multitone

TECHNICAL MANUAL

for

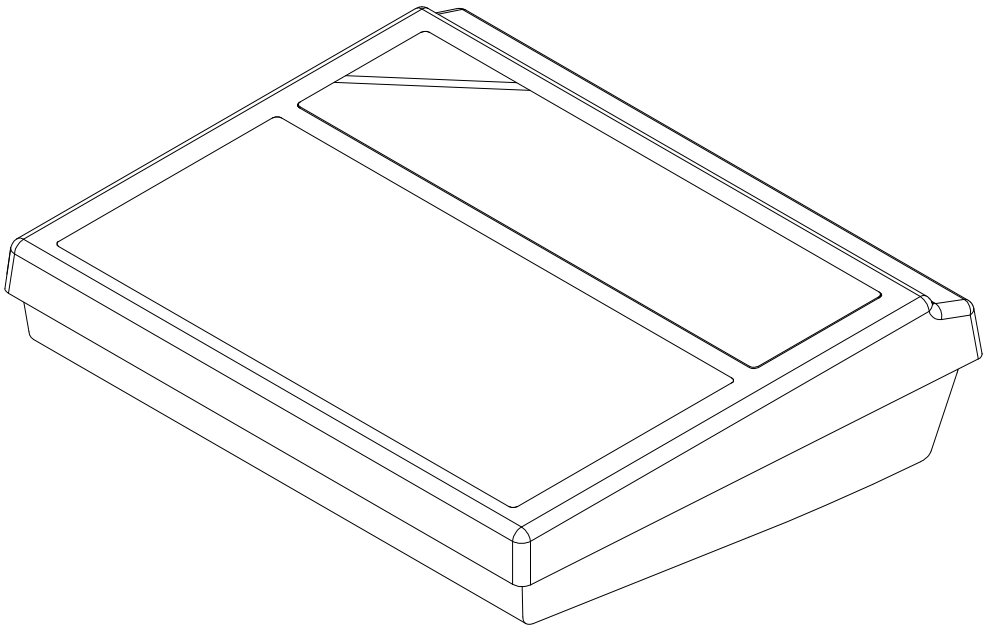
UHF TRANSMITTER

MODEL RPT 633

and

UHF SERIAL ENCODER

MODEL RPE 673



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4-1	1	7-3/4	1	A1-21	1 AL1
4-2	1	7-5/6	1	A1-22	1 AL1
4-3	1	7-7/8	1	A1-23	1 AL1
4-4	1	7-9/10	1	A1-24	1 AL1

SAFETY SUMMARY

The following information applies to both operating and servicing personnel. General Warnings and Cautions will be found throughout the manual where they apply.

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

CAUTION statements identify conditions or practices that could result in equipment damage.

WARNING

GREAT CARE MUST BE TAKEN TO AVOID BREAKING OPEN THE ENCAPSULATION OF TR10 ON THE TRANSMITTER BOARD WHEN REPAIR OR COMPONENT REPLACEMENT IS BEING CARRIED OUT, AS THIS COMPONENT CONTAINS TOXIC BERYLLIUM OXIDE.

CAUTIONS

DO NOT MOUNT OVER A HEATER OR RADIATOR, OR IN DIRECT SUNLIGHT AND ENSURE A DRY ENVIRONMENT.

STATIC SENSITIVE DEVICES ARE USED WITHIN THIS EQUIPMENT. CARE MUST BE TAKEN TO ENSURE DAMAGE TO THESE DEVICES IS NOT CAUSED BY HIGH LEVELS OF STATIC ELECTRICITY. SPARE BOARDS OR COMPONENTS SHOULD BE STORED IN ANTI-STATIC PACKAGING WHEN NOT INSTALLED IN THE EQUIPMENT.

SECTION 1

INTRODUCTION AND SPECIFICATION

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1. INTRODUCTION

2. ROLE OF THE TRANSMITTER

4. PHYSICAL CONSTRUCTION

SPECIFICATIONS
5. Transmitter
6. Connectors
7. Physical Characteristics
8. Operational Enviroment
9. Power Supply

10. CRYSTAL FREQUENCY CALCULATION

INTRODUCTION

1. Sections 1 to 7 of this manual outline the installation and operation of the Radio Paging Transmitter model RPT 633. Appendix 1 details the Serial Encoder model RPE 673 and provides appropriate cross references to the main part of this manual (Sections 1 to 7) where functionality is common.

ROLE OF THE TRANSMITTER

2. The transmitter is designed for operation with the RPE 340-series of telephone coupled encoders, or from the encoder output of the Access 3000, which together provide radio coverage with speech for smaller sites. The RPT 633 operates in the UHF band (420MHz to 470MHz), divided into three sub-bands, and has an output of 2.5 Watts.

3. Digital control reduces the wiring between the encoder and transmitter to a single pair for tone and display systems. A four wire connection is required for speech systems.

PHYSICAL CONSTRUCTION

4. The transmitter consists of two boards, a transmitter board mounted in the base assembly and a VOX keying module mounted in the cover assembly.

SPECIFICATIONS

Transmitter

5. The following describes the performance and physical characteristics of the RPT 633 UHF transmitter:

a)	Frequency Range:		420MHz to 470MHz
b)	Frequency Bands:		Band 1 420MHz to 424.99MHz Band 2 425MHz to 446.99MHz Band 3 447MHz to 470MHz
c)	Channel Spacing:		Factory set to 10kHz, 12.5kHz, 20kHz or 25kHz
d)	Frequency Stability	(normal):	±5ppm from -10EC to +55EC
		(high stability):	±1.5ppm from -10EC to +55EC ±2ppm from -25EC to +55EC ±2.5ppm from -30EC to +60EC
e)	Output Power:		2.5W ±1dB
f)	Duty Cycle:		50% (Max transmit time 2.5 minutes)
g)	Nominal Load Impedance:		50 Ohms
h)	VSWR Protection:		Protection against short term removal of antenna (maximum of five calls with antenna disconnected).

Connectors

6. The following connectors are mounted on the transmitter board:

a)	PSU	- SK3:	2.1mm jack socket
b)	Digital	- SK2:	2-way modular keyed connector
c)	Analogue	- SK1:	2-way modular keyed connector
d)	RF	- SK4:	TNC socket

Physical Characteristics

7. The dimensions and weight of the transmitter are as follows:

a)	Overall Dimensions:	Width	235mm (9.5in.)
		Depth	210mm (8.3in.)
		Height	90mm (3.6in.)
b)	Weight (Excluding PSU):	1.2kg (2.65lbs.)	

Operational Environment

8. The environmental characteristics of the transmitter are as follows:

a)	Temperature Range:	Operational -10EC to +50EC
b)	Humidity:	0-90% RH (non-condensing)
c)	Altitude:	Up to 2000 metres

Power Supply

9. 17V 0.8A DC Nominal supplies from Multitone Power Supplies:

0301-0605 240V (UK)
0301-0606 220V (EURO)
0301-0607 110V (US)

CRYSTAL FREQUENCY CALCULATION

10. To calculate the carrier crystal frequency the following formula should be used:

$$\text{Crystal Frequency} = \frac{\text{Operating Frequency}}{A}$$

Where A = 56 for Band 3
or A = 48 for Bands 1 and 2

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SECTION 2

OPERATING INSTRUCTIONS

The transmitter is fully automatic in use and operation is limited to switching on the mains supply.

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SECTION 3

TECHNICAL DESCRIPTION

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7. Crystal Oscillator
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INTRODUCTION

1. The RPT 633 Transmitter accepts analogue or digital information which is modulated onto an UHF signal. The transmitter output frequency is produced by doubling the frequency of a voltage controlled oscillator (VCO). The VCO is locked to a reference crystal oscillator which is frequency modulated by either the Data or Audio input signals. A basic block diagram is shown at Figure 1.

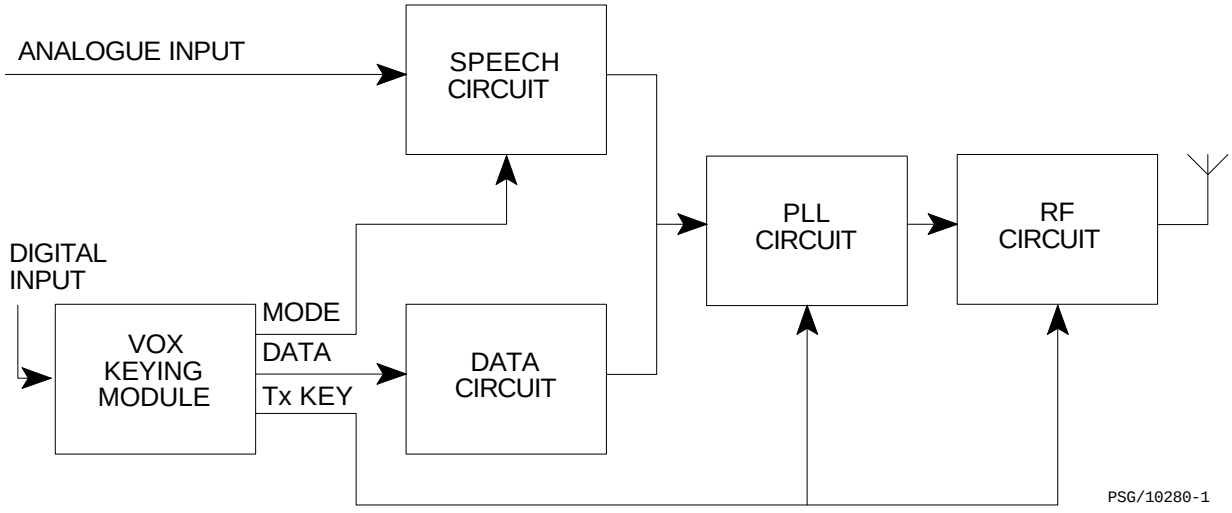

Figure 1: Block Diagram

TRANSMITTER

Power Supplies

2. A nominal 17V DC power supply is fed into the board at SK3 where it is filtered by L14, L15, L16, C67 and C68. Fixed voltage regulators IC3 and IC4 provide 12V for the transmitter circuit and output transistor respectively, while regulator IC5 produces 5V for the transmitter and VOX Keying module. Integrated circuit IC2 produces 8.2V for the VCO and buffer amplifiers and IC11 acts as a voltage converter to produce -11V from a 12V input.

Mode Select Circuit

3. With the mode input at 5V the Speech mode is selected. The output of IC6d is low, inhibiting the passage of Data by shorting the data path to 0V via D11 and enabling the passage of Audio by forward biasing D9. Variable resistor RV3 together with R102, R103, R108 and R116 hold the output of IC12d at approximately 0V, which in turn sets the voltage on varactor diode D8 to give the nominal carrier frequency of the transmitter.

4. With the mode input at 0V the Data mode is selected and the output of IC6d goes high, inhibiting the audio path by reverse biasing D9 and allowing data to pass from IC6b to IC6a.

Audio Input

5. The audio input is amplified and pre-emphasised by IC13b before passing through the audio gate D9 to the limiting amplifier IC13a, the output of which is limited to approximately 10V peak to peak. After limiting, the maximum speech deviation is set by RV4. The signal is then passed to TR12, IC10b and associated components, which form a modified 0.4dB four section Chebyshev Filter, which has a cut off frequency of 2.6kHz and a modified frequency response to give an approximate 2dB lift at 2.55kHz. This compensates for the fall off in deviation caused by the characteristics of the phase locked loop. Filtered audio passes through summing amplifier IC10a and unity gain buffer IC10d to modulating varactor diode D8. Summing amplifier IC10a also superimposes the audio signal onto the DC voltage produced by IC12b.

Data Input

6. Input data may be selected to either pass through IC6c, which inverts it, or bypass IC6c depending on the setting of data polarity selector link LK3. The data passes through IC6b and IC6a, the output of which switches between being high impedance or low impedance to 0V. The frequency of the crystal oscillator does not vary linearly with the voltage on D8 so the values of resistors R102, R103, R108, R116 and RV5 have been chosen to give a voltage swing, at the output of IC12d, of approximately +3V to -4.8V as the voltage on the input of IC6b switches between 0V and 5V. The data signal then passes through IC12a, IC12b and associated components, which form a fourth order Bessel filter, which give the data edges a controlled risetime of 250µs. After filtering, the signal passes through IC10a and IC10d to varactor diode D8, RV2 being used to set the data deviation level. The whole of this modulation path is DC coupled so that a constant logic level on the input produces a constant deviation of the output frequency.

Crystal Oscillator

7. The reference oscillator TR11 is of the crystal controlled Colpitts type, operating on the fundamental frequency of the crystal which is 1/48th of the output frequency for Bands 1 and 2 and 1/56th of the output frequency for Band 3. The oscillator frequency is trimmed by VC5. Varactor Diode D8 provides the modulation, The capacitance of the diode, and therefore the oscillator frequency varies with the voltage across the diode. The output of the oscillator is buffered by IC8b.

High Stability Version

8. On the high stability version a temperature controlled crystal oven OV1 is fitted which covers the special high temperature crystal.

Voltage Controlled Oscillator (VCO)

9. Transistor TR2 is a Colpitts oscillator running at half the carrier frequency, the frequency being determined by L1, C4, C5, C6 and the capacitance of the dual varactor diode D1. The output of the oscillator is buffered by IC1 and TR4.

Phase Locked Loop (PLL)

10. The VCO output frequency from TR4 is divided by 256 in IC9 and then buffered by linear amplifiers IC8c and IC8d before being fed to IC7. Within IC7 the signal is further divided by either 6 (for output frequencies less than 447Mhz) or by 7 by a programmable divider, the division ratio being set by shorting link LK2, 1-2 equals divide-by-6 and 2-3 equals divide-by-7. Also, within IC7, the crystal oscillator frequency is divided by 64 before being fed, together with the VCO signal, to a phase/ frequency comparator. E.g. for a carrier frequency of 448MHz the crystal oscillator frequency is 8MHz which gives an input to the comparator of 125kHz. The VCO is running at 224MHz which is divided by IC9 to give 875kHz and then by IC7 (LK2 2-3) to give 125kHz. The PLL control output is fed out of IC7 at pin 13 and via loop filter R47, R48, C69, and C70 to the VCO. The filter controls the dynamic behaviour of the loop, the modulation frequency response and the level of the PLL reference frequency sidebands. When the PLL has achieved lock it sends a high in-lock signal from IC7 pin 12, via delay circuit R49, R50, C71 and D5, the buffers IC8a and IC8f, to forward bias TR5 and TR8. D5 allows C71 to discharge quickly when the lock fail condition occurs and to charge slowly when the in-lock condition is restored.

Transmitter Keying

11. Normal transmitter keying is achieved by fitting a shorting link across LK1 pins 2-3. In the quiescent state the Tx Key line is at 5V, the output of IC6f is at 0V and the bias voltages of TR5 and TR8 are shorted to 0V. When the VOX keying module sets the Tx Key command to logic low the output of IC6f goes high impedance. Forward bias is applied to TR5 and TR8 providing the PLL is in lock.

12. Provision has been made for an alternative method of keying the transmitter which keys the VCO off when the transmitter is not in use, thus removing any carrier components in the standby mode. This is achieved by fitting LK1 pins 1-2. A 0V signal on the Tx Key line then turns on TR3, via inverter IC6f, which in turn turns on TR1 and supplies 8.2V to the VCO transistor TR2.

Frequency Multiplier

13. Transformer T1, enabled by the in-lock signal turning on TR5, provides a balanced feed to the multiplier diodes D3 and D4 which pass the desired transmit output frequency and reject the fundamental frequency and odd harmonics of it. The desired frequency is passed to TR6 for amplification

Band Pass Filter

14. This is made up of two cascaded two-section helical filters FL1 and FL2. The filters reject any VCO leakage and any unwanted frequencies generated by the multiplication process.

Driver Stages

15. Transistors TR7, TR8, TR9 amplify the filtered signal up to a level of approximately 250mW, inter stage matching being optimised by VC1 and VC2. The output power from TR9 and ultimately the output power of the transmitter, is controlled by RV1, while the bias for TR8 is controlled by the keying line ensuring a high attenuation of the output signal when the transmitter is keyed off.

Output Amplifier

16. Matching between TR9 and TR10, operating as a class C amplifier, is optimised by VC3. The output of TR10 is matched to the output filter by C50, C51 and a length of micro-strip line, the filter being formed by C53 to C60 and the micro-strip lines. Any harmonics of the output frequency are attenuated by the filter and any residual VCO signal is attenuated by VC4 and L13. The output power at SK4 is 2.5W.

VOX KEYING MODULE

General

17. The VOX keying module decodes encoder presented serial data and controls the transmitter. Interconnection between the Transmitter PCB and VOX Keying PCB is as shown in Figure 2.

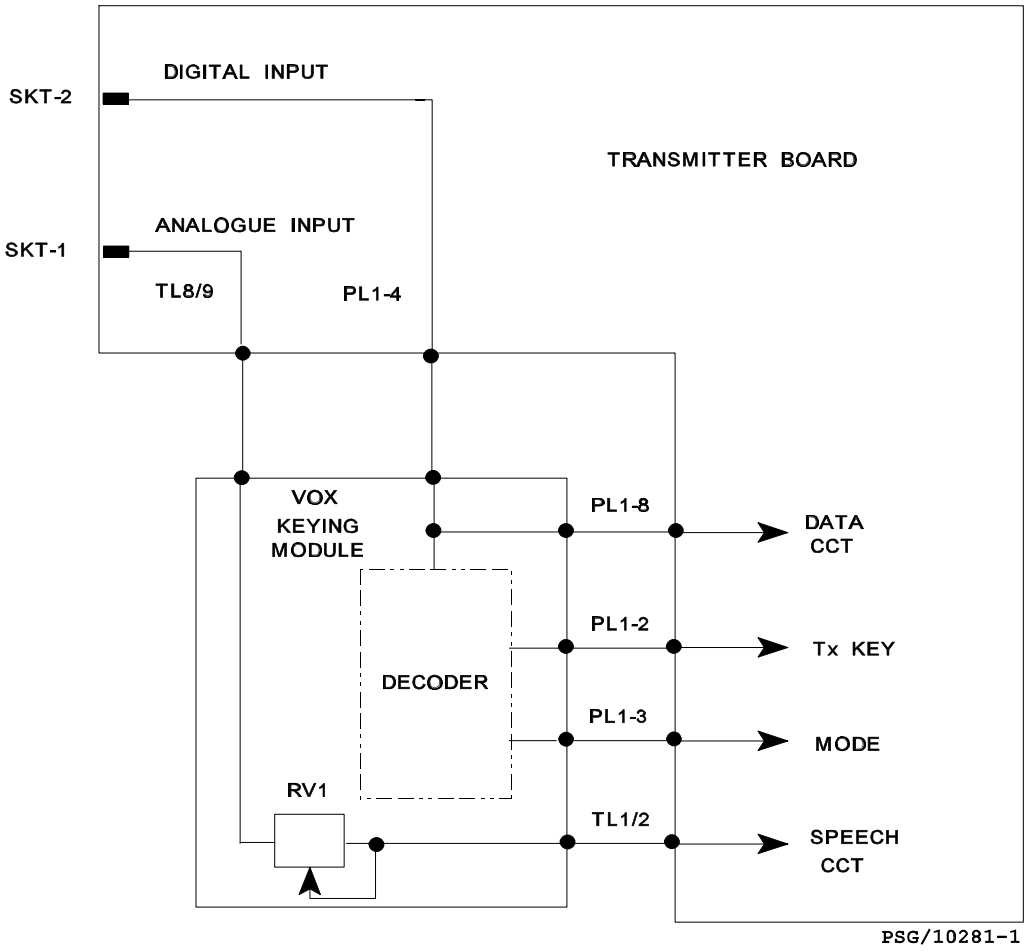

Figure 2: Module Interconnection Diagram

Analogue Path

18. Analogue signals are input via external connector SK1 of the transmitter PCB and internal connectors TL8 and TL9. The level is adjusted via RV1 (VOX keying module PCB) and output is via connectors TL1 and TL2 to the speech input of the transmitter PCB. This presents the correct audio level to the transmitter modulation circuits.

Data Mode

19. Data signals are input via external connector SK2 of the transmitter PCB, buffered by TR14 and then fed, via the internal connector PL1-4, to the VOX keying module.

Decoding

20. The VOX keying module decodes the incoming encoder serial data into the two logic signals shown in Table 1.

Table 1: VOX Keying and Mode Signals

NOTE: *Tx KEY is active low.*

Tx KEY (PL1-2)	MODE (PL1-3)	TRANSMITTER STATE
Low	Low	Data Mode
Low	High	Speech Mode
High	Low/High	Off

OPERATION

General

21. Components IC1a and IC1b are negative edge retriggerable monostables having output pulse widths of 4.5ms (OA) for the Mode signal and 2ms (OB) for the CLK signals to IC2. TR1 and associated components are not used in these transmitters and are therefore by-passed via LK1 and LK2.

Power-Up

22. At power-up R4 and C5 hold IC2 CLR input low. This causes IC2 pin 3 (QC) to route a low signal to IC3-6. Integrated circuit IC1a-6 routes a low signal to IC3-5, which results in the Tx Key signal at PL1-2 remaining high and holding the transmitter keyed off.

Data Path

23. To key the VOX keying module for data mode, the incoming data stream, via PL1-4, LK1, LK2, TP2 to IC1a-5, retriggers IC1a for the duration of the data. IC1a-7 routes a low Mode signal via PL1-3 to set the transmitter into data mode whenever data is present. Integrated circuit IC1a-6 (OA) routes a high signal to IC3-5. This results in a low Tx Key signal via LK4 illuminating D3 and, via PL1-2, Keying on the transmitter.

Switching to Speech

24. To switch into the speech mode, either as part of a speech paging call or for open channel speech, the encoder generates two 1ms pulses 4ms apart as shown in Figures 3 and 4.

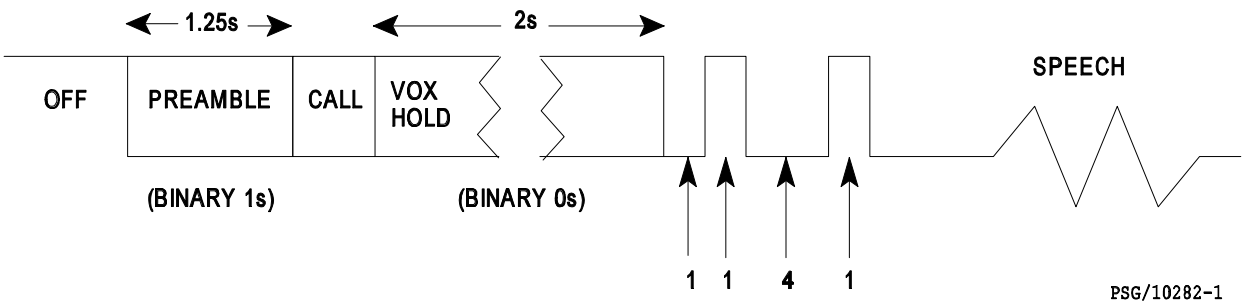

Figure 3: Speech Call

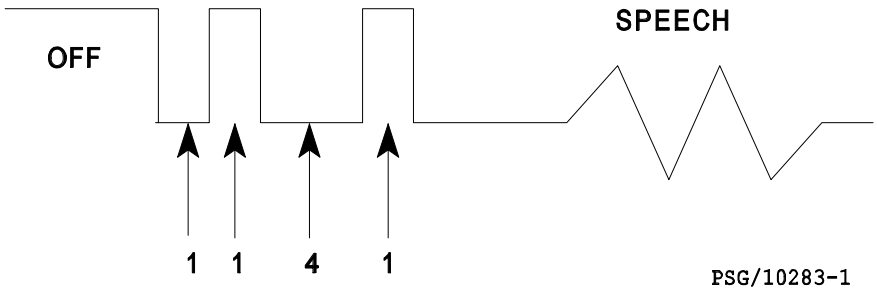

Figure 4: Open Channel Speech

25. The pulses are inverted at PL1-4 and the leading edge of the first pulse results in IC1-6 (OA) going high which switches PL1-2 low for 4.5ms (see Figure 3). The trailing edge of the first pulse results in IC1-7 and IC3-1 presenting two lows to IC3-12 and IC3-11 respectively, so that IC2-1 goes high. This has no immediate effect on the circuit since the resetting of IC1a after 4.5ms removes one of the two low states which caused J to go high.

26. The negative-going edge at IC1-6 clocks IC1b so that IC1-10 goes high for 2ms. The trailing edge of the second pulse sets IC2-1 high again, but this time IC1b resets after 2ms, clocking IC2-12 and resulting in IC2-3 going high. This ensures that IC3-4 remains low during the speech mode.

27. 4.5ms after the commencement of the second pulse, IC1-7 resets high so that the transmitter is now keyed in the speech mode.

28. Timings of IC1a and IC1b, controlled by RV2 and RV3 respectively, are absolutely crucial to the reliable switching of the circuit into speech and must be accurately set.

Switching from Speech to Data

29. The speech cancel signal consists of 1.25s of binary 1s. In the speech mode IC1-7 is high with the result that IC2-1 is low. The negative-going leading edge of the first bit of data clocks IC1a so that IC1-7 goes low, switching PL1-3 to the low DATA mode. The negative-going transition at IC1-5, IC1a times out with the result that:

    a) IC1-7 goes high putting PL1-3 into the quiescent condition.

    b) IC1-6 clocks IC1b for 2ms.

    c) The combined lows at PL1-4 and IC1-6 result in IC2-4 going high.

30. As IC1-10 goes low again, after 2ms, it clocks IC2 with the result that IC2-3 goes low, IC3-4 goes high and PL1-2 returns to its quiescent high condition.

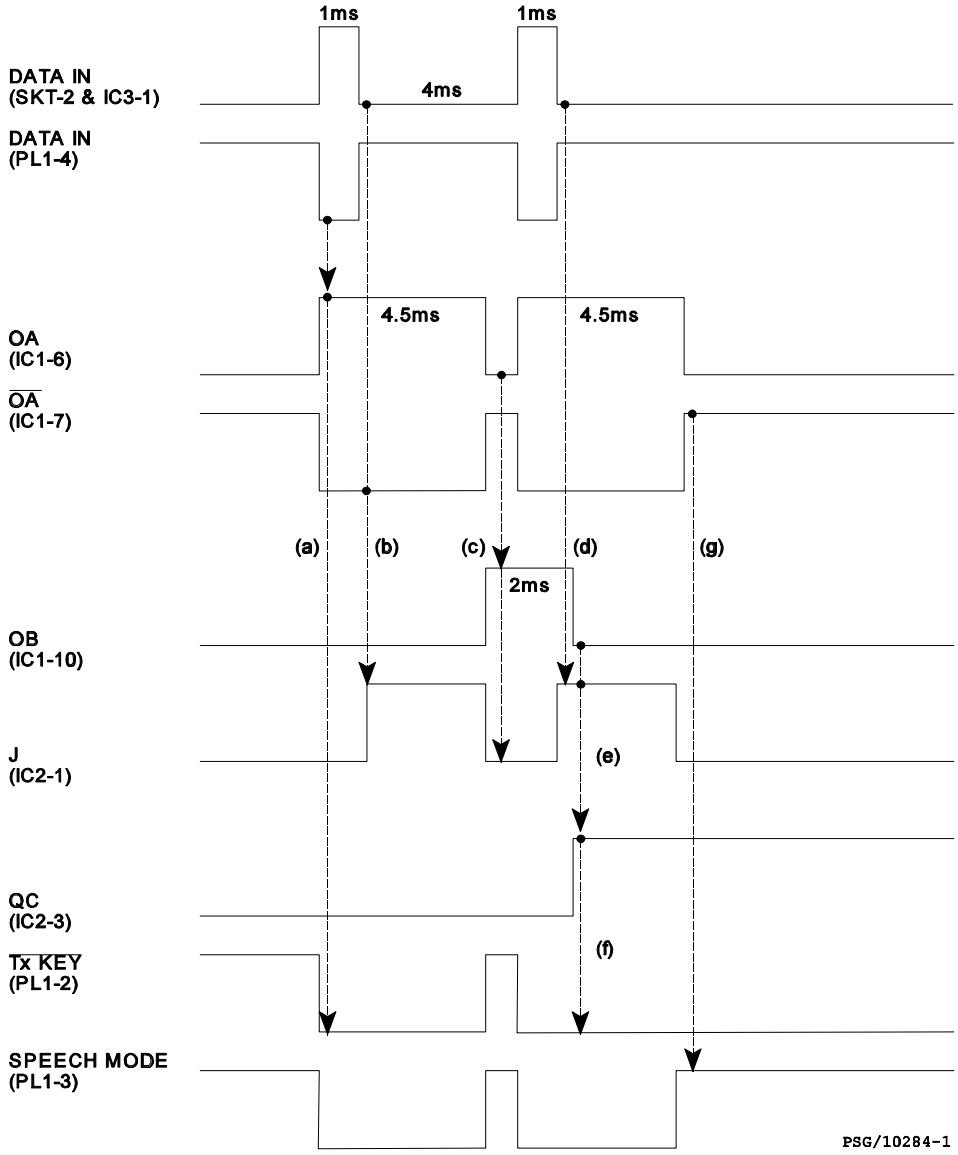

Figure 5: Switching Into Speech

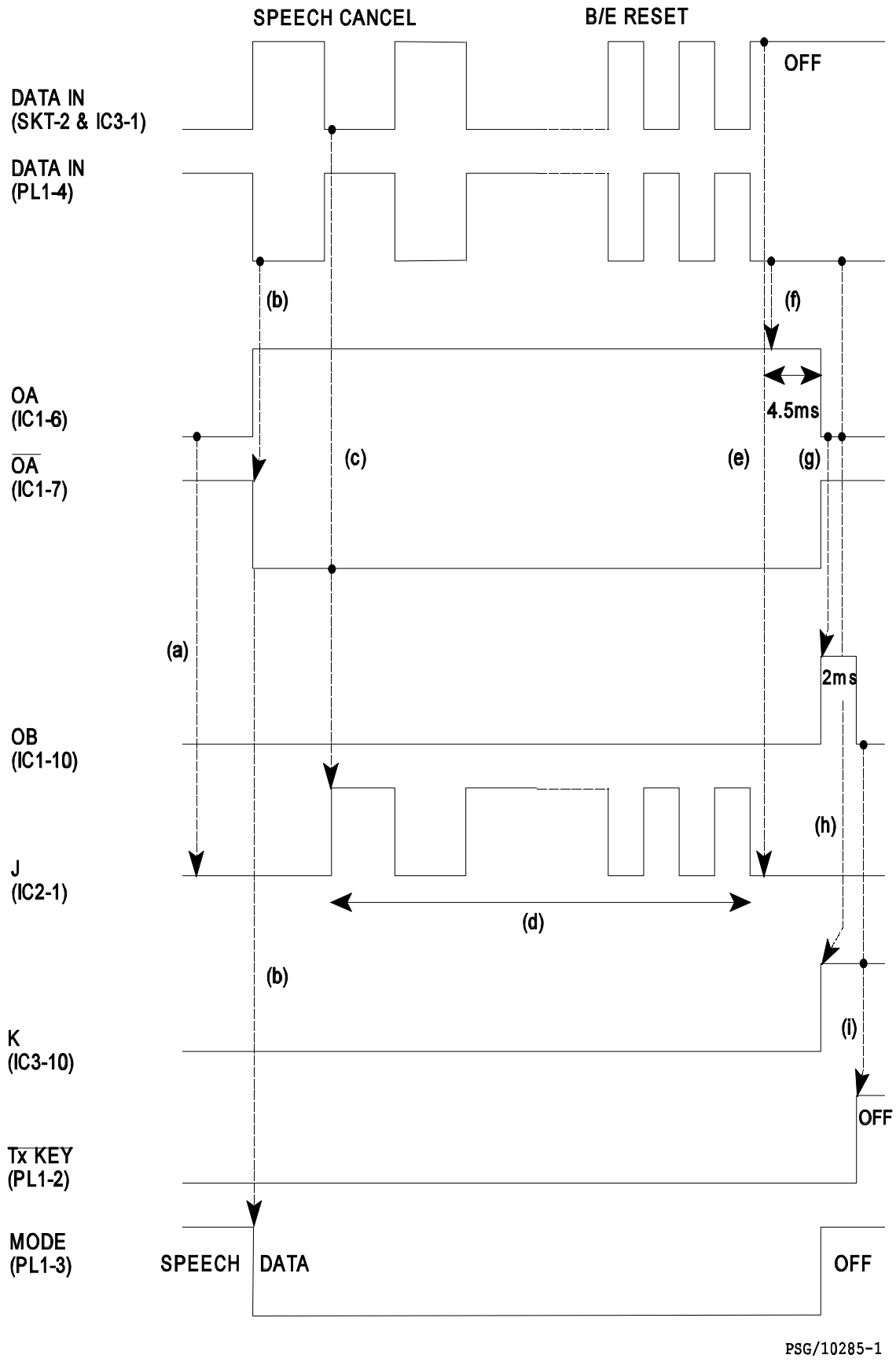

Figure 6: Switching From Speech

SECTION 4

INSTALLATION AND COMMISSIONING

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4. Wall Mounting
5. Antenna
6. Modulation Inputs
8. Power Supply

9. COMMISSIONING

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3. Typical Access 340 System Configuration 4 - 3

INTRODUCTION

1. Section 4 of this manual details the Installation and Commissioning procedures to be carried out on a new equipment.

INSTALLATION

Positioning

CAUTION

DO NOT MOUNT OVER A HEATER OR RADIATOR, OR IN DIRECT SUNLIGHT AND ENSURE A DRY ENVIRONMENT.

2. Carefully unpack the transmitter, power supply and antenna. Site the transmitter and power supply in a convenient working position within reach of an AC power outlet and within 1km of the encoder.

Shelf Mounting

3. Lay the transmitter on a suitable horizontal shelf on its integral mounting feet (sloping panel upwards). Connect the antenna as indicated in paragraphs 5 or 6 and the remainder of the electrical connections as paragraph 7.

Wall Mounting

4. Mark and drill the wall as shown, suitable for No 8 plugs and round-head screws. Insert screws into plugs with the top of the screw head a maximum of 10mm from the wall and the bottom of the screw head a minimum of 5mm from the wall. Remove the rubber pads from the bottom of the base tray and hook the transmitter onto the screws. The transmitter can be mounted either antenna up or antenna down.

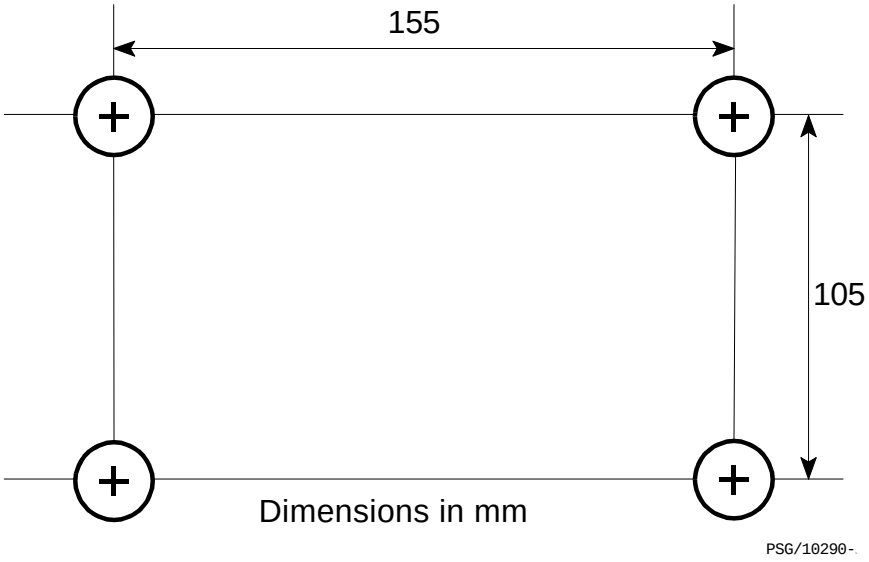

Figure 1: Mounting Hole Diagram

Antenna

5. Two versions of the UHF antenna are available, a straight vertical whip for wall mounted transmitters and a right angled whip for shelf mounted transmitters.

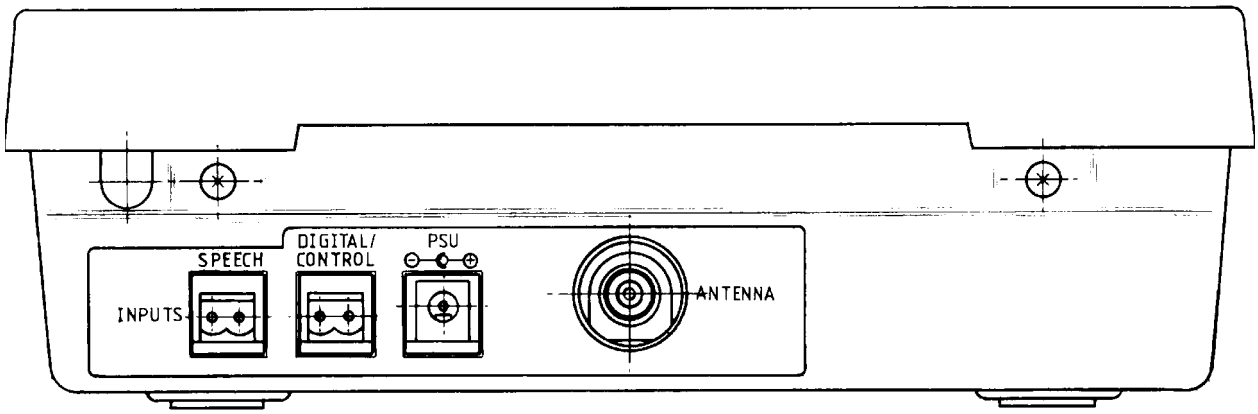

Figure 2: Rear Panel Connections

Modulation Inputs

6. When connecting the transmitter to an RPE 340 series encoder, SK1 and SK2 should be connected as shown in Figure 3.

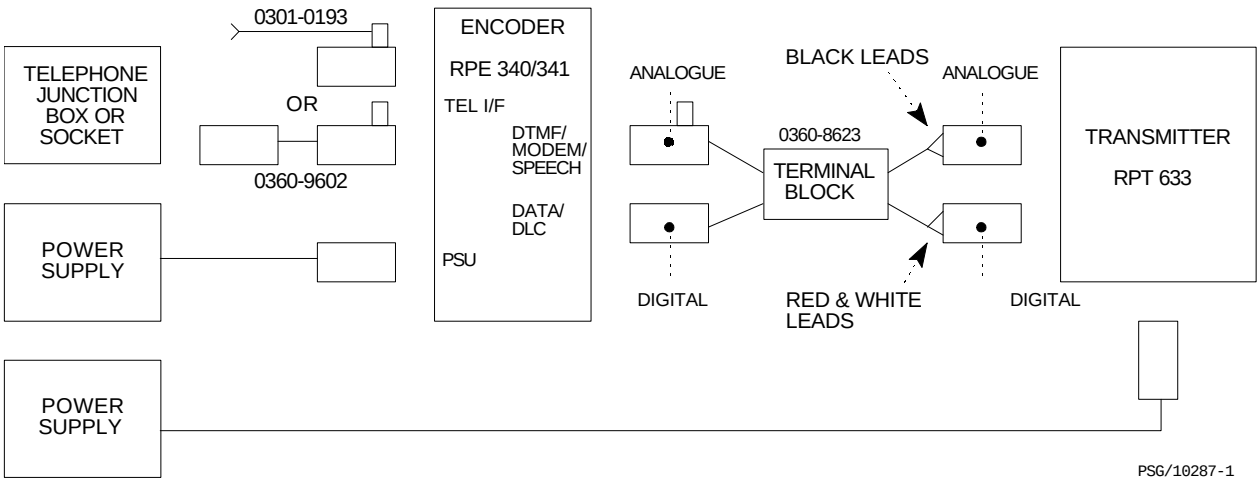

Figure 3: Typical Access 340 System Configuration

7. When connecting an RPT 633 transmitter to a Access 3000, it is first necessary to use Engineering Mode Test 50 to configure the Encoder into the Non-DTMF mode. The connections shown in Table 1 and 2, as applicable, should then be made between the encoder and transmitter.

Table 1: Encoder Mounted in a Card Frame Assembly

SIGNAL NAME	ENCODER PIN No.	D TYPE PIN No.	CABLE TYPE	COLOUR CODE	*TRANSMITTER INPUT
Data	29c	9	} 0401-0009 {	Orange	} SKT2 {left
0V	30a	23	} {	White/Blue	} {right
Speech {	12a	17	} 0401-0011 {	Violet	} SKT1 {right
{	12c	4	} {	Yellow	} {left

* As seen from the rear of the transmitter.

Table 2: Encoder mounted in a Single Slot Housing

SIGNAL NAME	ENCODER PIN No.	MODULAR JACK PIN No.	CABLE TYPE	COLOUR CODE	*TRANSMITTER INPUT
Data	29c	7	} 0301-0092 {	Yellow	} SKT2 {left
0V	30a	6	} {	Blue	} {right
Speech {	12a	2	} 0301-0091 {	Orange	} SKT1 {right
{	12c	4	} {	Red	} {left

* As seen from the rear of the transmitter.

8. **Power Supply**

Ensure that the power supply is correctly rated for your application and has the correct mains connector. Insert the power supply outlet plug into SK3 at the rear of the unit and plug the supply into the mains socket.

COMMISSIONING

9. Refer to Table 3 and carry out the operating procedures as detailed for the RPT 633 transmitter.

Table 3: Operating Instructions

ENCODER	REFERENCE
Access 1000 Access 3000	} LCU Operator's Guide } 9261-0382 or 9261-0682
RPE 340 RPE 341	} TM1158, Section 2, paragraphs 19-40 }
RPE 340A	TM1154, Section 4, paragraph 4.3
RPE 350	TM1164, Section 4, paragraph 11

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SECTION 5

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11. Transmitter Alignment
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INTRODUCTION

1. Section 5 details the dismantling and reassembly instructions, alignment procedure and the test equipment required to carry out the procedure. The transmitter contains two printed circuit boards (PCB's). It is recommended that field service engineers carry one complete VOX Keying Module for on-site replacement and subsequent base repair of the faulty board.

REPAIR POLICY

2. In Section 6 is a list of spare parts for servicing the transmitter board down to component level. Passive chip components (capacitors and resistors) are unlikely to contribute to failure of the equipment in the field. Chip transistors and diodes should be ordered in strips of 10 or more. A replacement antenna will need to be cut to length before fitting, according to the information given in paragraph 17.

TEST EQUIPMENT

3. The following test equipment is required to carry out the repair procedure.

- DC Power Supply 18V, 1A.
- Absorption Wattmeter, 5W 420-470MHz,
  or
- Thruline RF Power Meter 5W, 420-470MHz with Power Attenuator 5W, 20-30dB.
- Frequency Counter 500MHz, accuracy 1 part in 10^7 or better.
- Audio Signal Generator.
- Modulation Meter.
- Oscilloscope.

DISMANTLING AND RE-ASSEMBLY INSTRUCTIONS

CAUTION

STATIC SENSITIVE DEVICES ARE USED WITHIN THIS EQUIPMENT. CARE MUST BE TAKEN TO ENSURE DAMAGE TO THESE DEVICES IS NOT CAUSED BY HIGH LEVELS OF STATIC ELECTRICITY. SPARE BOARDS OR COMPONENTS SHOULD BE STORED IN ANTI-STATIC PACKAGING WHEN NOT INSTALLED IN THE EQUIPMENT.

Access To Circuit Boards

4. Disconnect the antenna and connectors from the rear of the case. At the rear of the unit unscrew and remove the two retaining screws. Lift the top cover at the rear and invert it so that it slides under the base from the front, ensuring that the ribbon cable and the two screened cables are not strained.

Removing the VOX Keying Module

5. Disconnect the ribbon cable at the keying module. De-solder the two screened cables at the transmitter board. Remove the four screws which secure the keying module to the lid and remove the module.

Removing the Transmitter Board

6. Disconnect the ribbon cable at the transmitter board. De-solder the two screened cables at the transmitter board. Remove the four nuts which secure the board to the base and remove the board.

Re-Assembly

7. Re-assembly is the reverse of the procedure for dismantling.

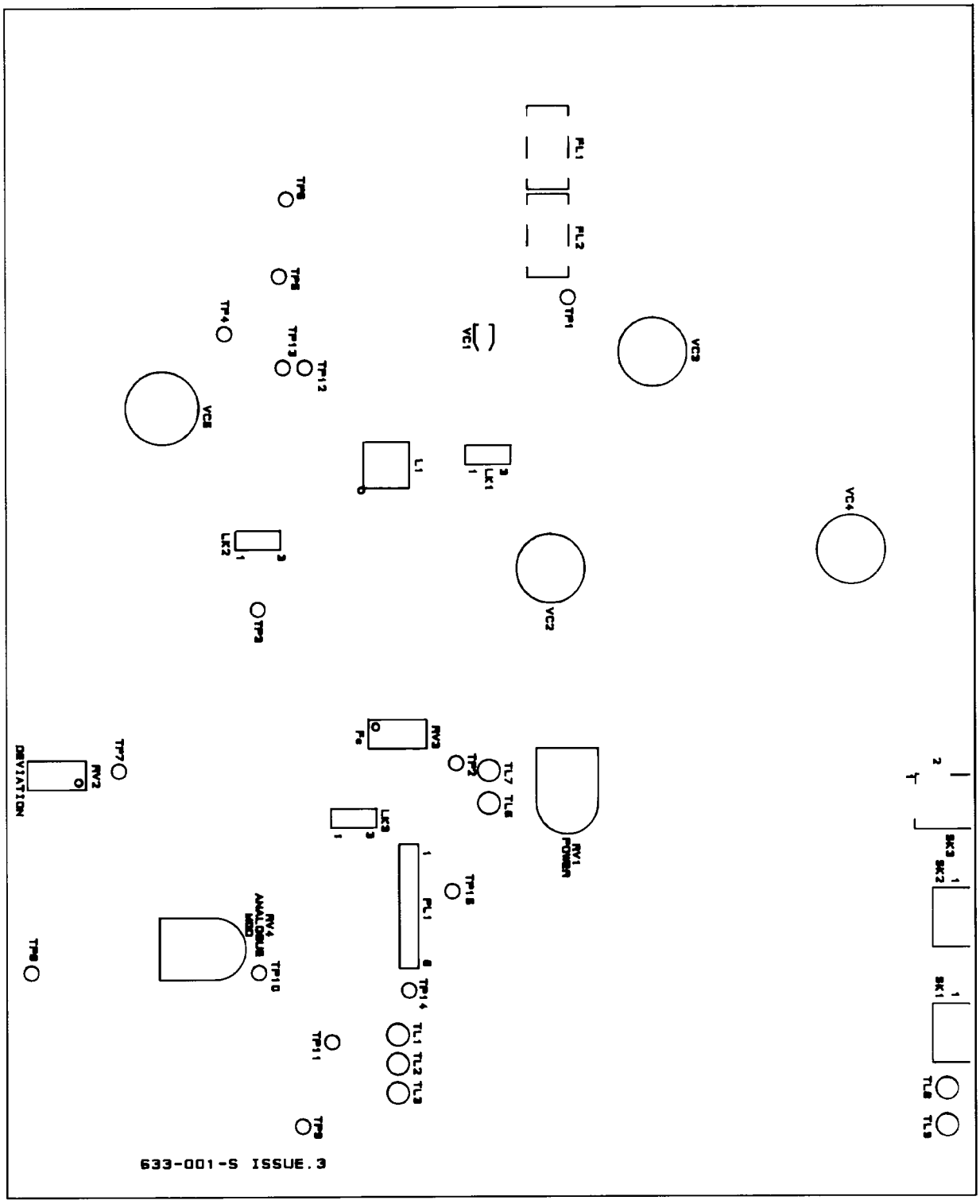

Figure 1: Transmitter Layout: Variables, Links and Test Points

TRANSMITTER BOARD ALIGNMENT PROCEDURE

Initial Settings

8. Set the variable components and links as follows:

VC1 - Anywhere.
VC2 - Half Meshed.
VC3 - Fully Un-meshed.
VC4 - Fully Un-meshed.
VC5 - 25% Meshed.

FL1 and FL2 - Adjusters standing proud by 2mm.

RV1 - Fully Anti-clockwise.
RV2 - Mid Position (15 turns from either end).
RV3 - Anywhere
RV4 - Mid Position

LK1 - Position 2-3 Normal Version.
Position 1-2 FTZ Version.

LK2 - Position 1-2 Output frequencies less than 447MHz.
Position 2-3 Output frequencies greater than or equal to 447MHz.

LK3 - Position 2-3 Normal Operation.
Position 1-2 Invert Data Sense.

Initial Connections

9. Set up the test equipment as follows:

a) Connect the absorption wattmeter or power meter to the antenna socket using a lead no longer than 300mm.

b) Connect the modulation meter and frequency counter to the attenuated output.

c) Connect the power supply to SK3.

d) Connect the audio signal generator via a 0.47µF capacitor to SK1.

Setting up Phase Lock Loop

10. Set up the Phase Lock Loop as follows:

    a) Switch on the power supply.

    b) Connect the oscilloscope to TP3.

    c) Adjust the slug of L1 to give 5V ±0.2V DC at TP3.

Transmitter Alignment

11. To align the transmitter carry out the following procedure:

    a) Connect the oscilloscope to TP7.

    d) Adjust RV3 to give 0V ±50mV DC at TP7.

    c) Key ON the transmitter by shorting TP2 to TP9.

    d) On FL1 and FL2 turn the four adjusters ½ turn at a time until the power meter indicates or the power supply current increases.

    e) If no power appears slightly adjust VC2 or VC3 and repeat (d).

    f) Tune the four adjusters of FL1 and FL2 for maximum power.

    g) Tune VC1, VC2 and VC3 for maximum power and then RV1 to give a power meter reading of 2.5W.

    h) Re-adjust VC1, VC2 and VC3 for maximum power then RV1 for 2.5W ±0.2W.

Setting Data Deviation and Centre Frequency

12. To set the data deviation and centre frequency carry out the following procedure:

    NOTE: *The purpose of this adjustment is to set the deviation, i.e. for 25kHz channel spacing, to ±4.5kHz (9kHz total) when the data polarity switch is set from "1" to "0".*

    a) Set LK3 of the VOX keying module to AB to select the DATA mode.

    b) Connect TP14 to TP15 (+5V) to select the binary 1 state.

c) Measure the output frequency to the nearest 10Hz; switch the data polarity to the binary O state by connecting TP14 to TP9 and again measure the output frequency. Adjust RV2 and repeat this process until the difference between the two frequencies is as given in the TOTAL DEVIATION column in Table 1 for the appropriate transmitter channel spacing, with a tolerance of ±100Hz.

d) Using a plastic trimming tool adjust VC5 until the mean of the two frequencies measured at (c) is within 100Hz of the specified center frequency of the transmitter.

e) Repeat sub-paragraphs (c) and (d) as necessary.

f) Switch the mode switch to ANALOGUE by setting LK3 on the VOX keying module to AC and adjust RV3 to give the specified centre frequency of the transmitter to a tolerance of ±100Hz.

Table 1: Data Deviation

CHANNEL SPACING kHz	DEVIATION kHz	TOTAL DEVIATION kHz
25	±4.5	9
20	±3.6	7.2
12.5	±2.25	4.5
10	±1.8	3.6

Setting Analogue Modulation

13. To set the analogue modulation carry out the following procedure:

a) Set LK3 of the VOX keying module to AC to select the ANALOGUE mode.

d) Set the audio generator output to 1.25kHz at a level of approximately 11mV peak-to-peak as measured on the oscilloscope. Monitor the deviation on the modulation meter.

c) Refer to Table 2(a) and adjust the generator output level to give give a deviation corresponding to the channel spacing.

d) Increase the signal generator output level by 20dB and adjust RV4 to give a deviation coresponding to that given in Table 2(b). This should be the larger of the Peak + or Peak - readings on the modulation meter.

e) Reduce the signal generator level by 20dB and re-adjust its level to give a deviation corresponding to that given in Table 2(c).

f) Increase the signal generator level by 20dB and re-adjust RV4 to give a deviation corresponding to that given in Table 2(b).

g) Vary the signal generator frequency between 300Hz and 2.5kHz and check that the deviation does not exceed that given in Table 2(d). If it does, tune to the frequency that gives the maximum deviation and adjust RV4 to give a deviation corresponding to that given in Table 2(e). This should also be the larger of the Peak + or Peak - readings.

Table 2: Analogue Deviation

CHANNEL SPACING kHz	DEVIATION (a) kHz	DEVIATION (b) kHz	DEVIATION (c) kHz	DEVIATION (d) kHz	DEVIATION (e) kHz
25	±3	4.75	±3	5	4.9
20	±2.4	3.8	±2.4	4	3.9
12.5	±1.5	2.4	±1.5	2.5	2.4
10	±1.2	1.85	±1.2	2	1.9

VOX KEYING MODULE ALIGNMENT PROCEDURE

14. To set the timing circuits of the VOX Keying Module carry out the following procedure:

a) With the RPE340 in the Engineering Mode, initiate Function 2, RPT calibration signal. Alternatively use a P391 Test A7 to generate the same signal.

b) Monitor TP6 and adjust RV2 so that the mark/space ratio is 4.4/3.6ms.

c) Monitor TP3 and adjust RV3 so that the mark/space ratio is 2.6/5.4ms.

ANTENNA CUTTING

Introduction

15. In the event of damage to the antenna, the replacement will require cutting to length in accordance with the following instructions.

Cutting

16. The antenna is a one piece UHF stub with internal connector. With reference to Figure 1 after removal of the cap, the antenna should be cut to the length indicated in Table 3, depending on frequency, and the cap replaced. The Part Numbers of the uncut stubs are 5501-0001 (right angled) and 5501-0002 (straight).

Table 3: Antenna Lengths

CUT LENGTH mm	FREQUENCY MHz
156	420
154	425
152	430
150	435
149	440
147	445
145	450
143	455
142	460
140	465
139	470

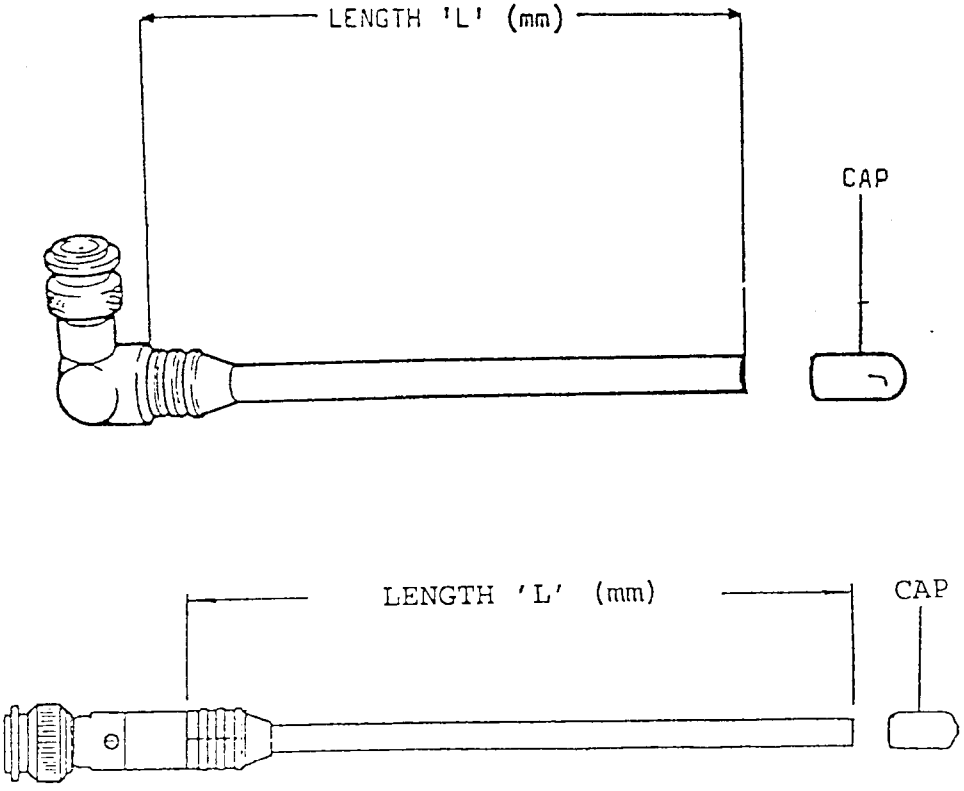

Figure 2: Antenna Cutting

FAULT-FINDING

WARNING

GREAT CARE MUST BE TAKEN TO AVOID BREAKING OPEN THE ENCAPSULATION OF TR10 ON THE TRANSMITTER BOARD WHEN REPAIR OR COMPONENT REPLACEMENT IS BEING CARRIED OUT, AS THIS COMPONENT CONTAINS TOXIC BERYLLIUM OXIDE.

17. Table 4 shows the signals to be expected at the various test points as an aid to fault-finding.

Table 4: Test Points

T.P.	SIGNAL
1	Carrier Frequency
2	Tx Key (low-going)
3	PLL Control Voltage (nominally 5V)
4	VCO Frequency (div. by 256)
5	Crystal Frequency
6	In-Lock (high going)
7	Modulating Signal
8	-12V
9	0V
10	Audio Signal (limited)
11	Audio Signal (un-limited)
12	Over-rides Lock Fail when connected to TP13
13	+12V
14	Data
15	+5V

SECTION 6

SPARE PARTS LIST

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4. Connectors
5. Crystals
6. Diodes
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8. Integrated Circuits
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13. Transistor
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16. Capacitors

VOX KEYING MODULE COMPONENTS
17. Capacitors
18. Connector
19. Diodes
20. Integrated Circuits
21. Resistors
22. Transistor

ITEM/CIRCUIT REFERENCE	DESCRIPTION	PART NO.

1. GENERAL

	INSERT MOULDING SCREENED	0960-9887
	8-WAY INTER CONNECT FLEXFOIL	4404-0001
	MOULDING COVER	0860-9846
	CLAMPING PAD ADHESIVE	1861-0225
	NUT M3	1 9 6 6 3
	ESCUTCHEON	2060-9878
	WASHER PLAIN M3	20662
	LABEL EQUIP.	31600X7
	RUBBER FEET 23MM	33996
	SCREW No. 6X16MM PAN HD POZI AB	8204-0616

2. MODULES

	ASSY PCB VOX KEYING MODULE	0260-7083
	PSU 240V UK PLUG	0301-0605
	PSU 220V EURO PLUG	0301-0606
	PSU 110V	0301-0607

TRANSMITTER BOARD COMPONENTS

3. Capacitors

C1,10,12,40,80	CAP CHIP 220p 10% 50V	3301-0150
C2,47,72,74,111,117	CAP AL 10F 20% 16V	3401-0089
C3,7,15,18,19,22,23,24,27,30	CAP CHIP 1n 10% 50V	3301-0100
C4	CAP CHIP 1p 0.25p 50V	3301-0001
C5,53,55	CAP CHIP 3p9 0.25p 50V	3301-0008
C8,62,63,64,108,109	CAP AL 4F7 20% 25V	3401-0093
C9,90,91,92,93	CAP AL 22F 20% 16V	3401-0090
C11	CAP CHIP 4p 0.25p 50V	3301-0151
C13,35	CAP CHIP 10p 0.25p 50V	3301-0013
C14,54	CAP CHIP 1p8 0.25p 50V	3301-0004
C16,17,36,67,68,75,79,85,87	CAP CHIP 4n7 10% 50V	3301-0108
C20,38,41,46,49,52,66,95	CAP CHIP 100n -20+80% 25V	3301-0149
C21,26,32,34,43,48,61,78,88,94, 102	CAP CHIP 220p 10% 50V	3301-0081
C25,60	CAP CHIP 5p6 0.25p 50V	3301-0010
C28,29	CAP CHIP 33p 5% 50V	3301-0025
C31,33,73,76,77	CAP CHIP 1n 10% 50V	3301-0100
C39,118,129	CAP CHIP 10n 10% 50V	3301-0112
C42	CAP CHIP 22p 5% 50V	3301-0021
C44	CAP CHIP 4p7 0.25p 50V	3301-0009
C45,70,116	CAP CHIP 1F 20% 16V	3306-0020

ITEM/CIRCUIT REFERENCE	DESCRIPTION	PART NO.

3. Capacitors (Continued)

C50,56,57	CAP CHIP 3p3 0.25p 50V	3301-0007
C51,89,113,132,133	CAP CHIP 47p 5% 50V	3301-0029
C58	CAP CHIP 6p8 0.25p 50V	3301-0011
C59	CAP CHIP Op75 0.25P 50V	3301-0251
C65	CAP AL 1000F -10+50% 40V	3402-0001
C69	CAP CHIP 2n2 10% 50V	3301-0104
C71,100	CAP POLYTR 330n 10% 63V	3304-0010
C81	CAP CER 180p N750 100V	3302-0231
C82	CAP CER 150p 2% 100V	3302-0151
C83,84	CAP CER 22p 2% 100V	3302-0141
C86	CAP CHIP 8p2 0.25p 50V	3301-0012
C96,101	CAP PLYPRP 6n8 2.5% 63V	3303-0003
C97,120,122	CAP CHIP 180p 5% 50V	3301-0043
C98,104	CAP PLYPRP 10n 2.5% 63V	3303-0004
C99,103	CAP PLYPRP 4n7 2.5% 63V	3303-0002
C105,107,114,115,124,125,126	CAP CHIP 220p 10% 50V	3301-0081
C106	CAP PLYPRP 2n2 2.5% 100V	3303-0009
C110,112,128,131	CAP CHIP 100n -20+80% 25V	3301-0149
C119	CAP AL 100F 20% 6.3V	3401-0084
C127,130	CAP CHIP 220p 10% 50V	3301-0081
VC1	CAP CHIP TRIM 10p	3506-0002
VC2,3,4	CAP VARIABLE 2-10p	3501-0002
VC5	CAP VARIABLE 4-40p	3501-0005

4. Connectors

SK1,2	PLUG 2-WAY	4501-0002
SK3	SOCKET 2.1mm PCB MOUNT	4431-0012
SK4	SKT RF COAX PANEL	4414-0001
	SOCKET 2-WAY	4501-0001

5. Crystals

XL1	XTAL GENERIC SPEC	3904
XL1	XTAL GENERIC SPEC (HIGH STABILITY)	3905
OV1	CRYSTAL OVEN PLC1-27-12-75	6201-0001

6. Diodes

D1	DIODE VARICAP KV1310A-3 DUAL	3701-0027
D2	DIODE ZENER CHIP BZX84C10	3703-0017
D3,4	DIODE CHIP BAR 18	3703-0004
D5	DIODE CHIP BAV99	3703-0001

ITEM/CIRCUIT REFERENCE	DESCRIPTION	PART NO.

6. **Diodes** (Continued)

D6,7	DIODE ZENER CHIP BZX84C5VI	3703-0010
D8	DIODE MV2109	3701-0001
D9,10,11	DIODE CHIP BAT54	3703-0044

7. **Inductors**

L1	COIL MC111 SERIES	4609-0001
L2	INDUCTOR 2F2H	4102-0009
L3,4	INDUCTOR 470nH	4102-0005
L5	INDUCTOR 10TURN	4160-6235
L6	AIR COIL	4160-6236
L7	AIR COIL	4160-6237
L8,9,11,12	INDUCTOR 220nH	4102-0003
L10,19,20,21	INDUCTOR 22nH	4102-0050
L13	INDUCTOR 100nH	4102-0001
L14,15,16	ASSY COIL	605753
L17,18	INDUCTOR 1mH	4102-0025
L22	INDUCTOR 6F8	4107-0002

8. **Integrated Circuits**

IC1	IC 560CDP	3803-0003
IC2	VOLT REG 78L82AWC	95520
IC3,4	VOLT REG 7812C	6001-0002
IC5	VOLT REG 7805	6001-0001
IC6	IC 74HCTO5	3819-0014
IC7	IC 14568BCP	3802-0001
IC8	IC HEF4069 SMD HEX INVERTER	3819-0007
IC9	IC SP4660DP	3803-0001
IC10,12	IC OP. AMP. LM348D	3819-0003
IC11	IC 7661	3803-0025
IC13	IC OP AMP MC 1458ND	3818-0001
IC14	VOLTAGE REG ICL8069.REF:1.2V	6002-0026

9. **Links**

LK1,2,3	2-WAY JUMPER LINK (GOLD PLATED)	4408-0001

ITEM/CIRCUIT REFERENCE	DESCRIPTION	PART NO.

10. Resistors

R1	RES CHIP 15k 5% 0.125W	3101-0174
R2,12,17,63	RES CHIP 2k2 5% 0.0625W	3105-0179
R3,52,96	RES CHIP 68R 5% 0.0625W	3105-0143
R4,6,9,14,24,47,61,62,80,87	RES CHIP 6k8 5% 0.0625W	3105-0191
R5,7,8,64,73	RES CHIP 33k 5% 0.0625W	3105-0207
R10,26,59,90	RES CHIP 560R 5% 0.0625W	3105-0165
R11	RES CHIP 22R 5% 0.0625W	3105-0131
R13	RES CHIP 3k3 5% 0.125W	3101-0158
R15,45,86	RES CHIP 15k 5% 0.0625W	3105-0199
R16,67,68,69,79,100	RES CHIP 10k 5% 0.0625W	3105-0195
R18,19,37	RES CHIP 220R 5% 0.0625W	3105-0155
R20	RES CHIP 3k9 5% 0.0625W	3105-0185
R21	RES CHIP 10R 5% 0.125W	3101-0098
R22	RES CHIP 100R 5% 0.125W	3101-0122
R23,25,29,74,109,115	RES CHIP 4k7 5% 0.0625W	3105-0187
R27,34	RES CHIP 47R 5% 0.0625W	3105-0139
R28,39,40,99	RES CHIP 33R 5% 0.0625W	3105-0135
R30,33,106	RES CHIP 470R 5% 0.0625W	3105-0163
R31	RES CHIP 15R 5% 0.0625W	3105-0127
R32,91	RES CHIP 1k2 5% 0.0625W	3105-0173
R35,104	RES CHIP 10R 5% 0.0625W	3105-0123
R36	RES CHIP 18k 5% 0.0625W	3105-0201
R41,42	RES MF 100R 1% 0.6W	3103-0188
R43,53,58,117,119	RES CHIP 100R 5% 0.0625W	3105-0147
R44,84,124	RES CHIP 22k 5% 0.0625W	3105-0203
R46,107,111,114,121,123	RES CHIP 1k0 5% .0625W	3105-0171
R48	RES CHIP 7k5 5% 0.0625W	3105-0192
R49	RES CHIP 1k5 5% 0.0625W	3105-0175
R50	RES CHIP 56k 5% 0.0625W	3105-0213
R51,55,56,57,83	RES CHIP 39k 5% .0625W	3105-0209
R54	RES MF 4R7 1% 0.6W	3103-0156
R60	RES CHIP 330R 5% .0625W	3105-0159
R66,75,77,97	RES CHIP 47k 5% .0625W	3105-0211
R65,72,88	RES CHIP 82k 5% .0625W	3105-0217
R76,89	RES CHIP 68k 5% 0.0625W	3105-0215
R81,85	RES CHIP 8k2 5% .0625W	3105-0193
R82	RES CHIP 27k 5% .0625W	3105-0205
R92,101	RES CHIP 100k 5% 0.0625W	3105-0219
R93,94,98	RES CHIP 2k7 5% 0.0625W	3105-0181
R95	RES CHIP 330k 5% 0.0625W	3105-0231

ITEM/CIRCUIT REFERENCE	DESCRIPTION	PART NO.
10. Resistors (Continued)		
R102	RES CHIP 820R 5% .0625W	3105-0169
R103,110,113,122	RES CHIP 10k 5% 0.0625W	3105-0195
R105	RES CHIP 1k8 5% 0.0625W	3105-0177
R108	RES CHIP 6k8 5% .0625W	3105-0191
R116	RES CHIP 3k3 5% 0.0625W	3105-0183
R118,120	RES CHIP 150R 5% .0625W	3105-0151
TH1	THERMISTOR 10k	3211-0002
RV1	POT CERMET 100R	3202-0001
RV2	POT MULTITURN 10k	3208-0010
RV3	POT MULTITURN 5k	3208-0009
RV4	POT CERMET 2k2	3202-0005
11. Transducer		
LS1	TRANSDUCER	5001-0001
12. Transformer		
T1	ASSY TRANSFORMER	0460-6222
13. Transistors		
TR1,13,14	TRANS BCW61C	3602-0018
TR2	TRANS MMBFU 310	3602-0008
TR3,12	TRANS BCW33	3602-0010
TR4,6	TRANS BFS 17	3602-0001
TR5	TRANS BCW31	3602-0011
TR7,8	TRANSISTOR BFR96-02	3601-0001
TR9	TRANSISTOR MRF559	3601-0003
TR10	TRANSISTOR MRF630	3601-0012
TR11	TRANSISTOR BFS19	3602-0003
14. Antenna		
	ANTENNA RPE303	5501-0001
	FLEXIBLE STRAIGHT ANTENNA	5501-0002

ITEM/CIRCUIT REFERENCE	DESCRIPTION	PART NO.

BANDED COMPONENTS

15. **Filters**

FL1,2	FILTER HELICAL 252-MX-1547A BAND 1	4605-0005
FL1,2	FILTER HELICAL 252-MX-1549A BAND 2	4605-0006
FL1,2	FILTER HELICAL 252-MX-1551A BAND 3	4605-0007

16. **Capacitors**

C6	CAP CER 10p 0.25p 63V BAND 1	3302-0099
C6	CAP CER 10p 0.25p 63V BAND 2	3302-0099
C6	CAP CER 8p2 0.25p 63V BAND 3	3302-0098

VOX KEYING MODULE COMPONENTS

17. **Capacitors**

C1	CAP AL 22FF 20% 16V	3401-0008
C2,3,5,6,7	CAP POLYTR 100n 10% 63V	3304-0002
C4	CAP POLYTR 220n 10% 63V	3304-0009
C8	CAP AL 10F 20% 35V	3401-0100

18. **Connector**

PL1	8-WAY PLUG RT ANGLED	4303-0044

19. **Diodes**

D1,2	DIODE 1N4148	17535
D3	INDICATOR LED HLMP1700	3704-0011

20. **Integrated Circuits**

IC1	IC 4538	3802-0043
IC2	IC 74HC107	3801-0049
IC3	IC 74HCO2	95993

ITEM/CIRCUIT REFERENCE	DESCRIPTION	PART NO.
21. Resistors		
R1	RES MF 39k 1% 0.6W	3103-0250
R2	RES MF 10k 1% 0.6W	3103-0236
R3	RES MF 680R 1% 0.6W	3103-0208
R4	RES MF 100k 1% 0.6W	3103-0260
R5	RES MF 1k5 1% 0.6W	3103-0216
R6	RES MF 47k 1% 0.6W	3103-0252
RV1	POT CERMET 2k2	3202-0005
RV2,3	POT CERMET 220k	3202-0011
22. Transistor		
TR1	TRANSISTOR BC183L	95785

APPENDIX 1

UHF SERIAL ENCODER MODEL RPE 673

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7. Transmitter PCB Layout A1 - 18
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INTRODUCTION

1. This Appendix outlines the installation and operation of the Radio Paging Serial Encoder (Transmitter/Encoder) model RPE 673. The Serial Encoder utilises the existing RPT 633 Transmitter PCB and, whenever necessary, reference is made to the appropriate section in the main body of this manual.

ROLE

2. The Multitone RPE 673 is a single channel radio paging Serial Encoder operating in the UHF frequency band. The Serial Encoder provides paging facilities for Mk6 or Mk7 code format alphanumeric and speech radio paging systems. The Serial Encoder can be used to call up to 10,000 radio paging receivers.

PHYSICAL CONSTRUCTION

3. The RPE 673 consists of an Encoder PCB combined with a 2.5W Transmitter PCB (as used in RPT 633) together in one moulded plastic housing.

SPECIFICATION

***NOTE*:** *For Transmitter characteristics and crystal frequency calculation refer to Section 1.*

Encoder

4. The performance characteristics of the Encoder are as follows:

a) Protocol:	ESPA 4.4.4. or MEP (Determined by firmware)
b) Code Format:	Multitone Mk6 or Mk7 (Programmable)
c) Paging Addressees:	10,000
d) Beep Codes:	Eight
e) Message Transmission:	Up to 60 alphanumeric characters
f) Speech Transmission:	Duration is unlimited and under the control of the External Device (speech is applicable only when ESPA 4.4.4. protocol is used)

Connectors

5. The RPE 673 Serial Encoder is fitted with the following external connectors:

a)	SK1:	Audio Input	Two pin moulded socket (600 Ohm)
b)	SK2:	Not Used	
c)	SK3:	Power Supply Unit	Four-way FCC68 socket
d)	SK4:	Antenna	TNC (50 Ohm)

6. In addition, the following internal connectors are fitted to the Encoder PCB:

a)	SK1:	Serial Data input	Eight-way FCC68 socket
b)	SK2:	Serial Data input	Four-way IDC
c)	SK3:	Remote DLCs 1-4	Four-way IDC
d)	SK5:	Remote DLCs 5-8	Four-way IDC
e)	SK4:	Ground for RS232 / DLCs RS485 Data I/P (Not used)	Four-way IDC

NOTE: *Physical Characteristics, Operational Environment and Power Supply Options are identical to the RPT 633.*

OPERATING INSTRUCTIONS

7. The Radio Paging Serial Encoder is fully automatic in use and operation is limited to switching on the mains supply.

TECHNICAL DESCRIPTION

NOTE: *For a circuit description of the Transmitter, refer to Section 3.*

8. The RPE 673 Serial Encoder provides a communications link between any device with a standard RS232 data output and up to 10,000 paging receivers. Valid data is processed by a purpose built digital Encoder and fed to a 2.5W UHF Transmitter (based upon the RPT 633) for onward transmission.

9. The Encoder is driven by the serial RS232 data input (SK1 or SK2) and the eight DLC inputs (SK3 and SK5) using ESPA 4.4.4 or MEP protocol (as determined by firmware). Receipt of serial data or closure of any DLC causes the Encoder to enter the call generation routine. A paging transmission is assembled in either Mk6 or Mk7 paging code format. The format is selected during installation (refer to paragraph 24).

10. The eight DLC inputs may be used for remotely sited contacts which must close to initiate paging calls. The DLC paging messages can be configured during installation (refer to paragraph 24).

11. Figure 1 illustrates Encoder input / output connections. Power (+5V) is supplied to the Encoder PCB from the Transmitter PCB on PL1-1 and ground is PL1-7.

12. The Encoder PCB also contains circuitry for the signal conditioning of the audio/speech input to the Serial Encoder. PL2 on the Encoder PCB is for factory test purposes only.

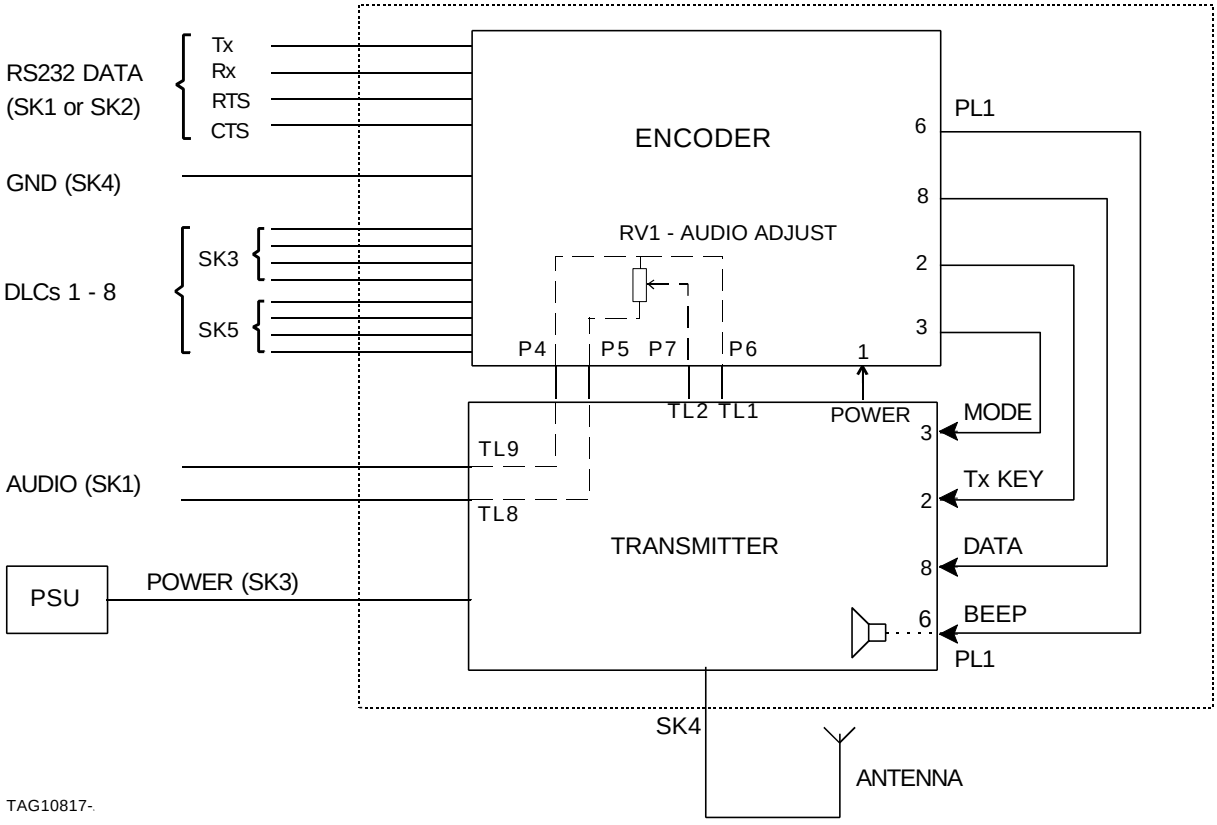


Figure 1: Encoder Connections

PRE-INSTALLATION CHECKS

CAUTION

STATIC SENSITIVE DEVICES ARE USED WITHIN THIS EQUIPMENT. OBSERVE STATIC SAFETY PRECAUTIONS.

Unpacking

13. Unpack the container and examine the contents against the list given below:

a)	RPE 673 Serial Encoder Unit	Qty 1
b)	Power Supply Unit, 3-pin plug (UK) or 2-pin (Europe)	Qty 1
c)	Antenna Assembly *	Qty 1
d)	Socket, 2-way (4501-0001)	Qty 2

* Supplied only when requested on Sales Specification Form

Tools Required

14. The following tools will be required:

a) Screwdrivers - Flat and Cross-Point

b) IDC Insertion Tool

Test Equipment Required

15. The following test equipment will be required:

a) PC with RS232C serial port

b) P910 Cable Assembly, 9-Way, D-Type or
P911 Cable Assembly, 25-Way, D-Type

c) 4404-0003 Interconnect Flexible

INSTALLATION PROCEDURE

Wall Mounting

CAUTION

ENSURE THE UNIT IS MOUNTED IN A DRY ENVIRONMENT. DO NOT MOUNT THE UNIT OVER A HEAT SOURCE OR IN DIRECT SUNLIGHT.

16. The unit may be mounted on a suitable horizontal shelf or wall-mounted using the following procedure:

    a) Referring to Figure 2 (or using the template supplied with the Serial Encoder), drill holes to accept 8mm plugs and screws.

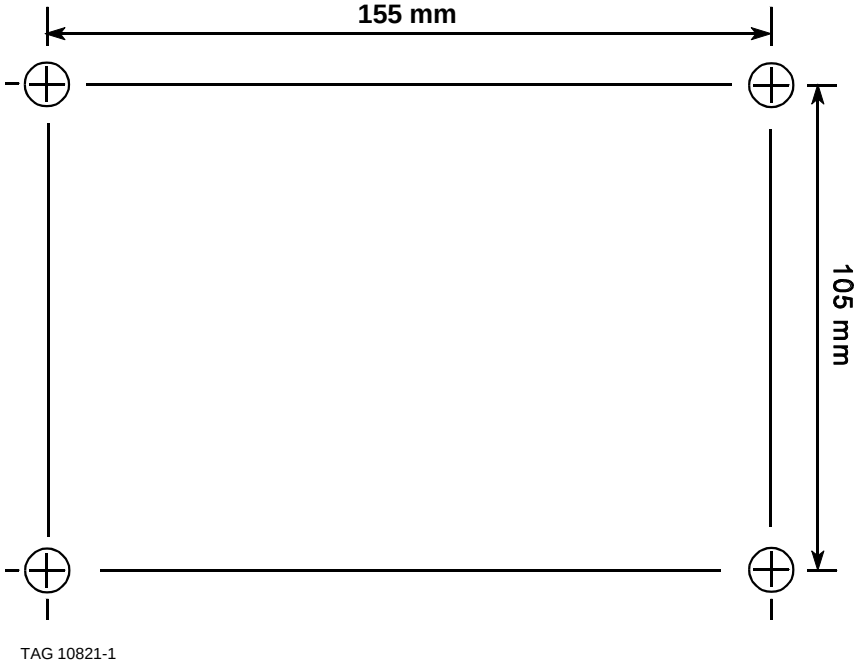


Figure 2: Wall Mounting Template

    b) Fit the plugs into the holes and insert the screws into the plugs leaving 5mm clearance between the screw heads and the wall.

    c) Remove the four rubber feet from the base and slot the Serial Encoder onto the screw heads.

***NOTE**: It may not be possible to carry out the Software Configuration using a PC whilst the External Device is connected. It is recommended that the Software Configuration is carried out before connecting the External Device.*

Software Configuration

17. To gain access to Encoder socket SK1, remove the two cross-point screws from the rear of the unit. Lift the cover slightly (it will only clear the base by 4 to 5 inches). Carefully disconnect the 8-way flexi-cable from PL1 of both Transmitter and Encoder. Pivoting on its front edge, invert the cover and slide it under the base. Fit test cable 4404-0003 to PL1 of Transmitter and Encoder.

18. Connect the serial port of your PC to SK1 (FCC 68) of the Encoder PCB using the P910 or P911 cable. If using Windows 95, run Hyper-Terminal; if using Windows 3.1, run Terminal.Exe. Configure your serial port as follows: 9600 Baud, 8 Data bits, 2 Stop bits, no Parity bit, Flow Control = Hardware.

19. Connect the external power supply to SK3 of the Serial Encoder. Power up the Serial Encoder, wait 3 seconds and, within a further 10 seconds, press <Enter>; the **(S)et-up / Test Menu** should appear on the VDU. Select **(S)et-up**; the Setup menu should appear on the VDU (see Figure 3).

```
Setup
=====
FIRMWARE M670101
Serial Port: 1200 Baud, 7 Data Bits, 2 Stop, Even Parity
Serial Protocol = MEP   Options: Timeout = 1
Code Format: Mk 7   System Address: 0   Time-of-Day: Off   Time-of-Day User No: 1234

DLC        Rx No          BC        Message
-------------------------------------------------------

1          1111           2         'Message 1'
2          1230           1         'Message 2'
3          333G           1         'Message 3'
4          45GG           1         'Message 4'
.                         .
.                         .
8          8910           1         'Message 8'

Choose:-
F    -  Set Code (F)ormat                  S  - Set (S)ystem Address
T    -  Set (T)ime-of-Day Option           U  - Set Time-of-Day (U)ser
P    -  Change Serial (P)ort Settings      O  - Change Serial Protocol (O)ptions
1-8  -  Edit DLC 1 - 8                     Q  - (Q)uit
```

Figure 3: Set-up Menu

20. Having accessed the Set-up Menu the following parameters may be set:

F	-	Code Format	**S**	-	System Address
T	-	Time-of-Day Option	**U**	-	Time-of-Day User
P	-	Serial Port Settings	**O**	-	Serial Protocol Options
1 - 8	-	Edit DLCs	**Q**	-	Quit

21. Definitions for each parameter are given in paragraph 24.

22. Once a setting has been selected, the following message will be displayed:

    '*....Writing to Eeprom - please wait.....Done*'

    and the Set-up screen will again be displayed.

23. For Serial Port Settings however, parameters are not written to the Eeprom until 'W' (Write to Eeprom) is selected from the Serial Port Set-up Menu.

Parameter Definitions

24. The Parameter Definitions are as follows:

DLC Configuration

Each DLC has a configurable Receiver Number (Rx No), Beep Code (BC) and Message.

a) **Rx No** — Four digit code in the range 0000 - 9999. The Rx No will be automatically prefixed with the System Address to form the RIC.

Group calls may be initiated in order to call a group of paging receivers within a specified range of addresses by inserting the wildcard character 'G' into the Rx No.

If one wildcard character is included as the least significant digit then a group of 10 receivers will be called, eg: ′333G will call receivers ′3330 to ′3339 (where ′ = SystemAddress).

If two wildcard characters are included as the two least significant digits then a group of 100 receivers will be called, eg: ′45GG will call receivers ′4500 to ′4599 (where ′ = System Address).

b) **Beep Code** — Single digit in the range 1 - 8

c) **Message** — Mk6: Maximum length of 10 characters in the range 0 - 9, (hyphen) and <Space>.

Mk7: Maximum length of 60 characters in the standard ASCII character set ie,<Space> (Hex 20) through to '~' (Hex7E).

Serial Port Settings

These parameters are for the V24/RS232 port and are set to match the External Device to which the Serial Encoder is connected. The selections are self explanatory however, once the settings have been made, they must be written to the Eeprom by entering 'W' ([W]rite changes to Eeprom).

NOTE: *During set-up and test, the Serial Encoder communicates using a fixed set of parameters (9600 Baud, 8 Data Bits, 2 Stop Bits, No Parity Bit). The above Serial Port Settings only take effect during normal operation.*

Serial Protocol Options

a) MEP: The only serial option for MEP protocol is the Timeout setting:

Setting	Timeout	Setting	Timeout
0	100 ms	4	4 seconds
1	1 second	5	5 seconds
2	2 seconds	6	6 seconds
3	3 seconds	7	7 seconds

NOTE: *The Timeout settings are designed to allow flexibility in the response times from different external devices.*

b) ESPA: There are two options: ‹Turn-Round / Response Time' and ‹Suppress Response Option'.

i) Turn-Round / Response Time:

Setting	Turn-Round Time	Response Time
0	approx 10ms	150ms
1	30 - 40 ms	300ms
2	100ms	3s
3	1s	10s

NOTE: *Turn Round time is a delay introduced before transmission allowing intervening hardware, such as convertors or modems, to change configuration or direction.*
Missed Response time is the period after transmission that the RPE 673 waits for an acknowledgement.

ii) Suppress Response - Valid input is ‹0' (disabled) or ‹1' (enabled). When enabled, the automatic responses back to the External Device from the RPE 673 will be suppressed (not sent).

NOTE: *Suppression is beneficial if the operation of the RPE 673 is slow.*

Code Format

Determines the digital data format (Mk6 or Mk7) to be sent by the Serial Encoder. Valid input is '6' or '7'.

System Address

A single numeric digit which must match the most significant digit of the Receiver Identification Code (RIC) for the corresponding paging receiver. Valid input is 0 - 9 for Mk6 and 0 - 3 for Mk7.

Time-of-Day Option

If set to '1' (on) then Time-of-Day paging calls will be sent at one-minute intervals and, Mk7 paging calls will contain an updated time-stamp.

If set to '0' (off) then Time-of-Day calls will not be sent and, Mk7 calls will contain a fixed time-stamp.

Time-of-Day User Number

This is a dummy User / Receiver which is used to allow the Time and/or Date to be set. If a call is sent to this receiver then the message content is used to set the system Time and/or Date as follows:

a) To set the Time, the Time-of-Day User is called with a 4-digit message in the form: '**HHMM'** where:

HH represents the Hours digits	(00 - 23)
MM represents the Minutes digits	(00 - 59)

b) To set the Date (Mk7 only), the Time-of-Day User is called with a 6-digit message in the form: '**YYMMDD**' where:

YY represents the last two digits of the Year	(00 - 99)
MM represents the Month of the Year	(01 - 12)
DD represents the Day of the Month	(01 - 31)

c) As an alternative, a 10-digit numeric message in the form ‹**YYMMDDHHMM'** will set both Time and Date together.

NOTE: *Mk6 paging receivers must be programmed with System Size set to '10,000' and System Type set to 'Other'.*

25. Once set-up is complete, turn off the power supply and disconnect the PC.

Connecting the External Device

26. Connection of the External Device to the RS232 port on the Encoder can be made in one of two ways:

a) Connecting the P910 or P911 to Encoder SK1.

b) Connecting an alternative cable to the Krone connections on Encoder SK2.

27. Note that Encoder SK1 and SK2 are connected in parallel; only one socket can be utilised.

28. Pin out details of Encoder sockets SK1 and SK2 are shown in Table 1.

Table 1: Encoder SK1 / SK2 Pin Outs

SK1 (FCC 68)	
Pin 1	Ground
Pin 2	TxD
Pin 3	RxD
Pin 4	CTS
Pin 6	RTS

SK2	
Pin 1	CTS
Pin 2	RTS
Pin 3	RxD
Pin 4	TxD

NOTE: *If connecting the External Device to SK2, a return connection (signal ground) should be made to 0V on SK4 (pin 1 or pin 2) of the Encoder PCB.*

29. Connection details for cable assemblies P910 and P911 are shown in Tables 2 and 3. Pin layout is illustrated in Figure 4.

Table 2: P910 Connections

8 Way Modular Jack Plug	9 Way D-Type Connector
Pin 1	Pin 5 Signal Ground
Pin 2	Pin 2 Transmit Data
Pin 3	Pin 3 Receive Data
Pin 4	Pin 7 CTS
Pin 5	Pin 6 N.C.
Pin 6	Pin 8 RTS
Pin 7	Pin 4 N.C.
Pin 8	Pin 1 N.C.

N.C. = Not Connected

Table 3 : P911 Connections

8 Way Modular Jack Plug	25 Way D-Type Connector
Pin 1	Pin 7 Signal Ground
Pin 2	Pin 3 Transmit Data
Pin 3	Pin 2 Receive Data
Pin 4	Pin 4 CTS
Pin 5	Pin 6 N.C.
Pin 6	Pin 5 RTS
Pin 7	Pin 20 N.C.
Pin 8	Pin 8 N.C.

N.C. =Not Connected

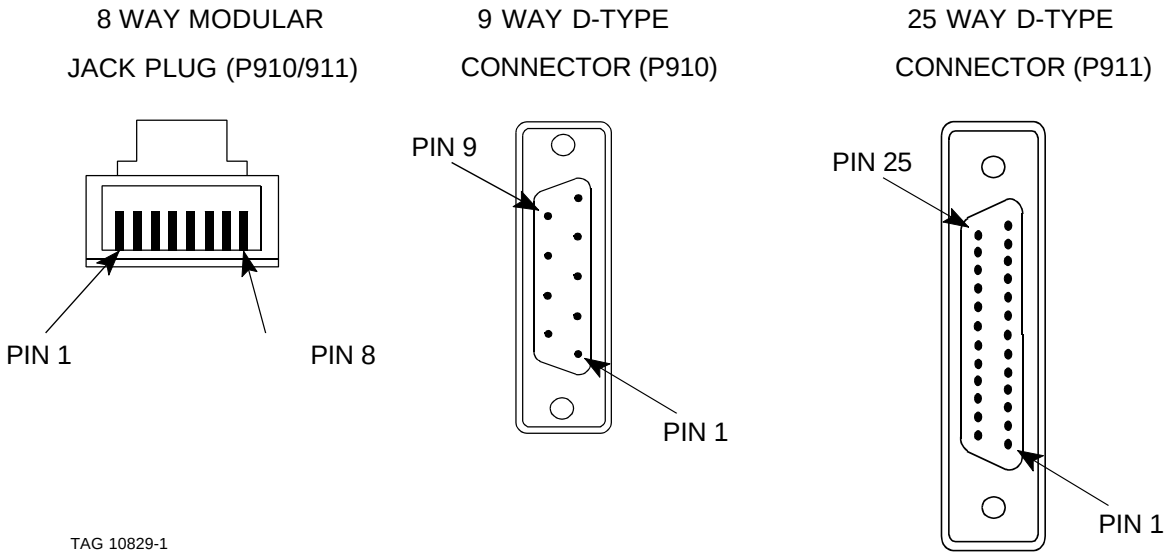


Figure 4: P910/P911 Connector Pin Layouts

Audio Connection

30. If required, the audio output from the External Device should be connected to Serial Encoder SK1 using the 2-Way Socket, Part No. 4501-0001 (provided) and suitable cable (RV1 on the Encoder PCB may be adjusted to compensate for the output level provided by the audio source at the customer's premises).

Direct Line Contacts (DLCs)

31. DLCs can be a door bell push, a security alarm, a sensor on a piece of machinery etc. Contacts must close to initiate a paging call and should be connected to the Serial Encoder by a twisted-pair wire.

32. The loop resistance of each DLC connection must not exceed 150 S.

33. DLC connections are listed in Table 4. Return connections are made to 0V on SK4 (pin1 or pin 2) of the Encoder PCB.

Table 4: DLC Connections

SK3	
Pin 1	DLC 1
Pin 2	DLC 2
Pin 3	DLC 3
Pin 4	DLC 4

SK5	
Pin 1	DLC 5
Pin 2	DLC 6
Pin 3	DLC 7
Pin 4	DLC 8

34. Remove the Interconnect Cable 4404-0003 and re-fit the flexi-cable to PL1 of Transmitter and Encoder. Replace and secure the cover.

Antenna

35. Following the manufacturer's instructions, connect the antenna to SK4.

36. If using the Whip Antenna, stand the antenna on a flat surface and lay the connecting lead as straight as possible to the Serial Encoder. The best transmission will be achieved with the antenna as high as possible and preferably stood on a metal surface such as a filing cabinet. This will achieve a good ground-plane.

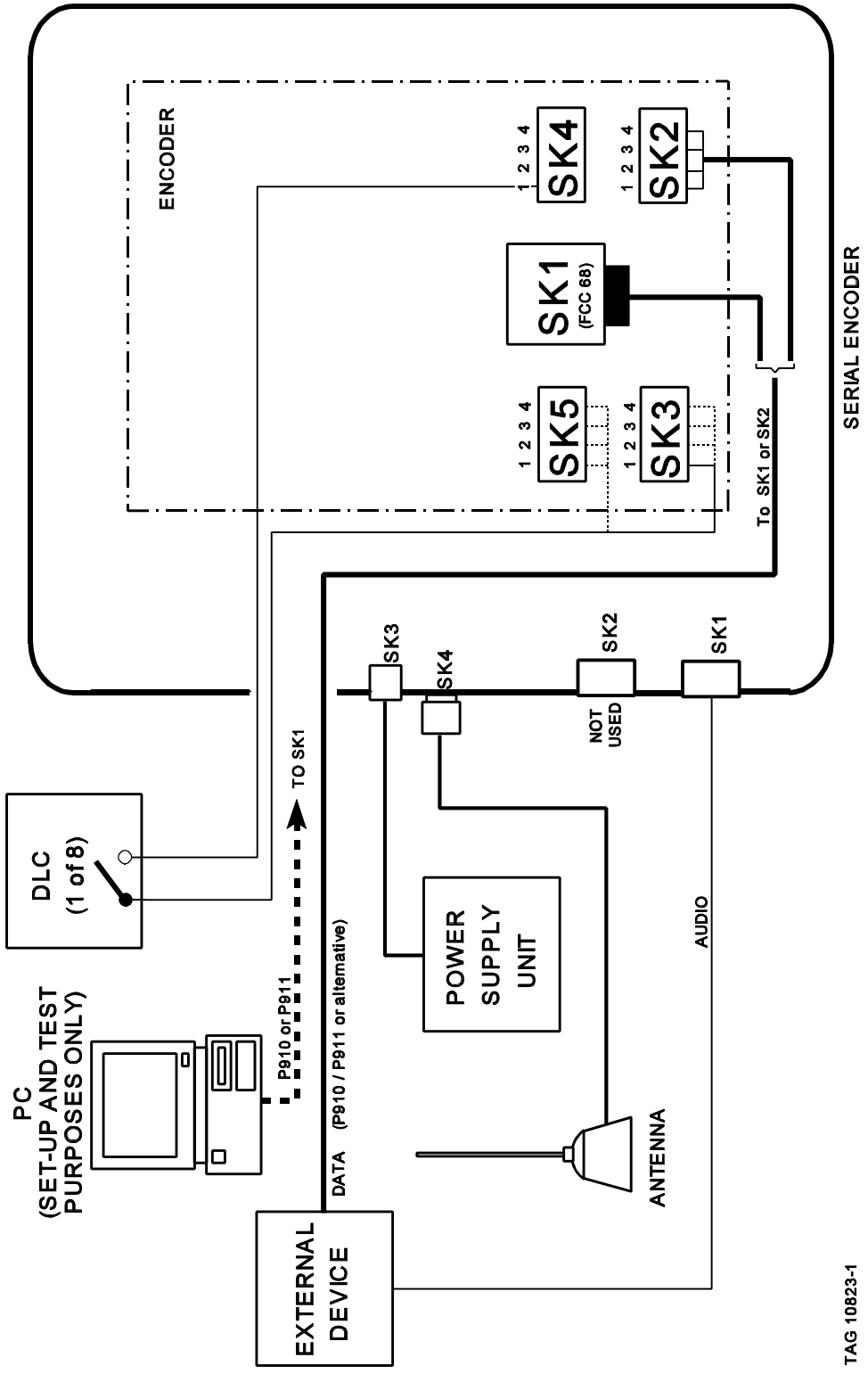


Figure 5: External Connections

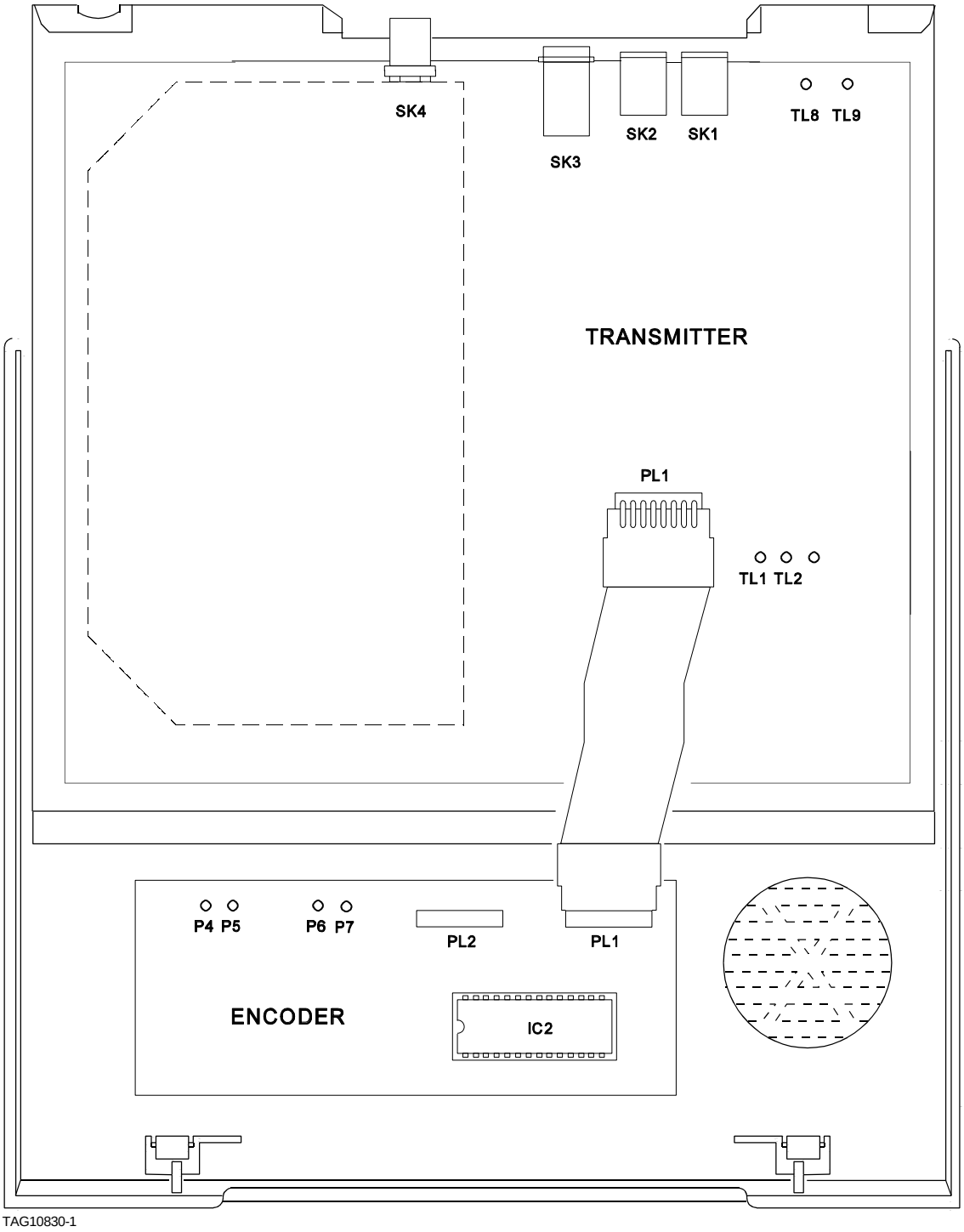


Figure 6: Serial Encoder - Service Layout

SERVICING

Repair Policy

37. The following service policy applies to the RPE 673:

    a) The Encoder PCB and the Encoder firmware device (IC2) are disposable modules; both are available as service spares.

    b) The Transmitter PCB is repairable to component level (for part numbers, refer to Section 6).

38. Transmitter alignment procedures (paras 45 - 49) rely on the use of a PC for Transmitter keying. For alignment procedures without the use of a PC, refer to Section 5.

Removal / Re-fitting of Circuit Boards

39. Disconnect the antenna and connectors from the rear of the case. At the rear of the unit unscrew and remove the two retaining screws. Lift the cover slightly (it will only clear the base by 4 to 5 inches). Carefully disconnect the 8-way flexi-cable from PL1 of the Transmitter. Pivoting on its front edge, invert the cover and slide it under the base.

40. To remove the Encoder board, de-solder the two screened cables from P4, P5, P6 and P7 of the Encoder PCB (see Figure 6). Remove the four screws to release the Encoder PCB.

41. When replacing a suspect Encoder PCB with a service replacement PCB, proceed as follows:

    a) Remove the suspect Encoder PCB.

    b) Remove the replacement Encoder PCB from its packaging.

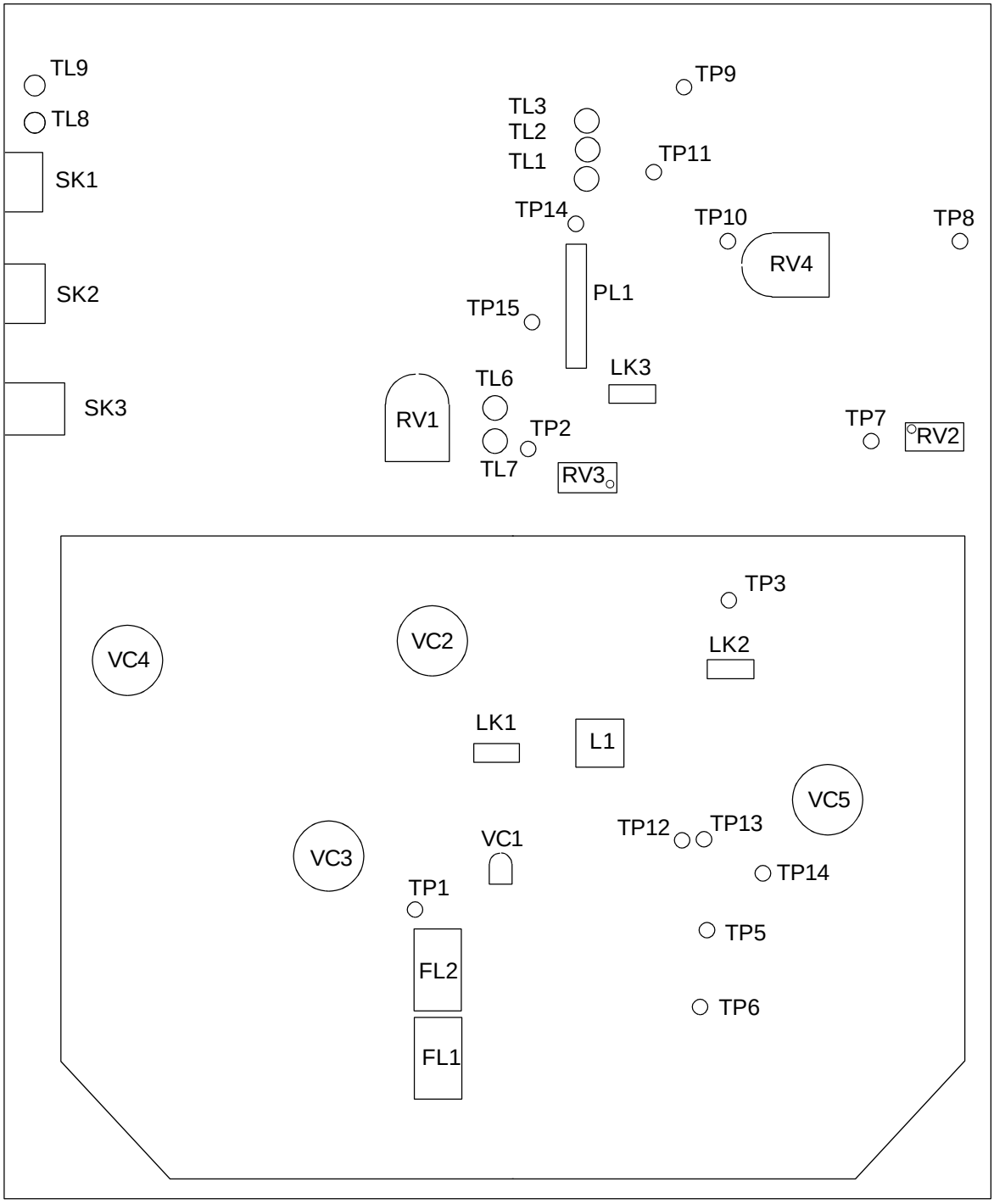
    c) Carefully transfer the firmware device (IC2) from the suspect Encoder PCB to the replacement Encoder PCB.

    d) Fit the service replacement Encoder PCB.

    e) Carry out the Set-up procedure detailed in paras 18 - 25.

42. To Remove the Transmitter board, de-solder the two screened cables from TL1, TL2, TL8 and TL9 of the Transmitter board (see Figure 6). Remove the four securing nuts to release the Transmitter PCB.

43. Re-assembly is the reverse of dismantling. Replace the 8-Way flexi-cable (removed in paragraph 39) before re-fitting the cover.



PSG10532-1

Figure 7: Transmitter PCB Layout

Transmitter Alignment - Initial Settings

44. Refer to Figure 7. Set the variable components and links as follows:

VC1 - Anywhere.
VC2 - Half Meshed.
VC3 - Fully Un-meshed.
VC4 - Fully Un-meshed.
VC5 - 25% Meshed.

FL1 and FL2 - Adjusters standing proud by 2mm.

RV1 - Fully Anti-clockwise.
RV2 - Mid Position (15 turns from either end).
RV3 - Anywhere
RV4 - Mid Position

LK1 - Position 2-3 (Normal Version).
Position 1-2 (FTZ Version).

LK2 - Position 1-2 (Bands 1 and 2).
Position 2-3 (Band 3).

LK3 - Position 2-3 (Normal Operation).
Position 1-2 (Invert Data Sense).

45. Set up the test equipment as follows:

a) Disconnect the external audio input from SK1 on the Transmitter PCB.

b) Connect the absorption wattmeter or power meter to the antenna socket using a lead no longer than 300mm.

c) Connect the modulation meter and frequency counter to the attenuated output.

d) Connect the power supply to SK3.

e) Connect the audio signal generator to Serial Encoder SK1.

f) Connect the serial port of your PC to SK1 (FCC 68) of the Encoder PCB using the P910 or P911 cable. If using Windows 95, run Hyper-Terminal; if using Windows 3.1, run Terminal.Exe. Configure your serial port as follows: 9600 Baud, 8 Data bits, 2 Stop bits, no Parity bit, Flow Control = Hardware.

g) Connect the external power supply to SK3 of the Serial Encoder.

h) Power up the Serial Encoder, wait 3 seconds and, within a further 10 seconds, press <Enter> on the Terminal keyboard; the **Set-up / Test Menu** should appear on the VDU (see Figure 8).

j) Select **(T)est Menu**.

NOTE: *The Transmitter Tests are used to key the Transmitter during alignment, Full Test is for factory use only.*

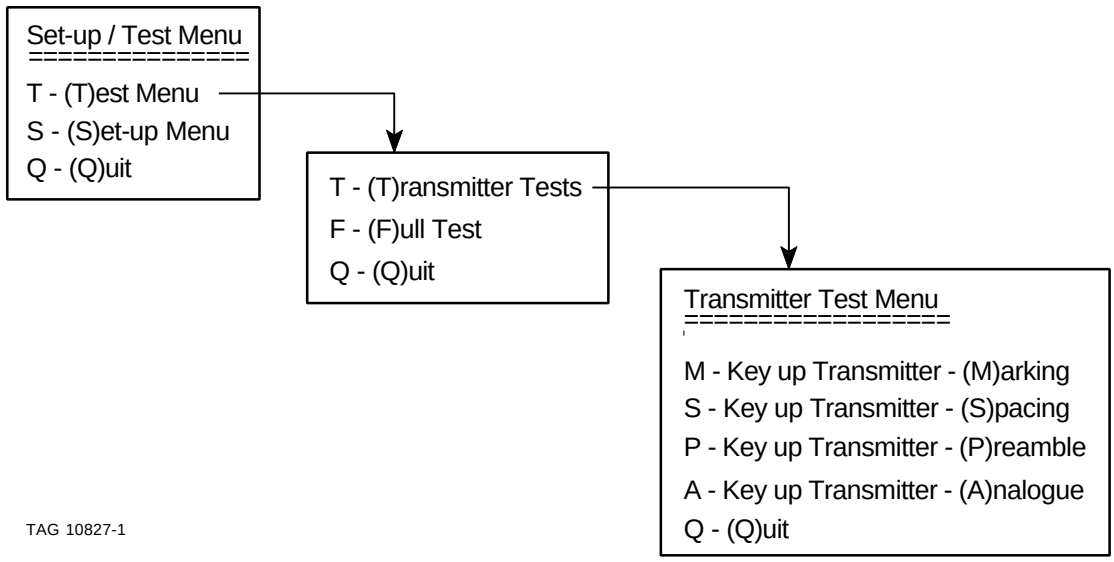


Figure 8: Test Menu Options

Setting up the Phase Lock Loop

46. Set up the Phase Lock Loop as follows:

a) Connect the oscilloscope to TP3.

b) Adjust the slug of L1 to give 5V ±0.2V DC at TP3.

Transmitter Alignment

47. To align the Transmitter carry out the following procedure:

a) Connect the oscilloscope to TP7.

b) Adjust RV3 to give 0V ±50mV DC at TP7.

c) Key up the Transmitter by selecting **(A)nalogue**.

d) On FL1 and FL2 turn the four adjusters ½ turn at a time until the power meter indicates or the power supply current increases.

e) If no power appears slightly adjust VC2 or VC3 and repeat (d).

f) Tune the four adjusters of FL1 and FL2 for maximum power.

g) Tune VC1, VC2 and VC3 for maximum power and then RV1 to give a power meter reading of 2.5W.

h) Re-adjust VC1, VC2 and VC3 for maximum power then RV1 for 2.5W ±0.2W.

Setting Data Deviation and Centre Frequency

48. To set the Data Deviation and Centre Frequency carry out the following procedure:

a) Select **(M)arking** (continuous ‘1's) from the Transmitter Test Menu. Measure the output frequency to the nearest 10Hz.

b) Select **(S)pacing** (continuous ‘0's) from the Transmitter Test Menu and again measure the output frequency to the nearest 10Hz.

c) Adjust RV2 as necessary until the measurement at (b) differs from the measurement at (a) by the amount given in the TOTAL DEVIATION column of Table 5 (within the specified tolerance).

d) Using a plastic trimming tool adjust VC5 until the mean of the two frequencies measured at (a) and (b) is within 100Hz of the specified centre frequency of the Transmitter.

Table 5: Data Deviation

CHANNEL SPACING kHz	DEVIATION kHz	TOTAL DEVIATION kHz	TOLERANCE
25	± 4.5	9	± 200Hz
20	± 3.6	7.2	± 200Hz
12.5	± 2.25	4.5	± 100Hz
10	± 1.8	3.6	± 100Hz

e) Repeat sub-paragraphs (a) to (d) as necessary.

f) Select **(A)nalogue** from the Transmitter Test Menu. Adjust RV3 to give the specified centre frequency of the Transmitter (to a tolerance of ±100Hz).

Setting Analogue Deviation

49. To set the Analogue Deviation carry out the following procedure:

a) Select **(A)nalogue** from the Transmitter Test Menu.

b) Set the audio generator output to 1.25kHz at a level of -13dBm (approximately 11.5mV peak-to-peak as measured on the oscilloscope). Monitor the deviation on the modulation meter. Adjust RV1 on the Encoder PCB fully clockwise.

c) Refer to Table 6(a) and adjust the generator output level to give a deviation corresponding to the channel spacing.

d) Increase the signal generator output level by 20dB and adjust RV4 to give a deviation corresponding to that given in Table 6(b) (this should be the larger of the Peak '+' or Peak '-' readings on the modulation meter).

Table 6: Analogue Deviation

CHANNEL SPACING kHz	DEVIATION (a) kHz	DEVIATION (b) kHz	DEVIATION (c) kHz	DEVIATION (d) kHz
25	± 3	± 4.5	± 5	± 4.9
20	± 2.4	± 3.6	± 4	± 3.9
12.5	± 1.5	± 2.25	± 2.5	± 2.4
10	± 1.2	± 1.80	± 2	± 1.9

e) Reduce the signal generator level by 20dB and re-adjust its output level to give a deviation corresponding to that given in Table 6(a).

f) Increase the signal generator level by 20dB and re-adjust RV4 to give a deviation corresponding to that given in Table 6(b).

g) Vary the signal generator frequency between 300Hz and 2.5kHz and check that the deviation does not exceed that given in Table 6(c). If it does, tune to the frequency that gives the maximum deviation and adjust RV4 to give a deviation corresponding to that given in Table 6(d) (this should be the larger of the Peak + or Peak - readings on the modulation meter).

h) Adjust RV1 on the Encoder PCB as necessary to compensate for the output level provided by the external audio source at the customers premises.

j) Remove the signal generator.

FAULT FINDING

50. Specific fault finding information is not provided. For Transmitter test points, together with expected signals, refer to Section 5.

NOTE: *When the Serial Encoder is fitted with MEP firmware, it can be tested using CITEST.EXE (supplied with the Developers Pack D3NA).*

ANTENNA CUTTING

51. Refer to Section 5.

52. SPARE PARTS LIST

NOTE: *For General Spares and Transmitter PCB components, refer to Section 6*.

ITEM / CIRCUIT REFERENCE	DESCRIPTION	PART No.
	ENCODER PCB	0201-0654
IC2	FIRMWARE RPE 671 /673 + ESPA	0501-0175
IC2	FIRMWARE RPE 671 /673 + MEP	0501-0179

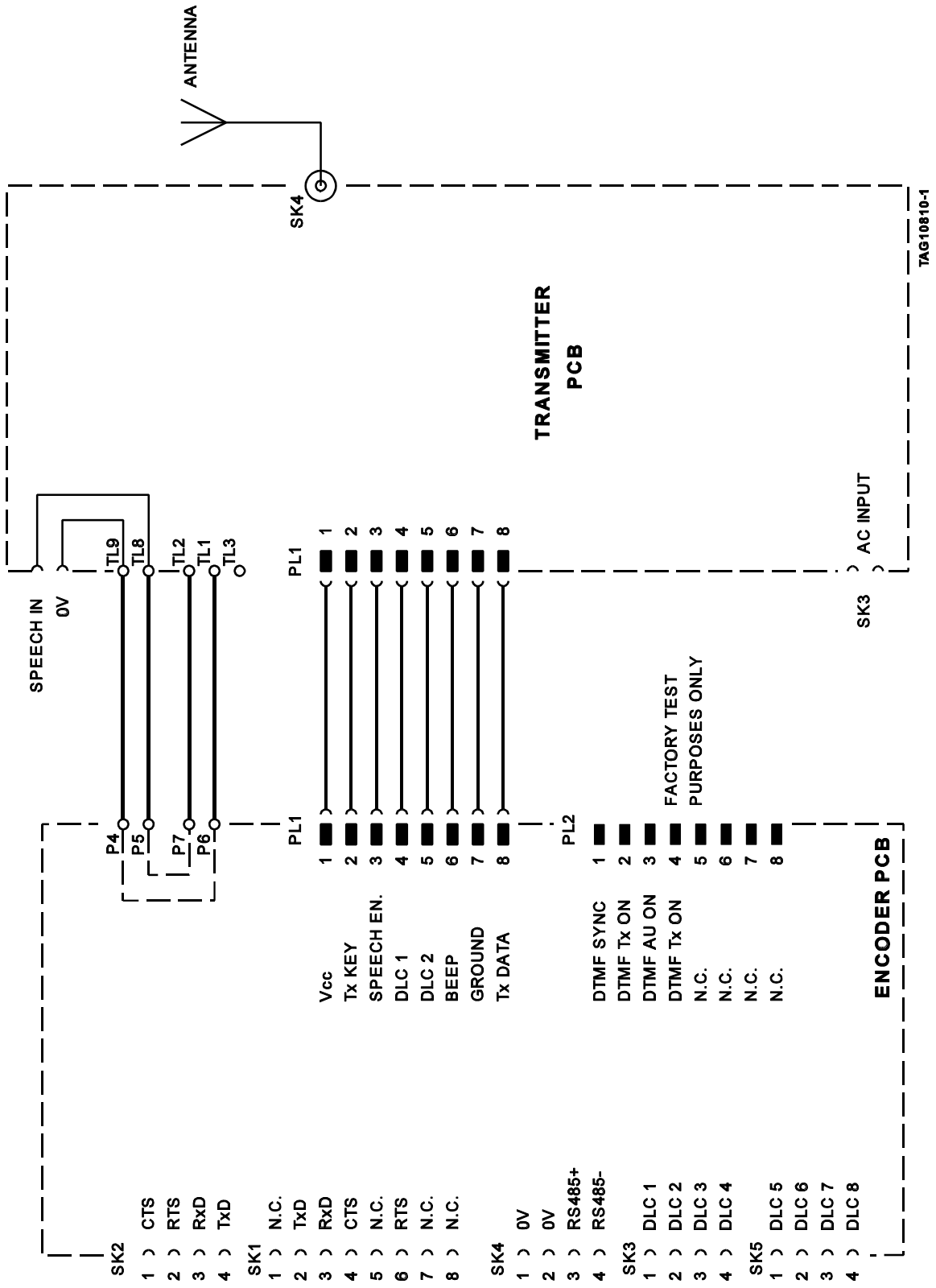


Figure 9: Serial Encoder Interconnection Diagram