KT1 & KT4 Series Telephones

LD and MF Versions

TMC Limited

Servicing Handbook

KT1 Series

KT4 Series

PHILIPS

The policy of the company is one of continuous development and improvement and the management reserves the right to alter designs and specifications without notice

Printed in England

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Edition 1

KT1 & KT4 SERIES TELEPHONES
LD & MF VERSIONS

CONTENTS

TABLES

FIGURES

TECHNICAL DATA

Overall Dimensions	
Width	150mm (KT1) 150mm (KT4)
Height (over handset)	100mm (KT1) 90mm (KT4)
Depth (over handset)	220mm (KT1) 225mm (KT4)
Handset cord (normal)	250mm (normal), 1.7m (extended)
Line Cord	3m
Weights	
Basic Instrument	672gm } Nominal. Weights between variants
Total Weight (packed)	950gm } may vary slightly
Environmental Conditions:	
Temperature (operational)	-10°C to 50°C (to BS2011)
Temperature (storage)	-20°C to 60°C
Humidity (classification 21)	95% relative humidity
Supply Voltage:	
Direct from exchange	a) 19V to 27V d.c. (24V nominal) b) 40V to 52V d.c. (48V nominal) c) 50V to 65V d.c. (60V nominal)
Line conditions	a) Suitable for use on lines of loop resistance in the range 0 to 1.25kohms, one leg at battery voltage, the other at 0V, with exchange voltages of 48V and 60V nominal b) With exchange voltage of 24V nominal, suitable on lines of loop resistance in the range 0 to 300 ohms
Speech Performance	
Send and receive sensitivities	Set at internationally accepted levels, and controlled electronically
Regulation	Applied within the integrated circuit to increase send and receive sensitivity of the telephone as the line length increases
Sidetone	Well controlled over all line lengths
Frequency responses	Tailored to suit speech transmission over local lines and trunk carrier systems
Keypad:	
10 keys (LD Version) or }	Keys laid out to C.C.I.T.T. recommendations and are 2-shot moulded for complete reliability
12 keys (MF Version) }	
Recall	Supplied with earthloop recall, timed break recall or register recall
Microelectronics	Single MOS-LSI circuit combines both signalling and transmission functions
Loop-Disconnect Dialling:	
Storage	Storage capacity of 18 decimal digits provided. Cyclical storage feature extends effective storage capacity

Speed/Ratio Versions:

10 p.p.s.	2:1	Break/make
10 p.p.s.	1.55:1	Break/make
20 p.p.s.	2:1	Break/make

Inter Digit Pauses:

10 p.p.s.	753-953 milliseconds
20 p.p.s.	377-477 milliseconds

(Dialling speed and ratio accuracy is maintained at ±2% over temperature range and lifetime)

Power: Line powered — no internal battery required

Tone Caller: Consists of an integrated circuit driving a piezo-ceramic element bonded to a large diameter metal disc. A pleasant two-tone calling signal is emitted alternating between frequencies in the region of 1.1 kHz and 1.25 kHz. At the loudest volume control setting, the output is at least 80 dBA at one metre. The caller is muted during dialling and a 'caller mute' wire is available in line cord to mute other callers and bells when the KT1 or KT4 is dialling as a multi-extension plan installation.

Transmitter/Receiver Inserts: High reliability moving coil transducers.

MF Dialling:

Frequency accuracy: ± 1.5% over temperature range and lifetime

Sending levels:

a) 9dBm ± 2dB high frequency group
b) 11dBm ± 2dB low frequency group
c) also available
   i) 6dBm ± 2dB high frequency group
   ii) 8dBm ± 2dB low frequency group

(with high frequency component 2dB ± 1dB above low frequency component)

MF Dialling Key Frequencies:

		High Frequency Group (Hz)		
		1209	1336	1477
Low Frequency Group (Hz)	697	1	2	3
	770	4	5	6
	852	7	8	9
	941	*	0	#

The sender gives guaranteed tone-burst duration and inter-tone pause duration of 70 milliseconds each

KT1 AND KT4 SERIES TELEPHONES

INTRODUCTION

1 This handbook covers the range of TMC KT1 and KT4 Series Telephones which are offered to suit various requirements, styling and colour preferences of customers throughout the world. The range is compatible with British Telecom systems. Each instrument is batteryless, being powered by supplies received from the telephone exchange lines. The pushbutton action keys enable positive, quick and easy switching, without switch contact bounce.

2 The standard instrument may include various optional facilities to suit site requirements. These are:

1) Message waiting circuit — a facility useful for example, in an hotel installation, whereby an external lamp, powered from the lines, is switched on to indicate that a call can be obtained from the reception desk.
2) Bell capacitor circuit — a spike protection and anti-tinkle circuit, fitted when the alternative circuit, normally fitted in a wall socket, is not available on site. The circuit prevents other telephones on the same line from ringing when dialling from one of the telephones.
3) 400 x 400 ohm feeding bridge circuit — additional components fitted to suit some overseas installations.
4) Tone caller ICs — alternative components fitted to be compatible with Texas Instruments or Ferranti tone caller ICs. Normal versions use special TMC (1503) ICs.
5) Locking version option — additional component, used to disable signals, but allow speech. This circuit is used to prevent outgoing calls, but allows incoming calls.
6) Additional component spaces — provided for possible future use.
7) Timed break recall — additional components as required, to introduce given time break in line (e.g. 70ms, 125ms or 280ms) for timed break recalls.

3 The special TMC integrated circuits are designed to meet the requirements of a new generation of telephone sets, in line with the latest developments in telecommunications technology.

MECHANICAL CONSTRUCTION

4 The TMC KT1 Series telephone comprises three major assemblies, the handset, the base instrument, and when mounted on a wall — the wall bracket assembly. The KT4 Series is a desk standing model only, and comprises the handset and base instrument assemblies.

5 The handset is connected to the base instrument by means of the 250mm handcord, which may be extended to 1.7 metres when used. The KT1 handset may be dismantled by removing the screw at the earpiece end and by releasing the mid-section retaining clips (with a flat-bladed tool such as a nail file or large screwdriver), to separate the two mouldings. The KT4 handset mouldings are separated in the same way, except that there is no retaining screw at the earpiece end. A cut-out is provided instead, to enable a large screwdriver to release the moulding clips at this end.

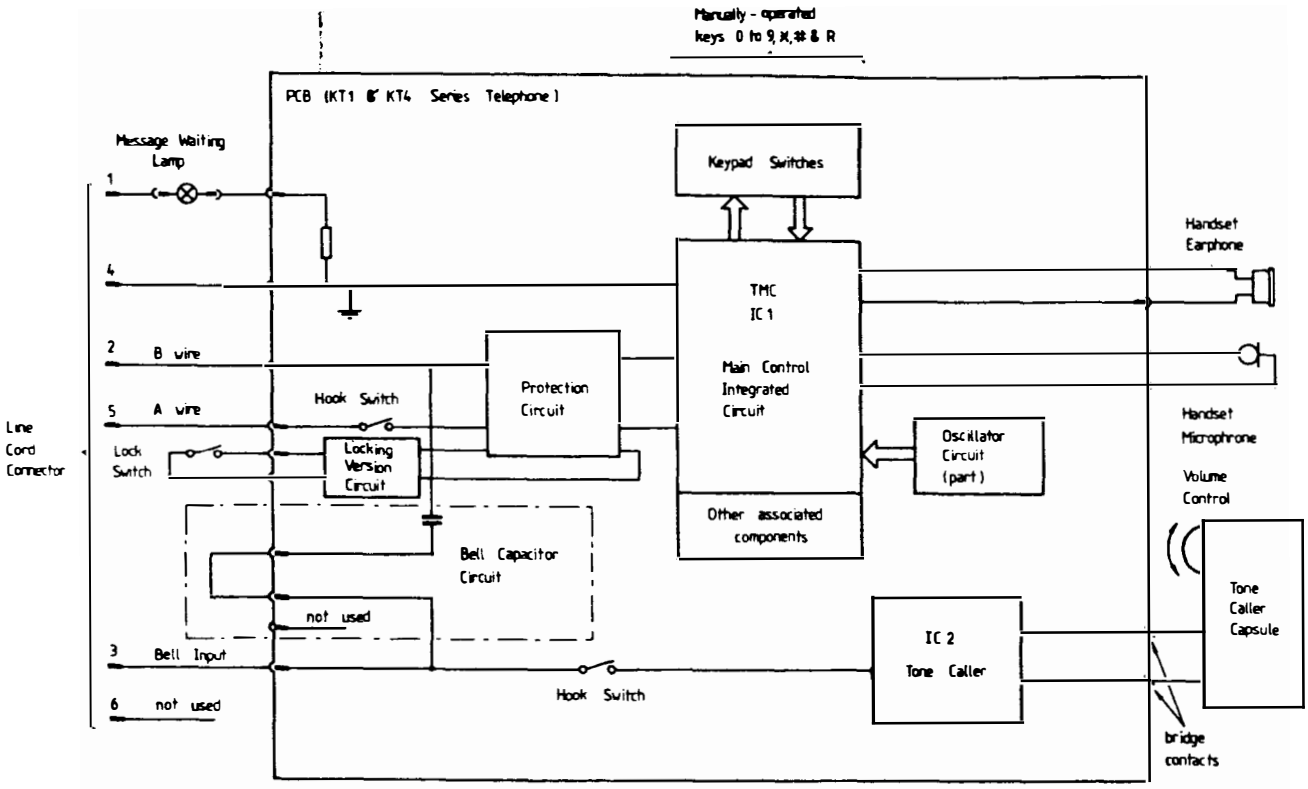
6 The base instrument contains the following major sub-assemblies:

1) Moulded base — containing the rubber mounted feet, telephone tone caller capsule and adjustable volume control.
2) Printed circuit board.
3) Rubber keypad mat.
4) Keyboard (individual pushbutton keys 0 to 9, ★, #, and R (Recall) with pushbutton guide housing.
5) Upper moulded case.

7 To dismantle the base instrument:

1) Lift off the handset. Turn the instrument upside down.
2) Remove the base screw and lift off the moulded plastic base.
3) Press back in turn, each of the plastic retaining clips and carefully free the PCB.
4) Lift out the rubber mat.
5) Hold the pushbutton guide housing in the instrument and turn the instrument upright. Lift off the upper case, leaving the keys in the pushbutton guide housing assembly.

8 The unit is reassembled in the reverse order. Care should be taken to ensure that the keys are replaced in the correct positions, if they have been previously disturbed.



PRINCIPLE OF OPERATION

9 The electronic circuit is centred on the specially designed TMC circuit which provides a comprehensive range of functions.

10 In the KT1 and KT4 Series telephones, associated components and links may be selected as required to suit various options (refer to the circuit descriptions below), and to the appropriate circuit diagram.

11 The keypad has been developed for positive, speedy, smooth action. The rubber mat conductive contacts directly operate the touch responsive switches on the PCB. The setting of these switches is monitored by the main control IC.

12 Figure 1 shows the principle of operation in block diagramatic form. A more detailed circuit description is given in the following paragraphs.

CIRCUIT DESCRIPTIONS

13 In order to identify the appropriate circuit diagram and descriptive text for any particular instrument, examine the integrated circuits IC1 and IC2, and check for the presence of TR3 and TR5. The references in table 1 may then be used to identify the appropriate variant.

TABLE 1 **CIRCUIT IDENTIFICATION**

IC1	IC2	TR3 & TR5	Circuit Diagram	Text Paragraph
TMC 1302	Texas TCM 1512P/Ferranti	No	2	14
TMC1302/TMC1604	TMC 1503	No	3	34
TMC 1317	Texas TCM 1512P/Ferranti	No	4	54
TMC1317/TMC1617	TMC 1503	No	5	71
TMC 1317	Texas TCM 1512P/Ferranti	Yes	6	89
TMC1317/TMC1617	TMC 1503	(See Fig. 7)	7	107

(Figure 2)

KT1 and KT4 Basic LD (Loop Disconnect) Version

14 The PCB is connected to the line via line cord terminal pins as follows:

Pin 1 — via optional message waiting lamp circuit
Pin 2 — B wire
Pin 3 — Bell input
Pin 4 — Earth Loop Recall (return)
Pin 5 — A wire
Pin 6 — Not used

15 The A and B wires (nominally 24V, 48V or 60V d.c. lines) are routed via Link L and the polarity bridge D4, D5, D7 and D8. The polarity bridge, including surge suppressor, D6, a 130V Zener diode, also provides transient protection.

16 The message waiting option comprises R15, PLG, SKG, PLH, SKH and lamp LP1. This option is most useful in say, an hotel, where the operator has received a call for a guest, but has been unable to contact him. The operator can remotely activate the message waiting lamp, which is directly connected to the line cord, to act as a reminder that a message is waiting to be collected.

17 The bell capacitor, C10 and PLC/SKC, is fitted in installations not using wall socket capacitors. The circuit provides protection from transient spikes, and is used as an anti-tinkle device to prevent other telephones ringing during dialling operations.

18 The tone caller capsule is fitted to the base of the instrument and connected to the PCB when the instrument is correctly assembled via BC1 and BC2, which are tin plated bridge contacts. The tone caller capsule is fitted with an adjustable volume control (attenuator), which should be turned clockwise (when looking at the base of the telephone) to increase volume.

19 When a Texas TCM1512P IC (IC2) is used for the tone caller, R22 and XL2 are omitted. Components R14, R19, R20, D17 and C11 are omitted when IC2 is a Ferranti device. C9 is then changed to 22 μf, 40V.

20 For the timed break recall option, links G and H are fitted, and links J and K are removed. Switch S12 is operated by the R (Recall) key. For the earth loop recall option, links J and K are fitted and links G and H are removed. All of these links and S12 are omitted in the basic version.

21 Link A is not fitted on commercial versions of KT1 and KT4. For 200 x 200 ohm feeding bridge systems, fit SKB to pins 1 and 2 of PLB. For some overseas installations using 400 x 400 ohm feeding bridge systems and when using the KT1 or KT4 telephone with a KBX10 or KBX100 system, fit SKB to pins 2 and 3 of PLB.

22 For the locking version option, additional components D19, S13, PLE, PLF, SKE and SKF are fitted. This circuit prevents outgoing calls being made.

23 In the circuits associated with IC1, R8, C12, C14 to C17, D2 and D16 are not required for initial units, but the positions are provided for possible future developments.

24 Most of the line current flows down the base of TR2 and through TR1. TR2 is then saturated in the on state. TR1 provides current amplification during speech periods as it is configured as a current source in series with the loop. TR1 and TR2 are switched off during impulses and line breaks. Capacitor C2 maintains the positive supply rail for IC1 under such circumstances. R9 provides a small bias current which is used to start up the circuit. XL1 is a 560kHz ceramic resonator, providing a clock signal for the internal logic of IC1.

25 The signal from the microphone is amplified by about 24dB by the IC microphone amplifier, which is of a special low noise design. This amplifier also provides a d.c. level-shift function which is applied, together with the amplified microphone signal to the base of TR1.

26 The signal from the line is obtained via an attenuator R7 and R3 and is fed into the earphone amplfier via C7 where it is summed with the sidetone signal from the microphone amplifier to provide sidetone cancellation. The earphone amplifier output stage consists of a large enhancement transistor with an actived driven load to provide the drive required by a 600 ohm earphone.

27 Both the microphone and earphone amplifiers have a line displacement gain which is controlled by the AGC control system. This circuit takes a voltage from the d.c. control block which is similar to that found on the base of TR1 and compares it with a voltage reference multiplier circuit.

28 When a pushbutton key is depressed, the circuit changes into the dial mode of operation and the oscillator is started. The microphone amplifier is disabled and its d.c. level-shift function is taken over by the dial mode d.c. regulator. The earphone amplifier is ramped to a low current state by the anti-ear click circuit which is a clock driven integrator. The button depression is verified by an anti-bounce circuit, and if accepted, the circuit will impulse out the required number. During impulses, the base of TR1 is pulled down, thus switching off TR1 and TR2, since the latter's base current is also removed. For the duration of the impulse, the circuit relies on the charge stored in C1 to maintain operation (hence the

necessity to reduce the earphone amplifier power consumption). The chip can store up to 18 digits in its memory, whilst signalling at any given time.

29 During signalling, the circuit may be subject to line breaks caused by the exchange and these should not interfere with the signalling. It is therefore necessary for the circuit to reorganise these and to conserve the power stored in C2 until the power returns. However, should the break last for more than a given period, it must be interpreted as a hook switch down action and therefore return to speech mode. The chip contains a line break detector which compares Vdd with the voltage at the emitter of TR2 and should the latter be of a lower voltage, the circuit will assume it is a break and switch off TR1 and TR2. The break is timed by the logic which resets the circuit to speech mode if the break lasts for more than 180 ms. Should the power return before a period of 180 ms, the circuit will continue to pulse out.

30 On very long lines, Vdd may not be high enough to maintain the operation of the logic during impulses and line breaks if the normal d.c. function were to be applied. For this reason, a minimum Vdd regulation is included which prevents Vdd dropping below a given value before impulsing commences.

31 Links D, E and F set the impulse speed and ratio according to the following:

Speed	Break/Make Ratio	Fit Link
10 p.p.s.	2:1	E
10 p.p.s.	1.55:1	D
20 p.p.s.	2:1	F

32 At the end of the signalling mode of operation, the microphone amplifier is switched on and the earphone amplifier is ramped back to normal again. Once the sequence is complete, the oscillator is switched off.

33 For KT1 Series telephones, link M is omitted, C3 to be 0.68μf if the microphone is to DNT2002-002-0199, Issue 6 or 0.47μf if the microphone is to DNT2002-002-0199, Issue 7. For KT4 Series telephones, R4 is omitted, C3 to be 0.22μf.

(Figure 3)

KT1 and KT4 (1503) LD (Loop Disconnect) Version

34 The PCB is connected to the line via the following line cord terminal pins:

Pin 1 — To optional message waiting lamp circuit

Pin 2 — B wire

Pin 3 — Bell input

Pin 4 — Earth Loop Recall (return)

Pin 5 — A wire

Pin 6 — Not used

35 The A and B wires (nominally 24V, 48V or 60V d.c. lines), are routed via the polarity bridge D9, D10, D12 and D13. The polarity bridge, including surge suppressor, D11, a 130 V Zener diode, also provides transient protection. C15 is not fitted, but its space provides for possible future development.

36 The message waiting option comprises R18, PLG, SKG and l.e.d. D22. This option is most useful, in say an hotel where the operator has received a call for a guest but has been unable to contact him. The operator can remotely activate the message waiting lamp which is directly connected to the line cord, to act as a reminder that a message is waiting to be collected.

37 The bell capacitor circuit, C17 and PLC/SKC, is fitted in installations not using wall socket capacitors. The circuit provides protection from transient spikes, and is used as an anti-tinkle device to prevent other telephones ringing during dialling operations.

38 The tone caller capsule is fitted to the base of the instrument and connected to the PCB when the instrument is correctly assembled via BC1 and BC2, which are tin plated bridge contacts. The tone caller capsule is fitted with an adjustable volume control (attenuator), which should be turned clockwise (when looking at the base of the telephone) to increase the volume.

39 The tone caller circuit is centred on a TMC 1503 integrated circuit. D20 and D21 are provided for future development and are not currently used. Links K and L, although currently fitted, allow for further future development. Components SKD, PLD and R17 are omitted and link M is fitted for British Telecom versions. Conversely, for commercial applications, link M is omitted and SKD, PLD and R17 are fitted. R17 in the circuit will reduce the volume of the tone called by 10dB.

40 For the timed break recall option, links F and G are fitted, and links H and J are removed. Switch S11 is operated by the R (Recall) key. For the earth loop recall option, links H and J are fitted and links F and G are removed. All these links and S11 are omitted in the basic version.

41 Link A is not fitted on commercial versions of KT1 and KT4. For 200 x 200 ohm feeding bridge systems, fit SKB to pins 1 and 2 of PLB. For some overseas installations using 400 x 400 ohm feeding bridge systems and when using KT1 or KT4 telephones with a KBX10 or KBX100 system, fit SKB to pins 2 and 3 of PLB.

42 For the locking version option, additional components D2, S13, PLE and SKE are fitted. This circuit prevents outgoing calls being made.

43 In the circuits associated with IC1, C1, C6, C11 to C14, D4 and D7 are not required for initial units, but the positions are provided for possible future developments. If IC1 is a TMC1604 device, D1 and R3 are omitted.

44 Most of the line current flows down the base of TR2 and through TR1. TR2 is then saturated in the on state. TR1 provides current amplification during speech periods as it is configured as a current source in series with the loop. TR1 and TR2 are switched off during impulses and line breaks. Capacitor C3 maintains the positive supply rail for IC1 under such circumstances. R10 provides a small bias current which is used to start up the circuit. XL1 is a 560kHz ceramic resonator providing a clock signal for the internal logic of IC1.

45 The signal from the microphone is amplified by about 24dB by the IC microphone amplifier which is one of a special low noise design. This amplifier also provides a d.c. level-shift function which is applied, together with the amplified microphone signal to the base of TR1.

46 The signal from the line is obtained via an attenuator R8 and R5 and is fed into the earphone amplifier via C10 where it is summed with the sidetone signal from the microphone amplifier to provide sidetone cancellation. The earphone amplifier output stage consists of a large enhancement transistor with an active driven load to provide the drive required by a 600 ohm earphone.

47 Both the microphone and earphone amplifiers have a line displacement gain which is controlled by the AGC control system. This circuit takes a voltage from the d.c. control block which is similar to that found on the base of TR1 and compares it with a voltage reference multiplier circuit.

48 When a pushbutton key is depressed, the circuit changes into the dial mode of operation and the oscillator is started. The microphone amplifier is disabled and its d.c. level-shift function is taken over by the dial mode d.c. regulator. The earphone amplifier is ramped to a low current state by the anti-ear click circuit which is a clock driven integrator. The button depression is verified by an anti-bounce circuit, and if accepted, the circuit will impulse out the required number. During impulses, the base of TR1 is pulled down, thus switching off TR1 and TR2 since the latter's base current is also removed. For the duration of the impulse, the circuit relies on the charge stored in C1 to maintain operation (hence the necessity to reduce the earphone amplifier power consumption). The chip can store up to 18 digits in its memory, whilst signalling at any given time.

49 During signalling, the circuit may be subject to line breaks caused by the exchange and these should not interfere with the signalling. It is therefore necessary for the circuit to reorganise these and to conserve the power stored in C2 until the power returns. However, should the break last for more than a given period, it must be interpreted as a hook switch down action, and therefore return to speech mode. The chip contains a line break detector which compares Vdd with the voltage at the emitter of TR2 and should the latter be of a lower voltage, the circuit will assume it is a break and switch off TR1 and TR2. The break is timed by the logic which resets the circuit to speech mode if the break lasts for more than 180ms. Should the power return before a period of 180ms, the circuit will continue to pulse out.

50 On very long lines, Vdd may not be high enough to maintain the operation of the logic during impulses and line breaks if the normal d.c. control function were to be applied. For this reason, a minimum Vdd regulation is included which prevents Vdd dropping below a given value before impulsing commences.

51 Links C, D and E set the impulse speed and ratio according to the following:

Speed	Break/Make Ratio	Fit Link
10 p.p.s.	2:1	D
10 p.p.s.	1.55:1	C
20 p.p.s.	2:1	E

52 At the end of the signalling mode of operation, the microphone amplifier is switched on and the earphone amplifier is ramped back to normal again, once the sequence is complete, the oscillator is switched off.

53 For the KT1 Series telephones, link B is omitted and C4 is 470nf, whilst for the KT4 Series, R6 is omitted and C4 becomes 220nf.

(Figure 4)

KT1 Basic MF (Multi-Frequency) Version

54 The PCB is connected to the line via the line cord terminal pins as follows:

Pin 1 — via optional message waiting lamp circuit
Pin 2 — B wire
Pin 3 — Bell input
Pin 4 — Earth Loop Recall (return)
Pin 5 — A wire
Pin 6 — Not used

55 The A and B wires (nominally 24V, 48V or 60V d.c. lines) are routed via link L and the polarity bridge D4, D5, D7 and D8. The polarity bridge, including surge suppressor, D6, a 130V Zener diode, also provides transient protection.

56 The message waiting option comprises R15, PLG, SKG, PLH, SKH and lamp LP1. This option is most useful in say, an hotel where the operator has received a call for a guest but has been unable to contact him. The operator can remotely activate the message waiting lamp, which is directly connected to the line cord to act as a reminder that a message is waiting to be collected.

57 The bell capacitor circuit C10 and PLC/SKC is fitted in installations not using wall socket capacitors. The circuit provides protection from transient spikes, and is used as an anti-tinkle device to prevent other telephones ringing during dialling operations.

58 The tone caller capsule is fitted to the base of the instrument and connected to the PCB when the instrument is correctly assembled via BC1 and BC2, which are tin plated bridge contacts. The tone caller capsule is fitted with an adjustable volume control (attenuator), which should be turned clockwise (when looking at the base of the instrument) to increase volume.

59 When a Texas TCM1512P IC (IC2) is used for the tone caller, R21 and XL2 are omitted. Components R14, R19, R20, D17 and C11 are omitted when IC2 is a Ferranti device. C9 is then changed to 22 μf, 40V.

60 For a timed break recall option, TR2, R9 and link H are fitted, links K, M and N are omitted. Switch S12 is operated by the R (recall) key. For earth loop recall, TR2, R9 and link H are omitted, whilst links K, M and N are fitted. On the basic version, with no recall facility, links M and N are fitted, links H and K, R9, S12 and TR2 are omitted.

61 Link A is not fitted on commercial versions of KT1 and KT4. For 200 x 200 ohm feeding bridge systems, fit SKB to pins 1 and 2 of PLB. For some overseas installations using 400 x 400 ohm feeding bridge systems and when using the KT1 or KT4 telephone with a KBX10 or KBX100 system, fit SKB to pins 2 and 3 of PLB.

62 In the circuits associated with IC1, R8, C4, D2 and D16 are not required for initial units, but these positions are available for possible future developments.

63 Most of the line current flows down the base of TR2 (if fitted, see paragraph 60) and through TR1. TR2 is then saturated in the on state. TR1 provides current amplification during speech periods as it is configured as a current source in series with the loop. TR1 and TR2 are switched off during timed break recall if this option is installed. Capacitor C2 maintains the positive supply rail for IC1 under such circumstances. If TR2 is fitted, R9 is required to provide a small bias current which is used to start up the circuit.

64 The signal from the microphone is amplified by about 24dB by the IC microphone amplifier which is of a special low noise design. This amplifier also provides a d.c. level-shift function which is applied, together with the amplified microphone signal to the base of TR1.

65 The signal from the line is obtained via an attenuator R7 and R3 and is fed into the earphone amplifier via C7 where it is summed with the sidetone signal from the microphone amplifier to provide sidetone cancellation. The earphone amplifier output stage consists of a large enhancement transistor with an active driven load to provide the drive required by a 600 ohm earphone.

66 Both the microphone and earphone amplifiers have a line displacement gain which is controlled by the AGC control system. This circuit takes a voltage from the d.c. control block which is similar to that found on the base of TR1 and compares it with a voltage reference multiplier circuit.

67 Operation of any of the twelve keypad pushbuttons causes the circuit to change from speech to tone mode. The on chip oscillator oscillates at the parallel resonance of XL1, which is 560kHz. The microphone and receive paths are switched off, but a small signal is fed from the tone generators to the earpiece, (confidence tone). The duration of any tone is a minimum of 70ms but will remain for the duration of the pushbutton operation. There is a 70ms 'silent' period at the end of each tone, when no tones or speech can be sent.

68 Links D and F are not currently required, but provision for their incorporation caters for future development. Link E is fitted only when tone levels of -6 to -8dB are required.

69 Link R is omitted for KT1 Series telephones, whilst R4 is omitted for the KT4 Series. C3 is to be 0.68 μf if the microphone is to DNT2002-002-0199, Issue 6, 0.47 μf if the microphone is to DNT2002-002-0199, Issue 7, or 0.22 μf for KT4 Series telephones.

70 C14 is used to trim the value of C1. If C1 is 2.4 μf, C14 is fitted. C14 is omitted if 2.7 μf is used for C1.

(Figure 5)

KT1 and KT4 (1503) MF (Multi-Frequency) Version

71 The PCB is connected to the line via the following line cord terminal pins:

Pin 1 — To optional message waiting lamp circuit

Pin 2 — B wire

Pin 3 — Bell input

Pin 4 — Earth Loop Recall (return)

Pin 5 — A wire

Pin 6 — Not used

72 The A and B wires (nominally 24V, 48V or 60V d.c. lines) are routed via the polarity bridge, D6, D7, D9 and D10. The polarity bridge, including surge suppressor, D8, a 130V Zener diode, also provides transient protection.

73 The message waiting option comprises R16, PLH, SKH and l.e.d. D19. This option is most useful in say, an hotel where the operator has received a call for a guest but has been unable to contact him. The operator can remotely activate the message waiting lamp which is directly connected to the line cord to act as a reminder that a message is waiting to be collected.

74 The bell capacitor circuit, C11 and PLE/SKE is fitted in installations not using wall socket capacitors. The circuit provides protection from transient spikes, and is used as an anti-tinkle device to prevent other telephones ringing during dialling operations.

75 The tone caller capsule is fitted to the base of the instrument and connected to the PCB when the instrument is correctly assembled via BC1 and BC2, which are tin plated bridge contacts. The tone caller capsule is fitted with an adjustable volume control (attenuator), which should be turned clockwise (when looking at the base of the telephone) to increase volume.

76 The tone caller circuit is centred on a TMC1503 integrated circuit. D17 and D18 are provided for future development and are not currently used. Links K and L, although currently fitted, allow for future development. Components SKF, PLF and R15 are omitted, and link M is fitted for British Telecom versions. Conversely, for commercial applications, link M is omitted, and SKF, PLF and R15 are fitted. R15 in circuit will reduce the volume of the tone caller by 10dB.

77 For the timed break recall option, IC1 must be TMC1617. Links C, E and J, PLD and SKD are omitted. For earth loop recall, TR2, link H, PLD and SKD are omitted. On the basic version with no recall facility, the locations for TR2, link H, link J, PLD and SKD are left vacant. For alternative recall, IC1 must be a TMC1617 chip, and links C, E, H and J are omitted. Switch S13 is operated by the R (recall) key.

78 Link B is not fitted on commercial versions of KT1 and KT4. For 200 x 200 ohm feeding bridge systems, fit SKC to pins 1 and 2 of PLC. For some overseas installations using 400 x 400 ohm feeding bridge systems, and when using the KT1 or KT4 telephone with a KBX10 or KBX100 system, fit SKC to pins 2 and 3 of PLC.

79 In the circuits associated with IC1, D3 and D5 are not required for initial units, but the positions are provided for possible future developments.

80 Most of the line current flows down the base of TR2 (if fitted, see paragraph 77) and through TR1. TR2 is then saturated in the on state. TR1 provides current amplification during speech periods as it is configured as a current source in series with the loop. TR1 and TR2 are switched off during timed break recall if this option is installed. Capacitor C3 maintains the positive supply rail for IC1 under such circumstances. If TR2 is fitted, R9 is required to provide a small bias current which is used to start up the circuit.

81 The signal from the microphone is amplified by about 24dB by the IC microphone amplifier which is one of a special low noise design. This amplifier also provides a d.c. level-shift function which is applied, together with the amplified microphone signal to the base of TR1.

82 The signal from the line is obtained via an attenuator R7 and R5 and is fed into the earphone amplifier via C8 where it is summed with the sidetone signal from the microphone amplifier to provide sidetone cancellation. The earphone amplifier output stage consists of a large enhancement transistor with an active driven load to provide the drive required by a 600 ohm earphone.

83 Both the microphone and earphone amplifiers have a line displacement gain which is controlled by the AGC control system. This circuit takes a voltage from the d.c. control block which is similar to that found on the base of TR1 and compares it with a voltage reference multiplier circuit.

84 Operation of any of the twelve keypad pushbuttons causes the circuit to change from speech to tone mode. The on chip oscillator oscillates at the parallel resonance of XL1 which is 560kHz. The microphone and receive paths are switched off, but a small signal is fed from the tone generators to the earpiece, (confidence tone). The duration of any tone is a minimum of 70ms, but will remain for the duration of the pushbutton operation. There is a 70ms 'silent' period at the end of each tone, when no tones or speech can be sent.

85 For the locking version option, S15, SKA and PLA are fitted, link A is removed. This prevents outgoing calls from being made by disabling the clock signal to the tone generators when S15 is open circuit.

86 Link G is not currently required, but provision for its inclusion is for possible future development. Link F is fitted only when tone levels of -6 to -8dB are required.

87 C4 is 470 nf and link D is omitted for KT1 Series telephones, whilst C4 is 220 μf and R6 is omitted for the KT4 Series.

88 C1 is used to trim the value of C2. If C2 is 2.4 μf, C1 is fitted. C1 is omitted if C2 is 2.7 μf.

(Figure 6)

KT1 and KT4 Mk2 Version, with Discrete Timed Break Recall

89 The PCB is connected to the line via line cord terminal pins as follows:

Pin 1 — Via optional message waiting lamp circuit

Pin 2 — B wire

Pin 3 — Bell input

Pin 4 — Earth Loop Recall (return)

Pin 5 — A wire

Pin 6 — Not used

90 The A and B wires (nominally 48V or 60V d.c. lines) are routed via link L and the polarity bridge D6, D7, D9 and D10. The polarity bridge, including surge suppressor, D8, a 130V Zener diode, also provides transient protection.

91 The message waiting option comprises R26, PLD, SKD, PLF, SKF and lamp, LP1. This option is most useful in say, an hotel, where the operator has received a call for a guest but has been unable to contact him. The operator can remotely activate the message waiting lamp which is directly connected to the line cord, to act as a reminder that a message is waiting to be collected.

92 The bell capacitor, C14 and PLC/SKC is fitted in installations not using wall socket capacitors. The circuit provides protection from transient spikes, and is used as an anti-tinkle device to prevent other telephones ringing during dialling operations.

93 The tone caller capsule is fitted to the base of the instrument and connected to the PCB when the instrument is correctly assembled via BC1 and BC2, which are tin plated contacts. The tone caller capsule is fitted with an adjustable volume control (attenuator), which should be turned clockwise (when looking at the base of the telephone) to increase volume.

94 When a Texas TCM1512P IC (IC2) is used for the tone caller, R22 and XL2 are omitted. Components R18, R21, R25, D13 and C12 are omitted when IC2 is a Ferranti device. C11 is then changed to 22 μf, 40V.

95 With SKG bridging pins 2 and 3 of PLG, the Darlington pair, TR3 and TR5, are connected in series with the line. These are normally turned on by means of base bias from R12. When the recall key, S14, is pressed, this bias is momentarily removed by C9 and the line is broken as TR3 and TR5 turn off. This immediately establishes a supply across the programmable unijunction transistor (PUT) circuit centred on TR7 or its functional equivalent formed by TR2, TR4 and R10. The supply is limited to 22V by Zener diode D14. As the supply is established, C15 begins to charge via R24, until the voltage across C15 reaches the gate potential at R15/R16 junction. TR7 is off and thus TR6 is on, ensuring that the Darlington pair are held off. When TR7 fires after the delay set by R24 and C15, TR6 is turned off, which releases the clamp from TR3 and TR5. These transistors turn on once again, reconnecting the line. The value of R24 can be changed to meet the various time break periods required, (see Figure 8).

96 For the timed break recall option, SKG is fitted across pins 2 and 3 of PLG, SKJ is fitted across pins 1 and 2 of PLJ and SKK is fitted across pins 2 and 3 of PLK. Links J and K are omitted. If PLG, PLJ and PLK are not fitted, then fit links J and K. For earth loop recall, SKG is fitted across pins 1 and 2 of PLG. SKJ is fitted across pins 2 and 3 of PLJ and SKK is fitted across pins 1 and 2 of PLK. Links J and K are again omitted. On register recall telephones, links J and K are fitted, whilst SKG, SKJ, SKK, PLG and PLK are omitted.

97 Link A is not fitted on commercial versions of KT1 and KT4. For 200 x 200 ohm feeding bridge systems, fit SKB to pins 1 and 2 of PLB. For some overseas installations using 400 x 400 ohm feeding bridge systems and when using the KT1 or KT4 telephone with a KBX10 or KBX100 system, fit SKB to pins 2 and 3 of PLB.

98 In the circuits associated with IC1, R5 is fitted only when an alternative D1 is used. D3 and D5 are not required for initial units, but the positions are provided for possible future developments.

99 TR1 provides current amplification during speech periods as it is configured as a current source in series with the loop. Capacitor C3 maintains the positive supply rail for IC1 during the interruption of a timed break recall.

100 The signal from the microphone is amplified by about 24dB by the IC microphone amplifier, which is one of a special low noise design. This amplifier also provides a d.c. level-shift function which is applied, together with the amplified microphone signal to the base of TR1.

101 The signal from the line is obtained via an attenuator R8 and R4 and is fed into the earphone amplifier via C5 where it is summed with the sidetone signal from the microphone amplifier to provide sidetone cancellation. The earphone output stage consists of a large enhancement transistor with an active driven load to provide the drive required by a 600 ohm earphone.

102 Both the microphone and earphone amplifiers have a line displacement gain which is controlled by the AGC control system. This circuit takes a voltage from the d.c. control block which is similar to that found on the base of TR1 and compares it with the voltage reference multiplier circuit.

103 Operation of any of the twelve keypad push-buttons causes the circuit to change from speech to tone mode. The on chip oscillator oscillates at the parallel resonance of XL1 which is 560kHz. The microphone and receive paths are switched off, but a small signal is fed from the tone generators to the earpiece, (confidence tone). The duration of any tone is a minimum of 70ms, but will remain for the duration of the pushbutton operation. There is a 70ms 'silent' period at the end of each tone, when no tones or speech can be sent.

104 Links D and F are not currently required but provision for their incorporation caters for future development. Link E is fitted only when tone levels of -6 to -8dB are required.

105 For KT1 Series telephones, link C is omitted, C4 is to be 0.68 μf if the microphone is to DNT2002-002-0199, Issue 6, or 0.47 μf if the microphone is to DNT2002-002-0199, Issue 7. For KT4 Series telephones, R6 is omitted, and C4 is 0.22 μf.

106 C1 is used to trim the value of C2. If C2 is 2.4 μf, C1 is fitted. C1 is omitted if 2.7 μf is used for C2.

(Figure 7)

KT1 and KT4 (1503) MF Version with Discrete Timed Break Recall

107 The PCB is connected to the line via line cord terminal pins as follows:

Pin 1 — Via optional message waiting lamp circuit
Pin 2 — B wire
Pin 3 — Bell input
Pin 4 — Earth Loop Recall (return)
Pin 5 — A wire
Pin 6 — Not used

108 The A and B wires (nominally 48V or 60V d.c. lines), are routed via link N and the polarity bridge, D6, D7, D9 and D10. The polarity bridge, including surge suppressor, D8, a 130V Zener diode, also provides transient protection.

109 The message waiting option comprises R23, SKG, PLG and l.e.d. D22. (PLJ to be 7-way). This option is most useful for example, in an hotel where the operator has received a call for a guest but has been unable to contact him. The operator can remotely activate the message waiting lamp which is directly connected to the line cord, as a reminder that a message is waiting to be collected.

110 The bell capacitor, C14, and PLF/SKF are fitted in installations not using wall socket capacitors. The circuit provides protection from transient spikes, and is used as an anti-tinkle device to prevent other telephones ringing during dialling operations.

111 The tone caller capsule XL3 may be fitted to the base of the instrument and connected to the PCB when the instrument is correctly assembled via BC1 and BC2, which are tin plated bridge contacts. The tone caller capsule is fitted with an adjustable volume control (attenuator), which should be turned clockwise (when looking at the base of the telephone) to increase the volume.

112 The tone caller circuit is centred on the TMC 1503 integrated circuit. Diodes D19 and D20 are designed for future development and are not currently used. Link P is fitted on all current versions. Components SKK, PLK and R24 are omitted and link Q is fitted for British Telecom versions. Conversely, for commercial applications, Link Q is omitted and SKK, PLK and R24 are fitted. R24 in circuit will reduce volume of tone caller by 10dB. When a bell is required in place of the tone caller, components C10, D11 to D14, D19, D20, IC2, links P, Q and R, R10, R14, R16, R20, R24, PLK, SKK, XL2, XL3, BC1 and BC2 are all omitted.

113 TR3 to TR6 and associated components are fitted when timed break recall is required. When SKC is bridging pins 2 and 3 of PLC, the Darlington pair, TR3 and TR4, are connected in series with the line. These are normally turned on by means of base bias from R12. When the recall key, S14, is pressed, this bias is momentarily removed by C11, (with link S omitted), and the line is broken as TR3 and TR4 turn off. An alternative circuit for TR3 and TR4 is TR7 and D21, with R13 being changed to 220k (instead of 100k), and D15 is omitted, but link S is provided to discharge C11. The recall operation immediately establishes a supply across TR6. The supply is limited to 22V by Zener diode D18. As the supply is established, C15 begins to charge via R22, until the voltage across C15 reaches the gate potential at R17/18 junction. TR6 is off, thus TR5 is on, ensuring that the Darlington pair (or alternatively TR7) is held off. When TR6 fires after the delay set by R22 and C15, TR5 is turned off, which releases the clamp from the Darlington pair. These transistors turn on once again, reconnecting the line. The value of R22 can be changed to meet the various timed break periods required (i.e. 70ms, 125ms or 280ms) as shown in Figure 8.

114 For alternative recall (on chip) connections for a timed break recall, SKE is fitted across PLE pins 2 and 3, and for an earth loop recall, SKE is fitted across PLE pins 1 and 2. The alternative recall (discrete) connections for a timed break recall are

SKC fitted across PLC pins 2 and 3, SKD fitted across PLD pins 1 and 2 and SKE fitted across PLE pins 2 and 3. The earth loop recall connections are SKC fitted across PLC pins 1 and 2, SKD fitted across PLD pins 2 and 3 and SKE fitted across PLE pins 1 and 2.

115 Link A is not fitted on commercial versions of KT1 and KT4. For 200 x 200 ohm feeding bridge systems, fit SKB to pins 1 and 2 of PLB. For some overseas installations using 400 x 400 ohm feeding bridge systems and when using the KT1 or KT4 telephone with a KBX10 or KBX100 system, fit SKB to pins 2 and 3 of PLB.

116 The main integrated circuit, IC1, may be either the TMC1317 or TMC1617, but for on chip timed break recall options, IC1 must be the TMC1617. Various link and bridging connections may be used to provide such options as no recall, earth loop recall, or timed break recall (discrete or on chip) or alternative recall. These links are conveniently listed with Figure 7.

117 Capacitors C9, C17, C18, C19, diodes D3, D5 and R26 are not fitted at present but provision is made for them for future development.

118 TR1 provides current amplification during speech periods as the circuit is configured as a current source in series with the loop. TR2 is also fitted when on chip TMC1617 timed break recall or alternative recall is required. R9 is provided to give a small bias current for TR2 which is used to start up the circuit.

119 The signal from the microphone is amplified by about 24dB by the IC microphone amplifier which is of a special low noise design. The microphone amplifier also provides a d.c. level-shift function which is applied, together with the amplified microphone signal to the base of TR1.

120 The signal from the line is obtained via an attenuator R5 and R7 and is fed into the earphone amplifier via C6, where it is summed with the sidetone signal from the microphone amplifier to provide sidetone cancellation. The earphone output stage consists of a large enhancement transistor with an active driven load to provide the drive required by a 600 ohm earphone.

121 Both the microphone and earphone amplifiers have a line displacement gain which is controlled by the AGC system. This circuit takes a voltage from the d.c. control block which is similar to that found on the base of TR1 and compares it with a voltage reference multiplier circuit.

122 Operation of any of the twelve keypad pushbuttons causes the circuit to change from speech to tone mode. The on chip oscillator oscillates at the parallel resonance of XL1, which is 560kHz. The microphone and receive paths are switched off, but a small signal is fed from the tone generators to the earpiece (confidence tone). The duration of any tone is a minimum of 70ms, but will remain for the duration of the pushbutton operation. There is a 70ms 'silent' period at the end of each tone, when no tones or speech can be sent.

123 Links E and G are not currently required, but provision for their incorporation caters for future development. Link F is fitted only when tone levels of -6 to -8dB are required.

124 For KT1 Series telephones, C4 is 470 μf, R6 is fitted and link B is omitted. For the KT4 version, C4 is 220 nf, R6 is omitted and link B is fitted.

125 C1 is used to trim the value of C2. If C2 is 2.7 μf, C1 is omitted.

INSTALLATION

126 The PCB link connections and other components selected for various options are detailed in the previous section and in the appropriate circuit diagrams, Figures 2 to 7. With the exception of the feed bridges, the options are fitted in the factory before despatch, to suit the site requirements, and should need no further adjustment before installation.

127 Both the KT1 and KT4 Series instruments are normally free-standing on a desk or table, but the KT1 Series may be wall-mounted, if required. For the wall-mounted version, the wall-bracket assembly should be installed in position as illustrated in Figure 10. The wall plate is fixed to the wall by three wood screws and the line cord routed so it can be conveniently plugged into the base instrument. The base instrument itself is attached to the base plate which can then be securely placed into the wall plate housing.

128 The instrument has a 3 metre line cord with one of the following end connectors:

1) British Telecom plug 431A (used in conjunction with a British Telecom master line jack unit, containing a bell capacitor).
2) Block Terminal 52A.
3) Western Electric plug.

British Telecom Plug 431A **(Figure 9a)**

129 To install a telephone set fitted with a British Telecom plug 431A terminal connector:

1) Check that a master line jack unit is already installed on the wall, or install one if necessary. The line jack unit must be fitted with a capacitor across terminals 2 and 3.
2) Connect the 'B' leg of the master line jack unit to terminal 2. Connect the 'A' leg to terminal 5.
3) If more than one telephone set is being installed on site, connect the system as shown in Figure 9a.
4) Connect extension bells, if required, across terminals 3 and 5. Extension bells should be of high impedance, nominally 4k ohms.

Block Terminal 52A **(Figure 9b)**

130 To install a telephone fitted with a block terminal 52A:

1) Mount the 8-way block terminal to the wall skirting with either wood screws or self-tapping screws.
2) Connect the telephone exchange 'A' and 'B' wires to terminals 8 and 5 respectively, as shown in Figure 9b.
3) If telephone sets are required to be connected in parallel, all telephones other than the main instrument should have the internal bell capacitor, if fitted, out of circuit. With the exception of the MF (1503) versions, this is achieved by plugging link SKC inside the telephone across pins 1 and 2 of PLC. On the MF (1503) instruments, link SKE and pins 1 and 2 of PLE serve this purpose. The line cord should then be connected as follows:
   a) 'B' leg to terminal 5.
   b) Bell wire to terminal 6 if required.
   c) Earth leg to terminal 7 if required.
   d) 'A' leg to terminal 8.
4) Connect extension bells, if required, across terminals 6 and 8. Extension bells should be of a high impedance (typically 4k ohms).

Western Electric Type Plug

131 To install a telephone fitted with a Western Electric Type Plug:

1) Check that a Western Electric type socket is mounted on the wall, or install one if necessary.
2) Make the following connections:
   a) 'B' leg to pin 2.
   b) Bell wire to pin 3.
   c) Earth leg to pin 4 if required.
   d) 'A' leg to pin 5.
3) For parallel operation of telephones fitted with Western Electric type plugs, paragraph 130 3) above applies.

132 After installing the telephone sets, carefully remove the transparent cover from the telephone number recess, using a flat bladed tool such as a nail file. Fit the appropriate label bearing the telephone number and replace the transparent cover.

OPERATION

Tone Caller

133 An adjustable attenuator/volume control is fitted on the base instrument. Adjust the control as required, by turning the indented disk on the right hand side of the base, forward to increse the volume (i.e. clockwise to increase the volume, when viewed from the underside).

Dialling

134 The instrument is active as soon as the handset is lifted from its cradle to operate the hook switch. On hearing the dialling tone, simply press the pushbutton keys in the required order. If a recall facility is provided, operation of the R (recall) pushbutton will give either timed break, earth loop or register recall. After use, replace the handset on its cradle to operate the hook switch.

MAINTENANCE

135 The use of specially designed integrated circuits have rendered unnecessary many wired-in components and moving parts. The complete unit is therefore, for all practical purposes, simple and robust, and will give many years of trouble-free service without regular maintenance.

FAULT FINDING

136 Any fault suspected in the unit is most likely to be caused by poor electrical connections. It is advisable to check that all connections are properly made. If dialling difficulty is experienced, dismantle the instrument and check the rubber mat for wear. In the unlikely event of any other fault, the information in this handbook will enable an experienced technician to trace a fault to a suspect area or board. The unit may then be dismantled and the faulty part or board replaced.

137 No difficulty should be experienced in dismantling or reassembling the handset or base instrument (see paragraphs 4 to 8). A faulty part or board can be replaced as part of a first line servicing policy, and the faulty board either returned to the manufacturer for repair, or repaired in the workshop and returned as a future replacement part.

SPARE PARTS

138 Table 2 lists the common parts of the KT1 Series telephones, which are also illustrated in the associated Figures 10 to 12. Similarly, Table 3 presents the parts of the KT4 Series as illustrated in Figures 13 and 14.

139 Parts may be ordered directly from:

TMC Limited
Marketing Dept
Swindon Road
Malmesbury
Wiltshire
England SN16 9NA

Telephone: Malmesbury (06662) 2861
Telex: 44208 TMCMAL G

Alternatively, the names and addresses of local stockists can be supplied on request.

140 When ordering parts, please give the following information:

1) Name and model number of the telephone set
2) Part number of part required, if known
3) Description of part required
4) Quantity of parts required
5) Full name and postal address of ordering department

141 Abbreviations used in the parts lists are as follows:

DTBR = Discrete Timed Break Recall
ELR = Earth Loop Recall
LD = Loop Disconnect
MF = Multi-Frequency
R = Recall

Ref No.	Part No.	Description of Part
Wall Bracket Assembly (See Figure 10):		
1	3513 401 31860	Wall Plate (Black)
2	3513 401 54900	Base Plate (Black)
3	2522 102 13079	No. 8 Woodscrew (3 required)
4	2522 002 11177	Base Screw (from Base instrument)
5	3513 305 00130	Wall Plug (3 required)
Base Instrument (See Figure 11):		
1	3513 401 27140	Upper Moulded Plastic Case (11 hole)
	3513 401 27340	Upper Moulded Plastic Case (13 hole)
2	3513 401 26240	Moulded Base
3	3513 446 35150	PCB complete (LD Version)
	3513 446 40150	PCB complete (MF ELR Version)
	3513 446 43240	PCB complete (MF version DTBR 70ms Version)
	3513 446 50660	PCB complete (LD 1503 Version)
	3513 446 51050	PCB complete (MF 1503 ELR Version)
	3513 446 47450	PCB complete (MF 1503 DTBR Version)
4	3513 401 22440	Keypad Mat (rubber)
5	3513 401 22350	Pushbutton Key Guide Housing
6	3513 401 22100 to 3513 401 22210	Pushbutton Keys 1 to 9, 0, # and ★
	3513 401 21600	Pushbutton Key, R
7	3513 304 01650	Line cord
8	3513 401 22280	Window Exchange Card Holder
9	2522 002 11177	Base Screw
10	3513 401 22450 or 3513 401 22460	Foot (rubber)
11	3513 441 99000	Tone Caller Capsule
Handset (See Figure 12):		
1	3513 401 07610	Upper Body
2	3513 401 23930	Lower Body
3	3513 305 90120	Receiver
4	3513 305 92000	Transmitter (Microphone)
5	3513 401 07590	Receiver Clip
6	3513 401 07580	Transmitter Clip
7		Spacer } supplied with Microphone
8		Locating Ring }
9	3513 304 01750	Handset Cord
10	2522 188 15065	Locking Screw
11		Self-Adhesive Foam

Parts quoted are for a light grey telephone. Alternative colours required should be specified when ordering.

TABLE 3 **KT4 SERIES TELEPHONES PARTS LISTS**

Ref No.	Part No.	Description of Part
Base Instrument (See Figure 13):		
1	3513 401 38000	Upper Moulded Plastic Case (11 hole)
	3513 401 38200	Upper Moulded Plastic Case (13 hole)
2	3513 401 02640	Moulded Base
3	3513 446 45150	PCB complete (LD Version)
	3513 446 45350	PCB complete (MF ELR Version)
	3513 446 49040	PCB complete (MF DTBR 70ms Version)
	3513 446 53850	PCB complete (LD 1503 Version)
	3513 446 53970	PCB complete (MF 1503 ELR Version)
	3513 446 47450	PCB complete (MF 1503 DTBR 280ms Version)
4	3513 401 22440	Keypad Mat (rubber)
5	3513 401 37990	Button Guide
6	3513 401 22100 to 3513 401 22210	Pushbutton Keys, 1 to 9, 0, # and ★
	3513 401 21600	Pushbutton Key, R
7	3513 304 01670	Line cord
8	3513 401 34430	Window
9	2522 002 11177	Base Screw
10	3513 401 22450 or 3513 401 22460	Foot (rubber)
11	3513 441 99000	Tone Caller Capsule
Handset (See Figure 14):		
1	3513 401 19810	Upper Body
2	3513 401 19710	Lower Body
3, 4	3513 401 91060	Speech Transducer
5	3513 401 31290	Cover
6	3513 401 15570	Frame
7	3513 304 01950	Handset Cord
8	3513 401 35730	Weight
9	3513 401 35400	Rubber Strip

STRAPPING/LINK OPTIONS

Feeding Bridge

200 x 200 ohm	Fit SKB to PLB pins 1 & 2
400 x 400 ohm	Fit SKB to PLB pins 3 & 4

Impulse Speed and Ratio

1.55:1 ratio, 10 p.p.s.	Fit Link D, omit Links E & F
2:1 ratio, 10 p.p.s.	Fit Link E, omit Links D & F
2:1 ratio, 20 p.p.s.	Fit Link F, omit Links D & E

Recall

Time Break Recall	Fit Links G & H, omit Links J & K
Earth Loop Recall	Fit Links J & K, omit Links G & H

Bell Capacitor (when fitted)

In Circuit	Fit SKC to PLC pins 2 & 3
Out of Circuit	Fit SKC to PLC pins 1 & 2

Other Links

Link A	Not fitted
Link B	Not used
Link C	Provided for future use, fitted at present
Link L	Fitted in B Line
Link M	Fitted on KT4 version only

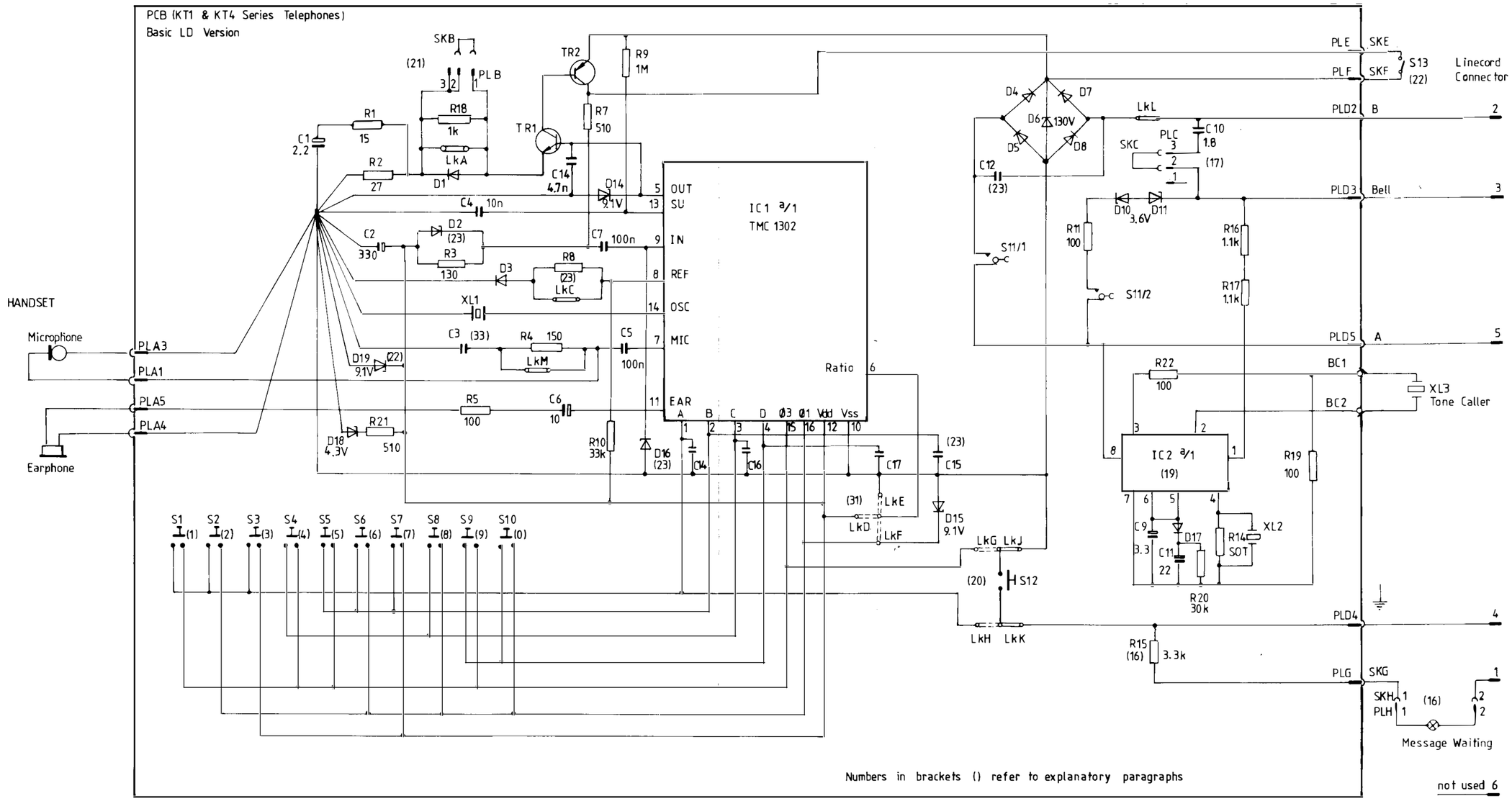


FIGURE 2: Basic LD Version — Circuit Diagram

STRAPPING/LINK OPTIONS

Feeding Bridge

200 x 200 ohm	Fit SKB to PLB pins 1 & 2
400 x 400 ohm	Fit SKB to PLB pins 2 & 3

Impulse Speed and Ratio

1.55:1 ratio, 10 p.p.s.	Fit Link C, omit Links D & E
2:1 ratio, 10 p.p.s.	Fit Link D, omit Links C & E
2:1 ratio, 20 p.p.s.	Fit Link E. omit Links C & D

Recall

Time Break Recall	Fit Links F & G, omit Links H & J
Earth Loop Recall	Fit Links H & J, omit Links F & G

Bell Capacitor (when fitted)

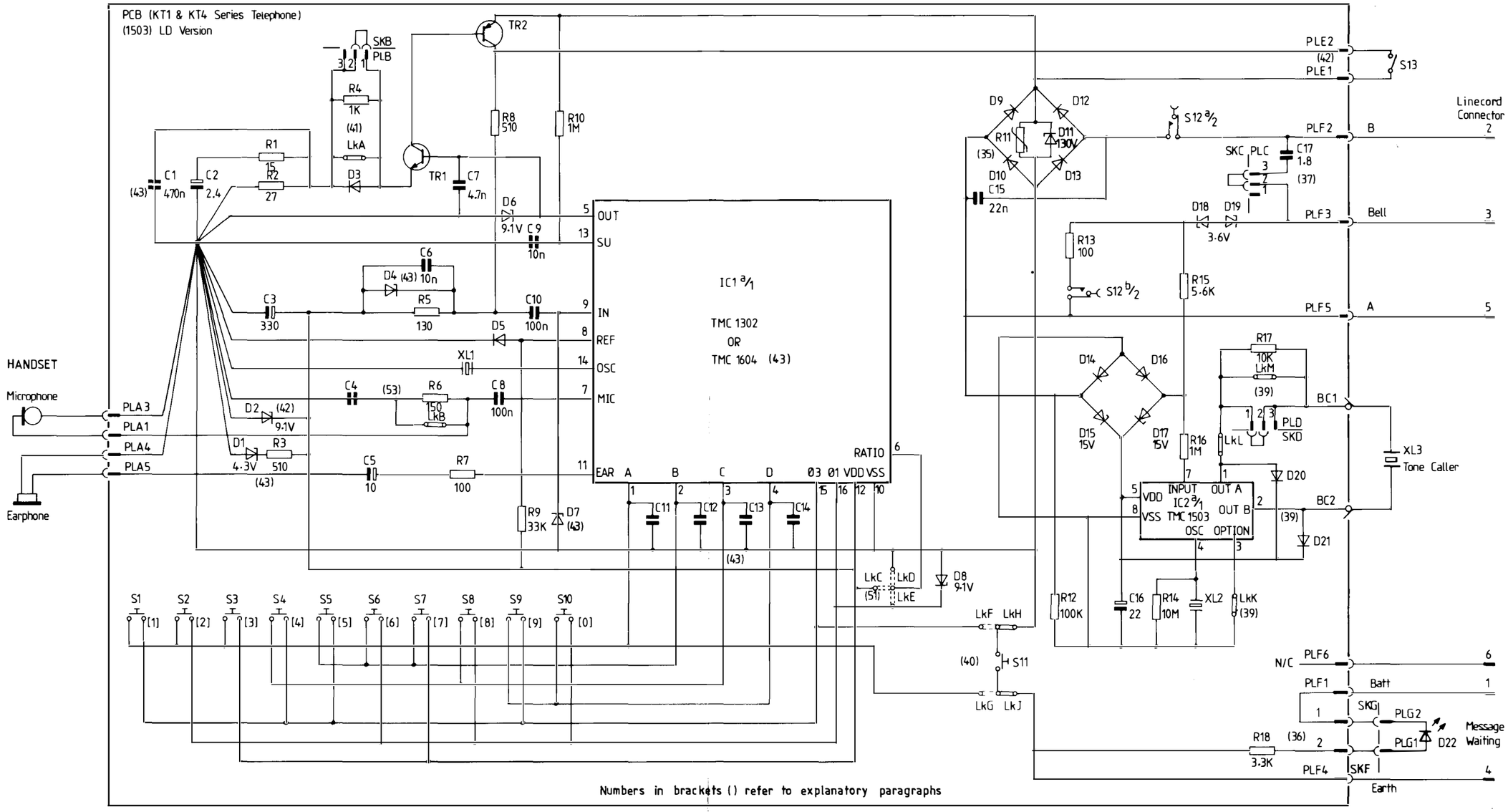
In Circuit	Fit SKC to PLC pins 2 & 3
Out of Circuit	Fit SKC to PLC pins 1 & 2

Tone Caller Volume Adjustment

Normal	Fit SKD to PLD pins 1 & 2
10dB Reduction	Fit SKD to PLD pins 2 & 3

Other Links

Link A	Not fitted
Link B	Fitted on KT4 Version only
Links K and L	Provided for future use, fitted at present
Link M	Fitted for British Telecom version, omitted for commercial versions



Numbers in brackets () refer to explanatory paragraphs

FIGURE 3: 1503 LD Version — Circuit Diagram

STRAPPING/LINK OPTIONS

Feeding Bridge

200 x 200 ohm	Fit SKB to PLB pins 1 & 2
400 x 400 ohm	Fit SKB to PLB pins 2 & 3

Tone Level

-9 -11 dB	Omit Link E
-6 -8 dB	Fit Link E

Recall

Time Break Recall	Fit TR2, R9 and Link H, omit Links K, M and N
Earth Loop Recall	Fit Links K, M and N, omit TR2, R9 and Link H

Bell Capacitor (when fitted)

In Circuit	Fit SKC to PLC pins 2 & 3
Out of Circuit	Fit SKC to PLC pins 1 & 2

Other Links

Link A	Not fitted
Link B	Not used
Link C	Provided for future use, fitted at present
Link D and F	Provided for future use, not fitted at present
Link G and J	Not used
Link L	Fitted in B Line
Link P	Not used
Link R	Fitted on KT4 version only

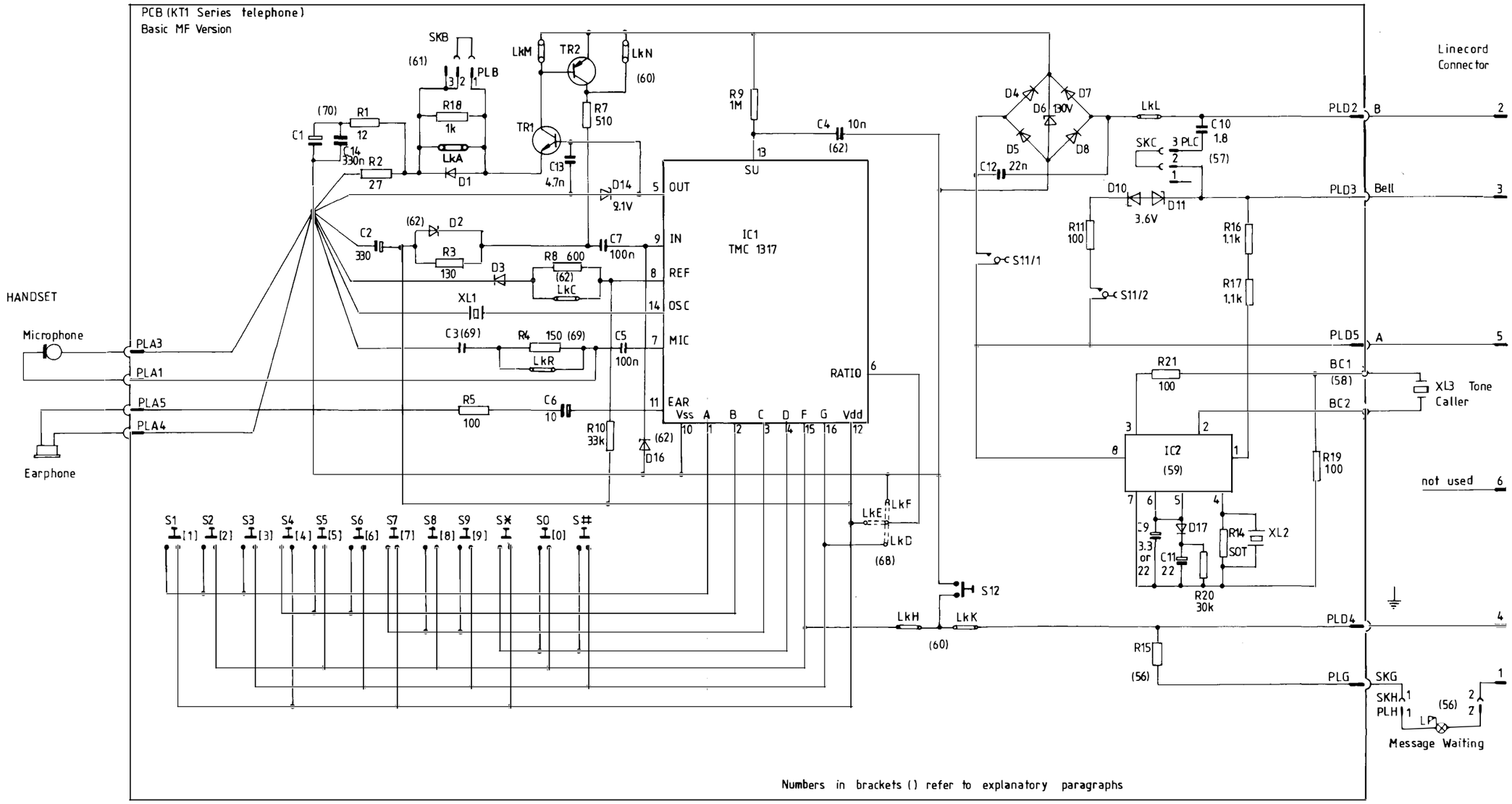


FIGURE 4: Basic MF Version — Circuit Diagram

STRAPPING/LINK OPTIONS

Feeding Bridge

200 x 200 ohm	Fit SKC to PLC pins 1 & 2
400 x 400 ohm	Fit SKC to PLC pins 2 & 3

Tone Level

-9 -11 dB	Omit Link F
-6 -8 dB	Fit Link F

Recall

Time Break Recall	IC1 must be TMC 1617, TR2 fitted, Fit Link H, omit Links C, E and J
Earth Loop Recall	IC1 must be TMC 1317, TR2 not fitted, Fit Links C, E and J, omit Link H
Alternative Recall	IC1 must be TMC 1617, TR2 fitted, Omit Links C, E, H and J

Bell Capacitor (when fitted)

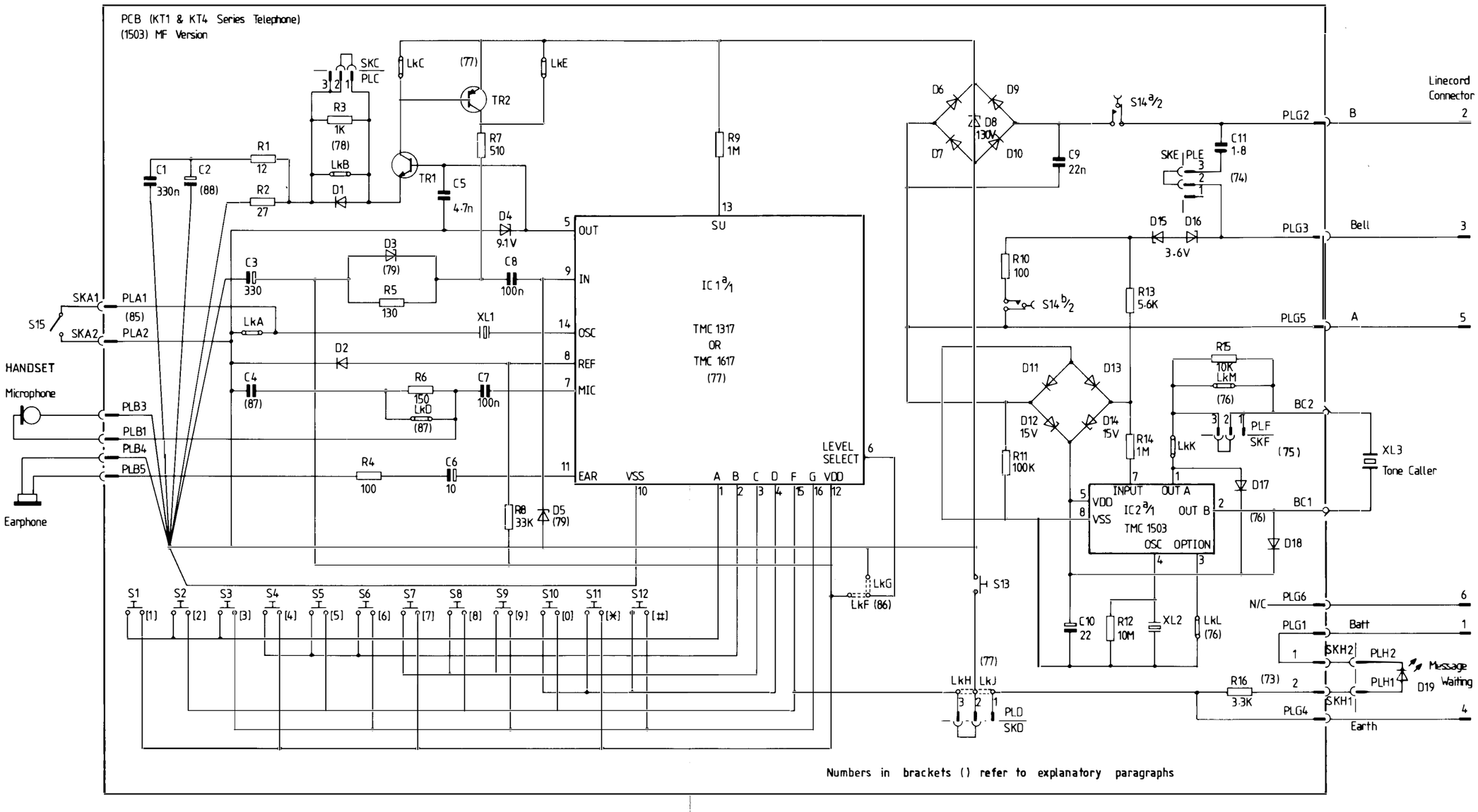
In Circuit	Fit SKE to PLE pins 2 & 3
Out of Circuit	Fit SKE to PLE pins 1 & 2

Tone Caller Volume Adjustment

Normal	Fit SKF to PLF pins 1 & 2
10 dB Reduction	Fit SKF to PLF pins 2 & 3

Other Links

Link A	Not fitted on Locking version
Link B	Not used
Link D	Fitted on KT4 version only
Link G	Provided for future use, not fitted at present
Link K and L	Provided for future use, fitted at present
Link M	Fitted for British Telecom version, omitted for commercial versions



Numbers in brackets () refer to explanatory paragraphs

FIGURE 5: 1503 MF Version — Circuit Diagram

STRAPPING/LINK OPTIONS

Feeding Bridge

200 x 200 ohm	Fit SKB to PLB pins 1 & 2
400 x 400 ohm	Fit SKB to PLB pins 2 & 3

Tone Level

-9 -11 dB	Omit Link E
-6 -8 dB	Fit Link E

Recall

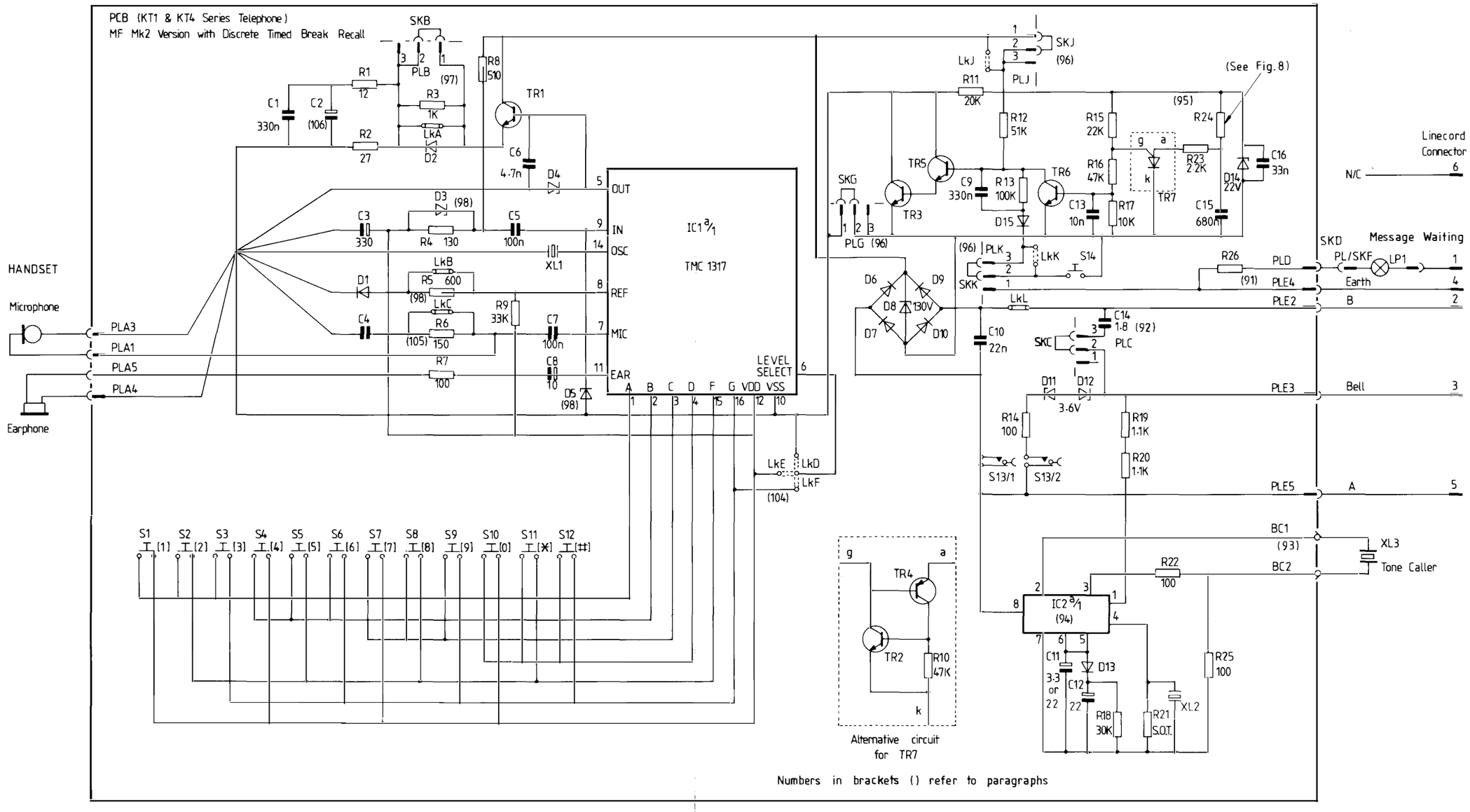
Time Break Recall	Fit SKG to PLG pins 2 & 3
(PLG, J & K Fitted)	Fit SKJ to PLJ pins 1 & 2, Fit SKK to PLK pins 2 & 3, Omit Links J & K
70 ms	R24 value 82K
280 ms	R24 value 330K
Time Break Recall	Fit Links J & K
(PLG, J & K Not Fitted)	
70 ms	R24 value 82K
280 ms	R24 value 330K
Earth Loop Recall	Fit SKG to PLG Pins 1 & 2, Fit SKJ to PLJ Pins 2 & 3, Fit SKK to PLK Pins 1 & 2, Omit Links J & K
Register Recall	As Time Break Recall

Bell Capacitor (when fitted)

In Circuit	Fit SKC to PLC Pins 2 & 3
Out of Circuit	Fit SKC to PLC Pins 1 & 2

Other Links

Link A	Not fitted
Link B	Provided for future use, fitted at present
Link C	Fitted on KT4 version only
Link D, F	Provided for future use, not fitted at present
Link G, H	Not used
Link L	Fitted in B Line



Numbers in brackets () refer to paragraphs

FIGURE 6: MF Mk 2 Version With Discrete Timed Break Recall — Circuit Diagram

STRAPPING/LINK OPTIONS

Feeding Bridge

200 x 200 ohm	Fit SKB to PLB Pins 1 & 2
400 x 400 ohm	Fit SKB to PLB Pins 2 & 3

Tone Level

-9 -11 dB	Omit Link F
-6 -8 dB	Fit Link F

Tone Caller Volume Adjustment (when fitted)

Normal	Fit SKK to PLK pins 1 & 2
10dB Reduction	Fit SKK to PLK pins 2 & 3

Bell Capacitor (when fitted)

In Circuit	Fit SKF to PLF pins 2 & 3
Out of Circuit	Fit SKF to PLF pins 1 & 2

Recall

Alternative Recall (on chip):

Timed Break Recall	Fit SKE to PLE pins 2 & 3
Earth Loop Recall	Fit SKE to PLE pins 1 & 2

Alternative Recall (Discrete):

Timed Break Recall	Fit SKC to PLC pins 2 & 3, fit SKD to PLD pins 1 & 2, fit SKE to PLE pins 2 & 3
Earth Loop Recall	Fit SKC to PLC pins 1 & 2, Fit SKD to PLD pins 2 & 3, Fit SKE to PLE pins 1 & 2

IC1 (TMC1317 or TMC1617) – See Table below

Other Links

Link A	Not fitted
Link B	Fitted on KT4 version only
Link E, Link G	Provided for future use, not fitted at present
Link N	Fitted in B Line
Link P	Fitted on all current versions
Link Q	Fitted for British Telecom versions, omitted for commercial versions
Link R	Fitted when tone caller is used.
Link S	Fitted when alternative TR7 is used instead of TR3/TR4.

STRAP/ LINK	TMC1317				TMC1617					
	No Recall	ELR	TBR (D)	AR (D)	No Recall	ELR	TBR (on chip)	TBR (D)	AR (on chip TBR)	AR (DTBR)
C	F	F	F	F	F	F	–	F	–	F
D	F	F	F	F	F	F	–	F	–	F
H	F	F	–	–	F	F	F	–	F	–
J	–	–	–	–	–	–	F	–	F	–
K	–	–	F	–	–	–	–	F	–	–
L	–	–	F	–	–	–	F	F	–	–
M		F	–	–	–	F	–	–	–	–
SKC/PLC	–	–	–	F	–	–	–	–	–	F
SKD/PLD	–	–	–	F	–	–	–	–	–	F
SKE/PLE	–	–	–	F	–	–	–	–	F	F

F = Link/Strap Fitted
– = Link/Strap Not Fitted
AR = Alternative Recall
ELR = Earth Loop Recall
D = Discrete
DTBR = Discrete Timed Break Recall
TBR = Timed Break Recall

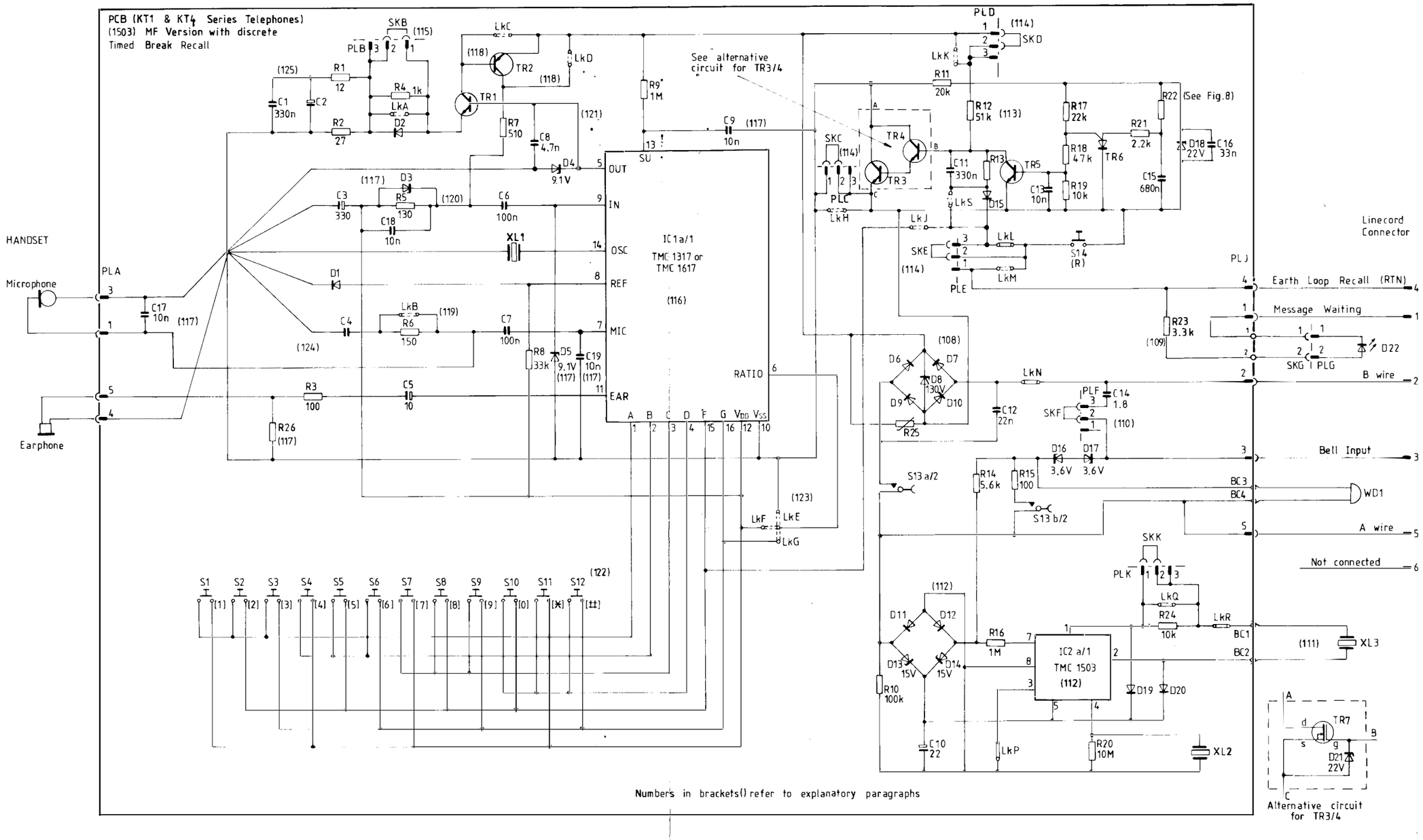


FIGURE 7: 1503 MF Version With Discrete Timed Break Recall — Circuit Diagram

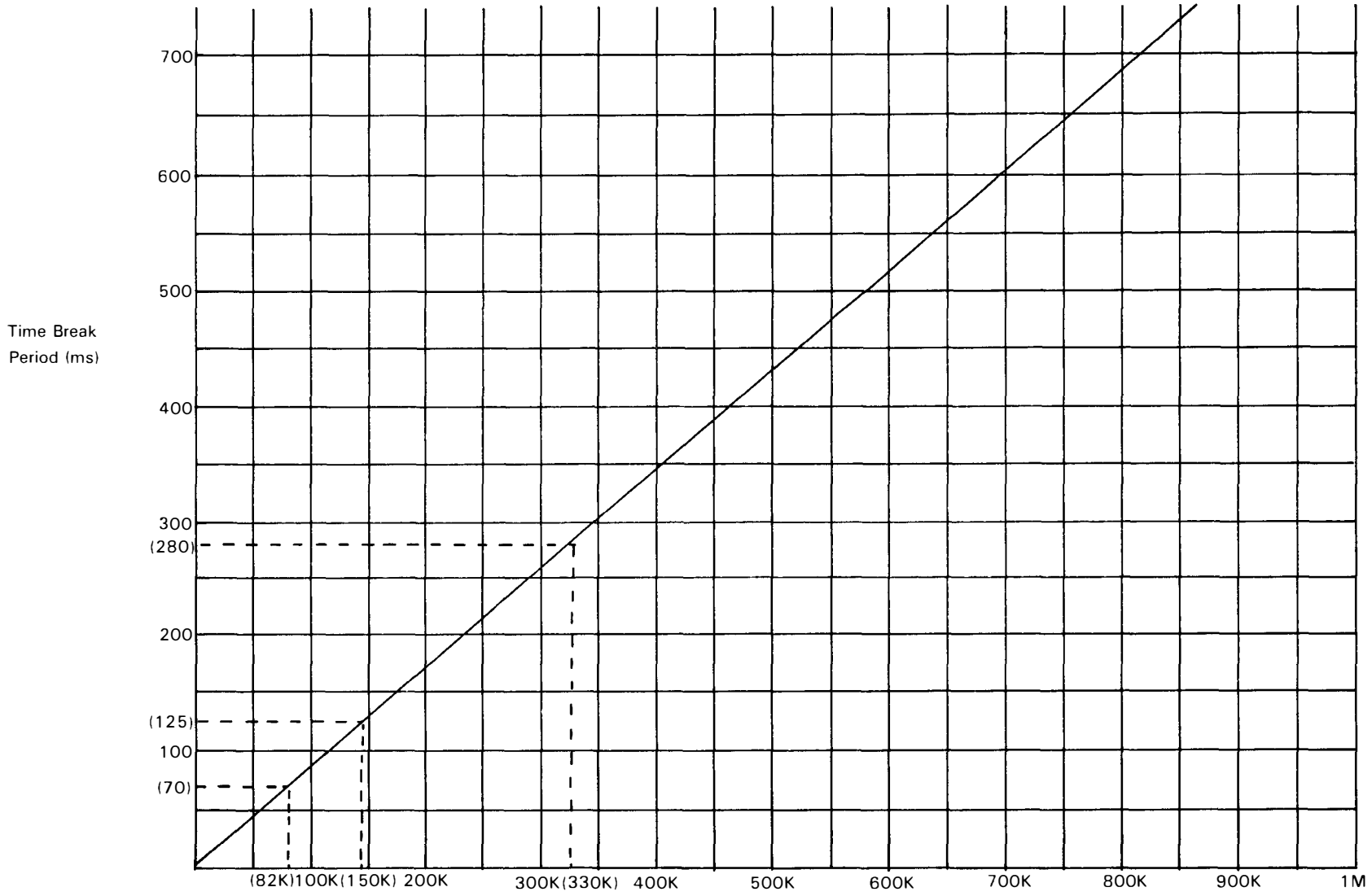


Figure 6: R24 Value Figure 7: R22 Value

FIGURE 8: Timed Break Period v Resistor Value KT1 and KT4 MF DTBR Version

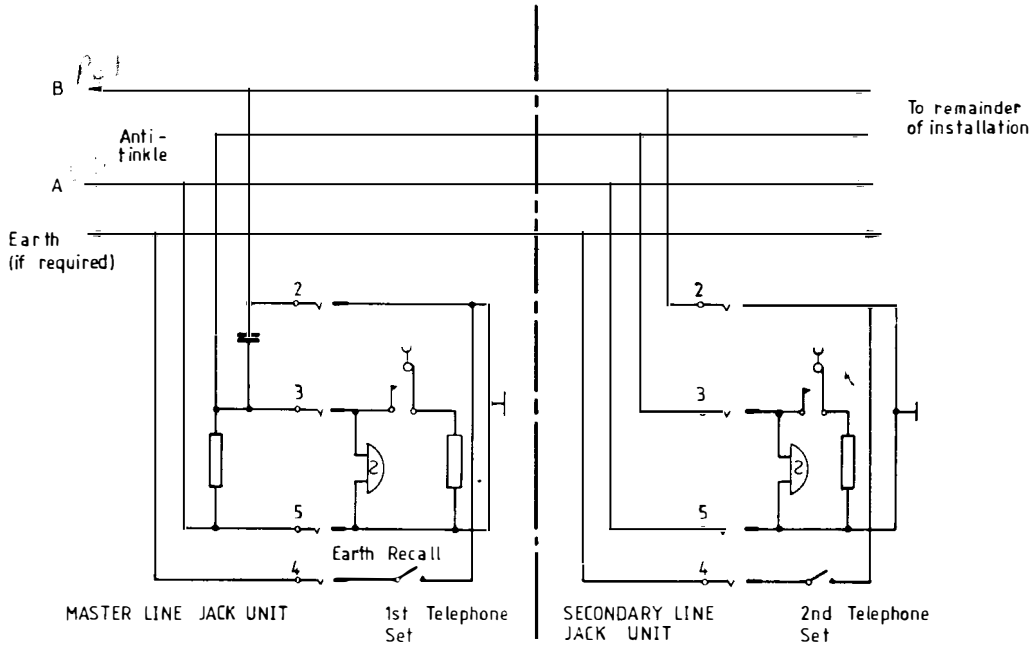


FIGURE 9a: Typical British Telecom Plug 431A Installation

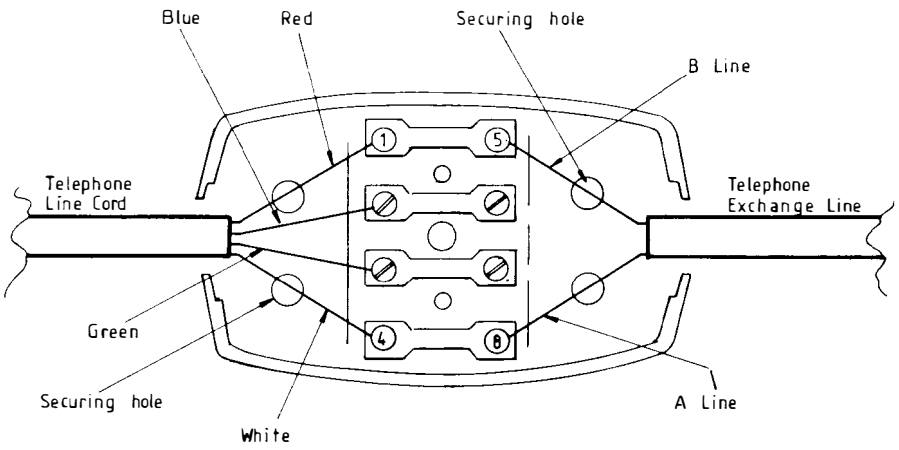
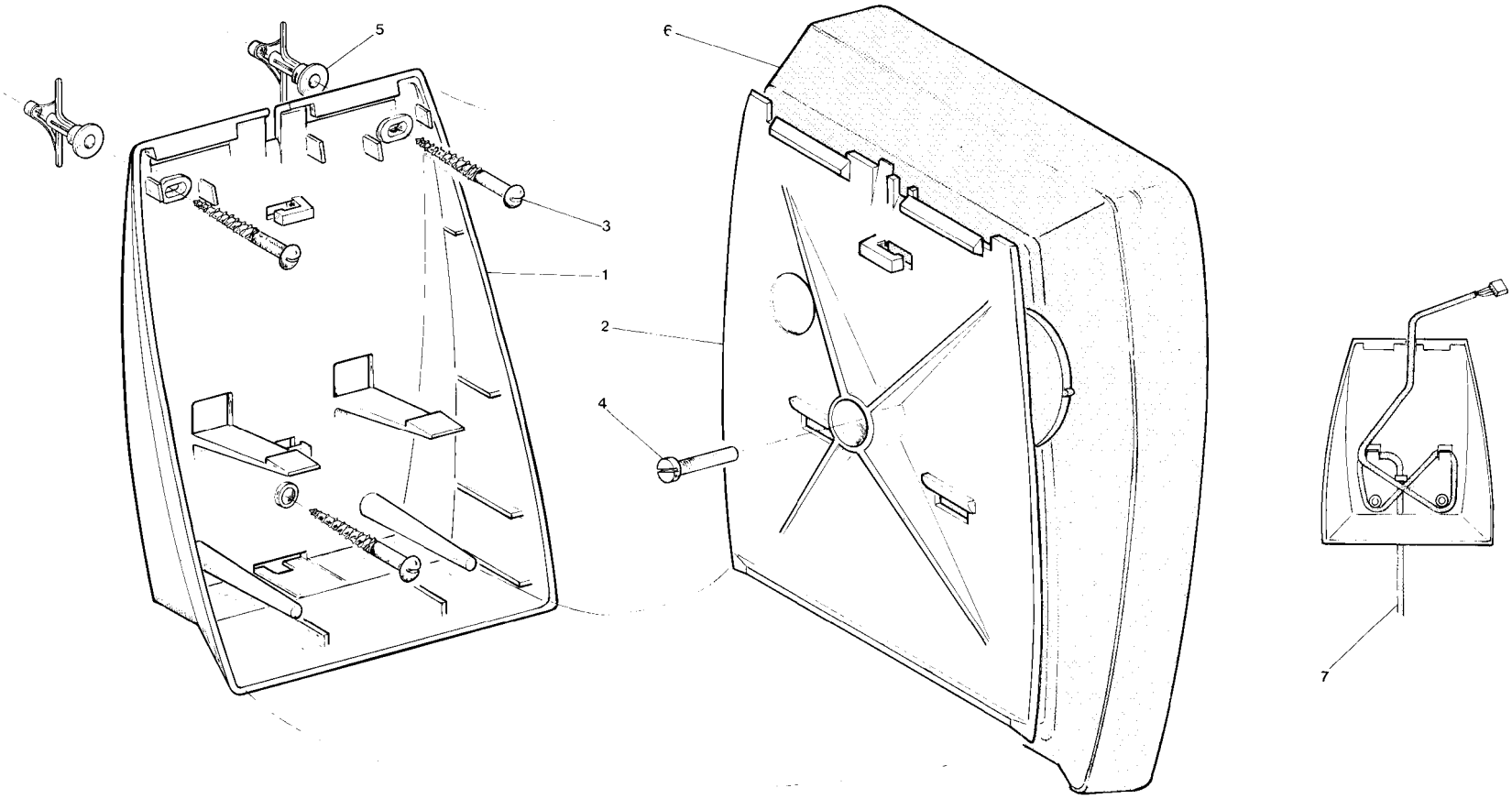
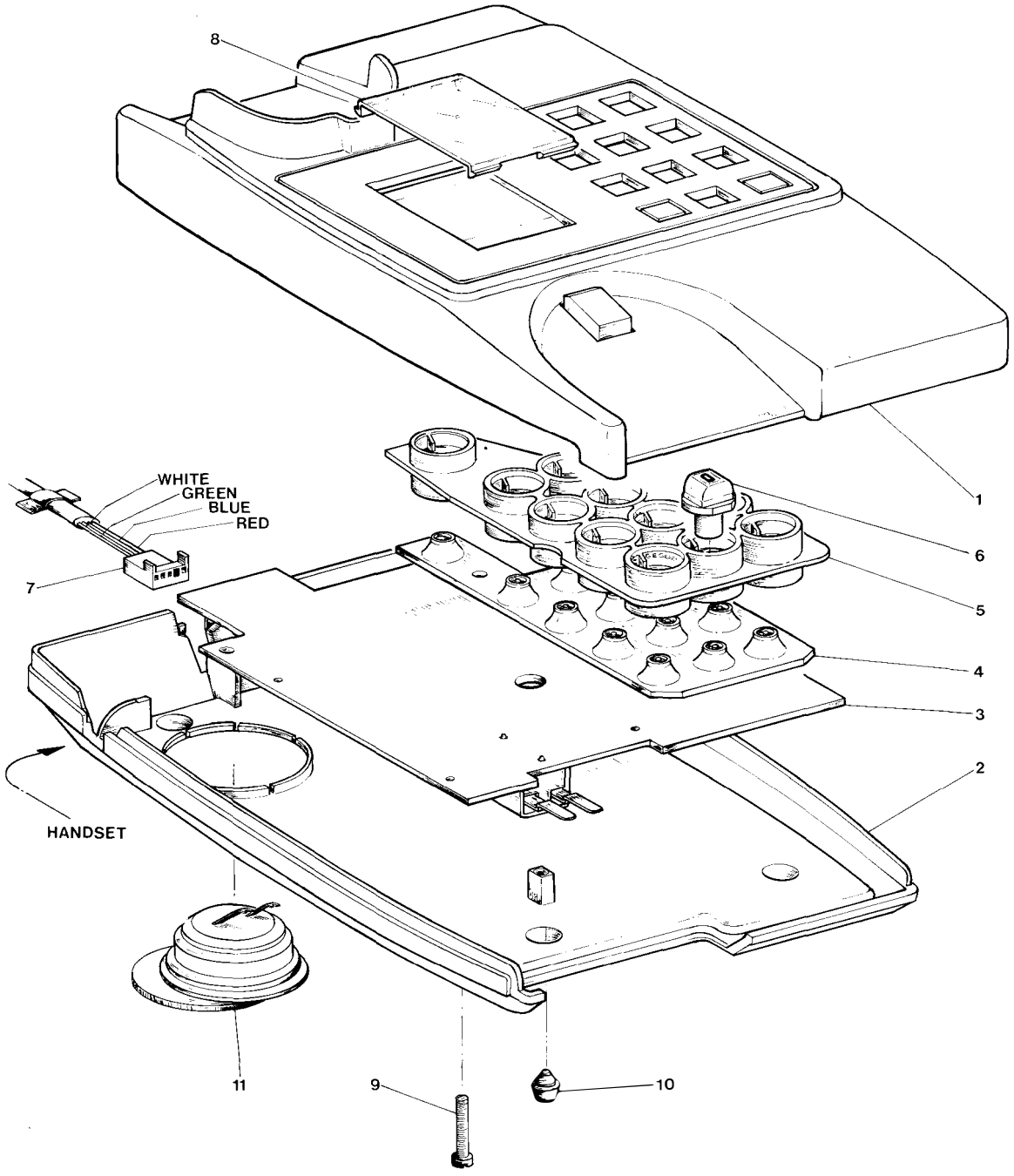


FIGURE 9b: Block Terminal 52A Connections



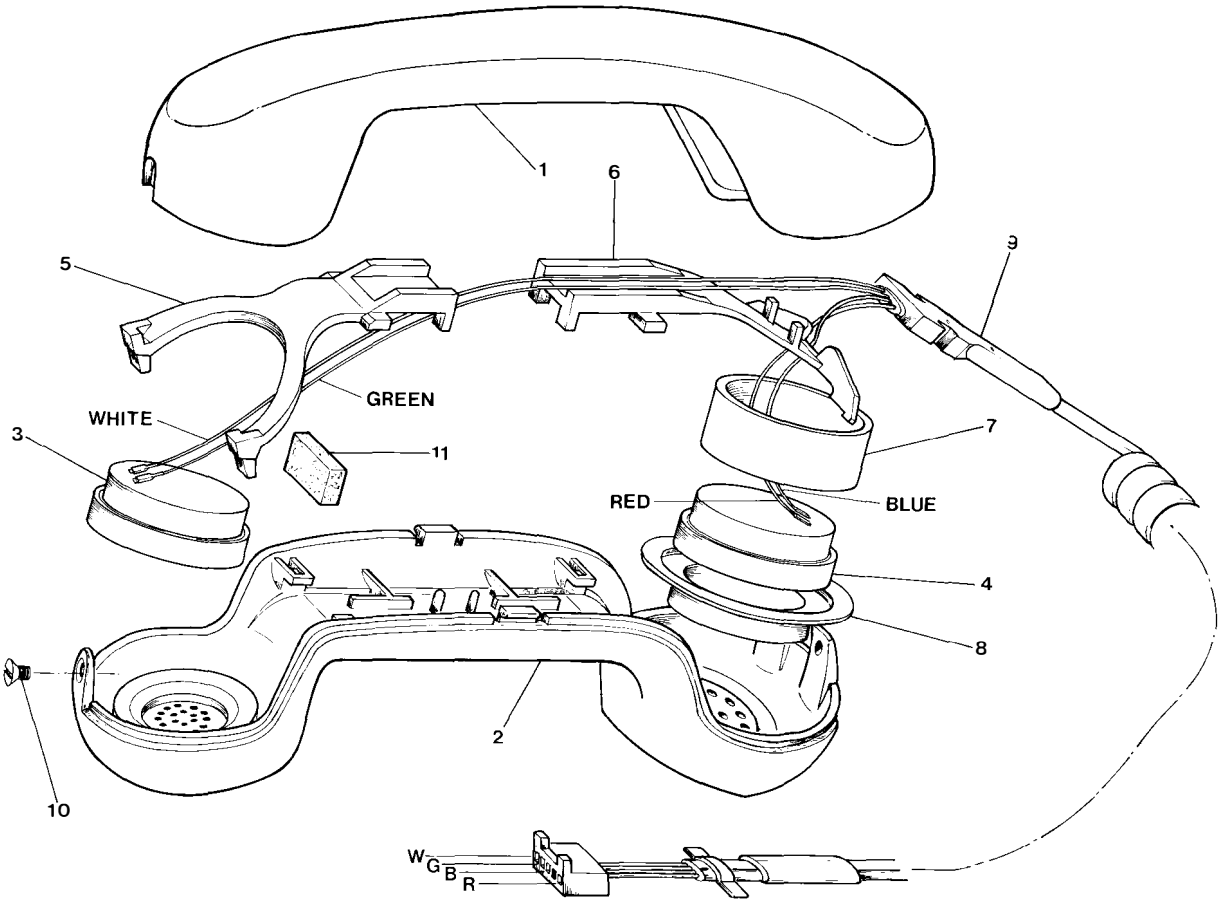
1.WALL PLATE, 2.BASE PLATE, 3.No8 WOODSCREW, 4.SCREW (from telephone), 5.WALL PLUG, 6. IXT TELEPHONE, 7.LINE CORD.

FIGURE 10: KT1 Wall Bracket Assembly Parts Details



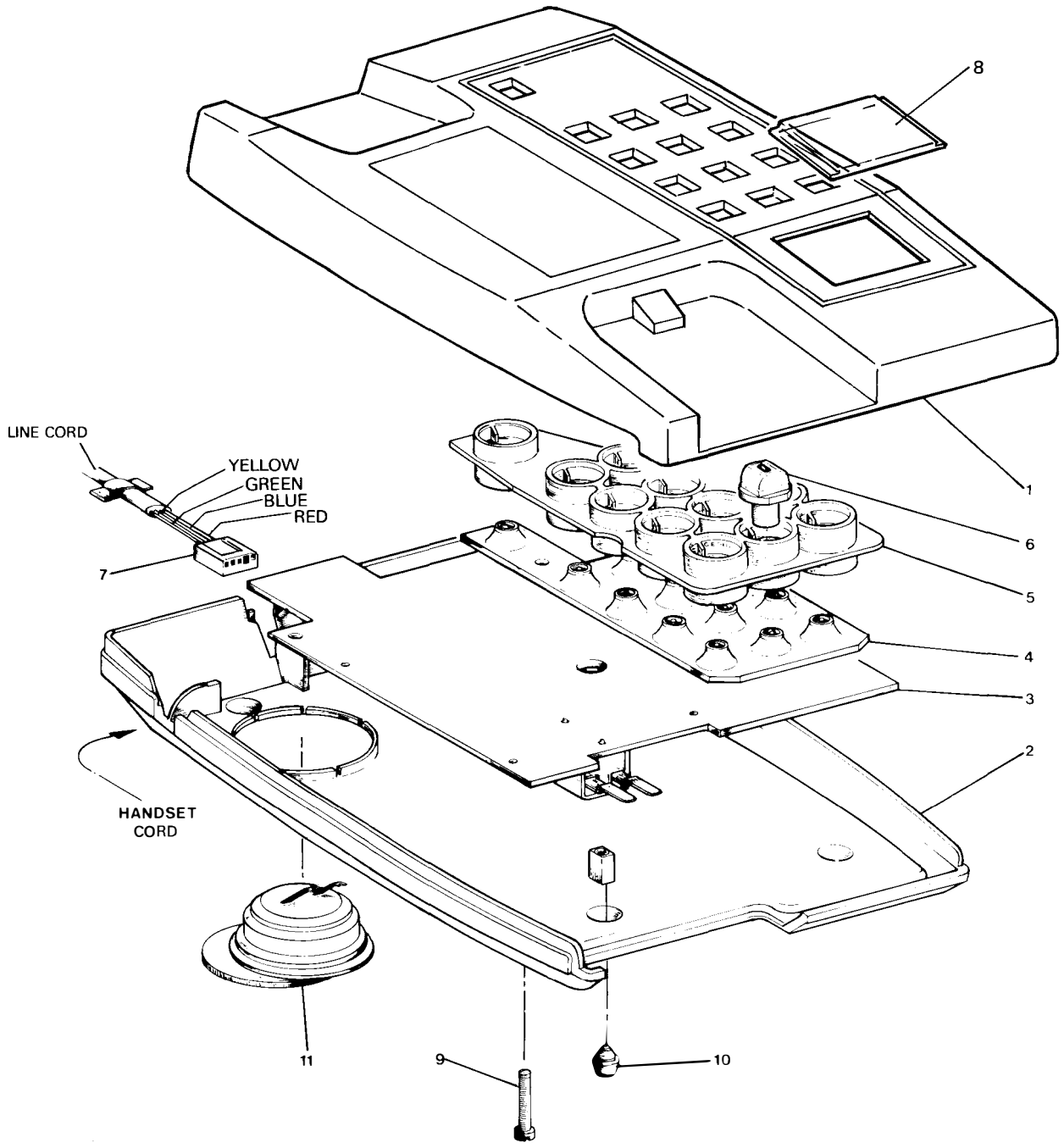
1. TOP CASE, 2. BOTTOM CASE, 3. PCB ASSY, 4. KEYPAD MAT, 5. BUTTON GUIDE, 6. BUTTONS 0-9,
7. LINE CORD, 8. WINDOW EXCH. CARD HOLDER, 9. SCREW. 10. FOOT 4-OFF, 11. TONE CALLER.

FIGURE 11: KT1 Series Base Instrument Parts Details



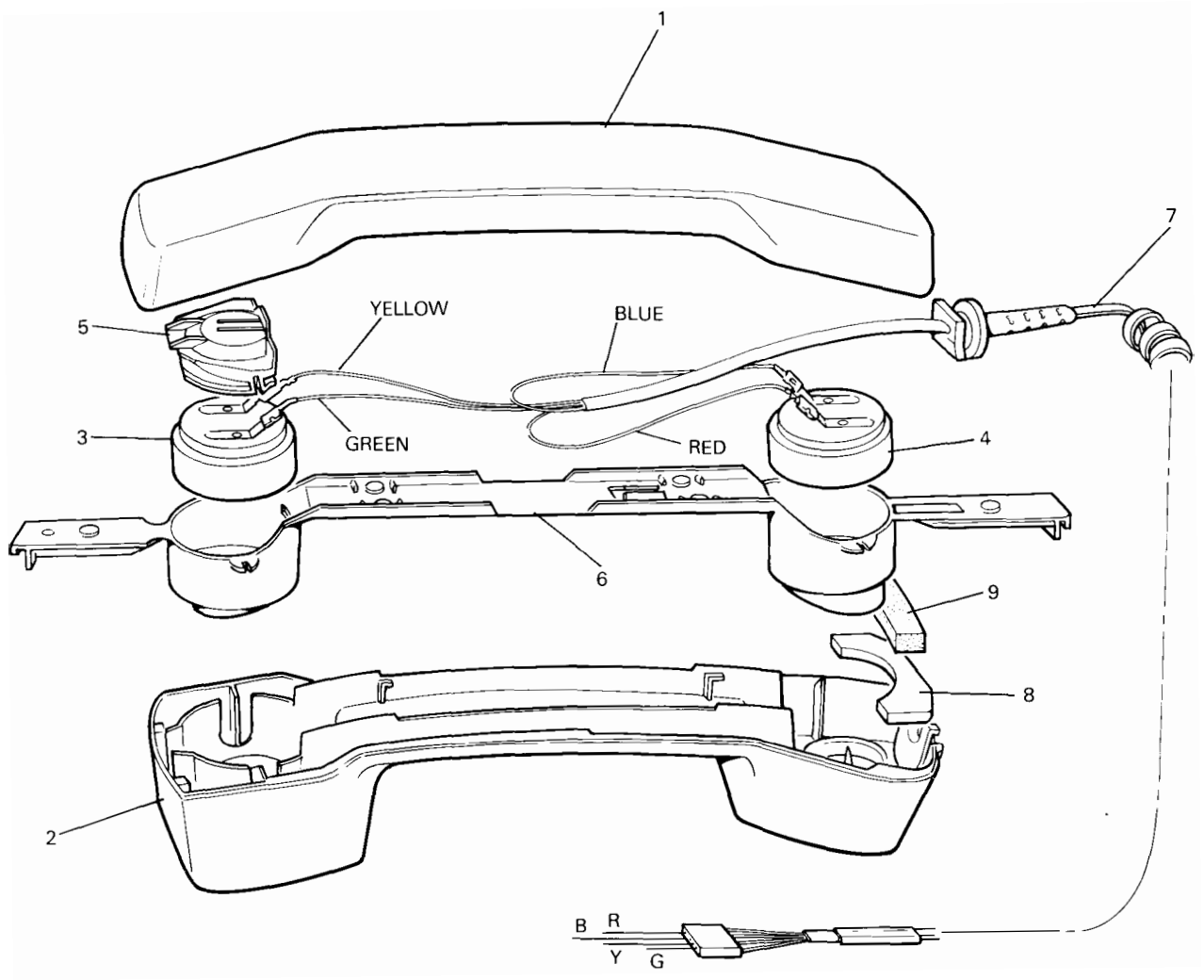
1. BODY-UPPER, 2. BODY-LOWER, 3. RECEIVER, 4. TRANSMITTER, 5. RECEIVER CLIP, 6. TRANSMITTER CLIP, 7. SPACER, 8. LOCATING RING, 9. HANDSET CORD, 10. SCREW, 11. SELF ADHESIVE FOAM.

FIGURE 12: KT1 Series Handset Parts Details



1. TOP CASE . 2. BOTTOM CASE . 3. PCB ASSY. 4. KEYPAD MAT . 5. BUTTON GUIDE . 6. BUTTONS 0-9 .
7. LINE CORD . 8. WINDOW EXCH. CARD HOLDER . 9. SCREW . 10. FOOT 4-OFF. 11. TONE CALLER .

FIGURE 13: KT4 Series Base Instrument Parts Details



1. BODY-UPPER, 2. BODY-LOWER, 3. RECEIVER, 4. TRANSMITTER, 5. RECEIVER COVER,
6. FRAME, 7. HANDSET CORD, 8. WEIGHT, 9. PACKING FOAM.

FIGURE 14: KT4 Series Handset Parts Details

TMC Limited

Swindon Road, Malmesbury, Wiltshire, England SN16 9NA
Telephone: Malmesbury (06662) 2861. Telex: 44208 TMCMAL G

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