

AJAX ELECTRONICS LIMITED.

=====
INSTRUCTION MANUAL
=====

CRYSTAL CHART

CRYSTAL	FREQUENCY
1	2182 kc/s
2	kc/s
3	kc/s
4	kc/s
5	kc/s
6	kc/s

AJAX ELECTRONICS LIMITED
Essex Works,
Kenway,
SOUTHEND ON SEA,
Essex

Telephone:
Southend on Sea 64873 (OS02)
Telegrams & Cables
AJAX SOUTHEND ON SEA.

AJAX A 20 RADIOTELEPHONE.

Technical Specifications.

This equipment complies with the specification laid down by the G.P.O. for voluntarily fitted Radiotelephone equipments. However, this is a minimum requirement, and in all respects this equipment is considerably better.

Receiver,

Frequency Range: Band 1 1.6 to 4 mc/s
" 2 550 to 1600 kc/s
" 3 160 to 400 kc/s
" 4 160 to 400 kc/s with B.F.O. and D/F
" 5 160 to 400 kc/s with B.F.O. and D/F

Mode: Telephony Reception Bands 1 to 3
C.W. Reception on Bands 4 and 5

Sensitivity: Band 1 at least 5 microvolts
" 2 do. 5 "
" 3 do. 5 "
30% modulation at 400 c/s
Band 4 at least 2 microvolts
" 5 do. 2 "

Signal Noise Ratio: Better than 10dB for the above sensitivities

I.F. Rejection: Band 1 better than 80dB

Image Rejection: Band 1 better than 45dB

Selectivity:	<u>Bandwidth.</u>	<u>Selectivity.</u>
	6 kc/s	- 5 dB
	20 "	-40 dB
	40 "	-70 dB

Audio Output: 1.5 watts to 3 ohm loudspeaker distortion less than 5%

Audio Response: Flat within 2dB from 200 to 3000 c/s

I.F.: 470 kc/s

Valves: 4 off ECH83 combined to give R/F Amplifier, Frequency change, 2 I.F. Amplifiers, A/F Amplifier and B.F.O.

Transistors: 1 NKT450 (or equivalent), 1 NKT213 (or equivalent), 3 OA81, 1 OA210 used as A/F Output, A/F Driver, signal A.G.C. and Meter detectors, Reverse mains polarity protection diode.

Power Consumption: 12 volts 1.15 amps 24 volts 0.85 amps

Transmitter

Frequency Range: 1.6 to 3.8 mc/s

Channels: Six crystal controlled

Frequency Stability: Better than .01%

Power Output: Nominal 20 watts into average aerial

Power Control: Provision to reduce power output to less than half

Modulation Depth: 90 - 100% with less than 10% distortion

AJAX A20 RADIOTELEPHONE EQUIPMENT

OPERATING INSTRUCTIONS

The equipment is extremely simple to operate - - in fact, very little different from operating the normal domestic receiver and G.P.O. telephone respectively. Firstly, however, one should become fully conversant with the Radiotelephone Section of the G.P.O. "Handbook for Wireless Operators" (obtainable from H.M.S.O. at low cost). This gives information on how messages should be sent, the standard form of calling Coast and Ship Stations, and general operating instructions, information and injunctions. Secondly, listening-in on the receiver will give an indication of how things are done in practice.

Reception

Place switch marked ON/OFF VOLUME to the ON position by turning clockwise. It will be noted that the scale illumination lamp will light, and after thirty seconds you will hear noises in the loudspeaker, when the volume control is turned up. Switch to the required range and rotate the tuning knob until the correct frequency is indicated by the pointer. If you do not hear the required station, rock the tuning control a small amount either side of the indicated frequency, until located. The ranges are:-

Range 1	1600	to	4000 kc/s	Trawler Band	
"	2	550	to	1600 kc/s	Medium Wave Broadcast Band
"	3	160	to	400 kc/s	Long Wave for Broadcast and D/F
"	4	160	to	400 kc/s	" " " Consol and D/F
"	5	160	to	400 kc/s	" " " D/F

On Range 1, the distress and calling frequency of 2182 kc/s is clearly marked by the letter D. From the table above it will be seen that Ranges 3, 4 and 5 all cover the same frequency band, but have different usages. Range 3 is mainly used to receive Long Wave Broadcast Stations: switching to Range 4 automatically switches in the Beat Frequency Oscillator (BFO) to make Consol Signals audible, allowing the count to be made on the loudspeaker, or by noting the flicks of the needle of the tuning meter. On Ranges 3, 4 and 5, the D/F loop is switched into circuit (where fitted). For instructions on the use of the D/F, see section on D/F Operation. When at sea, it is always good practice to leave the receiver tuned correctly to the Distress Frequency of 2182 kc/s, since seconds make a lot of difference in an emergency.

N.B. All receiver controls are identified by black lettering.

Transmission

Ensure that the receiver is operating and tuned to the required frequency, although, if necessary, the receiver can be left off without affecting the transmission side. Put the TRANSMITTER switch to the LOW position, and wait thirty seconds for the valves to heat up. Whether the receiver is switched on or not, make sure it is switched to Range 1, otherwise the tuning meter will not be switched for transmitter tuning purposes. Put the CRYSTAL switch to the required channel, then press the microphone switch, which will cause the transmitter to function, this being evident from the sound of the power unit, a low hum, and the movement of the needle of the tuning meter which will rise to about .6. Now rotate the TUNING control until the meter reading is a minimum. The transmitter is now tuned and aerial current will be indicated on the aerial indicator lamp (white).

Transmission Contd.

Speaking or whistling into the microphone will cause the brilliance of the lamp to increase. Now release the microphone switch, and put the TRANSMITTER switch to the HIGH position, this will allow the transmitter to operate with full output power when the microphone switch is next operated. In the full power condition, the aerial indicator lamp will be brighter, and the meter reading higher, than in the low power condition. You are now ready for normal transmission, but it is advisable to check that the tuning meter is correctly tuned to a minimum in the high power condition, this minimum should be between .6 and .8 on the meter. The tuning up process, although taking a lot of explaining, takes an average of 5 to 10 seconds to complete, Do not keep the microphone switch depressed for long periods with the transmitter out of tune, i.e. with the meter reading not at a minimum - this especially applies if the transmitter is in the high power condition. When transmitting speak fairly slowly and distinctly into the microphone with it held about four inches from the mouth, there is no need to shout. When you have finished your transmission, say 'Over', and let go of microphone switch, which will stop the transmission and allow the receiver to function again, so that you can hear the reply from the other station. When he says 'Over', you press the microphone switch again and speak. The main difference between the radiotelephone and the ordinary G.P.O. telephone is that you have to press the switch to speak, and let go to hear, thus it is not possible to interrupt a conversation or be interrupted. When you have finished transmitting, put the TRANSMITTER switch to the OFF position, and the red dial light (which comes on as soon as the TRANSMITTER switch is put to the LOW or HIGH positions) will go out.

As mentioned under Reception, it is a good practice to have the equipment ready for transmission/reception on the Distress Frequency, consequently, if you re-tune to 2182 kc/s before switching off the transmitter, you are ready in case of emergency. Always remember, the 2182 kc/s Crystal is selected by turning the CRYSTAL switch hard anti-clockwise, i.e. turn hard to the left.

It is a good idea to make sure that at least one other member of the crew can operate the equipment in case of emergency, and when at sea, and prior to going to sea, make sure that the equipment is working satisfactorily. At sea, a daily test is advisable. It will be noted that considerable stress is put on emergency condition. Do not forget that this is one of the essential uses of the equipment.

N.B. All transmitter controls are identified by red lettering.

WARNING. DO NOT ALTER THE POSITION OF THE TRANSMITTER SWITCH WITH THE MICROPHONE SWITCH PRESSED SINCE THIS WILL BURN THE CONTACTS OF THE TRANSMITTER SWITCH.

AJAX A20 RADIOTELEPHONE EQUIPMENT

INSTALLATION AND SETTING UP INSTRUCTIONS.

Installation

The unit should be mounted on a table using the anti-vibration rubber feet provided. The position of mounting should be such that the unit is kept dry and clean. A smear of Vaseline over screws etc., will prevent corrosion. It is suggested that a canvas cover be made, as this will provide added protection against damp and the inevitable spray and condensation ever present on small craft.

The unit has its chassis isolated from either pole of the battery.

The earth connection is an important part of the radiating system, and for best results a copper or aluminium plate of at least four square feet should be fitted externally to the hull, and a phosphor bronze bolt used from the centre of the plate through the hull for the actual earth connection. Thus there is a good contact with the sea, which is earth. A heavy gauge wire or braid is then connected between this earth bolt and the earth terminal on the front panel of the unit. All other large masses of metal, such as the engine, tanks, metal bulkheads, should have earth lines connected from them to the main earth point, otherwise these absorb the radiated signal and thus reduce the effective power output.

Next connect the ship's mains to the equipment via the junction box, ensuring correct polarity, the red lead going to the positive of the battery, the black lead going to battery negative. Attention should now be given to the aerial terminal of the unit. The aerial should be as close to 60' long as possible, well insulated at the ends and where it passes through the deckhead, normal feed-through insulator being used in the latter position. Do not forget to fit strain insulators to keep the weight off the feed-through insulator terminal. Do not allow the aerial to chafe on rigging or swing about in the breeze, since both will cause de-tuning of the transmitter. A suitable aerial material is 7/.029 or better still 110/.0076 wire with PVC insulation. This is robust, has good conductivity and adequate insulation in case the crew should happen to touch the aerial whilst transmission is in progress. A combination of an electric shock and a burn will result if the bare aerial is touched whilst transmitting. Beware of running the aerial up a mast in close proximity to the masthead light wiring, since this will cause power loss and make it difficult to set up. There is the other disadvantage that any mains borne electrical interference will be induced into the aerial, causing interference with reception. The aim in general is to get as much of the aerial as high as possible.

On yachts of sloop or cutter rig, the aerial can be the normal backstay with heavy insulators top and bottom, and the down lead spliced in near the lower end. On ketches or yawls, it may be possible to rig the aerial in place of the triatic stay with the down lead either down the main or mizzen as is convenient. Other possibilities are a 14' whip type aerial mounted at the mast head, or on motor cruisers, mounted on top of the cabin. These whips can put out a reasonable power, but are limited, of course, due to their short length in comparison with the optimum 60'. Remember that the equipment is as good as its aerial and earth is efficient, hence considerable care should be taken in the aerial positioning and the bonding to earth of large metallic masses. The care taken will be reflected in having excellent transmitted range and high receiving sensitivity.

Setting Up

Having installed the equipment correctly, connected earth, aerial and mains, switch on the Receiver, noting that the scale lamp is on. After 20-30 seconds signals should be heard in the loudspeaker. Check that signals are of good strength on all bands. If D/F is fitted, ensure that this is operating correctly, by taking a bearing on the local beacon, or failing that on the Long Wave Light Programme on 200 kc/s. Check that the BFO is operating correctly, by listening to C.W. signals on Range 4 and noting that what is a hiss or buzz on Range 3 becomes a whistle on Range 4. Alternatively, tune into the 200 kc/s Light, and note that there is a whistle present when you switch to Range 4. Start up the ship's engines and check whether any electrical interference is heard from the dynamo, voltage regulator, or other rotating machinery. This applies equally to the screen wipers or clear view screens, bilge pumps, or any other rotating electrical machinery. If there is interference from any of these sources, then electrical suppressors must be fitted, unless the items are non-essential units that can be switched off if interfering with communication or navigation. Normally it is preferable to suppress all items. Whenever new electrical items are ordered, be sure to specify that they are suppressed.

Next, it will be necessary to set up the transmitter. First remove the set from its case, and short out the gate switch, ensure that the crystals are correctly inserted, and push the unit back in its case. Switch on the transmitter, putting the switch in the TEST position. This will now read power amplifier grid voltage, and thus indicates correct tuning of the oscillator. Now press the microphone switch and check that the reading for each crystal position is between .6 and .65*. Do not leave the switch pressed for too long, since the transmitter power amplifier is detuned. The trimmers are normally set up before despatch, and should they require to be returned, then refer to the maintenance section. Now switch to crystal position 1*, and to low power. Press the microphone switch and see if the tuning meter can be tuned to a minimum by rotation of the tuning control. If no minimum can be obtained, then let go of the microphone switch, place tuning control about half mesh and adjust the aerial tap clip (brown) one turn at a time, replace in the unit, switch on microphone and see if resonance can be obtained. Once it is possible to tune, then the amount of the dip in the meter reading has to be correctly adjusted. This should be from .6 off tune down to about .4* on tune. When switched to high power the readings will be 1 down to between .7 and .8* this being the ultimate requirement, since the high power position is that normally used. To increase the dip, i.e. reduce the loading, move the tap down the coil, and the resonance reading on the meter will be seen to be lower. To decrease the dip, i.e. increase the loading, move the tap up the coil, and the meter reading at resonance will be seen to have increased. It will be noted that the aerial indicator lamp will get brighter as the loading is increased, and talking or whistling into the microphone will cause the brilliance of the lamp to increase. Once crystal position 1 has been correctly tuned up, then switch to the next position, tune up, and pass on to the following, until all positions have been correctly tuned. When the equipment is despatched, it is set up for standard aerial conditions, so if you note how many turns you have to move the first aerial clip, then a similar amount of movement will have to be done to the others, this giving you a fairly accurate starting point. Normally it will not be necessary to move the clips more than three or four turns. BEWARE OF TUNING UP TO THE SECOND HARMONIC, THIS CAN OCCUR ON LOWER FREQUENCIES, AND WILL BE APPARENT IF THE AERIAL CLIP IS VERY NEAR THE TOP OF THE COIL.

Setting Up (Contd.)

If it is necessary to start from scratch in the matter of tuning up, then start with the coil fully in circuit, i.e. with the clip right at the bottom, and work up the coil gradually. This will prevent tuning up inadvertently on the second harmonic. It may be found that on short aeriels and on the low frequencies, it is not possible to load sufficiently, the aerial clips being right at the bottom. In that case it will be necessary to bring more coil into circuit, and the short should be removed from the loading coil at the bottom of the former. This condition is not usual however. The aerial clips are associated with their respective crystal position by means of the standard colour code of their leads, this being as follows:-

<u>Crystal Position.</u>	<u>Lead Colour.</u>
1	Brown
2	Red
3	Orange
4	Yellow
5	Green
6	Blue

Remember to let go the microphone switch before pulling out the case, otherwise a nasty shock will result.

Whilst setting up is in progress the receiver should be tuned to the frequency that is being set up, so as to ensure that no interference is being caused with stations working on that frequency. You should also announce the name of the vessel at frequent intervals and 'Testing' (vide "Handbook for Wireless Operators", Telephony Section). The setting up is rather lengthy to explain, but in actual practice takes very little time.

When all positions are correctly tuned up, remove the short from the gate switch, secure the unit in its case, and endeavour to obtain communication with your nearest Coast Station. He will then advise on signal strength and readability.

WARNING. POTENTIALS EXIST THAT ARE DANGEROUS TO HUMAN LIFE AND EXTREME CARE SHOULD BE EXERCISED WHEN WORKING ON THE EQUIPMENT OUT OF ITS CASE.

WIRE SIZES.

Aerial	7/.029" or 110/0076" PVC insulated
Earth	Heavy braiding: 7/.044" single or double run 7/.029"
Power Line 24v	7/.029" PVC Insulated
Power Line 12v	7/.029" PVC Insulated for runs less than 7'6". 7/.044" PVC Insulated for longer runs

For general calculation purposes, the voltage drop along the power line shall be less than 0.5 volt on 12v at 15A or 1.0 at 8A on 24v.

* On De-Luxe Equipments meter reads:- On test: 3-6 on Low Power: Centre of Red Sector on High Power.

AJAX A20 RADIOTELEPHONE EQUIPMENT.

TECHNICAL DESCRIPTION

The A20 is a self contained unit comprising receiver, transmitter and power supplies. A ferrite 'Loop' for Direction Finding purposes mounts on top of the unit. The complete equipment is designed as a compact low priced communication and navigation installation for vessels of up to 500 tons G.R.T., yachts, fishing vessels, etc. The equipment is reliable, simple to operate and easy to service, and is Type Approved by the G.P.O. for Voluntarily Fitted Radiotelephone Installations.

Transmitter T.2.

The transmitter comprises a crystal controlled oscillator, V1 (EF91) with provision for six crystals over the range 1.6 to 3.9 mc/s. The oscillator is of the Pierce-Colpitts type, in which the screen acts as the anode of the oscillator, with electron coupling through to the anode. The anode is tuned by L1 and the trimmers CT1 to CT6. It should be noted that the tuned circuit should always appear inductive, i.e. should always be tuned slightly higher than resonance (less trimmer), otherwise the oscillation mode is unstable. The oscillator drives the power amplifier V2 (1625), which is biased for Class C operation by the grid leak R9. When S3 (TRANSMITTER switch) is put to the Test position the tuning meter reads the voltage across R9, hence it indicates correct tuning of the oscillator anode tuned circuit since the voltage developed is proportional to P.A. grid current, which in turn is proportional to the amplitude of the oscillator anode output voltage. The voltage across R9 should be in excess of 70 volts for optimum modulation conditions in the P.A. The P.A. is protected against damage from loss of drive or faulty aerial conditions by the cathode bias resistor R10. The voltage across the cathode resistor is monitored by the tuning meter when the receiver is switched to range 1, and the TRANSMITTER switch is in the HIGH or LOW power position. Thus the cathode current of the P.A. is indicated, F.S.D. on the meter being 100 m/a. As usual, correct tuning of the P.A. is indicated by a minimum on the P.A. cathode current meter. On HIGH power condition, the meter should read about 75-80 m/a (.75 to .8). Parasitic suppressors R7, R8 for screen and grid and R11, L2 for anode, are fitted. The P.A. tank circuit is a conventional 'L' match with each channel being tuned by the setting of the tapping clip, and finely tuned by C12. S1A, S1B and S1C the CRYSTAL switch, select the crystal, and the respective oscillator trimmer and P.A. tap. An indication of aerial current is provided by the current transformer I4 and a lamp PL2. R12 is provided to prevent the build up of static voltages on the aerial, and reduce the effective amplitude of the potential across C12. The aerial is connected to the transmitter through the relay R1A/1. A loading coil is supplied on the P.A. coil L13, which is normally shorted out, but may be required under some aerial conditions.

The modulator is a push pull amplifier V3 V4, biased to run in Class AB1. The output is transformer coupled into the P.A. by T1 and anode and screen modulates the P.A. to a depth of 90 to 100%. The carbon microphone receives its polarising supply from the split cathode resistor of the modulator via the primary of the microphone transformer T2.

Power for the transmitter is supplied by the transistor power unit, which is keyed by the microphone switch energises relay R1A.

The transmitter will give about 20 watts into a reasonable aerial and was designed for a 60' aerial, but can accommodate lengths of from 12 to 150 feet.

Receiver R.2

The receiver is a superheterodyne having a tuned R/F stage, frequency changer, two I.F. Amplifiers, detector and A/F Amplifier. Then follow a transistor driver and transistor audio output stage. For C.W. reception a B.F.O. is provided. The H.T. for the valves and transistors is supplied directly from the ship's battery, no H.T. generator being required. V1, the R/F Amplifier is a pentode strapped ECH83, the triode portion being unused. The BAND switch S1A to S1H switches in the BFO automatically when on Band 4 and Band 5. AGC is applied to the stage, and grid leak biasing via the AGC line is used. V2 ECH83 is a normal frequency changer, with temperature compensation for drift cancellation by means of NTC capacitors. No AGC is applied to this stage and grid leak biasing is used. V3A is a pentode strapped hexode section of an ECH83, with AGC applied. V4A is similar to V3A but no AGC is applied, so as to allow maximum signal voltage for the AGC detector, which is fed directly from the anode of V4A, to prevent sideband screech when tuning in a station. The AGC Detector is a germanium diode, and the time constant of the system has a fast attack and slow discharge (about .2 seconds) for optimum telephony operation. The signal detector is conventional, the output being via the A/F gain control (ON/OFF VOLUME), the on/off switch being combined with this control. V3B is an A/F amplifier, the main function of which is to present a high impedance to the detector and thus reduce loading on the last I.F. transformer. The anode of the amplifier is directly coupled to the base of the A/F driver transistor VT1, which is a NKT213 or equivalent, adjusted to have a standing current of about 3 mA. The un-bypassed portion of the emitter resistor (R18) gives a measure of negative feedback, which tends to hold the gain constant with change of current gain of the transistor (either through temperature change or through the changing of the transistor). The stage is maintained thermally stable. The output of the driver is transformer coupled by T10 to the output transistor VT2 which is a NKT402 or equivalent, running in class A, with a standing current of about 350 mA. The standing current for this stage is set by RV2. If the transistor is changed, then ensure all of RV2 is in circuit before applying power, and then adjust RV2 for 350 mA through the transistor. The stage is thermally stable. If either R2 or RV2 are replaced for any reason, they should be replaced with carbon and wire wound components respectively, since these are part of the temperature compensating circuits. Likewise, R23 is a copper resistor for similar reasons. The loudspeaker is a 3 ohm tropicalised unit, driven by T11 from VT2 collector. On ranges 2 to 5, the tuning meter is connected to the collector of VT2 via a rectifier MR3 and multiplier, so that the meter acts as an audio output indicator for D/F null indication, or Consol pulse counting. The switching is automatically done by S1H

The BFO, V4B is a series Colpitts oscillator, C16, C18 being the phase splitting capacitors. The output of the BFO is coupled into the detector diode by spray coupling, this being designated C19. As the AGC detector is fed from the anode of the last I.F. Amplifier, the BFO does not desensitise the receiver, due to rectification of the output by the AGC detector being prevented. The H.T. supply to the BFO is applied by S1G when on bands 4 and 5.

It will be noted that some items of circuitry are returned directly to the chassis, but most are returned to a negative rail. This is to allow isolation of chassis from either the positive or negative line.

R16 in conjunction with C22, C23 act as a pulse suppressor and H.T. line noise filter. The H.T. is applied via the on/off switch, fuse and series diode, which acts as an open circuit, should the polarity of the mains be reversed.

Power Unit (P.2)

This comprises the transistor Inverter Unit, control circuitry, fuses, heater supplies and relays.

The transistor inverter unit is a square wave oscillator running at a frequency of about 350 c/s, the frequency being controlled by the saturating feedback transformer T3, and the commutation resistor R20. The series resistor R23 and diode MR3 are a starting circuit which help the oscillator to start under load. T4 is the output transformer, the secondary output being rectified by a full wave voltage doubler MR4, MR5. On Low Power operation of the transmitter, the tap on the secondary is reduced, bring the H.T. voltage down from approximately 450 volts to 300. Taps are provided on the transformer for either 12 volt or 24 volt supplies. The mains are applied to the inverter via relay RLA, which when closed allows the oscillator to work and apply H.T. for the transmitter.

It will be noted that RLA can only be activated by the microphone pressel, as long as the gate switch S5 is closed, and the diode MR2 will only allow current to pass as long as the correct polarity of mains prevail. Thus if the gate switch is opened by pulling the unit from its case, the H.T. will be cut from the transmitter, whilst, if the mains has been incorrectly connected no power is applied to the inverter. Reverse polarity is fatal to the transistors.

S3, the TRANSMITTER switch acts as on/off switch, switches the secondary taps on the inverter transformer for High/Low power switching and switches the tuning meter from the cathode of the P.A. to measure the grid voltage of the P.A. on the TEST position, reversing the polarity of the meter as well.

The transmitter heaters and control voltages are fused by F1, the Receiver heaters and H.T. are fed via F3 fuse. S2, which is ganged with the receiver volume control, is the receiver on/off switch. The H.T. for the receiver is applied via the series diode MR1 for reverse polarity protection: R19, which is the series dropping resistor (in circuit only on 24 volt supplies), and the send/receive relay contact RLA/2. Thus on transmit, this contact opens and breaks the H.T. to the receiver thus desensitising the unit very effectively.

WARNING. POTENTIALS EXIST IN THE UNIT WHICH ARE DANGEROUS TO HUMAN LIFE. EXTREME CAUTION SHOULD BE EXERCISED WHEN WORKING WITH THE UNIT REMOVED FROM ITS CASE.

AJAX ELECTRONICS LIMITED

Direction Finding Section

The Direction Finder comprises a tuned ferrite loop which is normally mounted on top of the A20 cabinet together with the Compass Rose. The loop tuning control is mounted on the rear end of the loop cover and the calibration is in kilocycles (kc/s). The compass rose can be rotated to give any desired heading.

If required, the loop assembly can be mounted up to twelve feet from the A20, in which case the cable plugs into the EXT. D.F. Socket on the bottom left-hand corner of the A20. The marine D/F Band is from 275/325 kc/s, but the loop covers the band 220-400 kc/s so that suitable aircraft beacons may be used if required.

Operation

Ascertain the frequency of the required D/F beacon, the time of operation and identification signal, either from Admiralty List of Radio Signals Vol. 11, or a Nautical Almanac (Reed's, Brown's, etc.). The Admiralty List of Radio Signals Vol. 11. contains full instructions on the use of Direction Finding Equipment, especially with regard to possible causes of error etc. The following notes are a brief summary only.

Switch the A20 to range 3 for A2 Beacons or range 4 (or range 5) for A1 Beacons and tune to the required frequency. Set tuning knob on loop to same frequency. Now remove main aerial, adjust loop tuning knob for maximum signal strength, then rotate loop for a null (minimum signal strength). The null can be taken either by listening to signals from the loudspeaker, or by noting the movement of the meter. The direction of the beacon is then indicated by the pointed end of the loop. If the bearing null is broad and covers several degrees of arc, note the two positions either side of the null where the signals are of equal strength, then the correct bearing is mid-way between the two equal signal positions.

With practice, it will be found that the above operation is carried out automatically, allowing accurate bearings to be taken under all adverse conditions, e.g. interference, broad nulls, etc.

It will be noted that there are two possible null positions 180° apart, but the ambiguity is usually not important as one normally knows whether to expect the bearings to be on the bow and not the opposite quarter or abeam to starboard and not to port. In cases of doubt, two bearings on the same beacon with a short run between bearings, or bearings taken on two beacons laid off on chart will show the ambiguity.

Before taking bearings the compass rose should be set correctly. Normally, it is best to set the rose with 000° facing dead ahead, then by noting the compass reading at the time of bearing and adding the bearing and compass reading the true D/F bearing is ascertained.

E.G.	Bearing.	150°	Relative to ships ahead
	Compass	180°	True
D/F Bearing		330°	True
Bearing		190°	Relative to ships ahead
Compass		300°	True
D/F Bearing		490°	
		360°	
		130°	True

Direction Finding (Contd.)

If possible the D/F should be calibrated (see below) and the error applied to the bearing prior to applying the compass reading.

e.g.	Bearing	190°
	Correction	- 10°
	Correct rel: bearing	<u>180°</u>

If the vessel has an Auto Pilot or conditions are such that the vessel is steady on course, then the card can be set to the compass course (corrected) and the bearings will all be true bearings, apart from any calibration correction.

Warning. When homing on a beacon in thick weather, exercise extreme care when the beacon's fog horn is within earshot. The accuracy of the equipment is such that collision can occur.

Calibration.

Local metal work and radiation from rigging etc. causes error in D/F bearings and the equipment should be calibrated, and a calibration curve made out. This applies especially to metal vessels or metal ribbed vessels. Calibrate by going within visual distance of a Calibration beacon (e.g. North Forland etc) an optimum distance being 2-5 miles off.

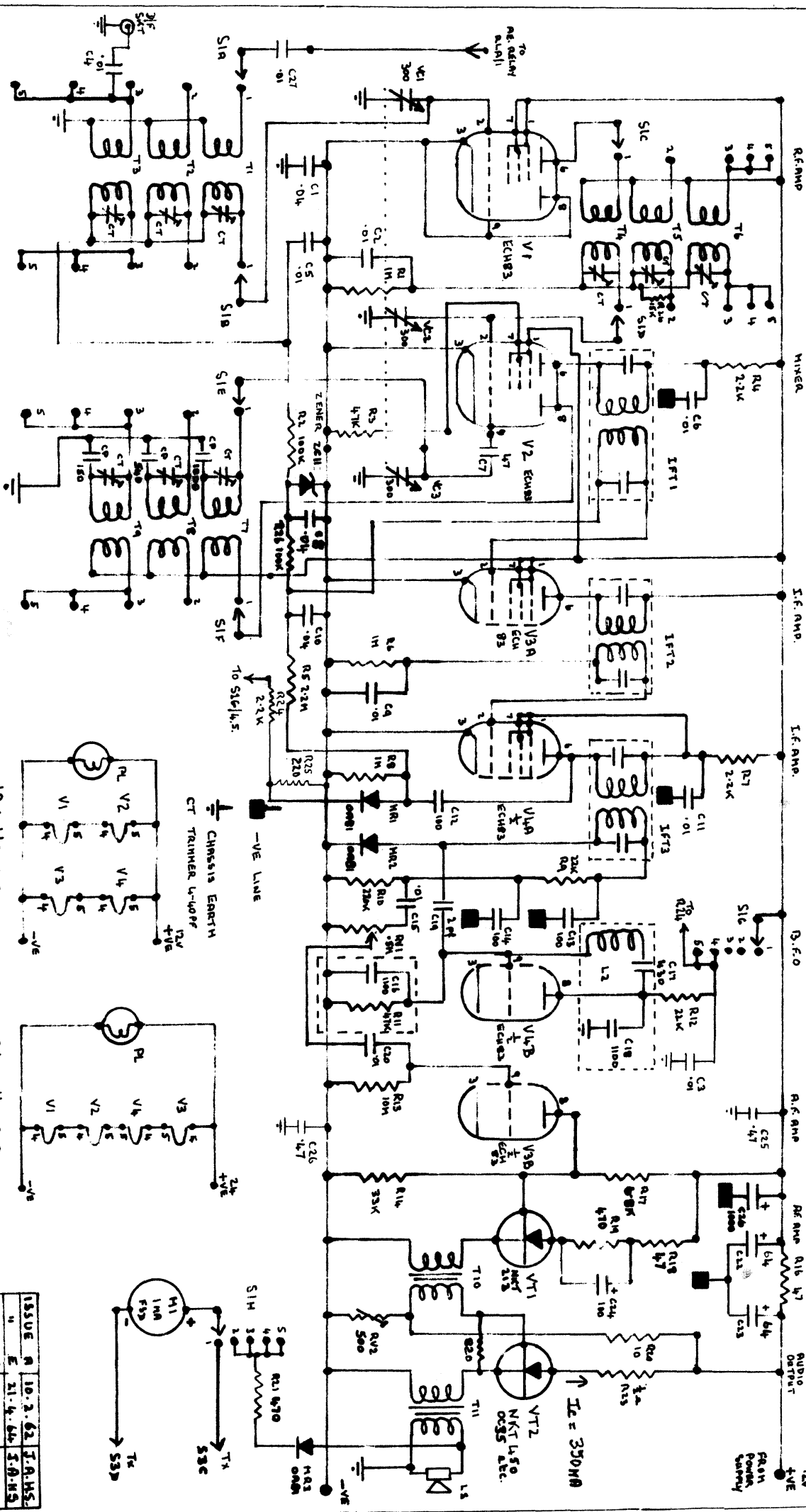
Using a Pelorus or the Azimuth ring of the compass, take simultaneous visual and D/F bearings at 10° to 20° degree intervals throughout the 360° and compile a chart as follows:=-

D/F Relative Bearing.	Visual Bearing.	Correction.
000	000	0°
010	005	- 5°
020	014	- 6°
030	020	-10°
040	029	-11°
	etc.	
200	210	+10°
240	250	+10°

The correction should then be applied each time a bearing is taken.

THE TIME TAKEN IN CALIBRATION IS WELL SPENT AND ONLY AFTER THIS HAS BEEN CARRIED OUT CAN ACCURATE BEARINGS BE OBTAINED.

RECEIVER UNIT R2



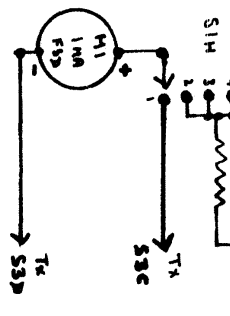
ERRATA NO. WHICH FOR PRODUCT'S USE
 SHOWING AS DATA WHICH OF T8-179
 S17, S18

12V HEATER

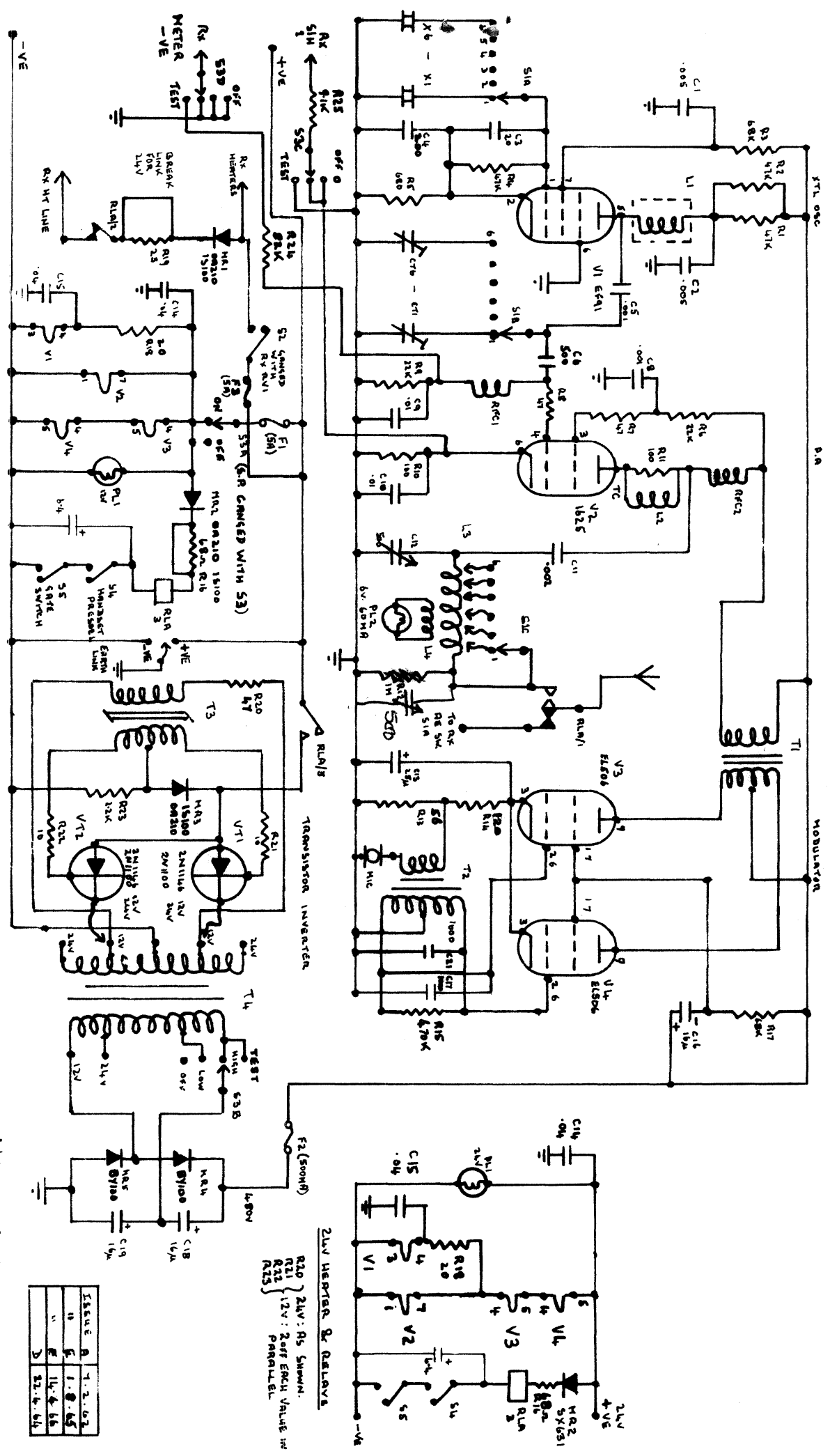
24V HEATER

ALL COMPONENTS ARE PREPARED BY EG, 1K10, 1C1 ETC.

ISSUE	R	10.2.62	J.A.H.S.
"	E	21.4.64	J.A.H.S.
"	F	4.8.65	J.A.H.S.
"	G	5.5.63	J.A.H.S.



TRANSMITTER T2 & POWER UNIT P2.



ALL COMPONENTS RITE PACKAGED T. R. 2, 2C1, 2R2 ETC.

2A V HERBERT & DELAYE
 R20 } 24V: R5 SHOWN.
 R21 } 12V: 20% EACH VALUE IN
 R22 } PARALLEL.
 R23 }

ISSUE	8	1-2-63
"	5	1-8-65
"	6	11-4-66
"	3	21-6-64