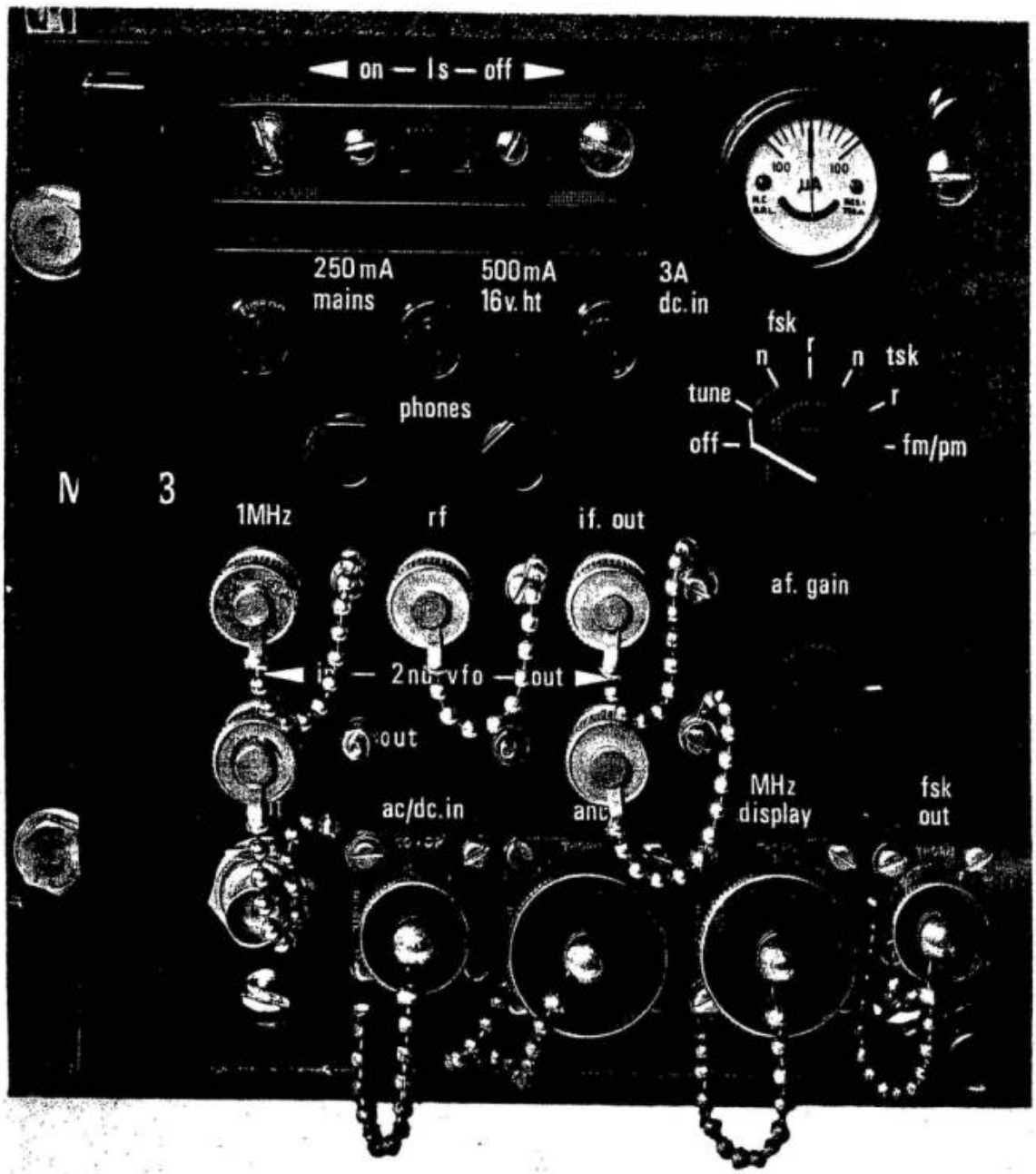
PART 3



F.S.K. And Terminating Unit MA.323

PART THREE

MA.323 MAINTENANCE

CONTENTS

CHAPTER 1

DETAILED TECHNICAL DESCRIPTION

INTRODUCTION

1. This chapter describes the signal flow when receiving an f.s.k. signal centred on the 100 kHz i.f. from the receiver unit. It is assumed that the reader understands the basic functional principles of the MA.323 Unit.

FM/PM DEMODULATOR, PRODUCT DETECTOR AND AUDIO AMPLIFIER BOARD

2. As indicated by the above title, this board contains three circuits whose functions are largely independent of each other. For this reason the circuits are shown in three separate illustrations (Figs. 4, 5 and 6).

FM/PM Demodulator (Fig. 6)

3. The 1.6 MHz i.f. input at pin 1 is applied to the integrated circuit X1 which is a high-gain amplifier limiter which limits all inputs greater than 10 mV, thus providing a signal free of amplitude modulation to the driver stage VT8.

4. The circuit between L3 and the base of VT10 is a discriminator which is designed to give good linearity. The normal working deviation is 4 kHz.

Product Detector and Crystal Oscillator (Fig. 5)

5. This section comprises a crystal oscillator VT1, a product detector VT3 and an emitter-follower VT9. The 100 kHz input is buffered by VT7. The oscillator, product detector and buffer amplifier are used only in the TUNE and F.S.K. modes, the emitter-follower VT9 is used in all operating modes.

6. The frequency of the oscillator is controlled by the crystal XL1 at 102.55 kHz; the coil L1 provides setting-up adjustment. The oscillator output is taken from L1 via the capacitors C7 and C8 which provide an impedance match into the base of the mixer stage VT3. The 100 kHz i.f., which carries the f.s.k. signal, is fed via the buffer amplifier VT7 to the emitter of VT3 where mixing occurs with the oscillator frequency. The 'difference' frequency is selected by the low-pass filter L2, C13 and C8, and

fed to the emitter-follower VT9 via the TUNE and F.S.K. settings of the Mode switch. When the Mode switch is set to T.S.K. the emitter-follower is fed with audio signals from the receiver. In either case the output is taken from the emitter of VT9 via C35 and the filter FLA to the input of the F.S. Tone Converter Board.

Audio Amplifier (Fig. 4)

7. The amplifier board accepts the audio signals from the a.m. detector stage of the associated receiver or from the FM/PM demodulator, and supplies approximately 50 mW to the speaker transformer. The circuit consists of an emitter-follower VT2 feeding a high-gain voltage amplifier VT4 which is directly coupled to a push-pull current amplifier VT5 and VT6.

8. The incoming audio signal is fed via the amplifier VT2 to the base of the grounded-emitter amplifier VT4. The diode D4 in the collector circuit of VT4 stabilises the quiescent current in transistors VT5 and VT6 against variations in temperature and supply voltage.

9. The push-pull output stage VT5 and VT6 operates in class B. Both transistors act as emitter-followers, VT5 handling the -ve going and VT6 handling the +ve going signal excursions. The audio output is fed to the loudspeaker transformer via C18 and board pin 11. The gain of the amplifier is determined by the negative-feedback network R28 and R9. To improve signal handling capability and linearity the collector load R21 of the driver transistor VT4 is bootstrap-connected to the amplifier load.

NOTE: While testing it is essential that either the loudspeaker transformer or an 82 ohm resistor be connected across the amplifier output at board pins 11 and 20.

Battery Filter

10. The capacitors C26, C27, C29 and C30, shown in Fig. 4, provide filtering on the d.c. power supply lines.

F.S.K. TONE RECEIVER PATH

11. The input frequency centred on 2.55 kHz is applied via the Mode switch and processed in the following stages:

(a) The plug-in Bandpass Filter unit FLA.

(b) The F.S. Tone Receiver Board,

(c) The F.S.K. Relay RLA.

The incoming aggregate audio tones are fed through the Bandpass Filter FLA. The filter passes only the band of frequencies containing the mark and space tones of a particular channel, which are fed to the Tone Receiver board at pins 1 and 2.

F.S.K. Tone Converter Board (Fig. 3)

12. The filtered tones enter the board at pins 1 and 2 and are transformer-coupled to the push-pull amplifier-limiter stage VT1 and VT2. The limiter circuit is arranged such that weak signals will be amplified and strong signals will be limited. The output of this stage is transformer coupled to a second push-pull limiter stage VT4 and VT5. This circuit limits all signals and provides a constant amplitude output. Two outputs are taken from the second push-pull limiter, the first output is taken from the collectors of VT4 and VT5 through R20 to the phase shift network L3, C16, R41. The second output of the limiter is transformer coupled via T3 to the phase discriminator.

Phase-Shift Network Circuit

13. Coil L3 and associated components shift the phase of one of the output voltages of the limiter by an amount which is dependent upon the input signal frequency. The phase-shifted signal is fed to a buffer stage VT11 which drives limiter stage VT10. The output of VT10 is transformer coupled to one section of the phase discriminator. The inductance of L3 is adjustable to allow the phase shift at 2550 Herz to be set to 90 degrees.

Phase Discriminator

14. The phase discriminator comprises diodes D4 to D7. The circuit is arranged so that when the two input voltages are 90° out of phase, the output of the detector, across R27 and R30, will be zero volts d.c. This occurs at an input signal frequency of 2550 Herz. When the input frequency changes to either the mark or space frequency, the phase relationship between the two applied voltages will depart from 90°, and the discriminator will deliver either a positive or negative d.c. voltage. The direction and amplitude of this voltage depends upon the phase of the two applied voltages. The discriminator output is taken via pin 9 (L0) and pin 12 (Hi) to the Mode switch for normal/reverse selection.

Low-Pass Filter

15. The output of the phase discriminator is fed via the Mode switch and the low-pass filter C11, L2 and C14 to the trigger circuit buffer VT12. The Mode switch selects the discriminator output polarity to give the 'normal' or "reversed" operation. The low-pass filter is designed

to pass data only up to the maximum rate of 150 bauds to give improved immunity to interfering signals.

Trigger Circuit

16. The trigger circuit VT12 and VT13 decides whether the data is at any instant, a 'mark' or a 'space' signal. The exact point on the data waveform at which the switch from mark to space occurs is determined by the bias controls RV2 and RV3. These controls are set to minimise telegraphy distortion, RV2 controls distortion in the "normal" positions of the Mode switch and RV3 in the 'reverse' positions. The use of two controls overcomes minor discrepancies in discriminator symmetry.

Relay Drive

17. The outputs from the collectors of the transistor switch VT15 and VT16 drive the windings of the F.S.K. relay in push-pull. Diodes D10 and D11 are used to suppress the inductive voltage spikes generated by the relay windings. The contacts of the relay are wired to the board via pins 4, 5 and 6 for spark suppression by the choke L1 and associated filter components. The F.S.K. relay is a dry contact type.

Carrier Failure Detection Circuit

18. This circuit consists of transistors VT3 and VT6-VT9 with diodes D1 to D3. The output is connected via D2 (or D3) and the strap position X (or Y) to the junction of D9 and R45 in the relay drive stage VT15. Assume that the strap is in position X. So long as the carrier level is adequate, the diode D2 is reverse-biased and there is no effect on the relay operation. A failure of carrier input will apply a forward bias to D2, causing VT15 to saturate and VT16 to cut off, which will hold the output relay in the Mark position.

19. The carrier is applied to the amplifier VT3 via the preset potentiometer RV1, thence via the envelope detector stage VT6 to the trigger circuit VT7, VT8. So long as a carrier of sufficient amplitude is present at the base of VT3 the emitter of VT6 remains at a negative level. This negative voltage causes VT7 to saturate thereby maintaining VT8 in a cut-off state. With strap X in circuit the diode D2 is reverse biased. This disconnects the circuit between VT8 and the junction of D9 and R45, and the operation of the output relay is not affected.

20. If the signal is removed from VT3 the negative potential is also removed from the emitter of VT6 thereby saturating VT8. This applies a forward bias (+ve) to D2 and also applies an earth to the junction of D9 and R45, which cuts off VT15. In consequence VT16 saturates thereby

holding the tongue of the relay in the 'Mark' position. If 'Space' hold is desired the strap 'X' is removed and strap 'Y' is inserted. The negative hold voltage derived from the inverter stage VT9 forward-biases diode D3 and saturates VT15 thereby cutting-off VT16 which holds the relay in the 'Space' position.

21. The carrier fail detection level can be adjusted by the setting of potentiometer RV1.

Tuning Indicator Circuit

22. The tuning indicator circuit consists of the 100-0-100 micro-ammeter M1, placed across the lines which carry the discriminator output (pins 9 and 11) it therefore indicates the presence of either Mark or Space signals. The tuning indicator also serves as an aid for the h.f. receiver tuning.

CHAPTER 2

TEST AND MAINTENANCE EQUIPMENT

NOTE: For the specification of the following items of test equipment refer to Chapter 2 in Part 1 of this Manual.

F.M. Signal Generator

Audio Frequency Generator

Digital Frequency Meter. Racal SA. 550 with active probe

Oscilloscope

L.F. Electronic Voltmeter

Output Power Meter

Multimeter

Telegraph Test Generator: Racal Type CA.496 or equivalent

Telegraph Distortion Measuring Set (T.D.M.S.)

(For use as a Message Generator. See NOTE below

Teleprinter with Power Supply.

Test Extension Leads Type CA.495

Resistor 2.2kΩ $\frac{1}{4}$ watt

Capacitor 0.1μF 30v

NOTE: The Racal Telegraph (F.S.K.) Test Generator Type CA.496 incorporates a simplified message generator which is adequate for testing without the use of separate T.D.M.S.

CHAPTER 3

TEST AND ALIGNMENT PROCEDURES : MA. 323

NOTES 1: The information in this chapter is intended for use in a major overhaul or servicing procedure.

2: The MA. 323 can be tested separately from the RA. 217D receiver provided that a separate power supply at -16 volts, 200 milliamps, is available. For the purposes of this chapter it is assumed that the MA. 323 is connected to the RA. 329B assembly using extension leads and that power is supplied from the RA. 217D receiver.

3: All r.f. voltages are r.m.s. unless otherwise stated.

CONNECTING THE MA. 323

1. (1) Withdraw the MA. 323 unit from the RA. 329 frame assembly. Refer to Chapter 4, paragraph 1 for withdrawal instructions.

(2) Remove the cover from the MA. 323 (six screws).

(3) Using the set of extension leads Type CA. 495 connect SKT1 on the MA. 323 to PL1 on the frame assembly Do not connect an extension lead to PL2 on the MA. 323 except for the Carrier Fail test.

POWER CHECK

2. (1) Connect the RA. 329B to the external power source. Set the Mode switch to TUNE.

(2) Connect the -ve lead of a d.c. voltmeter (25 volt range) to pin F of the ANC socket. The +ve lead to chassis. The indication should be 16 volts $\pm$0.5 volt.

CRYSTAL OSCILLATOR ADJUSTMENT

3. Equipment Required

(a) Oscilloscope.
(b) Digital Frequency Meter with active probe.
(c) A network consisting of a 2.2kΩ resistor connected in series with a 0.1μF capacitor.

CRYSTAL OSCILLATOR ADJUSTMENT (continued)

4. (1) Set the Mode switch to OFF.

(2) Remove the crystal XL1 from the Product Detector section of the Demod and Audio Amplifier board. (Fig. L-4).

(3) On the Demod and Audio Amplifier board connect the series network (2.2kΩ resistor with 0.1μF capacitor) between the following points:-

(i) Emitter of VT1.
(ii) Junction of crystal holder XL1 with inductor L1.

(4) Connect the oscilloscope and digital frequency meter to the base of VT3.

(5) Set the Mode switch to TUNE.

(6) Adjust the core of L1 to obtain a reading of 102550 ± 50 Hz on the digital frequency meter.

(7) Set the Mode switch to OFF.

(8) Remove the series network which was connected in (3) and replace the crystal XL1.

(9) Set the Mode switch to TUNE and adjust capacitor C3 to obtain an indication of 102550 ± 2 Hz on the digital frequency meter.

(10) Check that the waveform on the oscilloscope has an amplitude of 280 mV ± 60 mV peak-to-peak.

(11) Disconnect the test equipment.

FREQUENCY SHIFT TONE CONVERTER ADJUSTMENTS

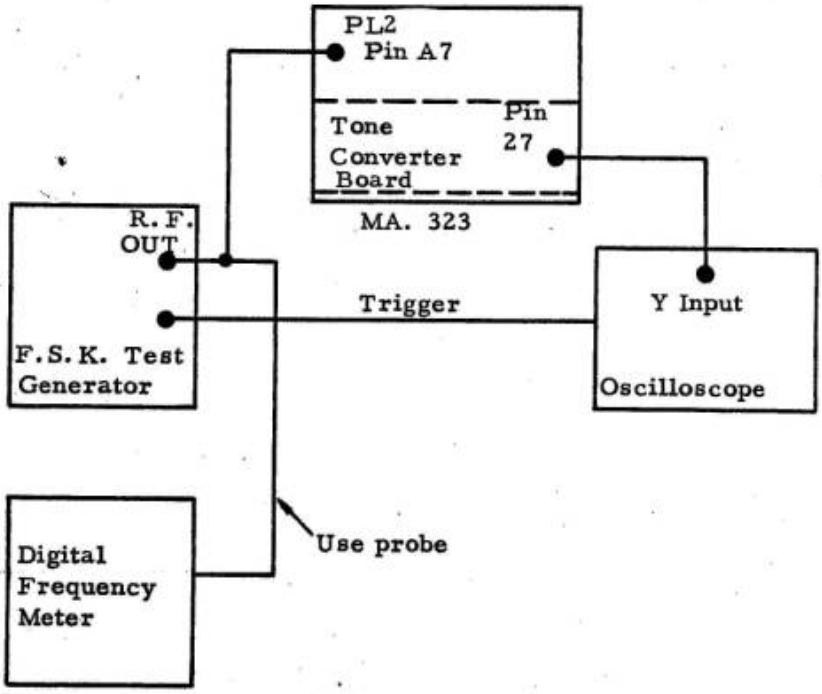
NOTE: For all tests, except Carrier Fail Adjustment, the extension lead should be removed from plug PL2 on the rear panel of the MA.323.

5. Equipment Required

(a) Oscilloscope.
(b) Digital Frequency Meter.
(c) F.S.K. Test Generator and Power Unit.
(d) Teleprinter and teleprinter power supply.
(e) T.D.M.S. (message Generator).

6. Connect up the test equipment as shown in Fig. 3.1 below. This arrangement is used for the following procedures:

(a) Discriminator Tuning.
(b) Bias Adjustment.
(c) Limiter Gain.
(d) Carrier Fail Adjustment.



F. S. K. TONE CONVERTER TESTS Fig. 3.1

F.S.K. Discriminator Adjustment

7. Connect the test equipment to the MA. 323 as shown in Fig. 3.1 above. Note that the r.f. output of the F.S.K. Test Generator is connected to the coaxial outlet A7 in plug PL2 at the rear of the MA. 323. The oscilloscope probe should be connected to pin 27 on the F.S. Tone Converter board.

(1) Set the Mode switch to TUNE.

F.S.K. Discriminator Adjustment (continued)

(2) Set the controls of the F.S.K. test generator as follows:

(a) Zero shift.
(b) Output level to 270 mV.
(c) Carrier Frequency to 100,000 ± 2 Hz as indicated on the digital frequency meter.

(3) Adjust the core of L3 (Fig. L-3) on the F.S. Tone Converter board to obtain a centre (zero) indication on the MA. 323 tuning meter.

(4) The test equipment should remain connected if further tests are to be made.

(5) Set the Mode switch to OFF.

Bias Adjustment

8. (1) The test equipment should be connected as shown in Fig. 3.1 (page 3-3). Check that the extension lead is removed from PL2 at the rear of the MA. 323.

(2) Set the Mode switch to F.S.K. (N).

(3) Set the controls of the F.S.K. test generator as follows:

(a) To provide a square-wave modulation of equal mark/space ratio.
(b) To a data rate and shift which correspond to the usual operating conditions. Alternatively, a data rate of 100 Bauds and a shift of 400 Herz will serve as a general-purpose standard.
(c) To an output level of 270 mV.
(d) To a carrier frequency of 100,000 ± 2 Hz as indicated by the digital frequency meter.

(4) Set the controls of the oscilloscope for external triggering. Adjust the timebase to the slowest speed consistent with a superimposed type of waveform with at least one rising and one falling edge. See NOTE below.

NOTE: Sync. pulses from the F.S.K. test generator enable the oscilloscope to display a waveform which has alternate scans trigged from the rising and falling edges, resulting

Bias Adjustment (continued)

in an apparent superimposition of the +ve portion of the waveform over the -ve portion. Distortion is revealed by a failure of the rising and falling edges to coincide, i.e. to cross at half-amplitude. To obtain maximum accuracy expand the scale on the oscilloscope when observing the rising and falling edges.

(5) Adjust potentiometer RV3 on the F.S. Tone Coverter board to obtain minimum distortion.

(6) Set the Mode switch to F.S.K.(R).

(7) Adjust potentiometer RV2 for minimum distortion.

(8) Set the Mode switch to OFF.

(9) The test equipment should remain connected if further tests are to be made.

Limiter Gain Test

9. (1) The test equipment should be connected as shown in Fig. 3.1 (page 3-3). Check that the extension lead is removed from PL2 at the rear if the MA.323.

(2) Connect a short-circuit across resistor R19 (Fig. L-4) on the F.S. Tone Converter board.

(3) Set the controls of the F.S.K. Test Generator as stated in paragraph 8 operation (3) a, b and d. Set the output level to 5 mV.

(4) Set the Mode switch to FSK (N).

(5) Check that the telegraph signal is displayed on the oscilloscope.

(6) Set the Mode switch to OFF.

(7) Disconnect the short-circuit from R19.

(8) Disconnect the test equipment.

Carrier-Fail Level Adjustment

NOTE 1: For optimum operational performance of the Carrier-Fail system it is recommended that the carrier-fail adjustment be carried out using the actual receiver which is to be used with the MA. 323 unit.

NOTE 2: For this test both SKT1 and PL2 on the MA. 323 must be connected to the corresponding outlets on the frame assembly, using the extension leads.

Equipment Required

10. (a) Signal generator.
(b) Multimeter.

Procedure

11. (1) Set the signal generator to 3. 5 MHz, c.w. and an output e.m.f. of 10 microvolts.

(2) Connect the signal generator output the ANTENNA socket on the front of the MA. 323.

(3) Set the multimeter to a current range (10 mA) and connect the +ve lead to chassis and the -ve lead to the emitter of VT9.

(4) Set the receiver control as follows:
Bandwidth to 1 kHz.
B.F.O. to L.S.B.
RF/IF GAIN fully clockwise (maximum).
System switch to AGC (M).
Meter switch to AF.

(5) Set the Mode switch to TUNE and tune the receiver to the signal generator frequency. Adjust the tuning to obtain a beat note of approximately 1. 5 kHz.

(6) Note the exact meter reading on the receiver.

(7) Set the System switch to MAN and adjust the RF/IF GAIN to give the same meter indication as was noted in (5).

(8) Reduce the signal generator output level by 10 dB.

(9) On the F.S. Tone Converter board rotate the potentiometer RV1 slowly through its entire range of movement and check that the multimeter indication changes abruptly from a higher level of 3.5 mA ± 1 mA to a lower level of less than 0.5 mA. This establishes that the carrier-fail detector is functioning correctly.

(10) Reset RV1 to obtain the higher level as indicated by the multimeter. This corresponds to an adequate carrier.

(11) Carefully turn RV1 to the point where the indication on the multimeter falls to the lower level. This is the required setting.

(12) Increase the signal generator output level by 6 dB and check that this restores the multimeter reading to the higher level noted in (10). This checks that the backlash in the changeover point is within acceptable limits.

(13) Set the Mode switch to OFF and disconnect the test equipment.

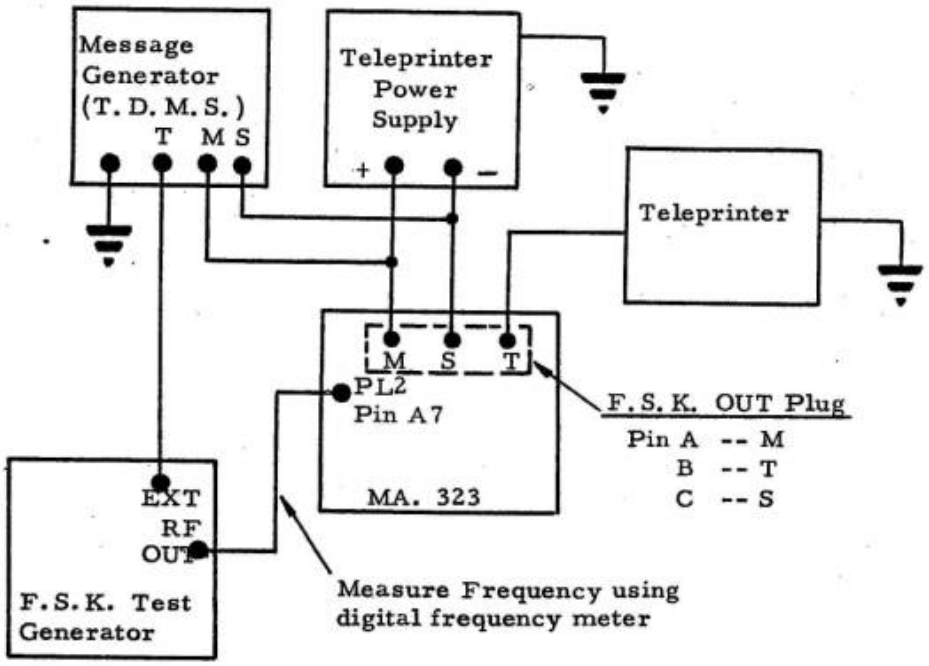
(14) Disconnect the extension lead from PL2 for the Teleprinter Test which follows.

TELEPRINTER TEST

12. (1) The equipment should be connected as shown in Fig. 3.2 on the following page. The extension lead should be removed from PL2 at the rear of the MA.323.

(Continued on page 3-8)

TELEPRINTER TEST



TELEPRINTER TEST. Fig. 3.2.

(2) Set the controls of the F.S.K. test generator as follows:

(a) To a shift of 400 Hz.
(b) To accept external modulation from the T. D. M. S.
(c) To an output level of 270 mV.
(d) To an output frequencies of 100, 000 ± 2 Hz as indicated on the digital frequency meter.

(3) Set the MA. 323 Mode switch to F.S.K. (N).

(4) Set the Message Generator (T. D. M. S.) to operate at the data rate required by the teleprinter.

(5) Print out for a period of not less than two minutes. Check that the print out is satisfactory.

(6) Set the Mode switch to OFF.

(7) Remove all test equipment.

FM/PM SENSITIVITY TEST

13. (1) Check that the extension lead is disconnected from PL2 at the rear of the MA. 323.

(2) Connect the output of the F. M. signal generator to the coaxial socket A6 on PL2 at the rear of the MA. 323.

(3) Set the F. M. signal generator as follows:

(a) Frequency to 1.6 MHz ± 50 Hz checked by the digital frequency meter. See NOTE below.
(b) Internal modulation at 1000Hz.
(c) Deviation 4000 Hz.
(d) Output level 10 millivolts.

NOTE: The carrier frequency of 1.6 MHz ± 50 Hz must be checked at frequent intervals, using the digital frequency meter, to ensure accuracy.

(4) Set the MA. 323 Mode switch to FM/PM.

(5) Connect the L. F. electronic voltmeter to pin M of the ANC socket on the front panel of the MA. 323.

(6) In the FM/PM section of the Audio Amp and Demod board (Fig. L-4) connect the -ve lead of the multimeter (set to the 2. 5V d. c. range) to the junction of C37/C38. The +ve lead to the board earth.

(7) In the FM/PM section adjust the core of L3 to obtain a maximum indication on the electronic voltmeter.

(8) Adjust the core of T1 for a zero voltage indication on the multimeter.

(9) Disconnect the multimeter. Check that the electronic voltmeter indication is not less than 70 mV.

(10) Set the Mode switch to OFF.

(11) Disconnect all test equipment.

AUDIO AMPLIFIER TEST

14. Equipment Required

(a) Audio Signal Generator
(b) Output Power Meter

(1) Set the loudspeaker (LS) switch to OFF. Unsolder the load resistor 1R2 (Fig. 7) from the loudspeaker switch and connect the output power meter in place of the resistor.

(2) Set the Audio Signal Generator to 1 kilohertz, output e.m.f. 55 millivolts. Connect the output to pin V of the ANC socket on the MA. 323 front panel.

(3) Ensure that the Loudspeaker (LS) switch is OFF.

(4) Set the AF GAIN control fully clockwise.

(5) Set the Mode switch to TUNE.

(6) Check that the output power meter indication is not less than 50 milliwatts.

(7) Set the output of the audio signal generator to produce a reference indication on the output power meter of 50 milliwatts. Sweep the frequency of the audio signal generator from 100 Hz to 15 kHz, at the same time observe the output power meter and check that any changes in output level are within a 3 dB range.

CHAPTER 4

DISMANTLING AND RE-ASSEMBLY

REMOVAL OF MA. 323 UNIT

1. (1) Remove the RA. 329 from the carrying case.

(2) On the underside of the frame assembly remove 4 retaining screws from the MA. 323 section.

(3) Pull the MA. 323 forward and out of the frame assembly.

REMOVAL OF COVER

2. Remove 4 screws from the top and 2 from the rear.

REMOVAL OF PRINTED CIRCUIT BOARDS

3. Each board in the MA. 323 is retained by six screws which are self-evident. Note the numerous connections which must be unsoldered prior to removing the screws.

4. When re-fitting a board the wiring harness will align approximately with the appropriate pins, but the following details may be of assistance.

CONNECTIONS TO BOARDS

FM/PM Prod. Detector and Audio Amp. Board.

Pin No.	Wire	Pin No.	Wire
1	Coaxial inner	13	Coaxial inners (two)
2	Coaxial screen Black	14	Coaxial screen
		15	Green and brown
3	Violet	16	Coaxial screen
4	Coaxial inners (two)		Black
5	Black	17	Violet (two)
6	Coaxial inner (blue sleeve)	18	Coaxial screens (two)
7	Coaxial screens (two)	19	Coaxial inners (two)
8	Coaxial inner (grey sleeve)	20	(Coaxial screen
9	Red		(Black (two)
10	Blue		
11	White/Orange		
12	Violet		

F.S.K. Tone Converter Board

Pin No.	Wire	Pin No.	Wire
1	Green/Grey	14	Green/Black
2	Black	15	Orange/Brown
3	Not used	16	Green/Grey
4	Red/Blue	17	Not used
5	Red/Orange	18	Violet (two)
6	Red/Brown	19	no pin
7	Brown	20	not used
8	Black (two)	21	White/Brown
9	Blue	22	Black
10	Not used	23	Blue/Brown
11	Red/Violet	24	Red/Brown
12	Black/Green	25	Red/Black
13	Blue/Green	26	Green/Orange
		27	Red/White

Removal of Loudspeaker

NOTE: The loudspeaker is mounted on a sub-chassis which is removed first, before attempting to remove the loudspeaker itself.

5. Large and small screwdrivers
Hexagonal box spanner : 2BA
Soldering iron.

(1) At the front panel remove the two screws and nuts which retain the loudspeaker ON/OFF switch.

(2) At the front panel remove the two larger chromium screws which are on either side of the loudspeaker switch.

(3) Within the MA. 323, under the upper flange of the vertical partition, remove the two screws which hold the rear side of the loudspeaker sub-chassis. These screws are diametrically opposite the screws removed in (2).

(4) The loudspeaker sub-chassis can now be eased upwards, drawing the loudspeaker switch with it. Carefully turn the sub-chassis over to bring the cover screws uppermost.

(5) Remove the cover screws and lift off the cover. Note the correct position of the rubber grommets on the wiring.

(6) Unsolder the two leads from the tag strip on the loudspeaker.

(7) Unscrew the four pillar screws and remove the loudspeaker.

(8) Re-assembly is a reversal of the above procedures. Note that the nuts on the pillar screws should be locked with a suitable varnish. When replacing the loudspeaker cover check that the grommets are correctly positioned in the cut-outs in the cover.

Removal of F.S.K. Relay

Un-plug the relay unit from its octal holder.

Filter Unit FLA

(1) Remove four screws from the feet of the metal cover.

(2) Remove the cover and un-plug the filter unit from its octal holder.

NOTE: When replacing the metal cover, check that the sorbo rubber pad has not become detached from the top, under-side, of the cover.

NOTES ON COMPONENT CHANGES AND ADDITIONS

:t. ef.	Value	Description	Rat.	Tol. %	Racal Part No	Manufacturer

CHAPTER 5

LIST OF COMPONENTS: MA. 323

CONTENTS

NOTE: Component values are given as follows: -

Resistors	Capacitors
No suffix = ohms	No suffix = microfarads
Suffix 'k' = kilohms	Suffix 'p' = picofarads
Suffix 'M' = megohms	

Cct Ref.	Value	Description	Rat	Tol %	Racal Part No.	Manufacturer

GENERAL ASSEMBLY ITEMS

(MA. 323 Fig. 2)

Printed Circuit Board Assemblies

1. F.M. Demod, Product Detector and Audio Amp. Board					BA39395	
2. F.S.K. Tone Converter Board					BA39199	

Components

Resistors

	ohms		watts			
R1	4.7k	Composition	0.1	5	905331	Erie 15
R2	3.3	Wirewound	1.5	10	903636	Painton MV1A
R3	680	Metal Oxide		5	908390	Electrosil TR4

Potentiometers

RV1	10k	A.F Gain: Log: 7/8 Spindle			911799	Morganite Type U.

Coil Assemblies and Transformers

FIA		Tone input bandpass filter				Telesignals FL200014
T1		Loudspeaker transformer			CT34736	

Plugs and Sockets

PL1		Plug: fixed: 6-way: AC/DC INPUT			911701	Thorn PT00E-10-6P
PL2		Plug: fixed: multiway (rear panel)			911714	Cannon DDM24W7P
PL3		Plug: fixed: 4-way: FSK OUT			911703	Thorn PT00E-8-4PA
PL4		Plug fixed: MHz DISPLAY			911702	Thorn PT00E-14-19P
Socket free, for PL1					911705	Thorn PT06W-10-6S
Socket free, for PL3					911706	Thorn PT06W-8-4SA
Socket free, for PL4					910423	Thorn PT06E-14-19S
SKT1		Socket fixed: multiway			911715	Cannon DDM24TS
SKT2		Socket fixed: coaxial 75Ω: RF			907457	Transradio BN12/7
SKT3		Socket fixed: coaxial 75Ω: 1 MHz			907457	Transradio BN12/7
SKT4		Socket fixed: coaxial 75Ω: 2ndVFO			907457	Transradio BN12/7
SKT5		Socket fixed: coaxial 75Ω: 2ndVFO			907457	Transradio BN12/7
SKT6		Socket fixed: coaxial 75Ω: ANT			905030	Transradio BN6/7A
SKT7		Socket fixed: coaxial 75Ω: I.F.			907457	Transradio BN12/7
SKT8		Socket: fixed: multiway. ANC			911704	Thorn PT00E-14-19S
Plugs, free for coaxial outlets					905034	Transradio BN1/7
Plug free for SKT8					911707	Thorn PT06E-14-19P

Cct. Ref.	Value	Description	Rat	Tol %	Racal Part No.	Manufacturer

GENERAL ASSEMBLY ITEMS (continued)

(MA. 323 Fig. 2.)

Coaxial Inserts for Cannon Connectors			
	Male inserts for PL2	908341	Cannon DM53740-5001
	Female inserts for SKT1	907076	Cannon DM53742-5001
JK1) JK2)	PHONES Jack Sockets	901509	Brookhurst Igranic Type 53080 P71
	Phones Jack plugs, free for JK1 or JK2	901557	Brookhurst Igranic P50
Outlet Protection Caps.			
	Cap and chain for coaxial outlets SKT2-SKT7	911711	Transradio BN81
	Protection Cap for ANC and MHz DISPLAY outlets	911710	Thorn 10-101960-143
	Protection Cap for AC/DC IN outlet	911708	Thorn 10-101960-103
	Protection Cap for FSK OUT outlet	911709	Thorn 10-101960-83
Switches			
SA	2nd V.F.O. in/out: break before make	912063	E.M.I. S5
SB	Mode switch:	BSW39653	
SC	Loudspeaker on/off: break before make	912063	E.M I. S5
SD	A.C power) Part of Mode		
SE	D.C. power) switch assembly.		
Fuselinks			
FS1	3 amp : D.C. IN	912698	Bulgin F300/3.0A
FS2	250 mA: MAINS (anti-surge)	911700	Beswick TDC134
FS3	500 mA: 16v HT.	906850	Belling Lee L562
Fuseholders			
	Fuseholders for FS1 to FS3	911145	Belling Lee L1596
Loudspeaker			
LS.	Loudspeaker: 3Ω tropicalised	900341	Goodmans T10/207/3
Meter			
M1		BD38362	
Relay			
RLA	FSK relay 10Ω: 14.4 mA d.c.	911816	Sigma 72AOZ-10-TG-TCP
Octal Holders			
	Holders for Relay RLA and Filter FLA	911716	A.E.I. VH238/8

MA. 323

BOARD COMPONENTS

Resistors

Demod, Prod. Detector & Audio Amp. Board (DC 39395)

Cct. Ref	Value	Description	Rat	Tol %	Racal Part No.	Manufacturer
	ohms		watts			
R1	1k	Metal Oxide		5	908267	Electrosil TR4
R2	10k	Metal Oxide		5	900986	Electrosil TR4
R3	12k	Metal Oxide		5	908274	Electrosil TR4
R4	150	Metal Oxide		5	909121	Electrosil TR4
R5	2.2k	Metal Oxide		5	908270	Electrosil TR4
R6	15k	Metal Oxide		5	908280	Electrosil TR4
R7	220	Metal Oxide		5	900988	Electrosil TR4
R8	8.2k	Metal Oxide		5	908275	Electrosil TR4
R9	220	Metal Oxide		5	900988	Electrosil TR4
R10	560	Metal Oxide		5	909841	Electrosil TR4
R11	1k	Metal Oxide		5	908267	Electrosil TR4
R12	2.2k	Metal Oxide		5	908270	Electrosil TR4
R13	33k	Metal Oxide		5	908291	Electrosil TR4
R14	1k	Metal Oxide		5	908267	Electrosil TR4
R15	2.2k	Metal Oxide		5	908270	Electrosil TR4
R16	100	Metal Oxide		5	908276	Electrosil TR4
R17	10k	Metal Oxide		5	900986	Electrosil TR4
R18	47	Metal Oxide		5	911930	Electrosil TR4
R19	56	Metal Oxide		5	908289	Electrosil TR4
R20	820k	Composition	0.1	10	902543	Erie 15
R21	1.5k	Metal Oxide		5	908296	Electrosil TR4
R22	10k	Metal Oxide		5	900986	Electrosil TR4
R23	10k	Metal Oxide		5	900986	Electrosil TR4
R24	2.2k	Metal Oxide		5	908270	Electrosil TR4
R25	100	Metal Oxide		5	908276	Electrosil TR4
R26	1.5k	Metal Oxide		5	908296	Electrosil TR4
R27	4.7k	Metal Oxide		5	900989	Electrosil TR4
R28	15k	Metal Oxide		5	908280	Electrosil TR4
R29	10k	Metal Oxide		5	900986	Electrosil TR4
R30	5.6k	Metal Oxide		5	908273	Electrosil TR4
R31	18k	Metal Oxide		5	908272	Electrosil TR4
R32	150k	Metal Oxide		5	908277	Electrosil TR4
R33	33k	Metal Oxide		5	908291	Electrosil TR4
R34	5.6k	Metal Oxide		5	908273	Electrosil TR4
R35	150	Metal Oxide		5	909121	Electrosil TR4

MA. 323

BOARD COMPONENTS (continued)

Resistors (continued)

Demod, Prod. Detector & Audio Amp. Board.

Cct. Ref.	Value	Description	Rat	Tol %	Racal Part No.	Manufacturer
	ohms		watts			
R36	56k	Metal Oxide		5	908287	Electrosil TR4
R37	56k	Metal Oxide		5	908287	Electrosil TR4
R38	150	Metal Oxide		5	909121	Electrosil TR4
R39	27k	Metal Oxide		5	908295	Electrosil TR4
R40	3.3k	Metal Oxide		5	900991	Electrosil TR4
R41	560	Metal Oxide		5	909841	Electrosil TR4
R42	47k	Metal Oxide		5	908391	Electrosil TR4
R43	47k	Metal Oxide		5	908391	Electrosil TR4
R44	4.7k	Metal Oxide		5	900989	Electrosil TR4
R45	100	Metal Oxide		5	908276	Electrosil TR4

F.S.K. Tone Converter Board (DC. 39199)

R1	1.5k	Metal Oxide		5	908296	Electrosil TR4
R2	15k	Composition	0.1	10	902522	Erie 15
R3	1.5k	Metal Oxide		5	908296	Electrosil TR4
R4	15k	Composition	0.1	10	902522	Erie 15
R5	470	Composition	0.1	10	902504	Erie 15
R6	18k	Composition	0.1	10	902523	Erie 15
R7	4.7k	Composition	0.1	10	902516	Erie 15
R8	10k	Composition	0.1	10	902520	Erie 15
R9	24k	Composition	0.1	5	911856	Erie 15
R10	4.7k	Composition	0.1	10	902516	Erie 15
R11	330	Composition	0.1	10	902502	Erie 15
R12	470	Composition	0.1	10	902504	Erie 15
R13	6.8k	Composition	0.1	10	902518	Erie 15
R14	150	Metal Oxide		2	910389	Electrosil TR4
R15	6.8k	Composition	0.1	10	902518	Erie 15
R16	470	Composition	0.1	10	902504	Erie 15
R17	4.7k	Composition	0.1	10	902516	Erie 15
R18	68	Metal Oxide		5	908278	Electrosil TR4
R19	2.2k	Composition	0.1	10	902512	Erie 15
R20	10k	Composition	0.1	10	902520	Erie 15

Cct. Ref.	Value	Description	Rat	Tol %	Racal Part No.	Manufacturer
		MA. 323				
		Resistors (continued)				
		F.S.K. Tone Converter Board (DC. 39199) (continued)				
R21	2.2k	Composition	0.1	10	902512	Erie 15
R22	24k	Composition	0.1	5	911856	Erie 15
R23	33	Composition	0.1	10	902490	Erie 15
R24	4.7k	Composition	0.1	10	902516	Erie 15
R25	3.3k	Composition	0.1	10	902514	Erie 15
R26	470	Composition	0.1	10	902504	Erie 15
R27	5.6k	Composition	0.1	10	902517	Erie 15
R28	470	Composition	0.1	10	902504	Erie 15
R29	470	Composition	0.1	10	902504	Erie 15
R30	5.6k	Composition	0.1	10	902517	Erie 15
R31	18k	Composition	0.1	10	902523	Erie 15
R30	470	Composition	0.1	10	902504	Erie 15
R33	10	Composition	0.1	10	902484	Erie 15
R34	330	Metal Oxide		5	908268	Electrosil TR4
R35	10k	Composition	0.1	10	902520	Erie 15
R36	1.5k	Composition	0.1	10	902510	Erie 15
R37	470	Composition	0.1	10	902504	Erie 15
R38	1k	Composition	0.1	10	902508	Erie 15
R39	3.3k	Composition	0.1	10	902514	Erie 15
R40	120	Composition	0.1	10	902497	Erie 15
R41	2.2k	Composition	0.1	10	902512	Erie 15
R42	2.2k	Composition	0.1	10	902512	Erie 15
R43	3.3k	Composition	0.1	10	902514	Erie 15
R44	10k	Composition	0.1	10	902520	Erie 15
R45	1k	Composition	0.1	10	902508	Erie 15
R46	4.7k	Composition	0.1	10	902516	Erie 15
R47	1.8k	Composition	0.1	10	902511	Erie 15
R48	240	Metal Oxide		1	907058	Electrosil TR5
R49	240	Metal Oxide		1	907058	Electrosil TR5
R50	82	Metal Oxide		5	908290	Electrosil TR4
R51	47	Metal Oxide		5	911840	Electrosil TR8
R52	4.7k	Composition	0.1	10	902516	Erie 15
R53	4.7k	Composition	0.1	10	902516	Erie 15

Cct. Ref.	Value	Description	Rat	Tol %	Racal Part No.	Manufacturer

MA. 323

POTENTIOMETERS

F.S.K. Tone Converter Board (continued)

	ohms				
RV1	1k	Resistor :variable		900671	Plessey Type G
RV2	1k	Resistor :variable		900671	Plessey Type G
RV3	1k	Resistor :variable		900671	Plessey Type G

CAPACITORS

Demod, Prod. Detector & Audio Amp. Board (DC 39395)

			volts			
C1	0.1	Ceramic	30	-25+50	906675	Erie 811T/30
C2	15p	Polystyrene	125		911696	Suflex HS7/D
C3	7-35p	Variable			908806	Steatite 7S-Triko 02/N1500
C4	.01	Ceramic	25	-25+50	911845	Erie 831T/25
C5	5	Tantalum	25	-20+50	909890	S.T.C. TAG 5.0/25
C6	.0022	Ceramic	350	20	902126	Lemco 310K
C7	470p	Polystyrene	125	2½	911848	Suflex HS10/E
C8	0.1	Ceramic	30	-25+50	906675	Erie 811T/30
C9	25	Electrolytic	25	-10+50	900610	Mullard C426AR/F25
C10	5	Tantalum	25	-20+50	909890	S.T.C. TAG 5.0/25
C11	125	Electrolytic	16	-10+50	908463	Mullard C426AR/E125
C12	20	Electrolytic	16	-10+50	909164	Mullard C426AR/E20
C13	.0033	Ceramic	350	20	902128	Lemco 310K
C14	0.1	Ceramic	30	-25+50	906675	Erie 811T/30
C15	.01	Ceramic	25	-25+50	911845	Erie 831T/25
C16	0.1	Ceramic	30	-25+50	906675	Erie 811T/30
C17	.0033	Ceramic	350	20	902128	Lemco 310K
C18	200	Electrolytic	10	-10+50	908951	Mullard C426AR/D200
C19		not used				
C20	125	Electrolytic	16	-10+50	908463	Mullard C426AR/E125
C21	150p	Polystyrene	125	2½	911846	Suflex HS10/D
C22	0.1	Ceramic	30	-25+50	906675	Erie 811T/30
C23	0.1	Ceramic	30	-25+50	906675	Erie 811T/30
C24	0.1	Ceramic	30	-25+50	906675	Erie 811T/30
C25	150p	Polystyrene	125	2½	911846	Suflex HS10/D
C26	8	Electrolytic	40	-10+50	910245	Mullard C426AR/G8
C27	8	Electrolytic	40	-10+50	910245	Mullard C426AR/G8
C28	470p	Polystyrene	125	2½	911848	Suflex HS10/E
C29	8	Electrolytic	40	-10+50	910245	Mullard C426AR/G8
C30	8	Electrolytic	40	-10+50	910245	Mullard C426AR/G8

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CAPACITORS (continued)

Demod, Prod. Detector & Audio Amp. Board (DC. 39395)

Cct. Ref.	Value	Description	Rat volts	Tol %	Racal Part No.	Manufacturer
C31	0.1	Ceramic	30	-25+50	906675	Erie 811T/30
C32	100p	Polystyrene	125	2½	911847	Suflex HS10/D
C33	100p	Polystyrene	125	2½	911847	Suflex HS10/D
C34	0.1	Ceramic	30	-10+50	906675	Erie 811T/30
C35	6.4	Electrolytic	25	-10+50	905371	Mullard C426AR/F6.4
C36	470p	Polystyrene	125	2½	911848	Suflex HS10/E
C37	470p	Polystyrene	125	2½	911848	Suflex HS10/E
C38	0.1	Ceramic	30	-10+50	906675	Erie 811T/30
C39	5	Tantalum	25	-20+50	909390	S.T C.TAG 5.0/25
C40	5	Tantalum	25	-20+50	909890	S.T.C.TAG 5.0/25
C41	0.1	Ceramic	30	-25+50	906675	Erie 811T/30

F.S.K. Tone Converter Board (DC39199)

C1	0.22	Polyester	250	10	911842	Mullard C281VV/A220K
C2	0.22	Polyester	250	10	911842	Mullard C281VV/A220K
C3	20	Electrolytic	16	-10+50	909164	Mullard C426AR/E20
C4	20	Electrolytic	16	-10+50	909164	Mullard C426AR/E20
C5	100	Electrolytic	6.4	-10+50	911691	Mullard C426AR/C100
C6	.0015	Ceramic		-20+40	911850	Erie 831 K350081
C7	.039	Polystyrene	30	1	911849	Suflex HS20/B
C8	50	Electrolytic	6.4	-10+50	911844	Mullard C426AR/C50
C9	0.1	Polyester	250	20	909428	Mullard C280AE/P100K
C10	50	Electrolytic	6.4	-10+50	911844	Mullard C426AR/C50
C11	0.22	Polyester	250	10	911842	Mullard C281VV/A220K
C12	0.1	Polyester	250	20	909428	Mullard C280AE/P100K
C13	100	Electrolytic	6.4	-10+50	911691	Mullard C426AR/C100
C14	0.47	Polyester	250	10	911843	Mullard C281VV/A470K
C15	20	Electrolytic	16	-10+50	909164	Mullard C426AR/E20
C16	20	Electrolytic	16	-10+50	909164	Mullard C426AR/E20
C17	200	Electrolytic	15	-10+50	909769	Hunts AW1424C00

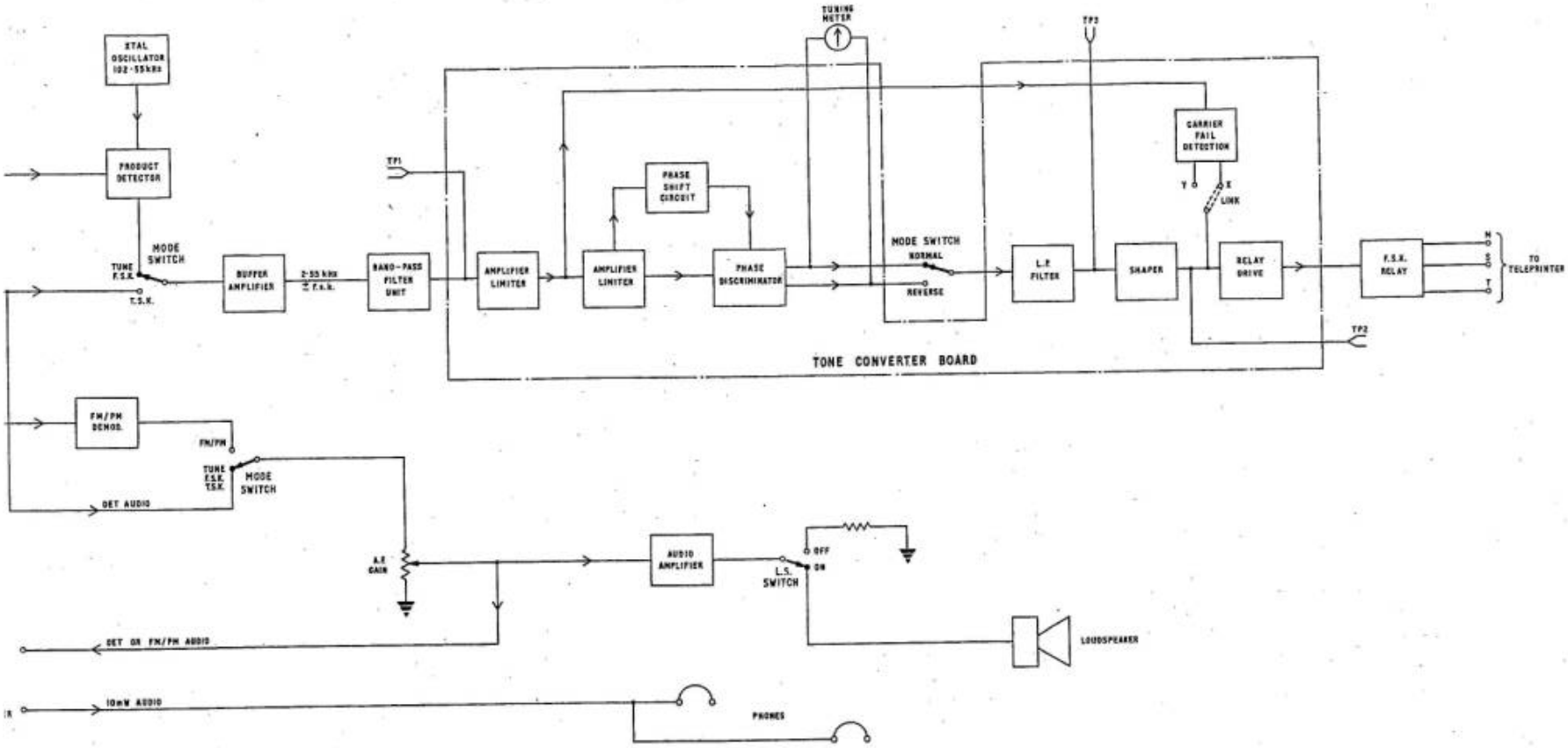
Cct Ref.	Value	Description	Rat	Tol %	Racal Part No.	Manufacturer
		COIL ASSEMBLIES AND TRANSFORMERS				
		Demod, Prod. Detector & Audio Amp. Board (DC. 39395)				
L1		Coil: xtal oscillator			CT34763	
L2		Choke: Prod. Detector			BT38332	
L3		Coil: F.M. Demod.			BT39420	
T1		Transformer: F.M. Demod.			BT39419	
		F.S.K. Tone Converter Board. (DC.39199)				
L1		Coil: R.F. moulded: 120µH			911918	Delwan 4500-50
L2		Coil assembly			BT39609	
L3		Coil assembly			BT39430	
T1		Transformer			911854	Tele-Signals XA10001
T2		Transformer			911855	Tele-Signals XA10002
T3		Transformer			911854	Tele-Signals XA10001
T4		Transformer			911854	Tele-Signals XA10001
		TRANSISTORS				
		Demod, Prod. Detector & Audio Amp. Board (DC39395)				
VT1		n.p.n.			910093	Texas 2S95A
VT2		n.p.n.			909927	Texas 2N3711
VT3		n.p.n.			900656	Texas 2S733
VT4		n.p.n.			909927	Texas 2N3711
VT5		p.n.p.			910681	Texas 2N3703
VT6		n.p.n.			910682	Texas 2N3705
VT7		n.p.n.			910093	Texas 2S95A
VT8		n.p.n.			910093	Texas 2S95A
VT9		n.p.n.			910093	Texas 2S95A
VT9		n.p.n.			910093	Texas 2S95A
VT10		n.p.n.			910093	Texas 2S95A
		F.S.K. Tone Converter Board				
VT1 to VT13		p.n.p.			911851	Texas 2N1305

Cct Ref.	Value	Description	Rat	Tol %	Racal Part No.	Manufacturer
		DIODES				
Demod, Prod. Detector & Audio Amp. Board (DC 39395)						
D1		Semi-conductor			908349	Hughes HD1871
D2		Zener: 4.7v ± 5%			909717	Mullard OAZ240
D3		Zener: 8.2v ± 5%			910116	Mullard OAZ246
D4		Semi-conductor			906720	Texas 1S44
D5		Semi-conductor			908349	Hughes HD1871
D6		Semi-conductor			908349	Hughes HD1871
F.S.K. Tone Converter Board (BC39199)						
D1		Semi-conductor: general purpose			900620	Mullard OA200
D2		Semi-conductor: general purpose			900620	Mullard OA200
D3		Semi-conductor: general purpose			900620	Mullard OA200
D4		Semi-conductor: general purpose			900620	Mullard OA200
D5		Semi-conductor: general purpose			900620	Mullard OA200
D6		Semi-conductor: general purpose			900620	Mullard OA200
D7		Semi-conductor: general purpose			900620	Mullard OA200
D8		Semi-conductor: general purpose			911853 *	General Electric 1N91
D9		Semi-conductor: general purpose			900620	Mullard OA200
D10		Semi-conductor: general purpose			900620	Mullard OA200
D11		Semi-conductor: general purpose			900620	Mullard OA200

* Alternative for D8 is Motorola CV8540.

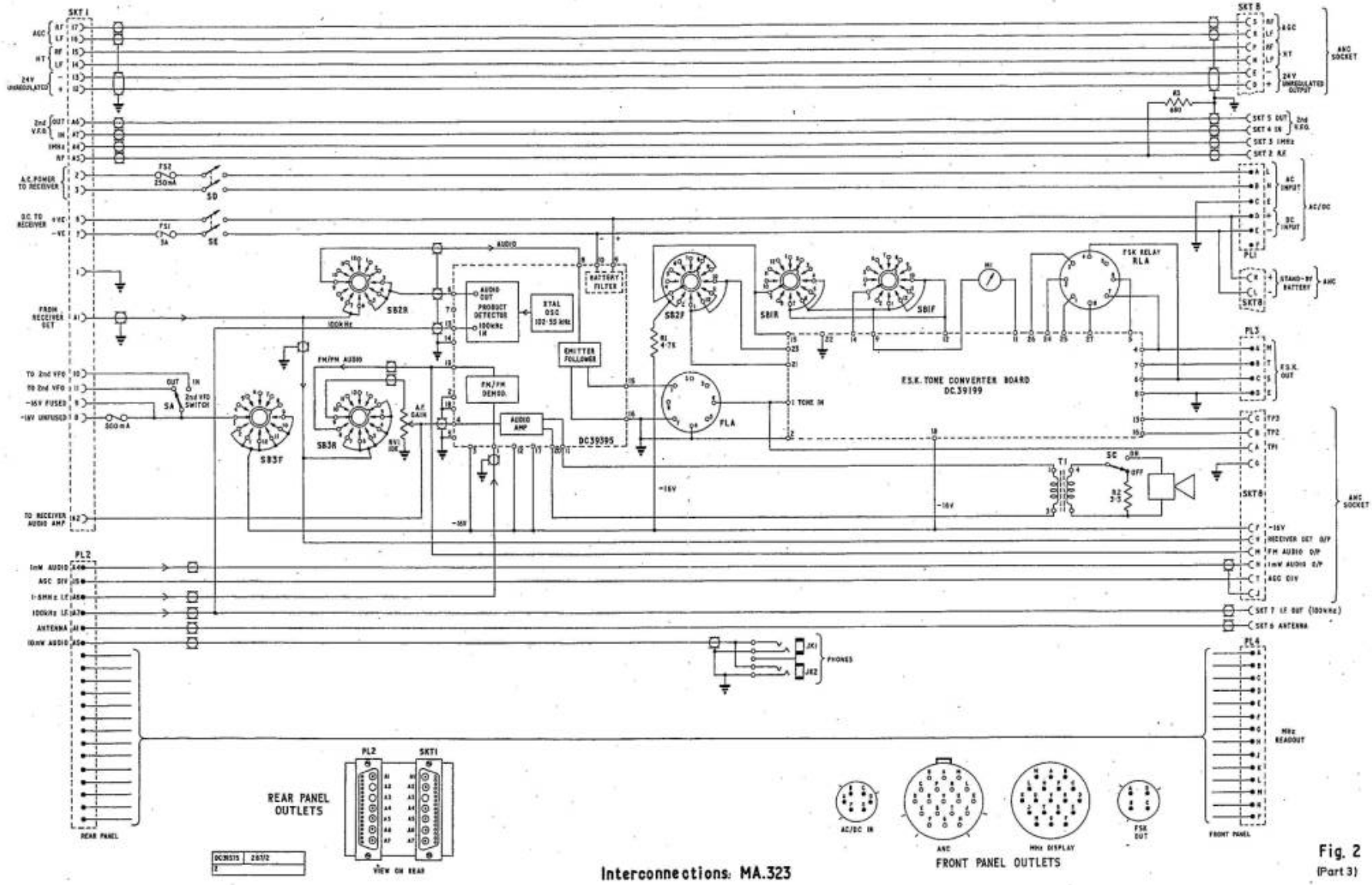
MISCELLANEOUS ITEMS

Demod, Prod. Detector & Audio Amp. Board (DC39395)			
X1	Integrated circuit element	912160	Fairchild μA702C
XL1	Quartz crystal	38335	
	Holder for XL1	900397	McMurdo X2/UG



Signal Flow Diagram: MA.323

Fig.1
(Part 3)



Interconnections: MA.323

Fig. 2
(Part 3)

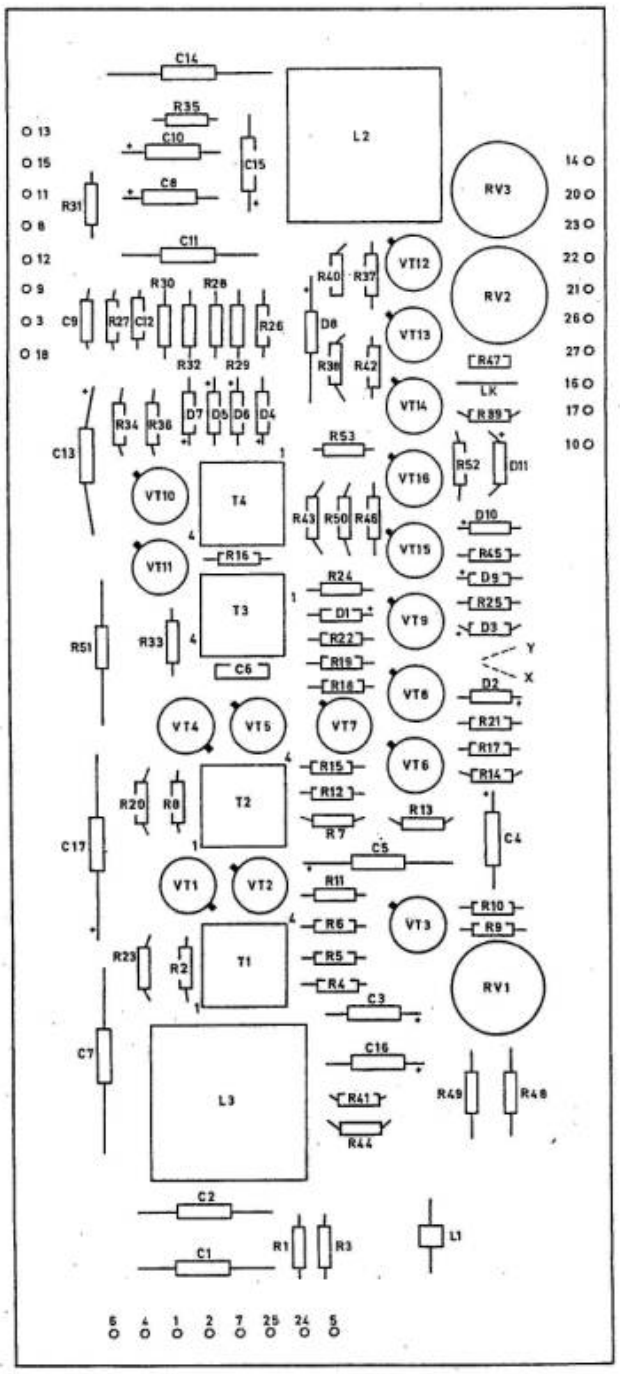
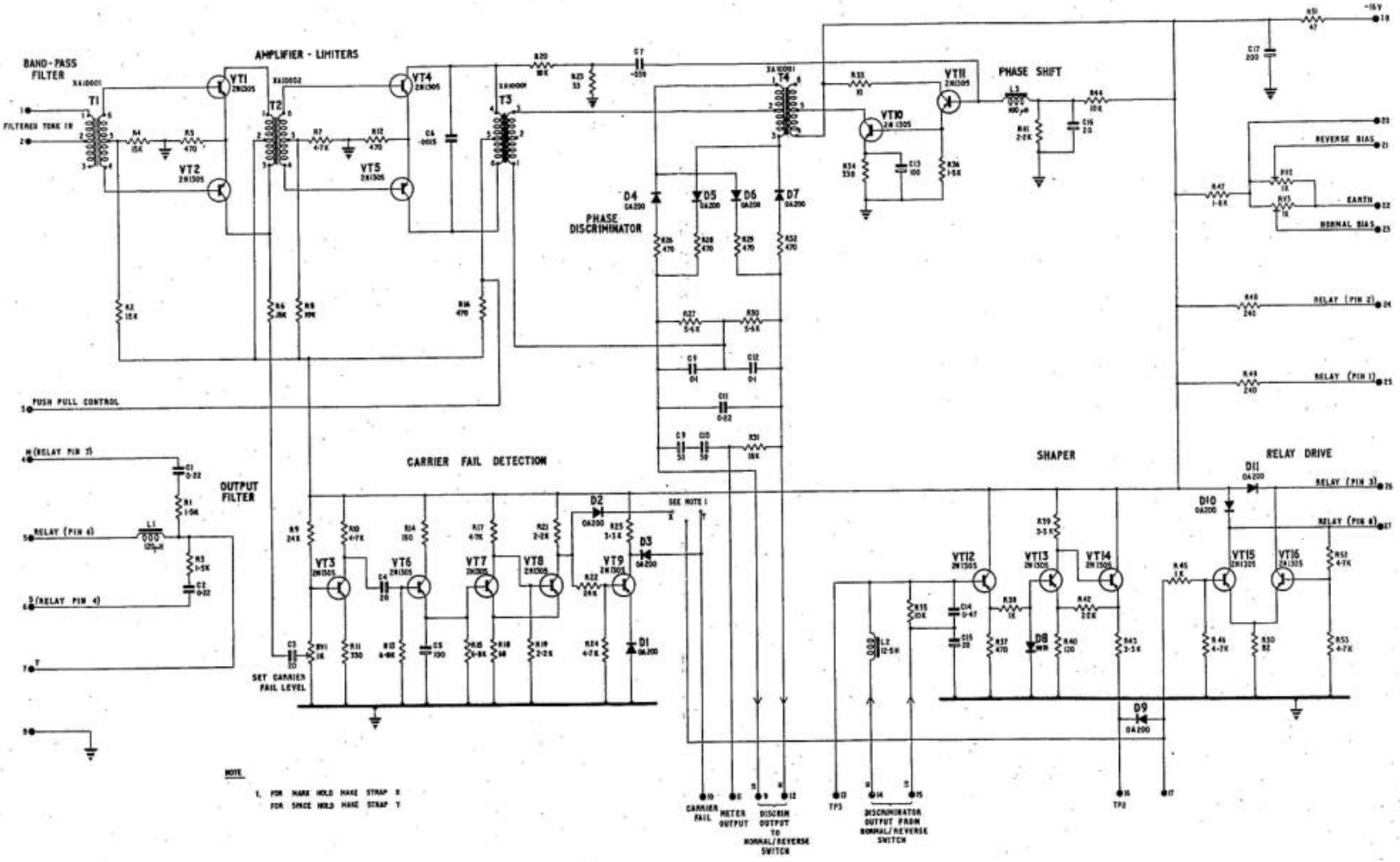


Fig. L-3
(Part 3)

Component Layout
F.S.K. Tone Converter Board
(Circuit Fig. 3)

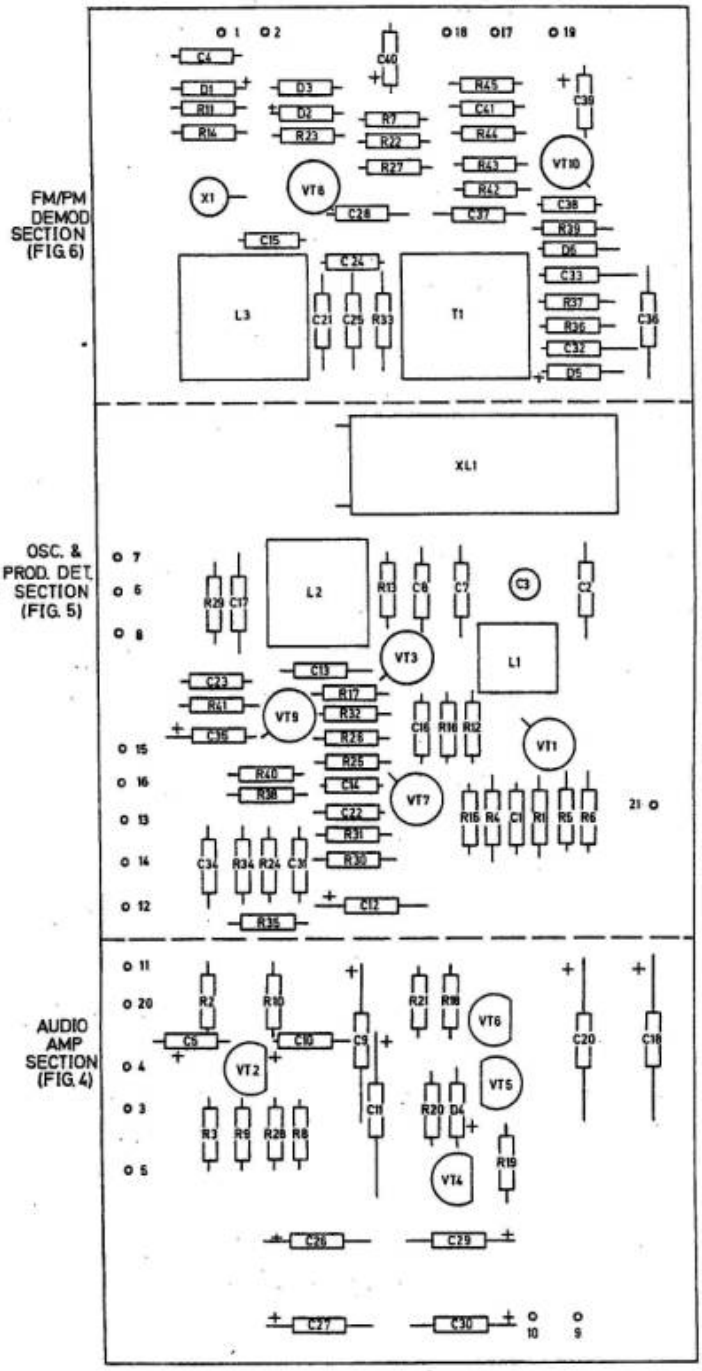
DD39277 | 287/7
1



DC39109	2813/3
2	

Circuit: Frequency Shift Tone Converter Board

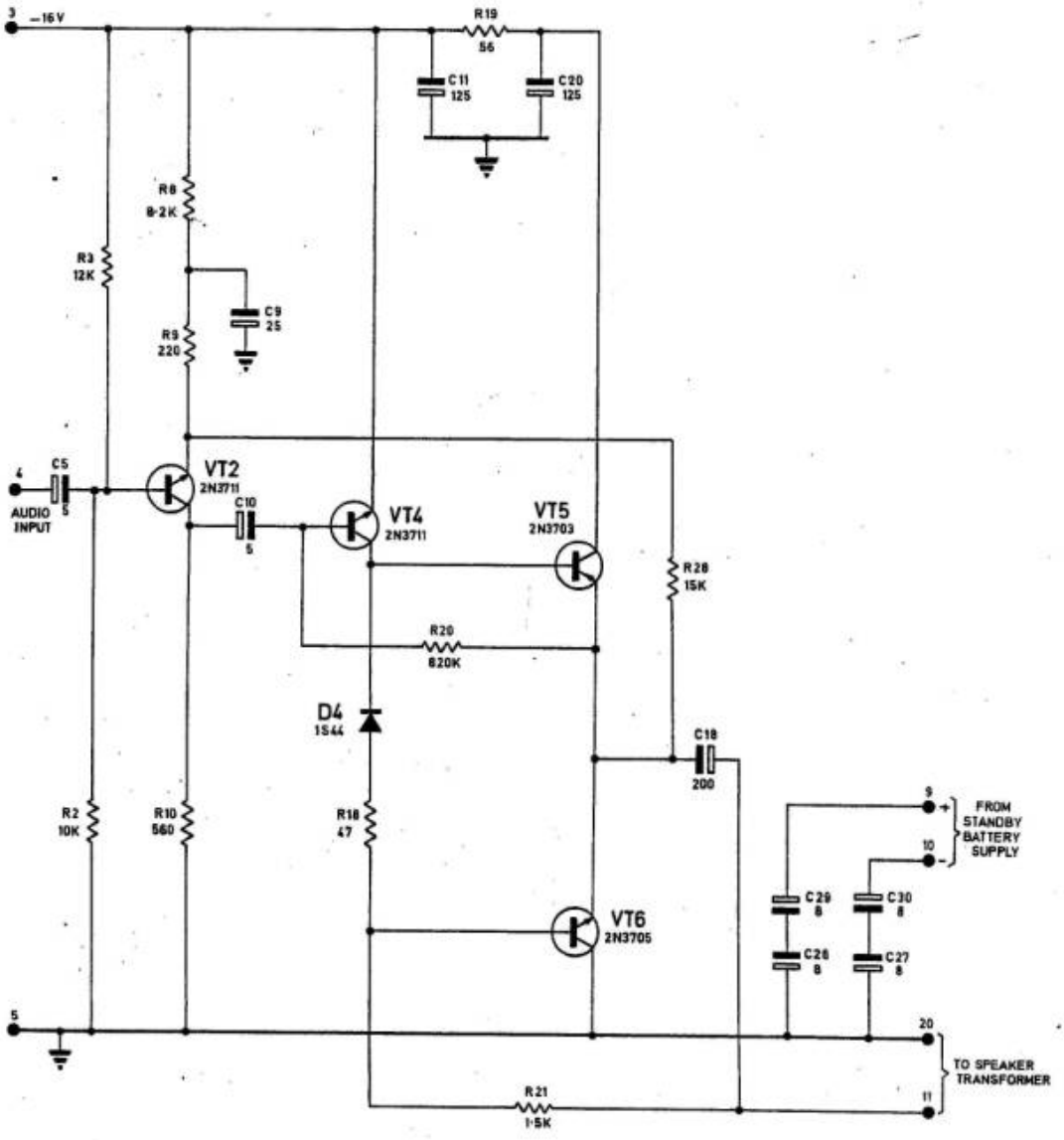
Fig. 3
(Part 3)



Component Layout: FM/PM Demod. Product Detector & Audio Amplifier Board (MA.323)

Fig. L-4
(Part 3)

OD394.06	287/8
2	



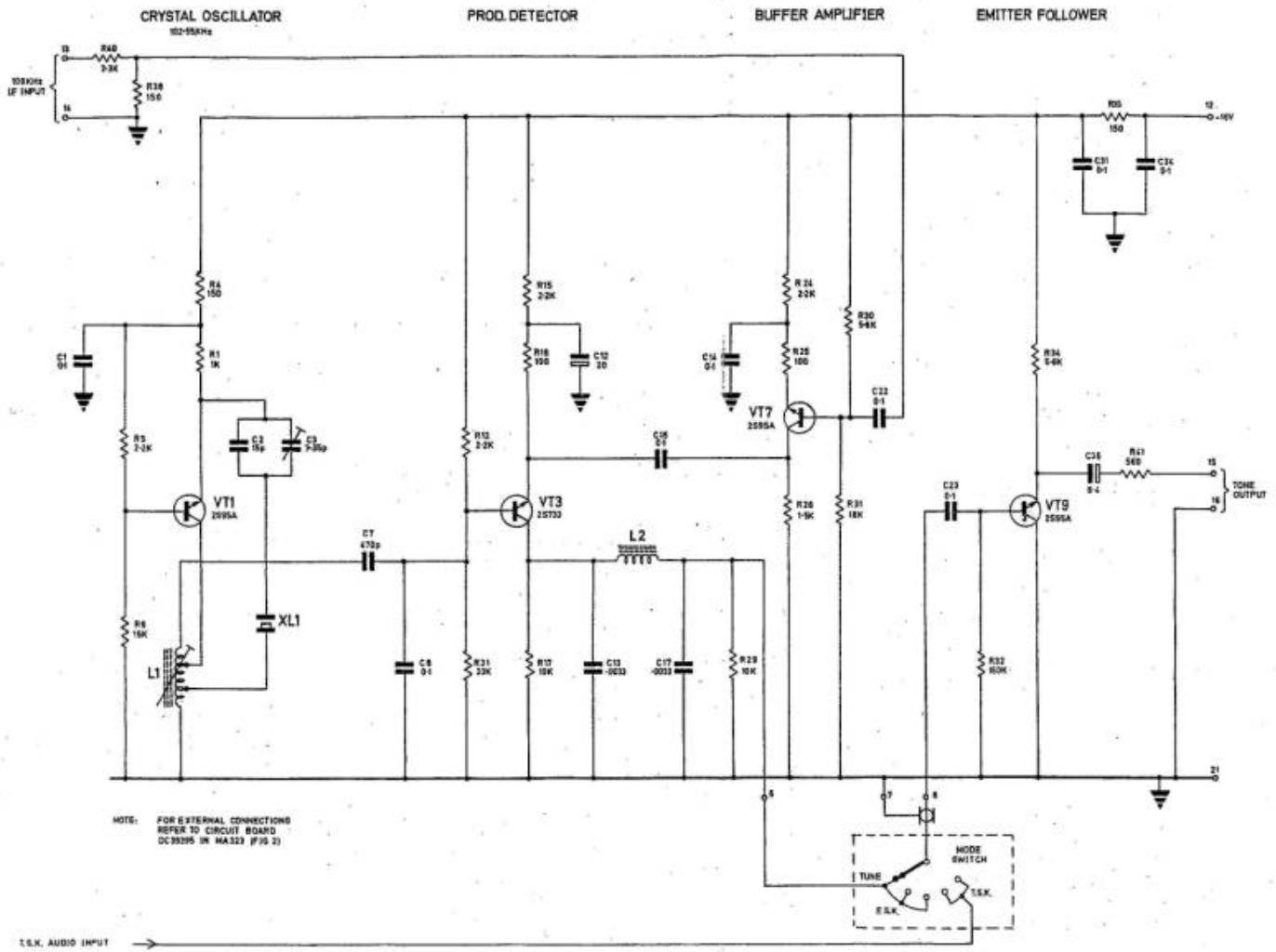
NOTE: FOR EXTERNAL CONNECTIONS
REFER TO FIG. 2

DC39395	2 of 4
3	

Circuit: Audio Amplifier

(PART OF BOARD DC39395 IN MA323)

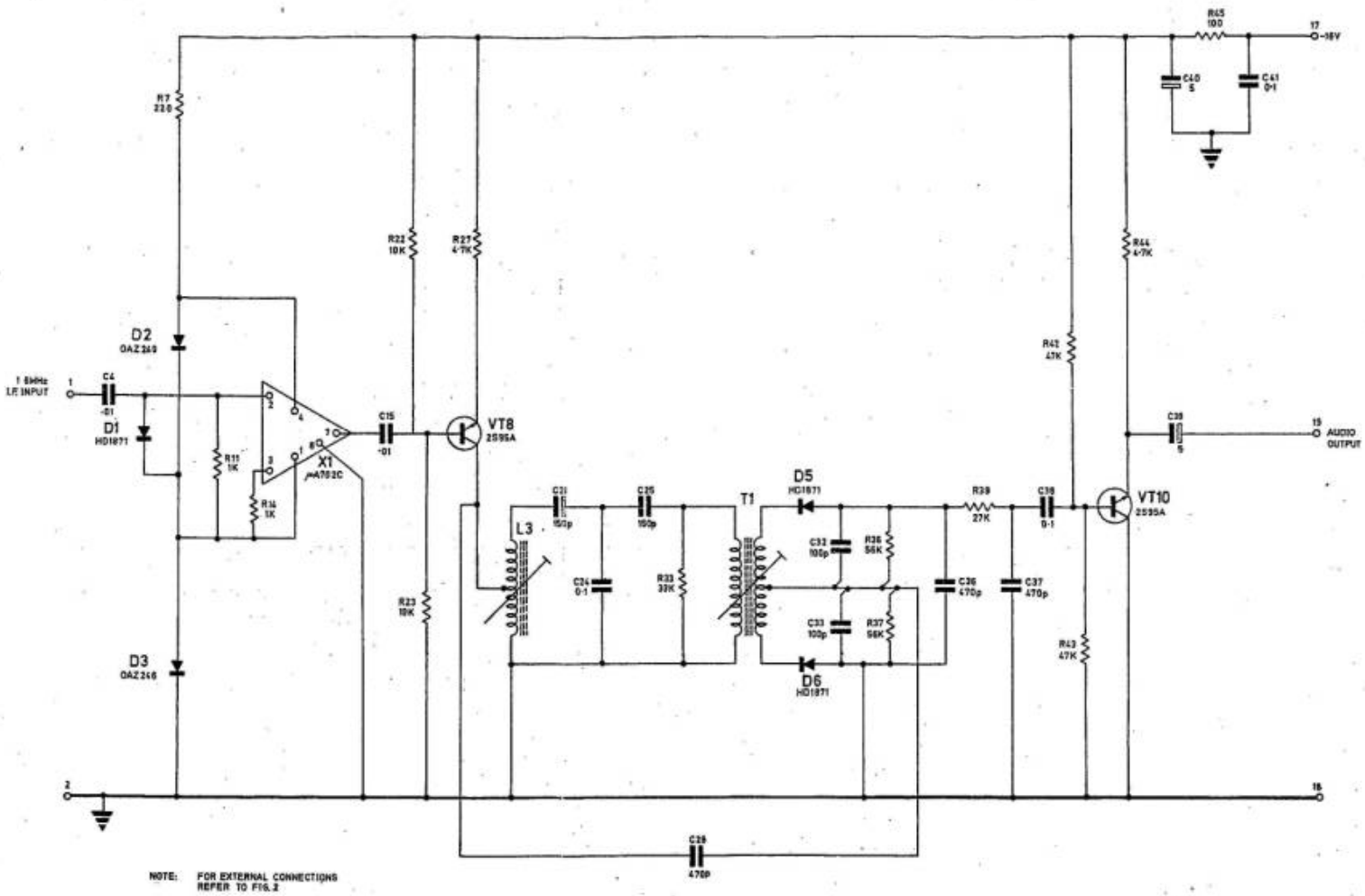
Fig. 4
(Part 3)



DC39395 2877/5
3

Circuit: Oscillator And Product Detector
(PART OF BOARD DC39395 IN MA323)

Fig. 5
(Part 3)



NOTE: FOR EXTERNAL CONNECTIONS REFER TO FIG.2

DC39395	297/6
3	

Circuit FM/PM Demodulator

(PART OF BOARD DC39395 IN MA.323)

Fig. 6
(Part 3)