select "DF" position on the NORMAL-DF-SENSE switch.

Release AGC push switch, and set RF GAIN to give a meter reading of less than 7.

DO NOT ALLOW READING TO RISE ABOVE 7.

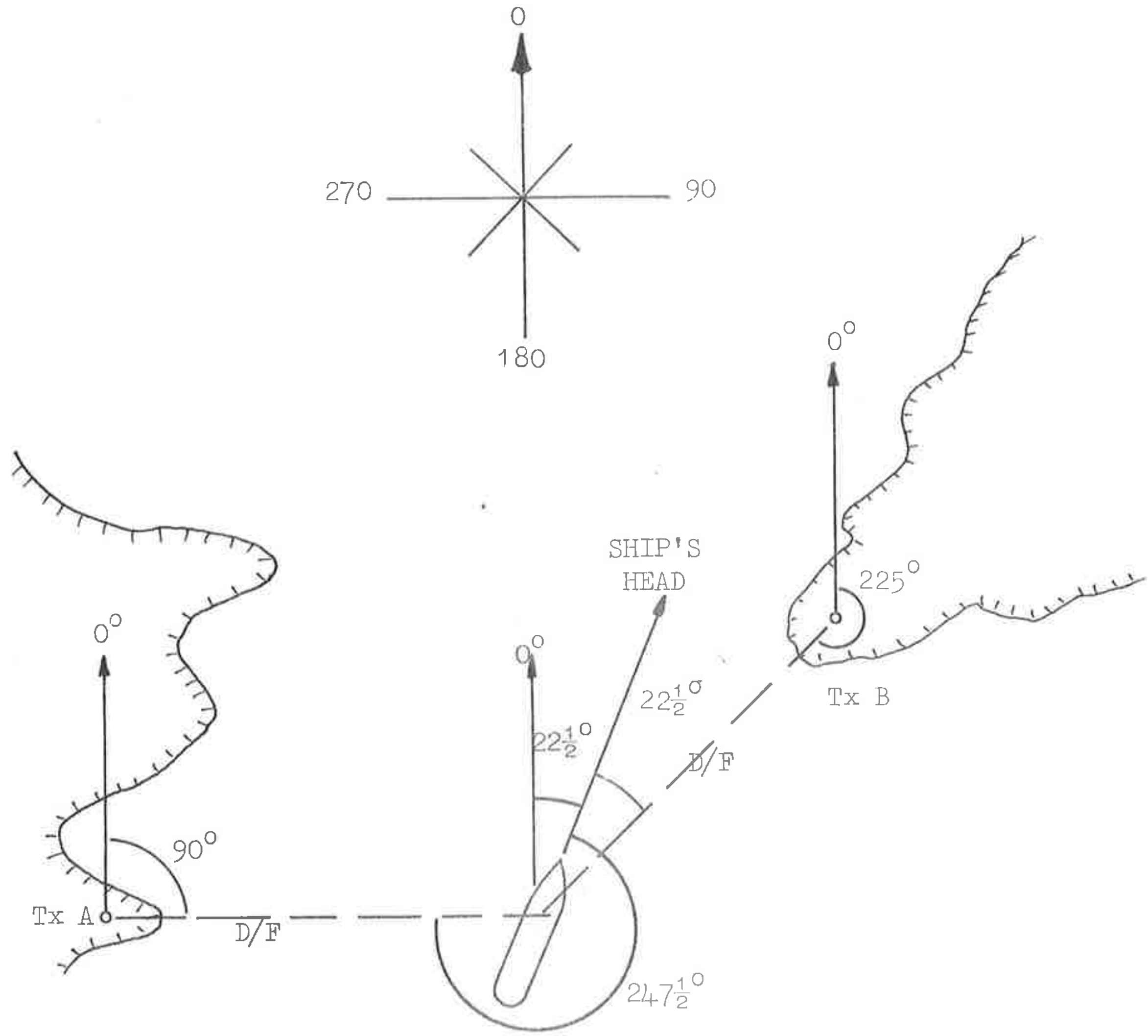
3.2 Obtaining a Bearing

With the Seaguide receiver set up as in 3.1 above, proceed as follows:-

Rotate the loop aerial or goniometer dial until the signal from the DF transmitter falls to a minimum. To obtain a clear minima, swing the dial or loop aerial backwards and forwards in a decreasing arc across this minima until its position is pin-pointed. Write down the figure indicated by the bearing pointer. Swing the loop or dial 180° and pinpoint and note the position of the second minima.

Rotate the SENSE pointer on the loop or dial to one of these minima positions. Press the NORMAL-DF-SENSE switch to SENSE. This will raise the signal level. Swing the loop or dial quickly 180°. This raised signal will rise more or will fall. If it falls, you are now on the correct minima· if it rises, it is the other minima which is the correct one.

Release the SENSE switch, swing the bearing pointer to the correct minima, and by slight swinging re-establish the pinpoint bearing of the DF transmitter. It may have changed slightly due to the vessels movement relative to the DF transmitter. Note this bearing down, at the same time note this ships head down.



	DF TRANSMITTER A		DF TRANSMITTER B
CORRECTED DF RELATIVE BEARING:	247·5°		022·5°
CORRECTED SHIP'S HEADING:	022·5°		022·5°
Tx TRUE BEARING:	270°		045°
	SUBTRACT 180°		ADD 180°
BEA RING FROM Tx:	090°		225°

Note:

If Tx true bearing greater than 180°, subtract 180°.
If Tx true bearing less than 180°, add 180°.

EXAMPLES OF DF BEARING CALCULATIONS

Rough notes can be made in the format shown below.

STATION CALL SIGN

FIRST MINIMA CORRECT MINIMA

SECOND MINIMA

QUADRANTAL ERROR CORRECTION ±

PINPOINT DF BEARING

PINPOINT DF BEARING CORRECTED SHIPS HEAD CORRECTED

The figures are then passed to the navigator on form S.40.

3.3 Forms

Forms S.41(a) and S.40, reproduced on pages 1.24 and 1.25, are provided for use with the equipment. The form described in 8. is for compulsory fittings.

4. TYPICAL EXAMPLES OF FINDING TRUE BEARINGS

Typical examples are given below:-

(a) D.F. relative bearing	104°	
Ship's head by compass	210°	
By addition	314°	= compass bearing
Say 15° westerly variation (subtract)	15°	
	299°	
Say $1{\cdot}5^\circ$ easterly deviation (add)	$1{\cdot}5^\circ$	
	$300{\cdot}5^\circ$	= true bearing
(b) Relative bearing	325°	
Ship's head by compass	210°	
By addition	535°	= compass bearing
Say 15° westerly variation (subtract)	15°	
	520°	
Say $1{\cdot}5^\circ$ easterly deviation (add)	$1{\cdot}5^\circ$	
	$521{\cdot}5^\circ$	= true bearing

From this, it is obviously necessary to subtract one complete scale, viz.:-
$521{\cdot}5 - 360 = 161{\cdot}5^\circ$ true.

5. HALF CONVERGENCY CORRECTION

Whenever the difference of longitude between the ship's estimated position and the transmitting station exceeds 1°, correction for half convergency should be applied to the true bearing obtained by the direction finder. Normally this correction does not apply to bearings under one hundred miles.

If, however, the middle latitude between the two positions is less than 20° north or south, and the difference of longitude does not exceed 2°, this correction may be ignored. A simple method for estimating the amount of half convergency to be applied is that obtained from the half convergency diagram, given on drawing WZ.5477 (page 1.21). To use this, lay a straight edge across the diagram joining the difference of longitude and the middle latitude. The point where it cuts the centre column indicates the amount of correction to be applied.

Another form of diagram and table for estimating the correction, will be found in the "Admiralty List of Wireless Signals", volume II.

Half convergency correction is applied to wireless bearings in exactly the same manner as in ordinary navigation; therefore, if all bearings are calculated from 000° (north) to 359° measured clockwise, the application of the half convergency can be easily determined thus:-

5.1 In North Latitude

If the true bearing of the observed station is between 000° and 180° ADD to the great circle bearing and if between 180° and 360° SUBTRACT from the great circle bearing.

5.2 In South Latitude

If the true bearing of the observed station is between 000° and 180° SUBTRACT from the great circle bearing and if between 180° and 306° ADD to the great circle bearing.

OR

If in either north or south latitude facing the Pole of that hemisphere, the observed station lies to the right of the observing station, the half convergency correction is "plus" and if to the left "minus", to the great circle bearing.

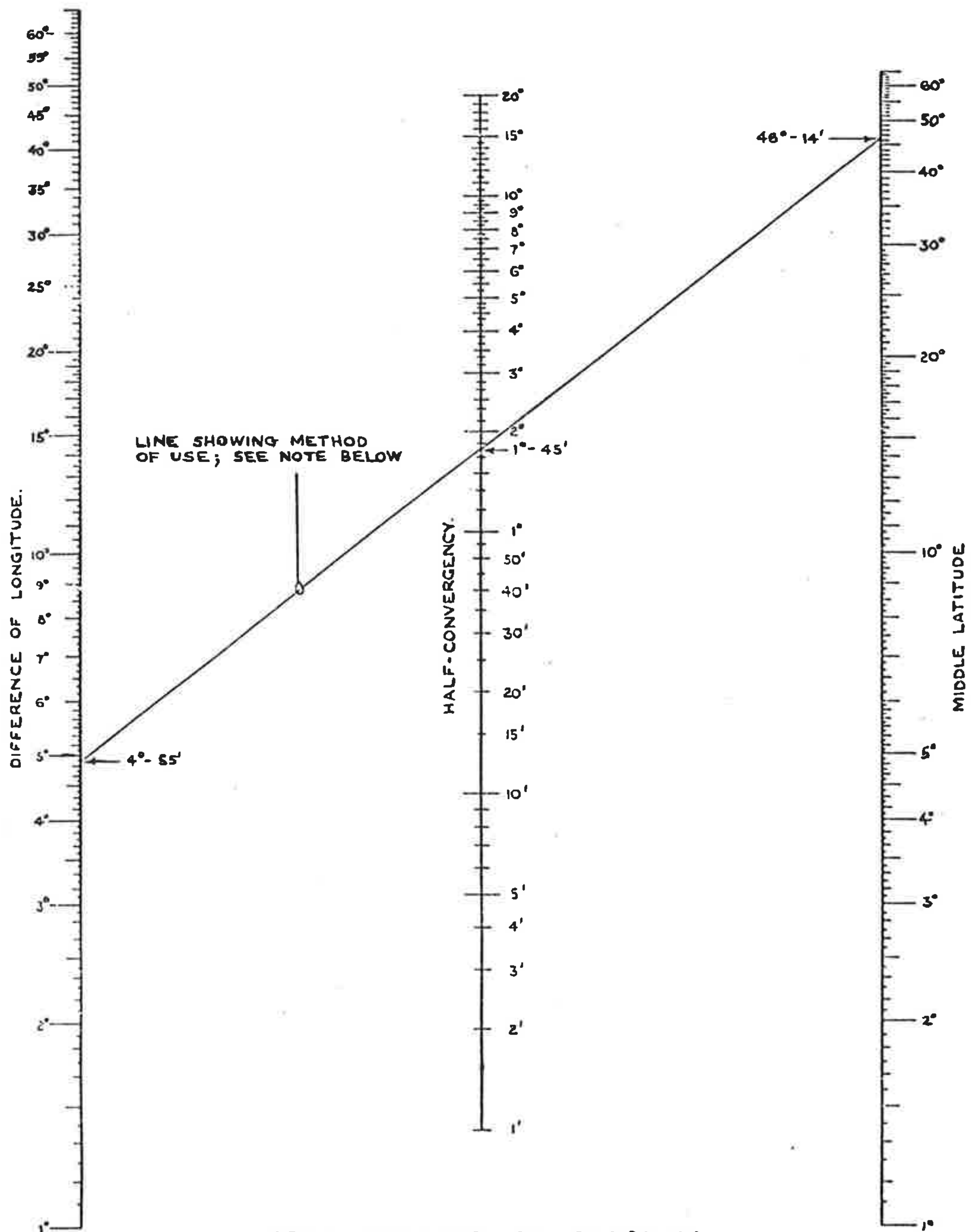
The "Rhumb line" bearing thus obtained is then laid off on the largest scale Mercator's chart of the area, through the position of the observed station, giving a "position line".

Should a bearing of the ship be obtained from a suitably equipped wireless station (or ship) at such a distance that half convergency correction is necessary, the bearing so obtained must be corrected. Care must be taken, however, in all cases that the correction is applied to the true directional bearing and not the reciprocal.

6. CALIBRATION ACCURACY

Navigators should note that once calibration has been effected, there must be no alteration to the Q.E.C. setting, except under exceptional and definite circumstances. Should any alteration be found necessary, a detailed report is to be submitted to the first Depot visited, and, if the ship is abroad and unlikely to visit a U.K. port a copy must be sent to Marconi House, Chelmsford, at the earliest opportunity.

The report should show exactly the reason for the alteration and give details of the relative direction finder bearings as checked by visual relatives.



NOTE ON USE OF DIAGRAM.

TO FIND THE HALF-CONVERGENCY IN RESPECT OF TWO PLACES, THE DIFFERENCE IN LONGITUDE OF WHICH IS 4°-55' AND THE MID-LATITUDE 46°-14', PLACE A STRAIGHT EDGE IN THE POSITION SHOWN, SO AS TO INTERSECT THE OUTER SCALES AT THE GIVEN POINTS, AND READ OFF THE HALF-CONVERGENCY 1°-45' ON THE CENTRE SCALE.

WZ.5477/B Sheet 1

HALF-CONVERGENCY DIAGRAM

Errors may be introduced by rigging and/or structural alterations in the vicinity of the D.F. aerial system.

If constant doubt is expressed in regard to the accuracy of wireless bearings, it is probable that some change has taken place, and the following are the chief points to be looked for in this connection:-

a) The erection or removal of broadcast aerials.

b) Alteration in position of derricks, engine room skylights, etc.

c) Rails, swinging ventilators, chimneys and/or gas-freeing pipes, not efficiently bonded to earth.

d) Short-circuiting of insulators inserted in funnel shrouds, whistle lanyards etc.

In certain extreme cases, the leads to the morse lamp can cause an error if they are not opened by a double pole switch.

The only reliable navigational checks for calibration purposes are those obtained by direct visual relative bearings or from a reliable "cross bearing" position, providing the range is reasonable.

7. RECORD OF CHECK BEARINGS

With reference to Rule 12 of the Merchant Shipping (Direction Finders) Rules 1965, the Master of the ship is required to cause the calibration tables and curves prepared in accordance with the rule to be:-

a) Verified at intervals not exceeding twelve months, and

b) Whenever any change is made in any structure or fitting on deck which is likely to affect the accuracy of the direction finder.

If such verification shall show that the calibration tables or curves are materially inaccurate, the Master of the ship must arrange for the direction finder to be re-calibrated as soon as possible.

It is emphasised that the verification form, as shown on page 8 of the Merchant Shipping (Direction Finders) Rules 1965 and reproduced in section 8 must be submitted to the wireless surveyors for inspection having been compiled within the preceding twelve months, including at least two satisfactory visual checks in each quadrant.

8. OFFICIAL RECORD FORM

Record of Check-Bearings taken by means of the direction finder

Signature of Observer or Observers		(16)
Correction required to make Col.(13) equal Col.(14) (indicating whether - or +)		(15)
True bearing by Calculation or by Visual Check (whether calculated or visual to be indicated)		(14)
True Bearing by Direction Finder Col.(8) and Col.(12)		(13)
Ship's Head Corrected (True)		(12)
Half Convergency Applied		(11)
Total Compass Error		(10)
Ship's Head by Compass 0/360 degrees		(9)
Direction Finder relative Bearing Corrected for QE		(8)
Direction Finder Bearing of(Name)		(7)
Distance from Transmitter		(6)
Ship's Approximate Position	Longitude	(5)
	Latitude	(4)
Times (G.M.T)		(3)
Date		(2)
Serial Number of Bearings		(1)

N.B. Disconnect and lower all Broadcasting Aerials prior to taking Bearings.

S.41a

C63701

DIRECTION FINDER BEARINGS

THE MARCONI INTERNATIONAL MARINE CO LTD,
ELETTRA HOUSE, WESTWAY, CHELMSFORD
ESSEX.

S.S / M.S .... Date ....

Ship's approximate position:- LAT. .... LONG. ....

	Bearing 1	Bearing 2	Bearing 3
Name of Beacon			
Callsign of Beacon			
Approx. distance from beacon			
Ship's time			
(a) D/F dial reading			
(b) D/F correction			
(c) D/F relative bearing (a+b)			
(d) Ship's head by compass			
(e) Total compass error			
(f) D/F true bearing (c+d+e)			
(g) Half convergency correction			
(h) D/F true bearing (f+g)			
(i) Bearing as checked by			
(j) Difference (i-h)			

REMARKS:-

D/F receiver type number .... Navigating Officer ....

N.B. Disconnect and lower all Broadcasting Aerials prior to taking Bearings

FORM S.40

DIRECTION FINDER BEARING
THE MARCONI INTERNATIONAL MARINE CO LTD,
ELETTRA HOUSE, WESTWAY, CHELMSFORD,
ESSEX.

S.S. / M.S. .... Date ....

	Bearing 1	Bearing 2	Bearing 3
Name of Beacon			
Callsign of Beacon			
Position of Beacon LAT.			
Position of Beacon LONG.			
Ship's time			
D/F Dial reading (a)			
D/F correction (b)			
D/F relative bearing (c = a+b)			
REMARKS			

Observer's Name ....

SECTION 2

Part II

MAINTENANCE AND SERVICING

1. REMOVING THE CABINET

i) Remove the battery container (or power unit) by unscrewing the two knurled retaining screws and disengaging the internal connector. In the case of a mains operated receiver make sure that the supply is disconnected before taking out the power unit.

ii) Remove the four cabinet retaining screws located at the rear.

iii) Free the cabinet from the panel by applying pressure with the fingers between the inner edge of the cabinet and the ends of the strip which supports the IF printed board (near top edge of cabinet). If stiff, use screwdriver as lever in slots at lower front edge of cabinet.

iv) Slide cabinet away from panel.

2. FUSES

These are fitted only for mains operation of the receiver and are located inside the power unit. The mains input is fused at 100mA and the 9V output feeding the receiver at 500mA. Standard $1\frac{1}{4}$" x $\frac{1}{4}$" cartridge fuses are required as replacements.

The holders are clearly labelled to indicate the rating of each fuse. If the replacement fails immediately the set is switched on, checks should be made as follows:-

100mA fuse - check power unit.
500mA fuse - check receiver.

3. DIAL LAMPS

Faulty dial bulbs can be changed by prising the holders free from the rubber mounting grommets at the extreme ends of the dial. Replacement bulbs should be of the L.E.S. type rated at 6V, 50mA.

4. VOLTAGE READINGS

The voltage readings given in the Table will prove useful in the event of the receiver developing a fault which makes it necessary to carry out voltage checks. All readings are typical and were taken with a meter having a sensitivity of 20,000Ω/V. The batteries were in new condition and a tolerance of 10% will apply to all readings taken with a meter of the sensitivity quoted. The tolerance should be increased if a meter of lower sensitivity is employed and allowance must be made for the state of the batteries.

Readings should be taken under "no-signal" conditions with the controls set as follows: All readings are NEGATIVE with respect to chassis and the stabilised supply should lie in the range 6•4-6•6V.

Wavechange	Range 1.	AF Gain	Maximum.
Tuning	20 Mc/s.	AGC	Off.
RF Gain	Maximum.	BFO	On.

Reference	Collector	Base	Emitter
TR1*	6•35V	1•0V	0•68V
TR2	6•5V	1•2V	1•1V
TR3	6•3V	1•35V	1•2V
TR4**	5•6V	1•15V	0•87V
TR5	7•5V	0•7V	0•4V
TR6	6•3V	0•75V	0•6V
TR7	4•0V	0•97V	0•9V
TR8	8•9V	1•5V	1•5V
TR9	9•1V	0•15V	0•07V
TR10	9•1V	0•15V	0•07V

* Readings become 6•5V, 0•1V and 0V with RF Gain at min.

** Readings become 7•35V, 0•35V and 0•16V with RF Gain at min.

5. HT VOLTAGE

6. INSTRUCTIONS FOR RE-STRINGING THE DRIVE CORD

In the unlikely event of the pointer drive cord either breaking or slipping out of the pulley grooves, replacement will present no real problems if the instructions given below are followed carefully. If the cord is broken, a new length should be obtained and this can be made longer than the length actually required (32" : 82cm) to make it easier to handle. Right-hand and left-hand in the instructions given below are as viewed from the rear of the receiver.

i) Remove the existing cord and then set the tuning gang to full mesh.

ii) Tie a double knot in one end of the replacement cord and feed the cord through the hole provided in the left-hand drive pulley with the knot on the inside of the rim. The hole should lie at approximately "4 o'clock."

iii) Wind approximately one and a half turns anti-clockwise round the drive pulley and then pass the cord under and over the left-hand guide pulley.

iv) Pass the cord across the dial from left to right and then, while holding the free end of the cord in tension, rotate the tuning control to fully unmesh the tuning gang. This operation will wind just over three complete turns of cord onto the left-hand drive pulley and tension must now be maintained to prevent the cord from slipping out of the pulley groove.

v) Pass the cord clockwise round the jockey pulley (right-hand side of the receiver) and then back across to the right-hand drive pulley. Feed the cord into the pulley groove and then through the hole in the rim (hole lies at about "10 o'clock"). Increase the tension on the cord until the outer rim of the jockey pulley takes up a position level with the nearest edge of the panel handle retaining screw. Mark the cord with a pencil at the point where the retaining knot must be tied.

vi) Free the cord from the jockey pulley and while maintaining tension, draw the cord through the hole in the right-hand drive pulley until the cord tightens on the left-hand guide pulley.

vii) Tie a double knot in the position marked in (5) above and cut off any surplus cord. Feed the cord back through the hole and replace in position round the jockey pulley.

viii) Set the tuning gang to full mesh and slide the pointer to '0' on the logging scale. Attach the pointer to the cord (when viewed from above the cord should pass under the two outer prongs at the rear of the pointer carrier) and then check the drive for free and normal operation.

SECTION 3
ALIGNMENT

SECTION 3 CONTENTS

ALIGNMENT

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SECTION 3

ALIGNMENT

1. RE-ALIGNMENT

The initial factory alignment of the receiver should hold for a long period of time and re-alignment should not be carried out unless there is a clear indication that it is in fact necessary. Alignment should be carried out only by individuals with a sound knowledge of the procedures involved and the test equipment listed below must be available it the task is to be completed satisfactorily. It should be noted that any figures quoted for sensitivity etc., are based on the assumption that a new set of batteries is in use. It is further assumed that the receiver cabinet has been taken off as described earlier.

1.1 Test Equipment for Re-alignment

The following items of test equipment are required for re-aligning the Seaguide receiver:-

Signal generator(s) covering the intermediate frequency of 465 kHz and the signal frequency ranges 150-350 kHz and 550 kHz-30 MHz. Output impedance 50/75Ω, modulation 30% at 400 Hz.

Modulated crystal-controlled harmonic-generator providing 100 kHz markers up to 7·5 MHz and 1 MHz markers up to 22 MHz.

Output meter matched to 8Ω with plug to mate with telephone socket on panel.

Trimming tools:- Miniature insulated screwdriver with 1/16" blade, small metal-tipped insulated screwdriver and a Neosid Type H.S.1. hexagonal core adjuster.

1.2 Re-alignment of the IF Stages and BFO.

First locate and remove the four screws holding the two angle strips on which the IF printed wiring board is mounted. Rotate the board through 90° and temporarily secure in this position using two of the screws just removed. Access to both ends of the IF Transformers is now possible and the receiver can be placed on its left-hand side-plate to permit connection of the generator output lead to the Range 5 Mixer coil L11 (see underside view of receiver). Generator output impedance should be arranged to match 50Ω, the earthy lead being clipped to the screen adjacent to the coil.

Short out the forward section of the tuning gange (C48) to disable the Local Oscillator and connect the output meter to the telephone socket on the panel. The speaker circuit is interrupted by insertion of the plug and the meter will therefore indicate true output power. Switch on the generator, allow it adequate time to stabilise against drift and set the receiver controls as follows:-

Range Switch	Range 5.	AGC/BFO	Off.
Tuning	560 k/c.	Audio Filter	Out.
RF/AF Gains	Maximum.		

Tune the generator to 465 kc/s (with modulation 30% at 400 c/s) and then set the attenuator to give a reading of approximately 50mW on the output meter. Peak the cores in IFT1, IFT2 and IFT3 for maximum output, all cores being set on the "outer" peak. Recheck each adjustment several times to ensure accurate alignment and then set the attenuator for an output reading of 50mW. The input should be of the order 4uV at 465 kc/s. If the IF sensitivity appears to be on the low side investigation can commence with a check on the AF sensitivity. At 1,000 c/s an input of 12mV across RV2 should result in an output of 50mW.

Leave the generator tuned to the intermediate frequency, switch off the modulation and unplug the output meter. Set the BFO pitch control to mid-travel (index on knob at 12 o'clock) and check that the mid position corresponds to the half-capacity setting of the capacitor and that clockwise rotation of the control results in an increase in capacity. If necessary, slacken the grub screw and re-set the knob before proceeding. With the control at mid-travel, switch on the BFO and adjust the core in L17 for zero-beat. Check for normal operation of the BFO control and then disconnect the generator and the shorting link across C48.

A low reading from the base of TR5 almost certainly indicates a fault in the audio section of the receiver. The appropriate stages can be tested by introducting a 1000 Hz signal via the Audio Input socket at the rear. An input of approximately 5mV should produce 50mW output.

Once the IF alignment has been completed, disconnect the generator(s) and output meter, remove the shorting link from C48 and re-fit the IF board in its normal position.

1.3 Re-alignment of the RF Section

The first step in this part of the procedure is a check on the overall calibration accuracy. Proceed as follows:-

Connect the output of the harmonic generator to the "A1" and "EARTH." Set the generator to provide 1 Mc/s markers and then with the BFO switched on, tune across Range 1, checking the scale accuracy at each megacycle point. The scale accuracy should be within 1% (i.e. 180 kc/s at 18 Mc/s etc.) and re-alignment of the Local Oscillator should not be attempted unless the error observed is greater than this.

Repeat the check on Range 2 and then select Range 3. The 100 kHz markers can be introduced on this range to permit checking at 500 kHz intervals. On Ranges 4 and 5, check each 100 kHz point.

If errors in excess of 1% are noted, carry out normal tracking procedure using the alignment frequencies and adjustments listed in the following Table. Adjustment should be restricted to the ranges on which excessive error is noted and care should be taken to repeat the adjustment of trimmer and core until interaction between the two adjustments is nullified.

Table 1

OSCILLATOR ALIGNMENT FREQUENCIES
AND ADJUSTMENTS

Range	Freq.	Trimmer	Freq.	Core
1	20·0 MHz	C39	8·0 MHz	L12
2	8·0 MHz	C40	3·6 MHz	L13
3	3·5 MHz	C41	1·5 MHz	L14
4	1400 kHz	C42	550 kHz	L15
5	330 kHz	C43	160 kHz	L16

On completion of any re-alignment of the Local Oscillator circuits, disconnect the harmonic generator and connect the signal generator in its place prior to commencing re-alignment of the RF (Aerial) and Mixer circuits. The generator output impedance should be arranged to match 75Ω when aligning Ranges 1-3 and 400Ω for Ranges 4 and 5. Modulation should be set to 30% at 400 Hz and re-connect the output meter and switch off the BFO.

Adjustments are made at the same frequencies employed for oscillator alignment but using the trimmers and cores listed in Table 2. As with oscillator alignment, each adjustment should be repeated several times to cancel the inevitable interaction between trimmer and core. The aerial input circuits should be adjusted for best signal/noise ratio.

Table 2

RF/MIXER ALIGNMENT FREQUENCIES
AND ADJUSTMENTS

Range	Trimmer			Core		
	Freq.	Aerial	Mixer	Freq.	Aerial	Mixer
1	20·0 MHz	C3	C21	8·6 MHz	L2	L7
2	8·0 MHz	C4	C22	3·6 MHz	L3	L8
3	3·5 MHz	C5	C23	1·5 MHz	L4	L9
4	1400 kHz	C6	C24	550 kHz	L5	L10
5	330 kHz	C7	C25	160 kHz	L6	L11

The IF rejector coil L1 should be adjusted when aligning Range 4, the procedure being as follows:-

Tune the receiver to 550 kHz (low frequency alignment point) and the generator to the intermediate frequency of 465 kHz. Increase output from the generator until an indication is obtained on the output meter. Adjust the rejector coil for minimum signal. Re-tune the generator to 550 kHz, reduce its output and check the adjustment of L5 for maximum signal. Repeat both checks to ensure accurate alignment of the two circuits.

Finally, carry out a check on the overall sensitivity at the mid-band frequency on each range. With the generator properly matched sensitivities of the order 5uV or better should be realised on the three higher frequency ranges. On Ranges 4 and 5 the sensitivity is a little lower being in the region of 15uV or better. All sensitivities are quoted for a signal/noise ratio of 15dB and an output of 50mW in 8Ω.

SECTION 4

DRAWINGS & PARTS LISTS

SECTION 4 CONTENTS

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Receiver circuit diagram - ZOO-2530Z(d) Sht. 1	4.1
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Type 8871A power unit circuit diagram SP/WD.2929	4.8
Type 945 power unit circuit diagram	4.9

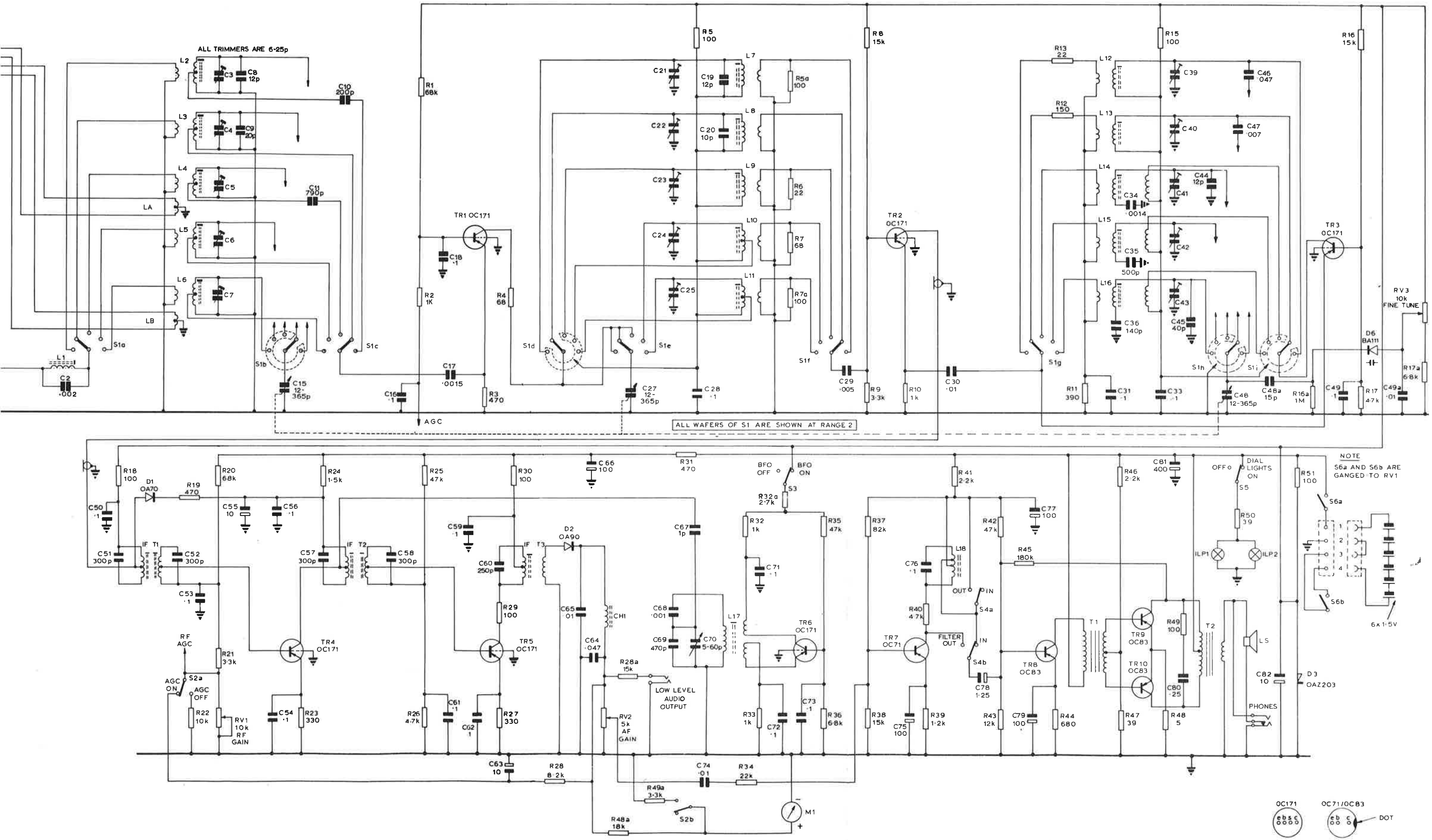
Component Schedule

for

Seaguide DF/Broadcast Receiver

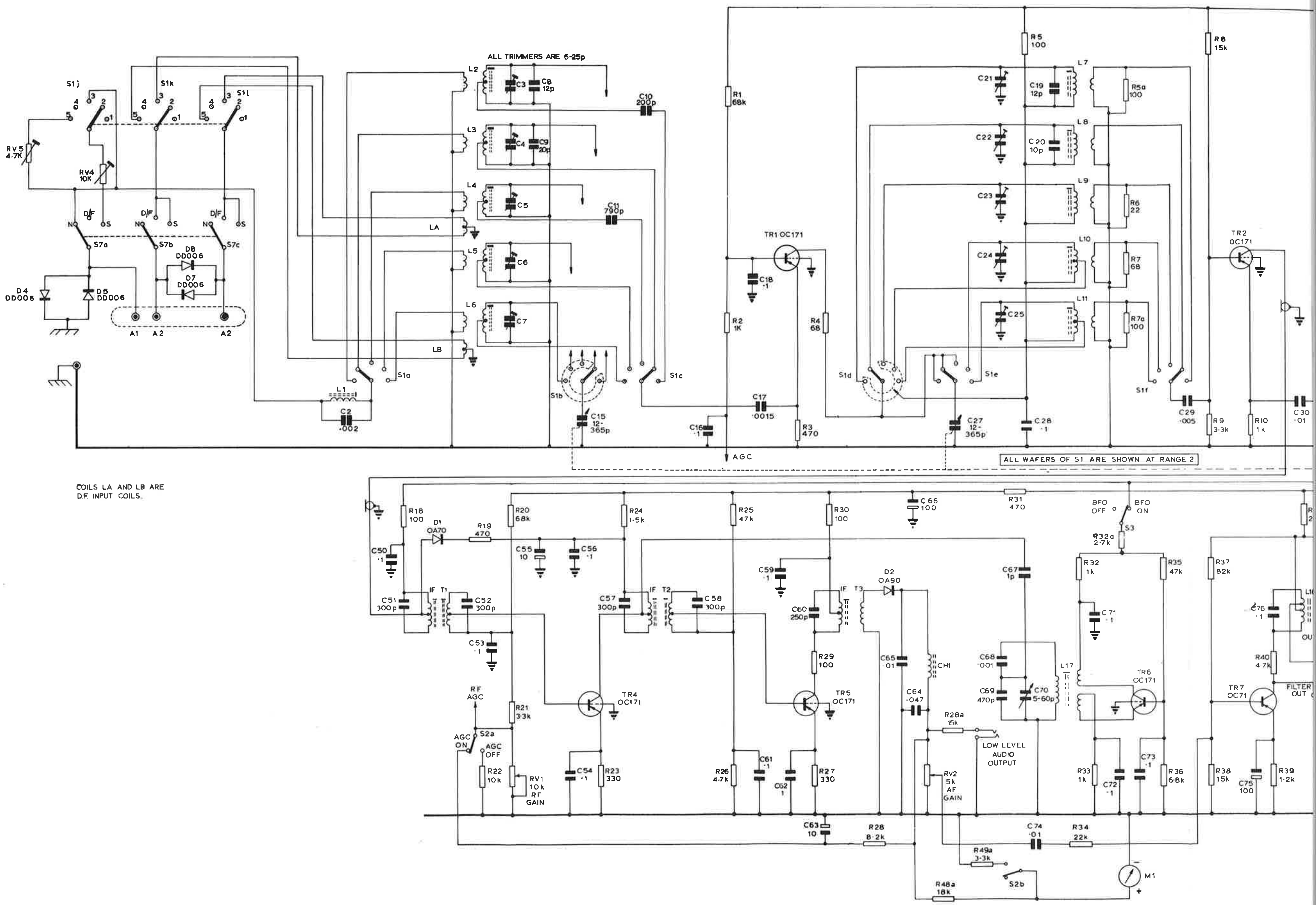
Z00-2530

Cct Ref	Description	Identity	Account No.
	CAPACITORS		
C1			
C2	Polystyrene, 0·002µF ±5% 125V		CR.4758
C3	Ceramic trimmer, 6-25pF		CRV.105
C4	Ceramic trimmer, 6-25pF		CRV.105
C5	Ceramic trimmer, 6-25pF		CRV.105
C6	Ceramic trimmer, 6-25pF		CRV.105
C7	Ceramic trimmer, 6-25pF		CRV.105
C8	Tubular ceramic, 12pF ±10% 750V		CR.1116
C9	Tubular ceramic, 20pF ±10% 750V		CR.1209
C10	Polystyrene, 200pF ±5% 125V		CR.2925
C11	Polystyrene, 790pF ±5% 125V		CR.4204
C12			
C13			
C14			
C15) C27) C48)	3-gang air spaced variable, 12-365pF		
C16	Polyester, 0·1µF ±20% 200V		CR.7084
C17	Tubular ceramic, 0·0015µF +50% -25% 750V		CR.4647
C18	Polyester, 0·1µF ±20% 200V		CR.7084
C19	Tubular ceramic, 12pF ±10% 750V		CR.1116
C20	Tubular ceramic, 10pF ±10% 750V		CR.1025
C21	Ceramic trimmer, 6-25pF		CRV.105
C22	Ceramic trimmer, 6-25pF		CRV.105
C23	Ceramic trimmer, 6-25pF		CRV.105
C24	Ceramic trimmer, 6-25pF		CRV.105
C25	Ceramic trimmer, 6-25pF		CRV.105
C26			
C27	Refer to C15 for details		
C28	Polyester, 0·1µF ±20% 200V		CR.7084
C29	Tubular ceramic, 0·005µF ±10% 750V		CR.5217
C30	Polyester, 0·01µF ±20% 200V		
C31	Polyester, 0·1µF ±20% 200V		CR.7084
C32			



SEAGUIDE RECEIVER
CIRCUIT DIAGRAM

Z00-2530Z(d) SHEET 1
ISSUE 2



ALL TRIMMERS ARE 6-25p
ALL WAFERS OF S1 ARE SHOWN AT RANGE 2
COILS LA AND LB ARE D.F. INPUT COILS.
S1j S1k S1L
RV5 4.7K
RV4 10K
D/F N S
S7a S7b S7c
D8 DD006
D7 DD006
D4 DD006
D5 DD006
A1 A2 A2
L1
C2 ·002
L2 L3 L4 LA L5 L6 LB
C3 C8 12p
C4 C9 20p
C5 C6 C7
C10 200p
C11 790p
S1a S1b S1c S1d S1e S1f
C15 12-365p
C16 ·1
R1 68k
R2 1K
AGC
TR1 OC171
C18 ·1
C17 ·0015
R4 68
R3 470
R5 100
C21 C22 C23 C24 C25
C19 12p
C20 10p
L7 L8 L9 L10 L11
R5a 100
R6 22
R7 68
R7a 100
C27 12-365p
C28 ·1
R8 15k
TR2 OC171
C29 ·005
R9 3·3k
R10 1k
C30 ·01
R18 100
D1 OA70
R19 470
C50 ·1
C51 300p
IF T1
C52 300p
C53 ·1
R20 68k
C55 10
C56 ·1
RF AGC
R21 3·3k
AGC ON
AGC OFF
S2a
R22 10k
RV1 10k RF GAIN
TR4 OC171
C54 ·1
R23 330
R24 1·5k
C57 300p
IF T2
C58 300p
R25 47k
R26 4·7k
C61 ·1
C62 1
TR5 OC171
R27 330
R30 100
C59 ·1
C60 250p
IF T3
R29 100
D2 OA90
C65 ·01
CH1
C64 ·047
C66 100
R31 470
C67 1p
C68 ·001
C69 470p
C70 5-60p
L17
R28a 15k
LOW LEVEL AUDIO OUTPUT
RV2 5k AF GAIN
C63 10
R28 8·2k
C74 ·01
R34 22k
R49a 3·3k
S2b
R48a 18k
M1
BFO OFF
BFO ON
S3
R32a 2·7k
R32 1k
C71 ·1
TR6 OC171
R33 1k
C72 ·1
C73 ·1
R35 47k
R36 6·8k
R37 82k
C76 ·1
R40 4·7k
TR7 OC71
FILTER OUT
R38 15k
C75 100
R39 1·2k

COMPONENT SCHEDULE

Cct Ref	Description	Identity	Account No.
C33	Polyester, 0·1μF ±20% 200V		CR.7084
C34	Polystyrene, 0·0014μF ±5% 125V		CR.4648
C35	Silver mica, 500pF ±2% 350V		CR.3725
C36	Polystyrene, 140pF ±5% 125V		
C37			
C38			
C39	Ceramic trimmer, 6-25pF		CRV.105
C40	Ceramic trimmer, 6-25pF		CRV.105
C41	Ceramic trimmer, 6-25pF		CRV.105
C42	Ceramic trimmer, 6-25pF		CRV.105
C43	Ceramic trimmer, 6-25pF		CRV.105
C44	Tubular ceramic, 12pF ±10% 750V		CR.1116
C45	Tubular ceramic, 40pF ±10% 750V		
C46	Polyester, 0·047μF ±20% 200V		CR.6412
C47	Polystyrene, 0·007μF ±5% 125V		CR.5602
C48	Refer to C15 for details		
C48a	Polystyrene 15pF ±1pF 125V		
C49	Polyester, 0·1μF ±20% 200V		CR.7084
C49a	Polyester, 0·01μF ±20% 200V		
C50	Polyester, 0·1μF ±20% 200V		CR.7084
C51	Polystyrene, 300pF ±5% 60V		CR.3217
C52	Polystyrene, 300pF ±5% 60V		CR.3217
C53	Polyester, 0·1μF ±20% 200V		CR.7084
C54	Polyester, 0·1μF ±20% 200V		CR.7084
C55	Tubular electrolytic, 10μF +50% -10% 16V		CR.8315
C56	Polyester, 0·1μF ±20% 200V		CR.7084
C57	Polystyrene, 300pF ±5% 60V		CR.3217
C58	Polystyrene, 300pF ±5% 60V		CR.3217
C59	Polyester, 0·1μF ±20% 200V		CR.7084
C60	Polystyrene, 250pF ±5% 60V		CR.3125
C61	Polyester, 0·1μF ±20% 200V		CR.7084
C62	Polyester, 0·1μF ±20% 200V		CR.7084
C63	Tubular electrolytic, 10μF +50% -10% 16V		CR.8315
C64	Polyester, 0·047μF ±20% 200V		CR.6412
C65	Disc ceramic, 0·01μF +80% -20% 250V		
C66	Tubular electrolytic, 100μF +100% -20% 16V		CR.9144
C67	Tubular ceramic, 1pF ±0·5pF 750V		CR.0102
C68	Polystyrene, 0·001μF ±5% 125V		CR.4543
C69	Polystyrene, 470pF ±5% 125V		CR.3623
C70	Air-spaced variable, 5-60pF		
C71	Polyester, 0·1μF ±20% 200V		CR.7084
C72	Polyester, 0·1μF ±20% 200V		CR.7084
C73	Polyester, 0·1μF ±20% 200V		CR.7084
C74	Metallized paper, 0·01μF ±20% 200V		CR.6189
C75	Tubular electrolytic, 100μF +100% -20% 16V		CR.9144

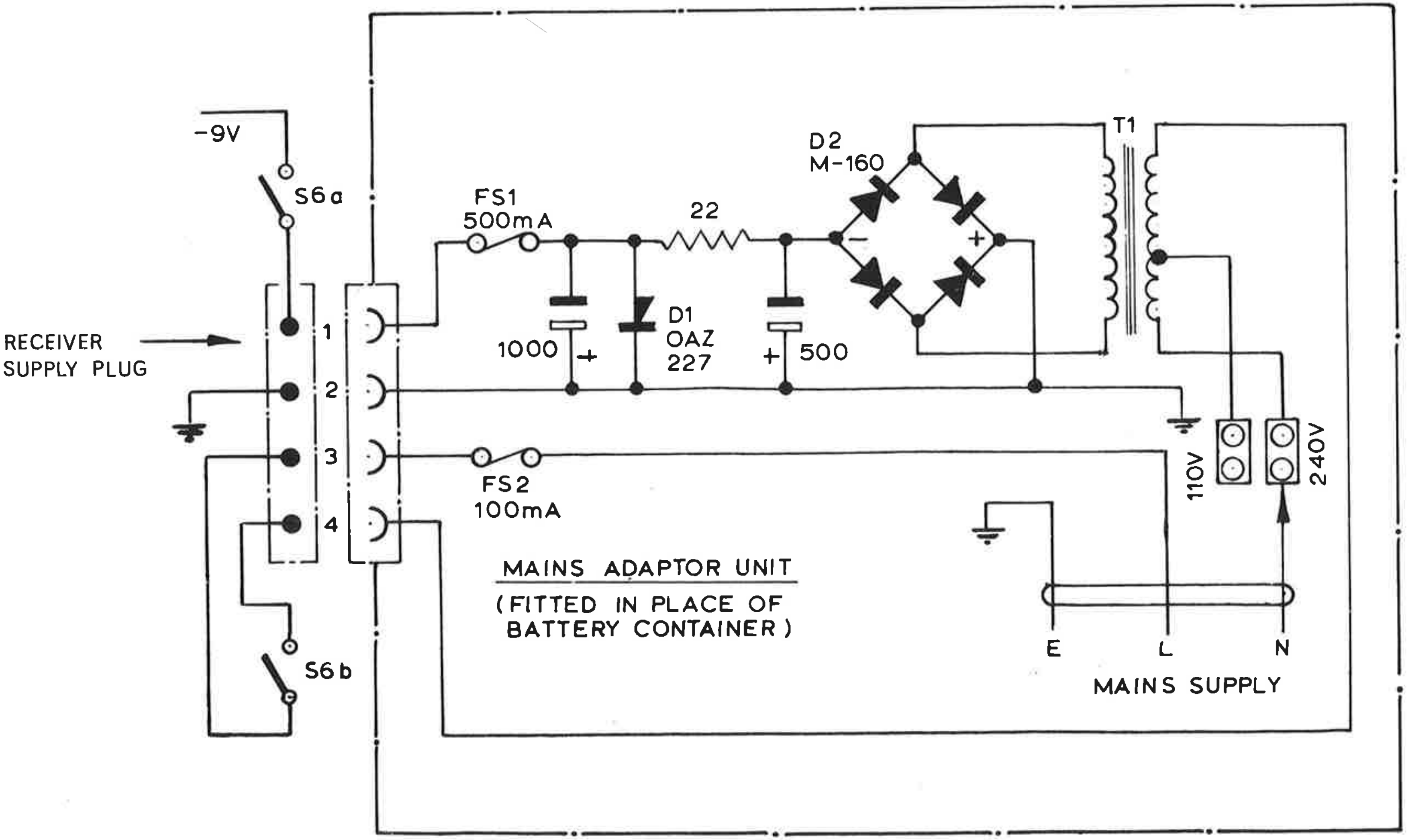
Cct Ref	Description	Identity	Account No.
C76	Polyester, 0·1μF ±2% 200V		CR.7084
C77	Tubular electrolytic, 100μF +100% -20% 16V		CR.9144
C78	Tubular electrolytic, 1·25μF +100% -10% 16V		CR.7455
C79	Tubular electrolytic, 100μF +100% -20% 16V		CR.9144
C80	Metallized paper, 0·25μF ±20% 150V		CR.7132
C81	Tubular electrolytic, 400μF +100% -20% 16V		
C82	Tubular electrolytic, 10μF +100% -10% 16V		CR.8315
	RESISTORS		
R1	68kΩ ±10% ½W	PC66609/41	RA.3121
R2	1kΩ ±10% ½W	PC66609/19	RA.3075
R3	470Ω ±10% ½W	PC66609/15	RA.3066
R4	68Ω ±10% ½W	PC66609/5	RA.3046
R5	100Ω ±10% ½W	PC66609/7	RA.3050
R5a	100Ω ±10% ½W	PC66609/7	RA.3050
R6	22Ω ±10% ½W	PC66609/72	RA.3033
R7	68Ω ±10% ½W	PC66609/5	RA.3046
R7a	100Ω ±10% ½W	PC66609/7	RA.3050
R8	15kΩ ±10% ½W	PC66609/33	RA.3104
R9	3·3kΩ ±10% ½W	PC66609/25	RA.3087
R10	1kΩ ±10% ½W	PC66609/19	RA.3075
R11	390Ω ±10% ½W	PC66609/14	RA.3064
R12	150Ω ±10% ½W	PC66609/9	RA.3054
R13	22Ω ±10% ½W	PC66609/72	RA.3033
R14			
R15	100Ω ±10% ½W	PC66609/7	RA.3050
R16	15kΩ ±10% ½W	PC66609/33	RA.3104
R16a	1MΩ ±10% ½W	PC66609/55	RA.3150
R17	4·7kΩ ±10% ½W	PC66609/27	RA.3091
R17a	6·8kΩ ±10% ½W	PC66609/29	RA.3096
R18	100Ω ±10% ½W	PC66609/7	RA.3050
R19	470Ω ±10% ½W	PC66609/15	RA.3066
R20	68kΩ ±10% ½W	PC66609/41	RA.3121
R21	3·3kΩ ±10% ½W	PC66609/25	RA.3087
R22	10kΩ ±10% ½W	PC66609/31	RA.3100
R23	330Ω ±10% ½W	PC66609/13	RA.3062
R24	1·5kΩ ±10% ½W	PC66609/21	RA.3079
R25	47kΩ ±10% ½W	PC66609/39	RA.3116
R26	4·7kΩ ±10% ½W	PC66609/27	RA.3091
R27	330Ω ±10% ½W	PC66609/13	RA.3062
R28	8·2kΩ ±10% ½W	PC66609/30	RA.3098
R28a	15kΩ ±10% ½W	PC66609/33	RA.3104
R29	100Ω ±10% ½W	PC66609/7	RA.3050
R30	100Ω ±10% ½W	PC66609/7	RA.3050

Cct Ref	Description	Identity	Account No.
R31	470Ω ±10% ½W	PC66609/15	RA.3066
R32	1kΩ ±10% ½W	PC66609/19	RA.3075
R32a	2·7kΩ ±10% ½W	PC66609/24	RA.3085
R33	1kΩ ±10% ½W	PC66609/19	RA.3075
R34	22kΩ ±10% ½W	PC66609/35	RA.3108
R35	47kΩ ±10% ½W	PC66609/39	RA.3116
R36	6·8kΩ ±10% ½W	PC66609/29	RA.3096
R37	82kΩ ±10% ½W	PC66609/42	RA.3123
R38	15kΩ ±10% ½W	PC66609/33	RA.3104
R39	1·2kΩ ±10% ½W	PC66609/20	RA.3077
R40	4·7kΩ ±10% ½W	PC66609/27	RA.3091
R41	2·2kΩ ±10% ½W	PC66609/23	RA.3083
R42	47kΩ ±10% ½W	PC66609/39	RA.3116
R43	12kΩ ±10% ½W	PC66609/32	RA.3102
R44	680Ω ±10% ½W	PC66609/17	RA.3071
R45	180kΩ ±10% ½W	PC66609/46	RA.3131
R46	2·2kΩ ±10% ½W	PC66609/23	RA.3083
R47	39Ω ±5% ½W	PC66609/2	RA.3039
R48 Wirewound	5Ω ±5% 3W	WIS4316/1/2	RF.2140
R48a	18kΩ ±10% ½W	PC66609/34	RA.3106
R49	100Ω ±10% ½W	PC66609/7	RA.3050
R49a	3·3kΩ ±10% ½W	PC66609/25	RA.3087
R50	39Ω ±5% ½W	PC66609/2	RA.3039
R51	100Ω ±10% ½W	PC66609/7	RA.3050
	VARIABLE RESISTORS		
RV1	10kΩ		RV.3103
RV2	5kΩ		RV.3102
RV3	10kΩ		RV.3103
RV4	10kΩ		RV.3103
RV5	4·7kΩ		
	TRANSISTORS		
TR1	Mullard OC171		TRS.36
TR2	Mullard OC171		TRS.36
TR3	Mullard OC171		TRS.36
TR4	Mullard OC171		TRS.36
TR5	Mullard OC171		TRS.36
TR6	Mullard OC171		TRS.36
TR7	Mullard OC71		TRS.5
TR8	Mullard OC83		TRS.30
TR9	Mullard OC83		TRS.30
TR10	Mullard OC83		TRS.30

COMPONENT SCHEDULE

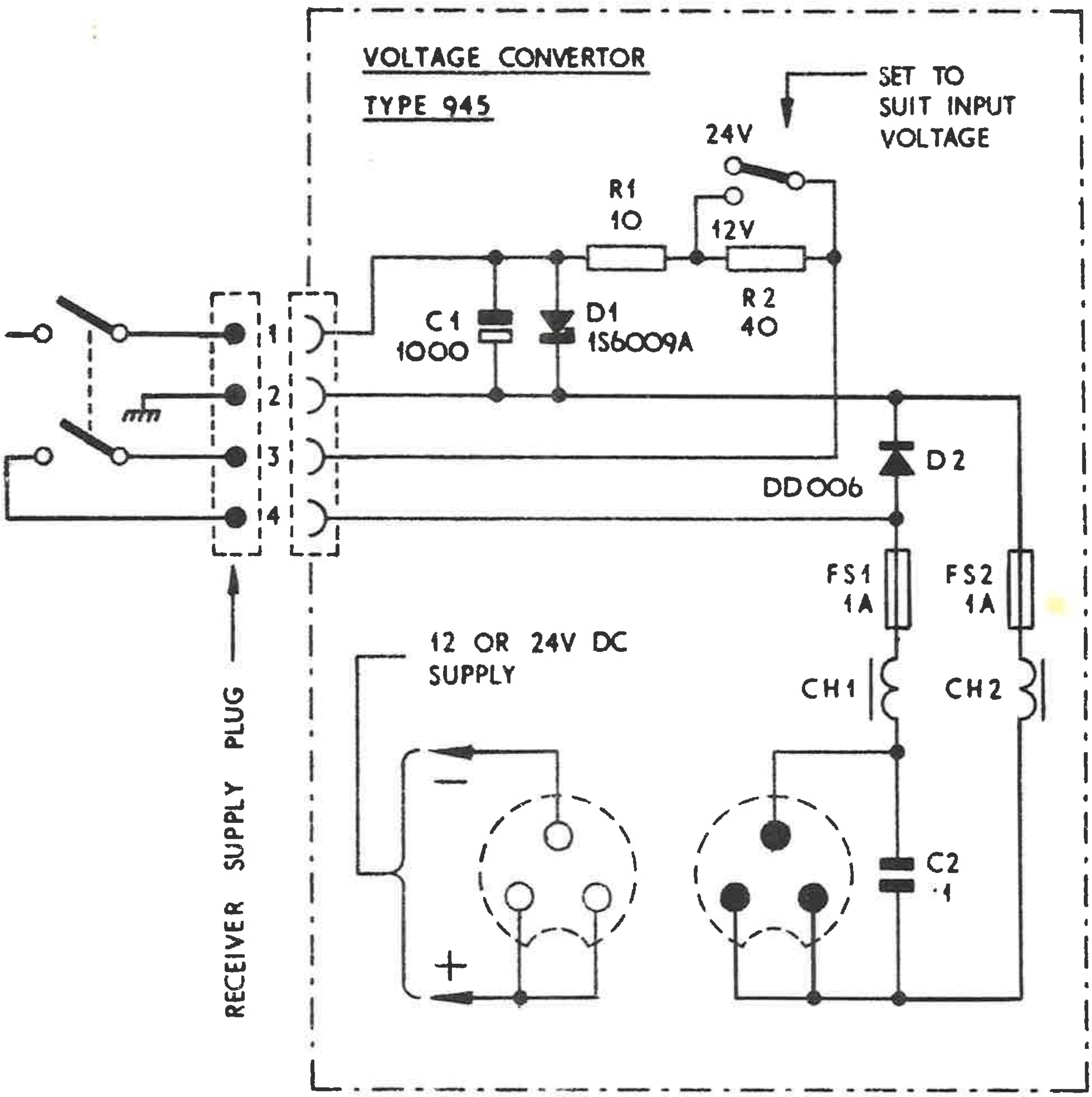
Cct Ref	Description	Identity	Account No.
	DIODES		
D1	Mullard OA70		CRX.37
D2	Mullard OA90		CRX.46
D3	Mullard OAZ203		CRX.99
D4	Lucas DD006		CRX.83
D5	Lucas DD006		CRX.83
D6	BA111		
D7	Lucas DD006		CRX.83
D8	Lucas DD006		CRX.83
	COILS		
L1	Stratton dwg no. D.3204		
L2 L3	Stratton dwg no. D.3517		
L4 L5	Stratton dwg no. D.3191		
L6	Stratton dwg no. D.3193		
L7 L8	Stratton dwg no. D.3519		
L9	Stratton dwg no. D.3196		
L10	Stratton dwg no. D.3197		
L11	Stratton dwg no. D.3198		
L12 L13	Stratton dwg no. D.3521		
L14	Stratton dwg no. D.3201		
L15	Stratton dwg no. D.3202		
L16 L17 L18	Stratton dwg no. D.3203		
LA	Eddystone dwg no. D.4771		
LB	Eddystone dwg no. D.4772		
	CHOKES		
CH1	350µH, Stratton dwg no. D.2414		
	TRANSFORMERS		
T1	Eddystone, dwg no. 6657P		
T2	Eddystone, dwg no. 6658P		
IFT1	Eddystone, dwg no. 6653P		
IFT2	Eddystone, dwg no. 6654P		
IFT3	Eddystone, dwg no. 6655P		

Cct Ref	Description	Identity	Account No.
	SWITCHES		
S1			
S2			
S3			
S4			
S5			
S6			
S7			
	MISCELLANEOUS ITEMS		
M1	Meter		
	Low-level audio output		
ILP1	L.E.S. 6V 50mA		LAL.83
ILP2	L.E.S. 6V 50mA		LAL.83
LS	Loudspeaker, 5"		LS.264
	Phones		
	Input plug		
	Aerial terminal assy.		



POWER UNIT TYPE 8871A
CIRCUIT DIAGRAM

SP/WD.2929/A SHEET 1
ISSUE 1



VOLTAGE CONVERTER TYPE 945 (EDDYSTONE)
CIRCUIT DIAGRAM